Prepared for

ACT Government
Major Projects Canberra

AECOM COX

LIGHT RAIL STAGE 2A CITY TO COMMONWEALTH PARK

ENVIRONMENTAL ASSESSMENT

Environmental Assessment

AECOM acknowledges the Traditional Custodians of country throughout Australia. We pay respects to Elders both past and present and to emerging community leaders. We recognise and celebrate the diversity of Aboriginal and Torres Strait Islander People and their ongoing cultures and connections to the lands and waters.

Client: Major Projects Canberra

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24-Mar-2023

Job No.: 60656949

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Executive Summary

Overview

The Canberra Light Rail network is better connecting Canberra to meet the growing city's transport needs now and in the decades to come. The light rail currently operates from Gungahlin Place, Gungahlin to Alinga Street, Canberra City, transporting between 4,000 to 13,000 passengers each day and over 10 million passengers since 2019.

Major Projects Canberra (MPC) proposes to extend the light rail from its current southern terminus at Alinga Street, City, to Woden (Light Rail to Woden). Light Rail to Woden is being progressed in two, self-contained stages for a faster Project delivery:

- Stage 2A City to Commonwealth Park (the Project, the subject of the Environmental Assessment (EA))
- Stage 2B Commonwealth Park to Woden.

The Project is needed as part of a coordinated and holistic delivery of a series of major projects in the City and surrounds, to realise the strategic planning and development for the City presented in the *National Capital Plan* (NCP), the *Territory Plan 2008*, and the *ACT Transport Strategy*.

The Project also supports the ACT Government's vision for a compact and efficient city and reaching net zero greenhouse gas emissions by 2045 as outlined in the *ACT Climate Change Strategy 2019-2025* (EPSDD, 2019a) and the *Sustainability Strategy 2021-2025* (CRA, 2021a). Furthermore, the Project is a specific directive identified as a key strategy for developing and delivering an efficient, compact and sustainable City within the *Moving Canberra Plan 2019-2045* (TCCS, 2018a), *The Light Rail Network Plan* (TCCS, 2015) and the *ACT Planning Strategy* (EPSDD, 2018).

The EA is not a statutory requirement for the Project but has been prepared to provide the community and other stakeholders with complete and consolidated details of the Project, its anticipated environmental impacts, and the management and mitigation measures proposed to address those impacts. The EA should be read in the context of the Commonwealth (Cth) *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Approval (2019/8582) which applies to the Project. The EA also serves to support:

- A Works Approval application to the National Capital Authority (NCA) under the *Australian Capital Territory (Planning and Land Management) Act 1988* (Cth) (PALM Act) for parts of the Project that would affect Designated Areas
- A Development Application to the Environment, Planning and Sustainable Development Directorate (EPSDD) under the *Planning and Development Act 2007* (ACT) (PD Act) for parts of the Project that would affect Territory Land.

The EA addresses the Project in its entirety to allow for consideration of the Project as a whole. Specific statutory requirements are addressed separately in the planning reports for the Works Approval application and Development Application.

Since Light Rail to Woden has been separated into two stages, the Project is subject to its own EA, Works Approval application and Development Application. Stage 2B Commonwealth Park to Woden would be the subject to its own future planning and environmental approvals processes.

The Project

The Project would involve extending the light rail network from the current southern terminus at Alinga Street to a new stop at Commonwealth Park.

The Project would include the following key elements:

- An extension of approximately 1.7 km of track, southbound from the current Alinga Street terminus to a new stop at Commonwealth Park. The alignment would extend southbound via the western half of London Circuit before continuing on Commonwealth Avenue, to a new terminus at Commonwealth Park

- Three new stops, one located on London Circuit and two located on Commonwealth Avenue
- One scissor crossover (crossover of railway tracks) to allow Light Rail Vehicles (LRVs) to reverse direction
- 'Green tracks' running along Commonwealth Avenue, Northbourne Place, and London Circuit between Northbourne Avenue and West Row that would involve planting grass or shrubs between and besides the alignment
- Intersection layout, traffic signal phasing and road traffic speed changes along the alignment, including new intersections and modifications to existing intersections
- Road widening and verge and kerb line changes
- Pedestrian footpaths and crossing upgrades and modifications
- Utility, stormwater drainage and streetlighting adjustments, relocations and provisions
- A new bridge across Parkes Way for the light rail
- Landscaping features sympathetic with Canberra's design as envisioned by the Griffins' along with requirements set out in other Territory and Australian Government policy

The completed Project, including its key features and elements, is shown on **Figure ES-1**.

Construction activities

Subject to securing and complying with the conditions of environmental and planning approvals, construction of the Project would commence in 2024 with completion planned in 2026. However, the duration of the construction would be dependent on the final construction methodology and staging selected by the delivery contractor, as well as any efficiencies identified during the program. Testing and commissioning would commence in the latter stages of construction and continue for a period of up to nine months following the conclusion of the main works. Successful completion of testing and commissioning would allow the delivery contractor to obtain accreditation from the Office of the National Rail Safety Regulator (ONRSR). Once complete, the system would be ready to be handed over for operation.

Construction activities associated with the Project would occur within a footprint referred to as the 'delivery phase area' (**Figure ES-2**). There would be four major compound sites, as shown on **Figure ES-2**. Several temporary construction compounds, stockpile sites and laydown areas would also be required as part of the Project. Upon completion of the works all established site compounds would be reinstated prior to handing back to the respective land owners.

Traffic management arrangements would include full and partial road closures and would introduce necessary traffic detours to direct the travelling public around work sites and construction access and egress points. Notification of these closures would be advertised in advance and sufficient time to deliver written notice would be required for the local businesses and residents. All temporary traffic management arrangements and diversionary routes would be agreed and approved by TCCS (RoadsACT) prior to implementation.

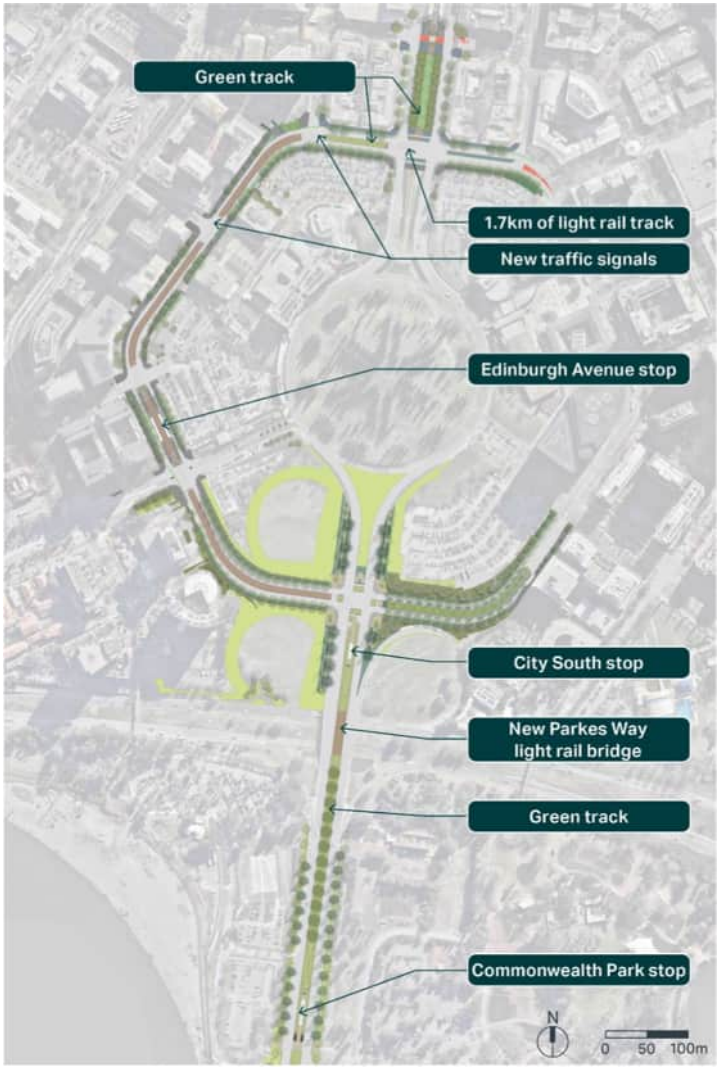

Figure ES-1 The Project and its key features

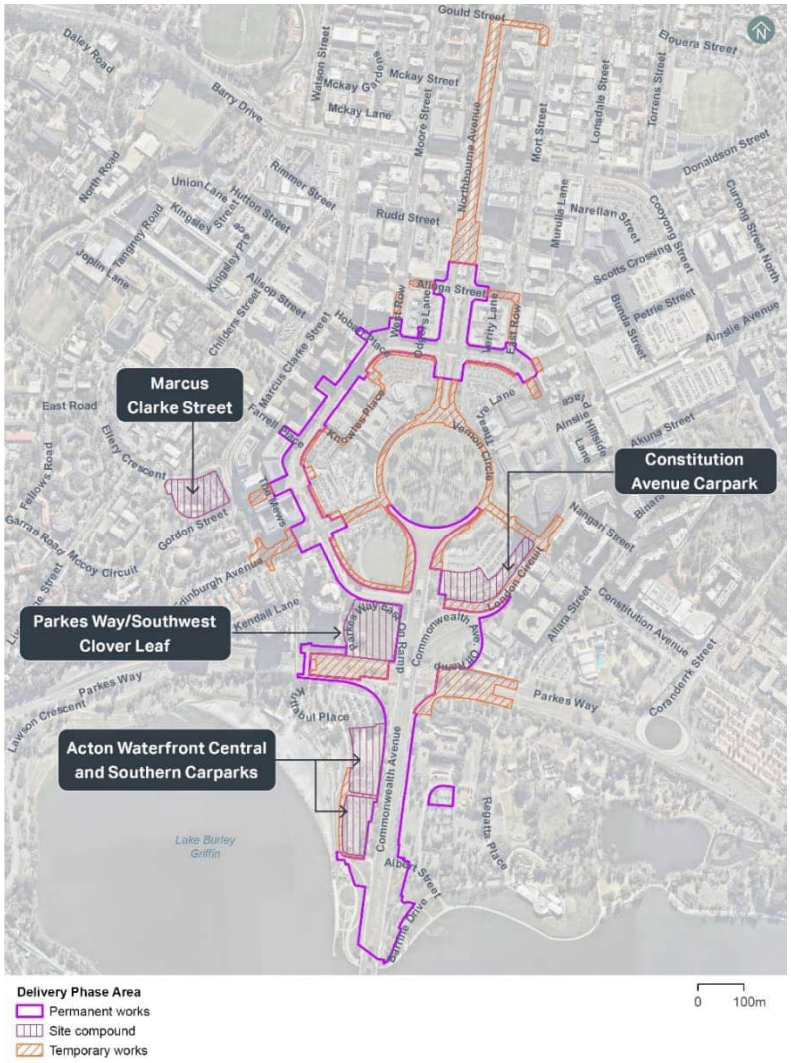

Figure ES-2 Delivery phase area

The construction strategy of the Project has been divided by construction zones: block closures, major intersections and the Parkes Way bridge (**Table ES-1**).

Table ES-1 Construction staging locations

Location	Description
Block closures	These are construction areas between major intersections. Block closures would be used to close off entire sections of the road network, typically between blocks to allow the Project contractor full access to the worksite and the best opportunity to complete the Project most efficiently. Stops would be constructed upon the occupation of the block section where it is located. Blocks would include: • Northbourne Avenue (between Alinga Street and London Circuit) • London Circuit (between Northbourne Avenue and Petrie Plaza) • London Circuit (between Northbourne Avenue and West Row) • London Circuit (West Row to Knowles Place North) • London Circuit (between Knowles Place North and Gordon Street) • London Circuit (between Gordon Street and Edinburgh Avenue) • London Circuit (between Edinburgh Avenue and Commonwealth Avenue) • Commonwealth Avenue (between London Circuit and Parkes Way) • Commonwealth Avenue (between Parkes Way and Lake Burley Griffin).
Major intersections	The major intersections include Northbourne Avenue and Alinga Street, Northbourne Avenue and London Circuit, London Circuit and Edinburgh Avenue, London Circuit and Gordon Street and Commonwealth Avenue and London Circuit. For works within major intersections, wherever possible the construction of the intersection would be carried out during normal working hours, within the confines of a protected worksite. Closures, where required, are expected to be carried out over several weekends (typically from Friday 10pm to Monday 6am) for a maximum of 56 hours at a time, except during construction of track slab where a continuous 80 hours would be required to facilitate concrete curing and ensure adequate concrete strength is achieved prior to intersection reopening and eventual trafficking. The Commonwealth Avenue and London Circuit intersection would not require full closure, and would be subject to a contraflow arrangement for several weeks.
Parkes Way bridge	A new bridge would be built between the two road bridges on Commonwealth Avenue over Parkes Way. In appearance, the gap would be infilled to create a single surface. The new rail bridge would be supported on eight concrete piles (four piles for each bridge abutment) and concrete-walled abutments. The construction of temporary roads would allow for the continued movement of traffic during bridge construction activities, with the location of temporary roads selected by the contractor in line with the Roads ACT requirements.

Sustainability

The Project has sought to align with ecologically sustainable development (ESD) principles as detailed in the PD Act and PALM Act, including:

- The precautionary principle
- The intergenerational equity principle
- Conservation of biological diversity and ecological integrity
- Appropriate valuation and pricing of environmental resources.

The Project is consistent with the principles for sustainable development in the Statement of Strategic Direction, outlined in the *Territory Plan 2008* (the statutory document that guides planning and development in the ACT). An overarching sustainability policy has been developed for the Project and Light Rail to Woden. This policy sets the theme and key objectives for sustainability and resilience for development and operation of Light Rail to Woden, and consequently, the Project.

The Project is undertaking a rating under the Infrastructure Sustainability (IS) Rating Scheme. The IS Rating Scheme is a comprehensive rating system for evaluating sustainability across planning, design, construction and operation phases of infrastructure projects. This rating is sought in accordance with the *ACT Climate Change Strategy 2019-2025*, which outlines the ACT Government's response to climate change.

Community and stakeholder consultation

A range of consultation and engagement tools have been developed to provide information about the Project and provide opportunities for feedback. These tools have been used throughout the development of the Project and would continue to be used in subsequent stages, including a dedicated Project hotline and email, dedicated Project website, social media, virtual engagement room, YourSay online engagement platform, visualisations, flythroughs, artists impressions, community information sessions and stakeholder meetings.

This EA will be placed on public exhibition in coordination with the applications made for Works Approval and Development Application for the Project.

MPC will continue to engage with the community and stakeholders on the Project during the assessment and approvals process, and during the construction period. Future engagement will continue to be integrated with Light Rail to Woden, to ensure consultation is timely and targeted, and to deliver engagement activities in a coordinated manner.

Environmental impacts

As the Project would generally be within the highly modified environment of the existing road easement, it would largely avoid impacts on environmental values. Despite best efforts to avoid impacts, there would be some adverse environmental effects, most temporary in nature, which are likely to occur. Adverse environmental impacts would be minimised by implementing management and mitigation measures outlined in this EA, and would include preparing and implementing a Construction Environmental Management Plan (CEMP). This EA found that, with suitable management and mitigation measures in place, the environmental and social risks generated through the construction and operation of the Project can be managed to a general overall residual risk rating level of Low. There would remain a high residual risk associated with noise from construction activities (in a worst case scenario), and a potential temporary decline in accessibility to services and business due to loss of parking during construction, with all remaining potential impacts for construction and operation reduced to a medium risk or below. Operation of the Project is anticipated to result in beneficial impacts to traffic and transport, biodiversity, landscape and visual realm and socioeconomic conditions.

A summary of the environmental impact assessment is provided below.

Traffic and transport

A Traffic and Transport Impact Assessment was undertaken to assess the potential impacts of the Project on traffic, public transport, active transport, parking, and road safety.

The construction of the Project would require full and partial road closures, as described in **Table ES-1**. During construction block closures, pedestrian and cycling access would be maintained, with minimal diversion from existing pedestrian and cycleways.

The construction assessment indicated that the local road network would experience some minor to moderate congestion, delays and travel times. Bus services are anticipated to experience travel time increases of between one and four minutes for bus routes in the delivery phase area in the AM and PM peak hours.

Construction would also result in the temporary loss of approximately 700 off street car parking spaces, causing moderate impacts to parking availability throughout the delivery phase area. However, there are under-utilised alternative car parks available for use. Other impacts such as temporary changes to property access would be minor in nature.

With the implementation of management and mitigation measures, it is anticipated that residual construction risks would be low to medium.

The operational assessment indicated that the proposed road network changes associated with Project are expected to have a minor impact to the local road network in the short-term (2026). The operational Project would have minor impacts on public transport, property access, parking and road safety. The Project would offer benefits including the opportunity to: improve public transport priority, as an enabling project for the future proposed Light Rail to Woden; reduce the dominance of cars through London Circuit west by allocating more space to walking, cycling and the future public transport; and provide safer and more direct pedestrian and cyclist crossing opportunities.

Heritage

A Heritage Impact Assessment was undertaken to assess the potential heritage impacts associated with the Project.

Construction of the Project would cause minor to moderate impacts to places of non-Aboriginal heritage significance. This is mostly due to temporary construction works that would obstruct views of heritage places. The delivery phase area has been previously assessed as having low potential for the likely existence of Aboriginal archaeological sites. Although the area is within a landscape of culture, significant to the local Aboriginal community, the Project would not affect such values any more than the existing development of Canberra.

Potential operational impacts include permanently changing views and obstructing some aspects of viewpoints towards heritage items, with the introduction of light rail infrastructure and landscape. These impacts are likely to be either minor or beneficial, given the provision of formalised and unified landscape and upgraded public realm.

Contamination and soils

A Contamination Assessment was undertaken to assess the potential contamination and soil impacts associated with the Project.

The construction of the Project has potential risks related to encountering fill materials of poor quality, inappropriately managed materials, and leaks and spills. There is a potential for encountering buried hazardous building materials during construction excavation works. Furthermore, if not appropriately managed, uncontrolled soil loss may occur due to scour erosion of exposed soils. There is potential for accidental spills and leaks of various chemical products to occur which may lead to contamination.

The potential for contamination and soil risks during operation of the Project would be low and generally consistent with existing conditions. It is considered there will be negligible operational contamination potential once vegetation becomes established, around six months after construction is complete.

With the implementation of management and mitigation measures, it is anticipated that residual construction and operation risks would be very low to negligible.

Noise and vibration

A Noise and Vibration Impact Assessment was undertaken to assess the potential impacts associated with the Project.

Construction works would be generally undertaken between 7am – 6pm for weekdays and 7am – 1pm Saturdays. To minimise disruption to daily traffic and disturbance to surrounding landowners and businesses, it would be necessary to carry out some work outside of standard construction work hours.

A qualitative construction noise assessment, based on a worst-case scenario, identified that highly intrusive noise impacts (>30 decibels (dB) above background levels) are occasionally expected during standard work hours, associated with high noise generating equipment, typically required during establishment of compound sites, utilities treatment, construction of tracks, stops and the Parkes Way bridge. It is important to note that the construction scenarios consider sound power levels based on a worst-case 15-minute period and would likely not represent the ongoing day-to-day noise impact at sensitive receivers for any extended period of time. Other impacts such as noise associated with construction vehicle movements and vibration from vibration intensive equipment would have a low impact on sensitive receivers. Construction impacts would be managed through a Noise and Vibration Management Plan.

The operational Project is unlikely to cause significant noise impacts. Operational LRVs would be compliant with the NSW EPA *Rail Infrastructure Noise Guideline (RING)* (ACT does not have relevant

light rail specific noise guidelines). Additionally, road traffic noise levels are not anticipated to increase by a significant amount due to the Project.

Landscape and visual realm

A Landscape Character and Visual Impact Assessment was undertaken to assess the potential landscape character and visual risks associated with the Project.

A landscape character assessment was undertaken to identify features and elements relevant to the Project. Landscape Character Zones (LCZ) are an area of landscape with similar properties or strongly defined spatial qualities, distinct from areas immediately nearby. The assessment of landscape effects considered the change due to the Project on the landscape as a resource in its own right. The assessment was based on the sensitivity to change and the magnitude of the change that is likely to occur. Landscape effects were assessed at the commencement of operation of the Project. There are no adverse impacts anticipated on landscape character during operation, with beneficial impacts identified at Major Avenues and Axes and London Circuit. The beneficial impact rating has been based on the scale and range of the Project within the LCZs, with details considered within the design process already minimising the impact of the Project on the landscape character.

A series of viewpoints were selected from which to assess the visual impact of the Project. Viewpoints were chosen to assess the changes due to the Project from publicly accessible locations. The visual impact assessment considered both the sensitivity of an existing viewpoint to change and the magnitude (scale, character and distance) of the change of view. Visual impacts were assessed during construction and at the commencement of operation of the Project. Of the 14 selected viewpoints, eight were assessed to have a temporary, adverse qualitative rating for visual impact during construction, typically related to the addition of the ‘visual clutter’ of equipment, activity and changes to traffic. One viewpoint was assessed to have an adverse qualitative rating for visual impact during operation, where a shade structure for a light rail stop would be seen against a backdrop of City Hill. The remaining viewpoints are anticipated to experience a neutral or beneficial impact.

Socioeconomic impacts

A Socioeconomic Impact Assessment was undertaken to assess potential socioeconomic risks associated with the Project.

Socioeconomic impacts associated with the construction of the Project may include temporary impacts to the road network, accessibility to services, active and public transport, health and wellbeing, amenity and visual landscape, and economic contributions including employment opportunities.

In the construction phase of the Project, there is the potential for road users to experience adverse impacts due to increased traffic congestion and traffic changes. Temporary disruptions to parking and changes to pedestrian and motorist access may impact people’s ability to access these businesses and services. There may also be disruptions to public transport which could reduce the community’s ability to access other areas and potentially increase traffic-related stress by increasing travel times. Furthermore, public transport users would experience temporary delays and changes to the bus schedule. There may be minor health and wellbeing impacts felt by residents and commuters, however, air quality, noise, and light pollution impacts have been assessed as being of low risk to the community. Lastly, there may be a temporary change in the aesthetic value of the existing surroundings.

Canberra Light Rail Stage 1 demonstrated that light rail construction increases local job opportunities in the Canberra Region. During peak construction period, Canberra Light Rail Stage 1 generated approximately 4,750 direct construction related jobs. The Project would therefore also provide increases in construction related job opportunities within the Canberra Region. Additional indirect jobs would also be created through the supply chain and employee’s expenditure on goods and services occurs largely within their local communities.

Socioeconomic impacts during operation of the Project are anticipated to be largely beneficial. By facilitating more sustainable transport choices, improving the convenience of connectivity, and supporting affordable transportation for all, the operation of the Project would likely increase use of public transport due to the convenience of the network. This would contribute significantly towards a broader goal of preventing traffic congestion and improving how people move around the city. The Project would improve access to Canberra City and surrounds, and provide an opportunity to combine light rail travel with other travel modes when accessing activity centres, services and social facilities.

Overall, the Project is anticipated to cause temporary negative socioeconomic impacts during the construction phase of the Project, but would have beneficial socioeconomic impacts for residents and the community in the long-term.

Air quality

An Air Quality Impact Assessment was undertaken to assess the potential risks associated with the Project.

The construction phase of the Project would have potential risks associated with dust emissions, generated from activities involving demolition, earthworks and vehicle movement. Dust may be generated through the removal of vegetation and soil removal, excavation, construction traffic, exposed soil and stockpiles and transporting materials. Construction activities would produce emissions from plant and machinery. Dust generation and combustion of emissions may impact local air quality. However, with the implementation of management and mitigation measures, all air quality risks during construction are considered to be very low to negligible.

Following the completion of construction, all disturbed areas would be reinstated, and areas of exposed soil would be paved or vegetated. Further, no ongoing dust generating activities form part of the operational Project description. The Project is not expected to generate additional traffic, as such, no increase in vehicle emissions are anticipated. As such, the potential air quality emissions attributed to the operation of the Project would be negligible.

Biodiversity and ecology

The assessment of potential biodiversity and ecology risks has been based on the EPBC Act Preliminary Documentation prepared to inform the assessment of the City to Commonwealth Park component of Light Rail to Woden.

The removal of vegetation is required to facilitate the construction of the Project and to allow site access. Direct and indirect impacts to Golden Sun Moth (*Synemon plana*) GSM, and their associated mitigation measures, have been approved under the EPBC Act approval (2019/8582), and subsequently through the approved GSM Plan. With the implementation of management and mitigation measures, residual biodiversity construction impacts are anticipated to be low.

Other biodiversity impacts would include the removal of vegetation, including about 100 mature trees within the delivery phase area, to facilitate the proposed works and site access. Following construction, more than 140 trees would be planted within the delivery phase area.

The operational Project aims to have a net positive impact on biodiversity and ecology, through purchasing biodiversity offsets to achieve no net loss of GSM habitat and landscaping works to restore native grasslands. Offsets have been secured for GSM impacts associated with all activities approved under EPBC2019/8582, which includes the City to Commonwealth Park component of the Light Rail to Woden project. The offsets package was delivered through the NSW Biodiversity Offsets Scheme.

Hydrology and water quality

A Hydrology and Water Quality Assessment was undertaken to assess potential hydrology risks associated with the Project.

Construction of the Project would not directly impact waterways. There is potential for the water quality of Lake Burley Griffin to be impacted by the Project during construction through stormwater network discharges into the lake, such as during flood events where sediment, and potential contaminants from spills and leaks, may be washed from the delivery phase area. However, with standard management and mitigation measures in place, construction is not anticipated to have any significant impact on existing water quality in the receiving waters downstream of the site. Any impacts to water quality would be localised, short term and within natural water quality variances.

The Project would include large-scale civil works, which would temporarily modify normal drainage direction and overland flow paths. There is potential sediment to be directed into the drainage network during construction. However, with the implementation of management and mitigation measures, this risk remains very low.

The Project involves upgrading the existing stormwater network to cater for flow characteristic changes and mitigate any potential adverse drainage impacts during operation of the Project. This upgrade is designed to cater for up to 1% Annual Exceedance Probability (AEP) events (a flood with a one in a 100 chance of being exceeded in any year). An increase in rainfall intensity of 20% was conservatively adopted in the modelling for major storm events. Sensitivity analysis for climate change was undertaken to assess the potential impacts on flood behaviour. There are some areas outside the proposed alignment that would still experience flood depths of more than 50 mm in a major storm event, however these areas would still experience reductions in flood depth compared with existing conditions.

Resource management and waste

Resource management and waste risk was assessed qualitatively within this EA.

The Project would generate construction and demolition waste during the construction of the Project. The Project would seek to minimise the requirement for new materials as far as practical, through reuse and recycling of materials onsite. Where this is not possible, recyclable materials would be sent to local recycling centres, and waste would be managed appropriately in accordance with the Project CEMP.

Resource consumption and waste generation during the operational phase of the Project are anticipated to be minimal and limited to maintenance activities.

Measures to mitigate the resource use and waste generation of the Project would be implemented.

Cumulative impacts

Cumulative environmental risk was assessed qualitatively within this EA.

Cumulative environmental risks are the combined effect of individual impacts from multiple proposals occurring in proximity or concurrently at a given time. There are a number of proposals identified within the vicinity of the Project that have the potential to contribute to a potential cumulative impact with the Project. Considering the potential overlaps in construction (timing and proximity), key potential cumulative impacts include traffic, heritage, biodiversity, noise and vibration, air quality, landscape and visual, and socioeconomic. MPC would continue to liaise with relevant internal and external stakeholders and proponents in an effort to manage the coordination of the projects in construction.

During operation, cumulative risks are not anticipated, given that the study area retains its pre-construction land use. The Project would contribute towards and enhance the land use function of the travel corridor during operation.

Management and mitigation measures

Management and mitigation measures are proposed to be implemented to reduce the potential impacts of the Project. These management and mitigation measures would be incorporated into the CEMP, other relevant management responses, and operational management plans and systems.

With the implementation of the management and mitigation measures specified in this EA during construction and operation of the Project, the identified environmental impacts and risks are considered to be acceptable and manageable.

Summary

The Works Approval Planning Report and Development Application Statement against relevant Criteria conclude that the Project is consistent with the PALM Act and NCP, and the PD Act and Territory plan, respectively. Both the Works Approval and Development Application also conclude that the Project does not create adverse planning impacts, and is aligned with the strategic planning and development objectives for the various Designated Area precincts under the NCP, and Territory Land under the Territory Plan respectively, affected by the Project.

Acronyms and Abbreviations

Acronym	Definition
ABS	Australian Bureau of Statistics
ACT	Australian Capital Territory
AFP	Australian Federal Police
ANU	Australian National University
AS	Australian Standard
ASGS	Australian Statistical Geography Standard
AVATG	Assessing Vibration: A Technical Guideline
BoM	Bureau of Meteorology
BS	British Standard
CBD	Central Business District
CEMP	Construction Environmental Management Plan
CHL	Commonwealth Heritage List
CHS	Canberra Health Services
CMTEDD	Chief Minister, Treasury and Economic Development Directorate
CNHA	Climate and Natural Hazards Assessment
CNVMP	Construction Noise and Vibration Management Plan
CoRTN	Calculation of Road Traffic Noise
CPTED	Crime Prevention Through Environmental Design
CRA	City Renewal Authority
CRG	Community Reference Group
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CSR	Combined services route
Cth	Commonwealth
CTMP	Construction Transport Management Plan
dB	Decibel
DCCEEW	Australian Government Department of Climate Change, Energy, the Environment and Water formerly known as DAWE (Department of Agriculture, Water and the Environment and DEWHA Department of the Environment, Water, Heritage and the Arts
DEC	Department of Environment and Conservation
DECC	NSW Department of Energy and Climate Change
DITRDCA	Department of Infrastructure, Transport, Regional Development, Communications and the Arts
DPE	NSW Department of Planning and Environment
DSAPT	*AS 1428 DDA and Disability Standards Accessible Public Transport*
EA	Environmental Assessment
EDM	Electronic direct mail

Acronym	Definition
EIS	Environmental Impact Statement
EPA	Environment Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
EPSDD	ACT Environment, Planning and Sustainable Development Directorate
ESD	Ecologically sustainable development
GBCA	Green Building Council of Australia
GHG	Greenhouse gas
GSM	Golden Sun Moth
GSUD	Gender sensitive urban design
HIA	Heritage Impact Assessment
HMP	Heritage Management Plan
IAIA	International Association for Impact Assessment's
ICNG	Interim Construction Noise Guideline
IPCC	Intergovernmental Panel on Climate Change
IS	Infrastructure Sustainability
IS Rating Scheme	Infrastructure Sustainability Rating Scheme
ISC	Infrastructure Sustainability Council (formerly referred to as the Infrastructure Sustainability Council of Australia)
ISCA	Former name of the Infrastructure Sustainability Council (ISC)
JSC	Joint Standing Committee
Kg	Kilogram
km	Kilometre
kN	Kilonewton
LBG	Lake Burley Griffin
LCVIA	Landscape Character and Visual Impact Assessment
LCZ	Landscape Character Zone
LoS	Level of service
LRV	Light Rail Vehicle
m	Metres
MNES	Matters of National Environmental Significance
MPC	Major Projects Canberra
NC Act	Nature Conservation Act 2014
NCA	National Capital Authority
NCP	National Capital Plan
NHL	National Heritage List
NMG	Noise Management Guideline
NVIA	Noise and Vibration Impact Assessment

Acronym	Definition
NVMP	Noise and Vibration Management Plan
ONRSR	Office of the National Rail Safety Regulator
PALM Act	*Australian Capital Territory (Planning and Land Management) Act 1988* (Cth)
PBS	Performance Based Standard
PD Act	ACT Planning and Development Act 2007
PERA	Preliminary environmental risk assessment
RAO	Representative Aboriginal Organisation
RLC	Raising London Circuit
RMS	NSW Roads and Maritime Services (now TfNSW)
RWMP	Resource and Waste Management Plan
SA	Statistical Area
SEIA	Socioeconomic Impact Assessment
TCCS	Transport Canberra and City Services
TfNSW	Transport for New South Wales
the light rail	Canberra Light Rail
TTIA	Traffic and Transport Impact Assessment
TTLG	Traffic and Transport Liaison Group
TTM	Temporary Traffic Management
VENM	Virgin Excavated Natural Material
VP	Viewpoint
WHS	Work health and safety
WSUD	Water Sensitive Urban Design

1.0 Introduction

The Canberra Light Rail network is better connecting Canberra to meet the growing city's transport needs now and in the decades to come. The light rail currently operates from Gungahlin Place, Gungahlin to Alinga Street, Canberra City, transporting between 4,000 to 13,000 passengers/day and over 10 million passengers since 2019.

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The Project is needed as part of a coordinated and holistic delivery of a series of major projects in the City and surrounds, to realise the strategic planning and development for the City presented in the *National Capital Plan* (NCP) (NCA, 1990) (**Section 2.2.1**), the *Territory Plan 2008* (EPSDD, 2008) (**Section 2.2.2**), and the *ACT Transport Strategy* (TCCS, 2020a) (**Section 2.2.3**). In accordance with these plans, the Project would:

- Provide additional sustainable transport options
- Enhance liveability by improving connectivity and access
- Future-proof the transport network to accommodate growth
- Support affordable public transport.

The Project also supports the ACT Government's vision for a compact and efficient city and reaching net zero greenhouse gas emissions by 2045 as outlined in the *ACT Climate Change Strategy 2019-2025* (EPSDD, 2019a) and the *Sustainability Strategy 2021-2025* (CRA, 2021a) (**Section 2.2.3**). Furthermore, the Project is a specific directive identified as a key strategy for developing and delivering an efficient, compact and sustainable City within the *Moving Canberra Plan 2019-2045* (TCCS, 2018a), *The Light Rail Network Plan* (TCCS, 2015) and the *ACT Planning Strategy* (EPSDD, 2018) (**Section 2.2.3**).

This EA is not a statutory requirement for the Project but has been prepared to provide the community and other stakeholders with complete and consolidated details of the Project, its anticipated environmental impacts, and the management and mitigation measures proposed to address those impacts. This EA should be read in the context of the Commonwealth (Cth) *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Approval (2019/8582) which applies to the Project. This EA also serves to support:

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Since Light Rail to Woden has been separated into two stages, the Project is subject to its own EA, Works Approval application and Development Application. Stage 2B Commonwealth Park to Woden would be the subject to its own future planning and environmental approvals processes.

1.1 Background

Light Rail Gungahlin to City is currently operational with 13 stops provided along Flemington Road, the Federal Highway and Northbourne Avenue. With more than 2.5 million passengers boarding the light rail each year between 2020 and 2022, and approximately 3.2 million in 2019 (pre-Covid), the light rail has proven successful in providing the public a sustainable, accessible and affordable public transport option[1]. Building on the success of Light Rail Gungahlin to City, the ACT Government has committed to continue to better connect Canberra by providing a north-south public transport spine, extending the current light rail network to Woden. The Project forms the first stage of Light Rail to Woden, and would better connect the City to Lake Burley Griffin. The Project would frame the future shape of development along the Northbourne Avenue-London Circuit-Commonwealth Avenue corridor, supporting the activation of underutilised land around City West, City Hill and the Acton Waterfront and enabling the delivery of city wide initiatives for urban renewal and diversity of place. Extending the light rail network along London Circuit would bring the network closer to businesses along London Circuit and the Australian National University. The Project, and in the future, Stage 2B Commonwealth Park to Woden, would contribute to supporting the 500,000 people Canberra is expected to be home to by 2030 (MPC, 2019). Since the 2019 estimates, and with the release of the 2021 Census, there are nearly 22,000 more Canberrans than previously thought, and the population has been growing at an average annual rate of 2.4% over the five years between the 2016 and 2021 Censuses (CMTEDD, 2022). On the basis of forward estimates from ACT Treasury (CMTEDD, 2022) and recent population projections published as part of the Commonwealth October 2022/23 Budget Papers, it is expected that previous 2030 population projections will likely be exceeded. By extending the light rail network to Woden, Canberra would be better equipped to provide more public transport options, reduce traffic congestion, reliance on cars and urban sprawl, and transition to a net zero greenhouse gas emissions future[2].

The Project would act as a key enabler to meet the strategic outcomes outlined in the NCP and the Territory Plan, which are the principal strategic documents that govern the planning, design and development of Canberra and the ACT. The Project would deliver on the following strategic outcomes outlined in the NCP and the Territory Plan:

- Improve connectivity and facilitate the transition to a compact city to future-proof against urban sprawl by providing more public transport options closer to the City to limit car use and limit the stress of a growing Canberra population
- Provide more convenient, sustainable and reliable transport options by increasing public transport options powered by renewable energy and increasing the extent of the light rail network
- Reduce transport emissions to support Canberra's transition to net zero greenhouse gas emissions by providing public transport that runs on renewable energy
- Enhance liveability and accessibility by providing more accessible public transport options closer to the City
- Provide for improved urban design and amenity by encouraging urban renewal, sustainable development and investment in the City
- Achieve economic vitality, community wellbeing and environmental quality by supporting the activation of underutilised land around City West, City Hill and the Acton Waterfront
- Facilitate efficient use of resources whilst reducing reliance on non-renewable resources by providing public transport powered by renewable energy
- Facilitate active living through the provision of active transport infrastructure connected to existing networks by providing more choice and increasing public transport patronage and reducing car dependency
- Recognise the needs of people with disabilities by providing accessible public transport.

[1] ACT Government, 2022, Accessed at: https://www.data.act.gov.au/Transport/Light-Rail-Patronage/x7dn-77he

The NCP, Territory Plan and other strategic planning documents are discussed in **Chapter 2.0 Strategic need and context**.

1.2 The Project

The Project would involve extending the light rail network from the current southern terminus at Alinga Street to a new stop at Commonwealth Park. The completed Project, including its key features and elements, is shown on **Figure 1-1**. A detailed plan is provided in **Appendix A (Project Layout)**.

The Project would include the following key elements:

- An extension of approximately 1.7 km of track, southbound from the current Alinga Street terminus to a new stop at Commonwealth Park. The alignment would extend southbound via the western half of London Circuit before continuing on Commonwealth Avenue, to a new terminus at Commonwealth Park (**Sections 3.3.1** and **3.3.2**)
- One scissor crossover (crossover of railway tracks) to allow Light Rail Vehicles (LRVs) to reverse direction (**Section 3.3.1**)
- 'Green tracks' running along Commonwealth Avenue, Northbourne Place, and London Circuit between Northbourne Avenue and West Row that involve planting grass or shrubs between and beside the alignment (**Section 3.3.1**)
- Three new stops, one located on London Circuit and two located on Commonwealth Avenue (**Section 3.3.2**)
- Intersection layout, traffic signal phasing and road traffic speed changes along the alignment, including new intersections and modifications to existing intersections (**Section 3.3.4**)
- Road widening and verge and kerb line changes (**Section 3.3.4**)
- Pedestrian footpaths and crossing modifications (**Section 3.3.5**)
- Utility, stormwater drainage and streetlighting adjustments, relocations and provisions (**Sections 3.2.2.3**, **3.2.2.4** and **3.2.2.9**)
- A new bridge across Parkes Way for the light rail (**Section 3.2.2.7**)
- Landscaping features sympathetic with Canberra's design as envisioned by the Griffins along with requirements set out in other Territory and Australian Government policy (**Section 3.4**).

Further details of the Project, including proposed construction activities, are provided in **Chapter 3.0 Project description**.

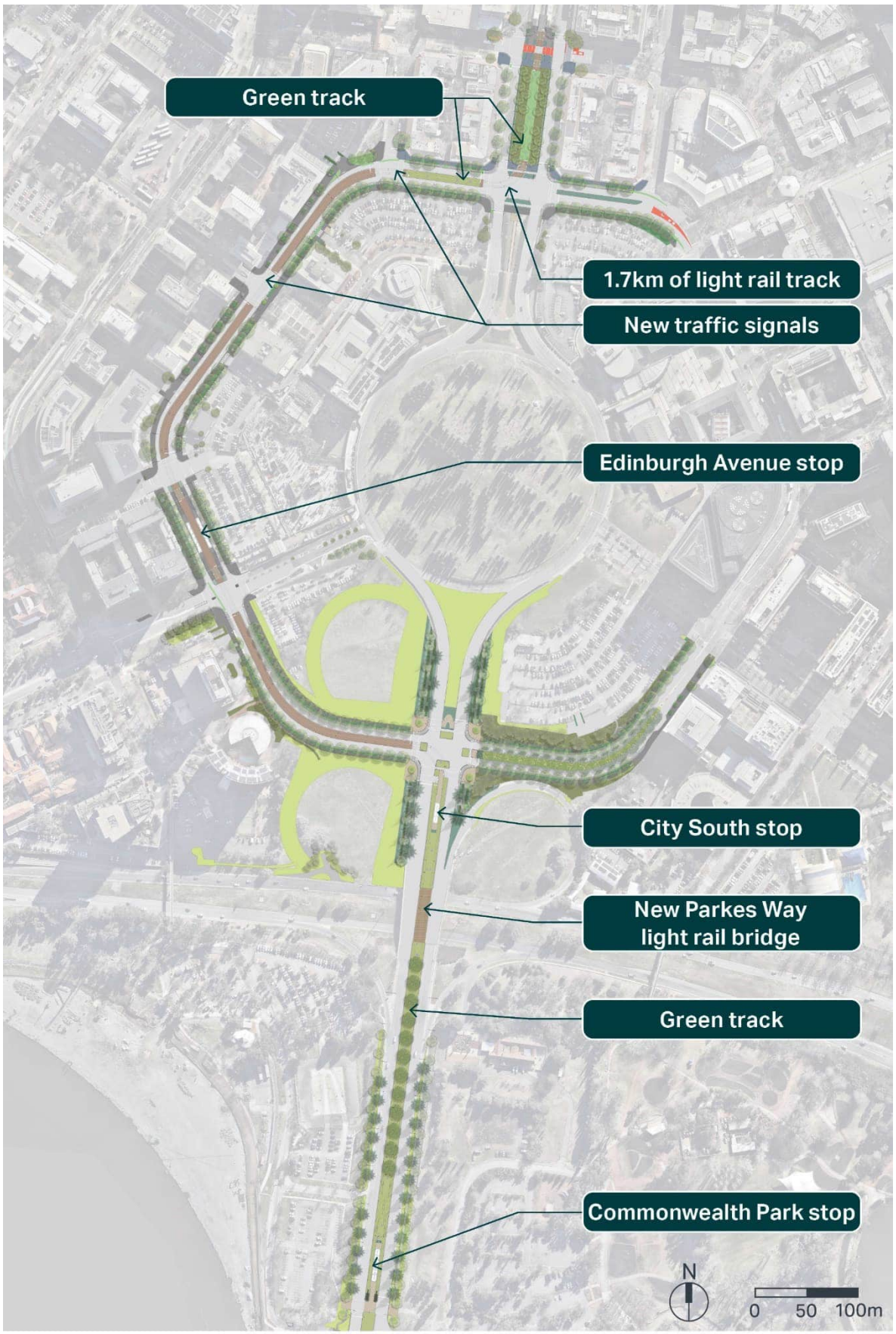


Figure 1-1 The Project and its key features

1.3 The Proponent

The Proponent for the Project is MPC. MPC was formed as a directorate in July 2019 to lead the procurement and delivery of infrastructure projects in the ACT. Its main responsibilities are:

- Procurement and delivery of infrastructure projects designated by the Chief Minister to MPC
- Delivery of other whole-of-government infrastructure projects in partnership with other directorates.

Other functions performed by MPC include contractor pre-qualification and industrial relations and employment certification, project management and reporting, superintendency of works and work health and safety (WHS) active certification.

MPC has had no previous or current legal proceedings taken against it under ACT or Commonwealth law in relation to the protection of the environment, or the conservation and sustainable use of natural resources.

1.4 Structure of this Environmental Assessment

This EA is structured in three main parts, as summarised in **Table 1-1** below.

Table 1-1 Structure of this EA

Part/chapter	Description
Part A – Introduction, Project description and context	
Chapter 1.0 Introduction	This Chapter provides the introduction and background to the Project, details of the Project and the proponent, and the structure of the EA.
Chapter 2.0 Strategic need and context	This Chapter outlines the strategic need and context for the Project, including details of how the Project would respond to key policies and plans.
Chapter 3.0 Project description	This Chapter provides details of the Project and its design. This Chapter also provides details of how the Project would be constructed, and details utility adjustments and relocations.
Chapter 4.0 Sustainability, resilience, climate change and greenhouse gas emissions	This Chapter discusses how the Project includes consideration of sustainability and resilience, accounts for the impacts of climate change (refer to **Appendix K (CNHA)**), and has been designed with the aim of minimising greenhouse gas emissions (refer to **Appendix J (GHG Assessment)**).
Chapter 5.0 Project development and alternatives	This Chapter outlines how the design of the Project has been developed, including alternatives to the Project and design options.
Chapter 6.0 Statutory approvals context	This Chapter provides the statutory context of the Project and describes the environmental and planning approvals that would be required to carry out the Project.
Chapter 7.0 Consultation	This Chapter outlines engagement activities that have been carried out with the community and other stakeholders in relation to the Project, key issues that have been raised, and how these issues have been addressed (refer to **Appendix B (Consultation Report)**).
Chapter 8.0 Environmental risk analysis approach	This Chapter provides the methodology for the environmental risk analysis for the Project. The risk assessment guided the identification and assessment of environmental issues in this EA.

Part/chapter	Description
Part B – Assessment of environmental impacts	
Chapter 9.0 Traffic and transport	This Chapter presents an assessment of traffic and transport impacts, based on a technical specialist study (refer to **Appendix D (TTIA)**).
Chapter 10.0 Heritage	This Chapter presents an assessment of both Aboriginal and non-Aboriginal heritage impacts, based on a technical specialist study (refer to **Appendix E (HIA)**).
Chapter 11.0 Contamination and soil	This Chapter presents an assessment of contamination and soil related impacts, based on a technical specialist study (refer to **Appendix F (Contamination Assessment)**).
Chapter 12.0 Noise and vibration	This Chapter presents an assessment of noise and vibration impacts, based on a technical specialist study (refer to **Appendix G (NVIA)**).
Chapter 13.0 Landscape and visual realm	This Chapter presents an assessment of landscape and visual realm impacts, based on a technical specialist study (refer to **Appendix H (LCVIA)**).
Chapter 14.0 Socioeconomic impacts	This Chapter presents an assessment of socioeconomic impacts, based on a technical specialist study (refer to **Appendix I (SEIA)**).
Chapter 15.0 Air quality	This Chapter presents an assessment of air quality impacts.
Chapter 16.0 Biodiversity and ecology	This Chapter presents an assessment of biodiversity impacts.
Chapter 17.0 Hydrology and water quality	This Chapter presents an assessment of surface water and hydrology impacts.
Chapter 18.0 Resource management and waste minimisation	This Chapter presents an assessment of resource management and waste impacts.
Chapter 19.0 Cumulative impacts	This Chapter presents an assessment of potential cumulative impacts from the Project in conjunction with other projects.
Part C – Management, mitigation and justification	
Chapter 20.0 Management and mitigation measures	This Chapter presents a consolidated list of management and mitigation measures that would be applied in carrying out the Project, and describes the approach to environmental management of the Project.
Chapter 21.0 Justification and conclusion	This Chapter presents the conclusions of the EA and a justification for carrying out the Project.
Chapter 22.0 References	This Chapter presents a reference list of sources for citations throughout this EA.

2.0 Strategic need and context

This Chapter details the strategic need and objectives for the Project and outlines how the Project responds to key strategic plans and policies. Generally, the Project aligns with several key themes across all policies investigated which, in no particular order of importance, are summarised in **Table 2-1**.

Table 2-1 Key policy themes and actions that the Project supports

Theme	Actions
Sustainability	• Contributing to reaching the ACT Government's net zero greenhouse gas emissions goal by 2045 • Reducing car dependency • Providing environmentally responsible public transport • Supporting sustainable urban growth that responds to a growing population.
Urban renewal	• Improving liveability and vibrancy of urban centres • Providing improved metropolitan infrastructure • Facilitating new and diverse investment in and around the City • Reflecting architect Walter Burley Griffin's original plan for the ACT.
People-focused projects	• Ensuring that transport needs of the community are met • Ensuring inclusivity, accessibility and safety • Improving the liveability of Canberra • Improving access to key business centres • Prioritising health and comfort and encouraging active travel.
Transport	• Focusing on customer needs • Encouraging active travel • Providing public transport that is safe, secure, convenient, affordable, accessible, inclusive, sustainable and efficient • Integrating with other transport systems and modes of travel.
Wellbeing	• Contributing to access and connectivity throughout the community, including improved access to health services, educational facilities, and employment opportunities, and providing timely and efficient transport options for all community members • Improving social interaction and access to social and community services • Contributing to green and low carbon transport options.

2.1 Strategic need and Project objectives

2.1.1 Strategic need

The Project is proposed as one of a series of major projects being planned and delivered in a coordinated and holistic way to give effect to the strategic planning and development vision in the NCP (NCA, 1990) and *Territory Plan 2008* (Territory Plan) (EPSDD, 2008) for the City and its surrounds. The need for the Project is underpinned by several significant strategic roles:

1. **Direct facilitation of Stage 2B Commonwealth Park to Woden** by facilitating and providing an opportunity for the light rail network extension to connect past Commonwealth Avenue southbound towards Woden
2. **Future-proofing the transport network** by providing public transport infrastructure that responds to current needs and also provides strategic capacity for future growth
3. **Providing sustainable transport options and reaching net zero greenhouse gas emissions** by providing public transport that utilises renewable energy
4. **Facilitating the transition to a compact and connected city** by providing more public transport closer to the City to limit urban sprawl and car use, and to limit the stress of a growing Canberra population.

2.1.2 Project vision and objectives

The ACT Government made a clear commitment in the *Canberra: A Statement of Ambition 2016* (ACT Government, 2016) and the *City Plan 2014* (ACT Government, 2014) to construct the light rail network over the coming years to help achieve its vision for Canberra and to:

- Deliver an attractive public transport choice for the City
- Support and generate urban renewal
- Diversify the Canberra economy.

The vision and objectives for the Project have been developed taking into account the Project's role in responding to the planning and development vision in the NCP, Territory Plan and the other strategies and plans discussed in this Chapter.

In pursuit of visions outlined across relevant planning strategies, the design, development and delivery of the Project would be guided by the seven objectives shown on **Figure 2-1** (MPC, 2019).

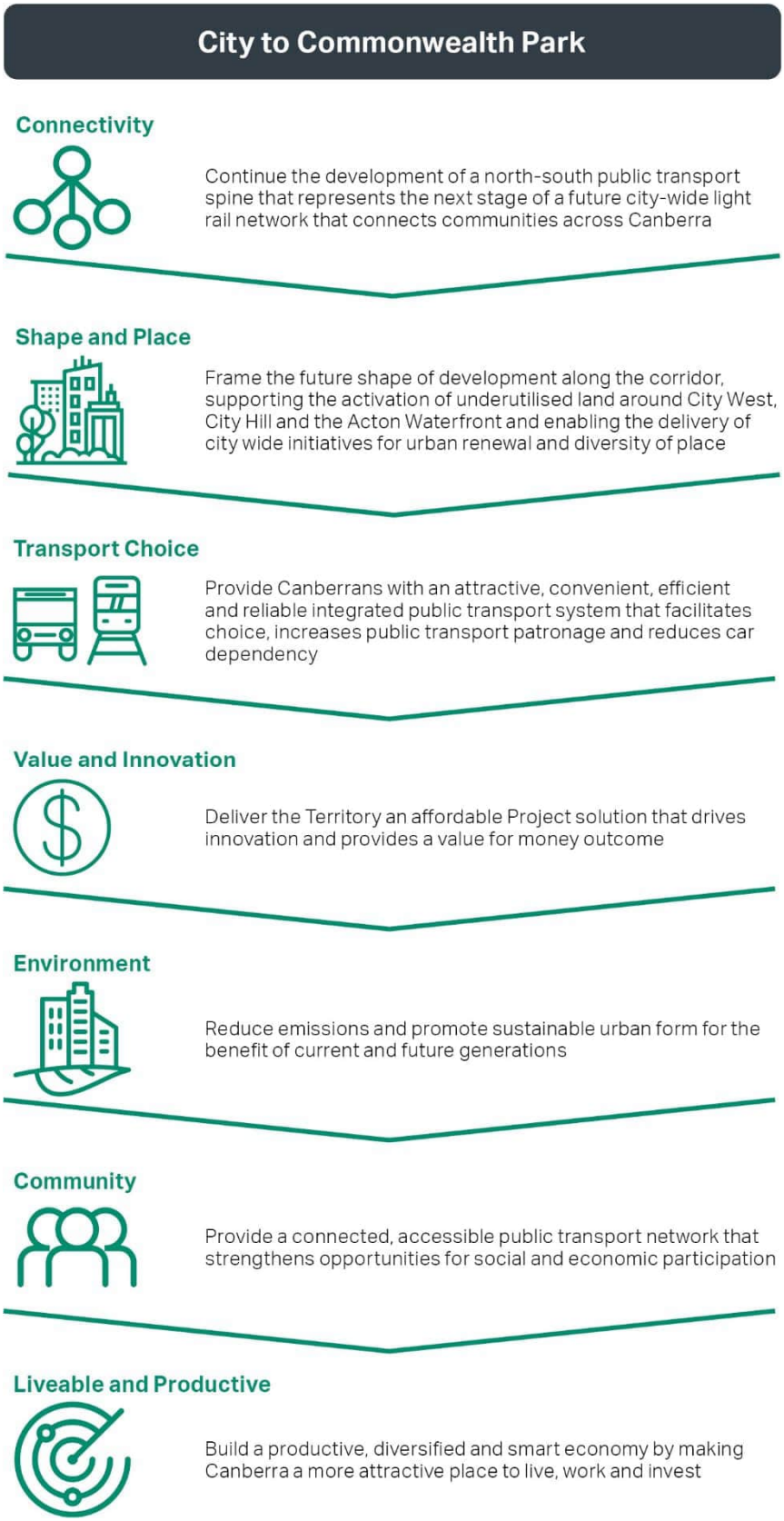


Figure 2-1 Objectives of the Project

2.2 Strategic planning and policy context

2.2.1 The National Capital Plan

The NCP is the strategy and blueprint giving effect to the Commonwealth Government's interests and intentions for planning, designing and developing Canberra and the ACT. It is prepared and delivered by the NCA under the PALM Act, and is focused on planning and development matters of national significance.

The NCP includes provisions in three key areas that are relevant to the Project:

- The Statement of Planning Principles that aim to give effect to the object of the NCP to ensure that Canberra and the Territory are planned and developed in accordance with their national significance, including:
  - Productivity: ensure that infrastructure supports the development of Canberra's National Capital functions
  - Sustainability: ensure the development of a city that both respects environmental values and reflects national concerns with the sustainability of Australia's urban areas
  - Liveability: enhance and preserve Canberra's symbolic and unique design and role as the National Capital
  - Accessibility: support a connected and equitable multi-modal transport system
- Land use plans and general land use controls
- Requirements applicable to Designated Areas, particularly the City Hill, West Basin, and Constitution Avenue and Anzac Parade Designated Area Precincts.

The Project would span several Designated Areas regulated under the NCP and is subject to planning principles, policies and requirements under relevant precincts of the NCP.

The Works Approval Planning Report concludes that the Project is consistent with the PALM Act and the NCP, and does not create adverse planning impacts (**Section 6.1**). As discussed above, the Project would provide positive planning outcomes through the provision of sustainable public transport that would enhance connectivity and accessibility throughout the City. This is consistent with the NCP vision for London Circuit and Commonwealth Avenue operating as principal public transport routes through the City, in the context of an integrated public transport system in the City Hill precinct.

2.2.2 Territory Plan

The Territory Plan is the key statutory planning document in the ACT, providing the policy framework for the administration of planning in the ACT under the PD Act. The purpose of the Territory Plan is to manage land use change and development in a manner consistent with strategic directions set by the ACT Government, Legislative Assembly and the community, and must not be inconsistent with the NCP (**Section 2.2.1**). The Territory Plan includes a statement of strategic directions, a map (the Territory Plan Map) which sets out zones and precincts in the ACT, objectives and development tables applying to each zone, and a series of general, development and precinct codes. It also includes structure plans and concept plans for the development of future urban areas.

The Territory Plan is a requirement of the PD Act (refer to **Section 2.2.2**).

The Development Application Statement against Criteria concludes that the Project is consistent with the PD Act and the Territory Plan, and does not create adverse planning impacts. The Project would support the following transport objectives outlined in the Territory Plan:

a) *"Make provision for a transport network that can provide for the efficient, safe and convenient movement of people and goods*

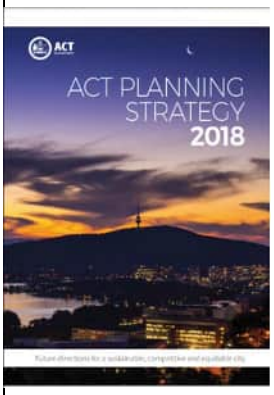
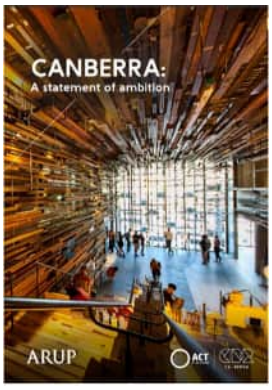
b) Ensure that major roads, light rail and transport infrastructure are developed in a comprehensive manner, including the provision of appropriate landscaping, street furniture and lighting, traffic control devices, and noise attenuation measures

c) Provide for active travel and public transport".

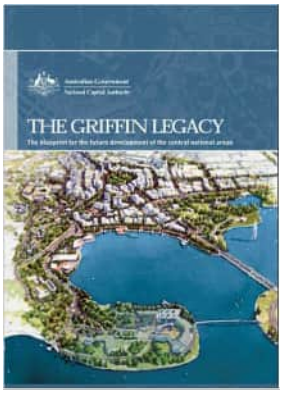
2.2.3 Other key strategic plans, policies and guidelines

The Project has been designed with consideration of the NCP and Territory Plan. The Project is consistent with the key strategic plans, policies and guidelines listed in **Table 2-2**, of relevance to strategic transport planning, including integration with land use planning, urban planning and placemaking, sustainability planning and wellbeing.

Table 2-2 Key strategic plans, policies and guidelines

Guiding policy documents	
	**ACT Planning Strategy 2018** The *ACT Planning Strategy 2018* is the key strategic document for managing growth and change in the ACT (EPSDD, 2018). Key challenges the strategy aims to respond to include a growing population, growing transport needs and climate change. The Project supports the following directions of the strategy: • **A compact and efficient city** by providing additional public transport within the City. LRVs have a carrying capacity of 200 passengers and would have a frequency of up to five minutes during peak hours. This would enable the mass transport of people in and out of the City and the potential reduction of private vehicles on the road • **Sustainable and resilient territory** by offering a transport option that utilises the ACT's renewable energy and incorporates climate-wise and sustainable design • **Accessible Canberra**: the Project would enhance accessibility to the City, and provide additional and improved cycling (shared on street and off street grade separated cycleways) and pedestrian paths and amenities.
	**City Plan 2014** The *City Plan 2014* sets out a vision and a framework for the development of the City. The plan provides a long-term vision for the desired form and structure of the City, guides the location and nature of development and infrastructure, and provides responses to possible future changes and challenges. Importantly, the plan specifically recognises the light rail network as an opportunity in supporting transport and movement in the West Basin and the City's northwest, as well as urban design in these areas.
	**Canberra: A Statement of Ambition 2016** *Canberra: A Statement of Ambition 2016* outlines a plan for developing a compact and competitive city, which attracts and retains talented people, has a diversified economy, delivers high-quality metropolitan infrastructure and embraces a digital mindset (ACT Government, 2016). Building the light rail network is specifically identified as a key urban renewal task, that will be critical to meeting the needs of a growing population, developing compact urban centres and boosting sustainable growth by improving transport options, settlement patterns and employment opportunities.

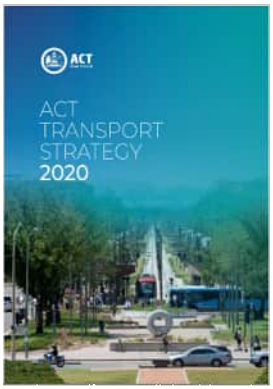
Guiding policy documents



The Griffin Legacy

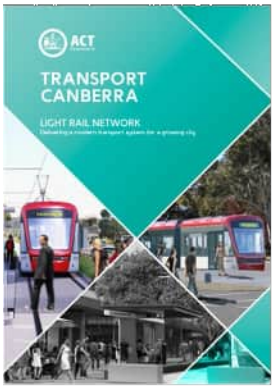
In 2004, the NCA prepared *The Griffin Legacy* – A Policy Framework as a major strategy to unlock the potential of Canberra's Central National Area, its landscape setting and approaches (NCA, 2007).

The Project responds to key Griffin Legacy propositions including linking the city to the Central National Area, extending the City to Lake Burley Griffin, reinforcing Canberra's main avenues as primary corridors for transport, and the development of improved linkages with high quality and efficient public transport networks.



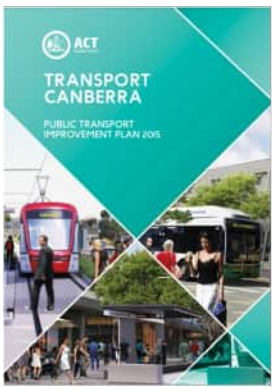
ACT Transport Strategy 2020

The *ACT Transport Strategy 2020* sets the ACT Government's objectives for developing Canberra's transport network (TCCS, 2020a). The strategy established three principal outcomes for Canberra's public transport network, including managing congestion, reducing emissions and supporting a compact and efficient city. A key concept within this strategy includes the 30-minute city concept, to ensure all Canberrans are able to travel around Canberra in an efficient way. The strategy highlights the positive outcomes of Light Rail Gungahlin to City and specifically identified the Project as a key priority investment in further developing the public transport network.



Transport Canberra – Light Rail Network 2015

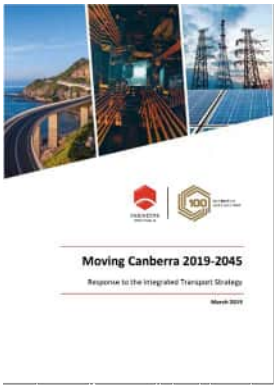
The *Transport Canberra – Light Rail Network 2015* plan is the ACT Government's vision for the light rail that showcases Canberra as a prosperous, sustainable, and liveable city (TCCS, 2015). The plan details the strategic directions for building the light rail network. The plan also highlights that Light Rail to Woden, which includes the Project, is a high priority corridor, connecting Woden and surrounds to the City.



Public Transport Improvement Plan 2015

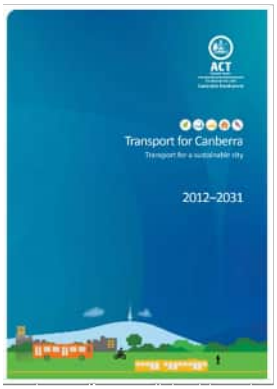
The *Public Transport Improvement Plan 2015* sets out how Transport Canberra and City Services (TCCS) will deliver the ACT Government's vision for a quality public transport system that is convenient and easy to use, efficient, affordable, reliable and integrated (TCCS, 2015). The Plan emphasises that the light rail network would be pivotal for delivering a modern transport system, and that it would play a pivotal role in building the next stage of Canberra's public transport network. Furthermore, the plan emphasises that Light Rail to Woden would support economic development opportunities along and adjacent to the alignment.

Guiding policy documents



Moving Canberra 2019-2045, Integrated Transport Strategy

Moving Canberra 2019-2045, Integrated Transport Strategy is the ACT Government's transport strategy for Canberra, which provides a strategic direction that identifies the policies, infrastructure, programs and services necessary to meet Canberran's needs and expectations (TCCS, 2018a). The strategy highlights the importance of strengthening the north-south public transport spine for the functionality of the wider network. The strategy also identifies the ability for the light rail to improve the north-south spine, reduce cars on the road, and improve the efficiency of the road network.



Transport for a Sustainable City 2012-2031

Transport for a Sustainable City 2012-2031 is the ACT Government's plan that establishes mode share targets and frames an integrated transport and land use approach to create a cleaner, more sustainable Canberra (EPSDD, 2012). A key action within the plan includes actively planning for mass public transport such as the light rail. Key messages from the Canberra community included within the plan also highlight that the community generally supports a shift from car dependency to more sustainable options, such as the light rail. Additional objectives within the plan include managing travel demand, such as by promoting sustainable transport options.

City and Gateway Urban Design Framework 2018

The *City and Gateway Urban Design Framework 2018* sets expectations for, and guides, future development and urban renewal in the City and gateway corridor (NCA, 2018). The framework provides a collective long-term vision and principles for Canberra drawing upon the legacy of historic planning and contemporary design. The framework specifies that the light rail would encourage urban renewal, sustainable development and investment in the City. It also identifies that Northbourne Avenue forms a central spine through the City, and that the light rail could support the revitalisation adjacent to the alignment.

City Renewal Authority 2025 Strategic Plan

The *City Renewal Authority* (CRA) *2025 Strategic Plan* is responsible for the revitalisation of central Canberra within the designated City Renewal Precinct (CRA, 2021b). The Plan specifically states that advocating and coordinating with the light rail and TCCS to optimise the success of London Circuit is a key annual priority for the CRA.

Guiding policy documents

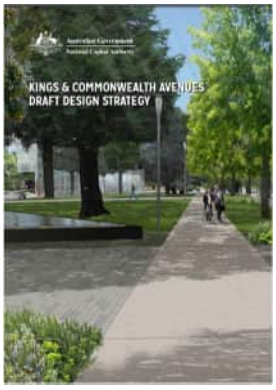
ACT Climate Change Strategy 2019-2025

The *ACT Climate Change Strategy 2019-2025* outlines the ACT Government's response to climate change (EPSDD, 2019a). Specifically, it details how the ACT Government aims to reach a 50-60% reduction in emissions by 2025 and establishes the foundations for reaching net zero emissions by 2045. The strategy strongly focuses on reducing emissions from transport, since it was one of the largest sources of emissions in the ACT in 2020. The Strategy specifically identifies Light Rail to Woden as key objectives for increasing public transport use and reducing emissions in the ACT from private vehicle use.

Sustainability Strategy 2021-2025

The *Sustainability Strategy 2021-2025* sets out how the CRA aims to create a vibrant city and help deliver on the ACT's social and environmental goals (CRA, 2021a). Key to delivering the strategy is design-led urban renewal that is focused on social and environmental sustainability, to create spaces that foster social connectedness. The Project would support the following objectives of the strategy:

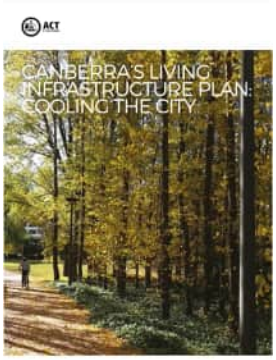
- **Climate positive development** by reducing reliance on private vehicles and therefore contributing to achieving the ACT Government's net zero goal by 2045
- **People-centred urban design and liveability** by providing a community feedback system to ensure the design, development and operation of the Project considers community needs
- **Inclusive, accessible places for all** by providing safe, affordable and convenient transport. The Project would include accessibility features, for example parking nearby stops, passenger ramps, handrails, and designated seating for those with mobility impairments
- **Highly efficient use of resources** by providing public transport that utilises the ACT's renewable energy
- **Active travel including public transport** by providing cycling and pedestrian infrastructure, such as additional cycling and pedestrian paths, bike spaces on board LRVs and integration with existing with pedestrian and cycleways.



Kings and Commonwealth Avenues Draft Design

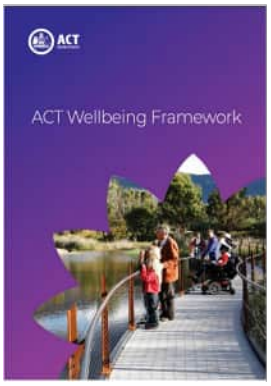
The *Kings and Commonwealth Avenues Draft Design* was developed to guide future development of the Kings and Commonwealth Avenues, to restore their status as key, memorable and functional boulevards and as integral components of Canberra's identity (NCA, 2017). Key principles highlighted in this strategy include a setting where pedestrians, cyclists and public transport are encouraged. The Project is included in the design of Commonwealth Avenue and plays an important role in accentuating its character and special quality. The design identifies that the light rail would play an essential part in improving the effective movement and connection along Commonwealth Avenue, and its role as a key traffic route, that is integrated with public transport systems.

Guiding policy documents



Canberra's Living Infrastructure Plan: Cooling the City 2019

Canberra's Living Infrastructure Plan: Cooling the City 2019 outlines the actions the ACT Government will take to design, construct and manage the City in a way to ensure a climate wise, prosperous and healthy city that incorporates nature in the built environment (EPSDD, 2019b). A key action under the Plan includes a living infrastructure target to "*achieve 30% tree canopy cover and 30% permeable surfaces in Canberra's urban footprint by 2045*" (EPSDD, 2019b). Based on the current landscaping strategy (**Section 3.43.4.2**), The Project would increase canopy cover within the delivery phase area from 14% to 31%.



ACT Wellbeing Framework

The *ACT Wellbeing Framework* identifies a range of factors which contribute to the wellbeing of Canberrans and the liveability of Canberra (Treasury and Economic Development, 2020). A key domain identified by the framework is 'access and connectivity'. The Project would support this domain, which is also closely linked to other identified domains, including access to health care services, access to educational facilities, employment opportunities, social interaction and access to community services, housing options, efficient transport options and green and low carbon transport options.

The Socioeconomic Impact Assessment prepared for the Project (refer **Appendix I (SEIA)**) provides further information and assessment within the context of this framework.

3.0 Project description

This Chapter provides a description of the Project, including land affected by the Project (**Section 3.1**), construction activities (**Section 3.2**), operation (**Section 3.3**), and the urban design vision for the Project (**Section 3.4**).

3.1 Land affected by the Project

Construction activities associated with Project would occur within a footprint referred to as the 'delivery phase area', shown on **Figure 3-1**. The operation of the Project would occur within a subset of the delivery phase area.

The delivery phase area includes both Designated Areas and Territory Land, with a summary of relevant locations provided in **Table 3-1**. This EA addresses the Project in its entirety to allow for consideration of the Project as a whole. Specific statutory requirements, and a breakdown of Block and Section details, for each land type are addressed in the planning reports for the Work Approval and Development Application, respectively.

Table 3-1 Project location

Designated Areas within which the works would be located
• Northbourne Avenue road reserve from Bunda Street to the intersection with London Circuit • London Circuit road reserve along the southern extending from the intersection with Northbourne Avenue to the intersection with Commonwealth Avenue • Edinburgh Avenue road reserve west of London Circuit to the intersection with Marcus Clarke Street, and east of London Circuit adjoining Section 63 City • Land comprising the Parkes Way and London Circuit cloverleafs, including Block 1 Section 119 City • Part of the Parkes Way road reserve eastbound, east of the Commonwealth Avenue bridge adjacent to the vehicle off-ramp to Commonwealth Avenue • Commonwealth Avenue road reserve to the east and southbound vehicle off-ramps at Parkes Way • Part Block Section 116 City, which is to accommodate Compound A • Blocks 2 and 3 Section 20 City, which is to accommodate Compound B • Part Block 24 Section 33 and Block 1 Section 95 Acton, which is to accommodate Compound C • Parkes Way bridge • Commonwealth Avenue between Parkes Way and Lake Burley Griffin.
Territory Land within which the works would be located
• Blocks 2 and 3 Section 20 City • London Circuit road reserve between Petrie Plaza and Northbourne Avenue • London Circuit road reserve between Northbourne Avenue and University Avenue • London Circuit road reserve between University Avenue and Edinburgh Avenue • Alinga Street road reserve • West Row road reserve • Hobart Place road reserve • Gordon Street road reserve • Farrell Place road reserve.

The location and statutory requirements for works on Designated Areas and Territory Land are further discussed in **Chapter 6.0 Statutory approvals context**.

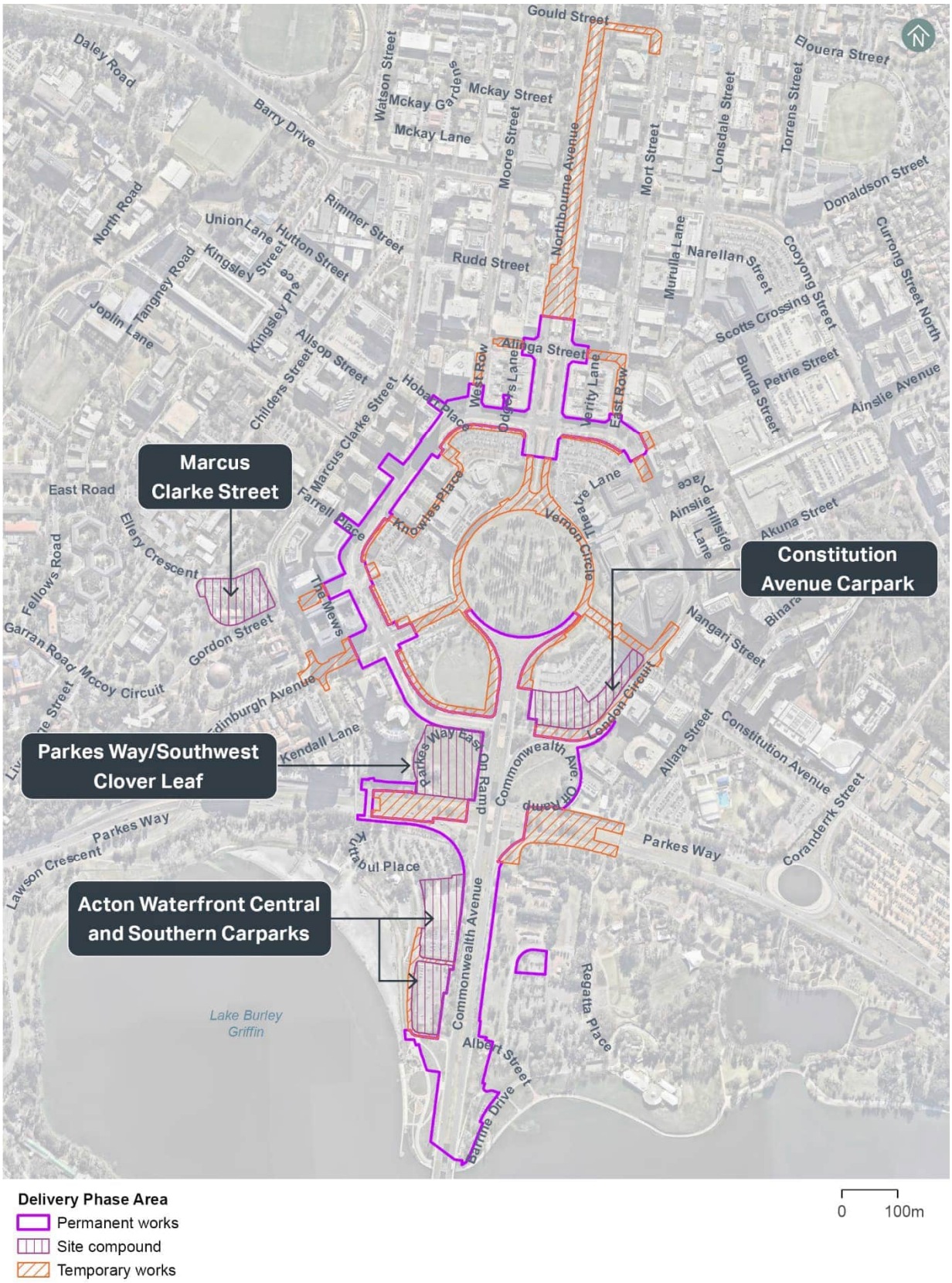


Figure 3-1 Delivery phase area

3.2 Construction

Construction of the Project is anticipated to commence in 2024, with completion planned in 2026. An indicative construction strategy has been developed for the Project, however the final construction methodology and staging would be selected by the delivery contractor.

The indicative construction strategy is described in the following sections in terms of construction zones (**Section 3.2.1**), activities (e.g., site establishment, track, road works and stop construction) (**Section 3.2.2**), and a high level construction program (**Section 3.2.3)**.

3.2.1 Construction zones

The construction of the Project has been split into 15 zones, summarised in **Table 3-2** and shown on **Figure 3-2**. Three zone types (block, intersection, or bridge) have been nominated, reflective of the indicative construction methodology in that zone. These types are described below:

- Block: These are construction areas between major intersections. Block closures would be used to close off entire sections of the road network, typically between blocks to allow the Project contractor full access to the worksite and the best opportunity to complete the Project most efficiently. Stops would be constructed upon the occupation of the block zone where it is located.
- Intersections: For works within major intersections, wherever possible the construction of the intersection would be carried out during normal working hours, within the confines of a protected worksite. Closures, where required, are expected to be carried out over several weekends (typically from Friday 10pm to Monday 6am) for a maximum of 56 hours at a time, except during construction of track slab where a continuous 80 hours (typically from Friday 10pm to Tuesday 6am or Thursday 10pm to Monday 6am) would be required to facilitate concrete curing and ensure adequate concrete strength is achieved prior to intersection reopening and eventual trafficking. The Commonwealth Avenue and London Circuit intersection would not require full closure, and would be subject to a contraflow arrangement for several weeks.
- Bridge: A new bridge would be built between the two road bridges on Commonwealth Avenue over Parkes Way. This is further described in **Section 3.2.2.7**.

A summary of works occurring within each construction zone is provided in **Table 3-4**. As shown on the program in **Section 3.2.3**, it is likely that construction would occur in multiple zones concurrently.

Table 3-2 Description of construction zones

Zone	Type	Description
1	Intersection	Northbourne Avenue and Alinga Street Intersection
2	Block	Northbourne Avenue (between Alinga Street and London Circuit)
3	Block	London Circuit (between Northbourne Avenue and Petrie Plaza)
4	Intersection	Northbourne Avenue and London Circuit Intersection
5	Block	London Circuit (between Northbourne Avenue and West Row)
6	Block	London Circuit (West Row to Knowles Place North)
7	Block	London Circuit (between Knowles Place North and Gordon Street)
8	Intersection	London Circuit and Gordon Street Intersection
9	Block	London Circuit (between Gordon Street and Edinburgh Avenue)
10	Intersection	London Circuit and Edinburgh Avenue Intersection
11	Block	London Circuit (between Edinburgh Avenue and Commonwealth Avenue)
12	Intersection	Commonwealth Avenue and London Circuit Intersection

Zone	Type	Description
13	Block	Commonwealth Avenue (between London Circuit and Parkes Way)
14	Bridge	Parkes Way bridge (including Parkes Way)
15	Block	Commonwealth Avenue (between Parkes Way and Lake Burley Griffin)

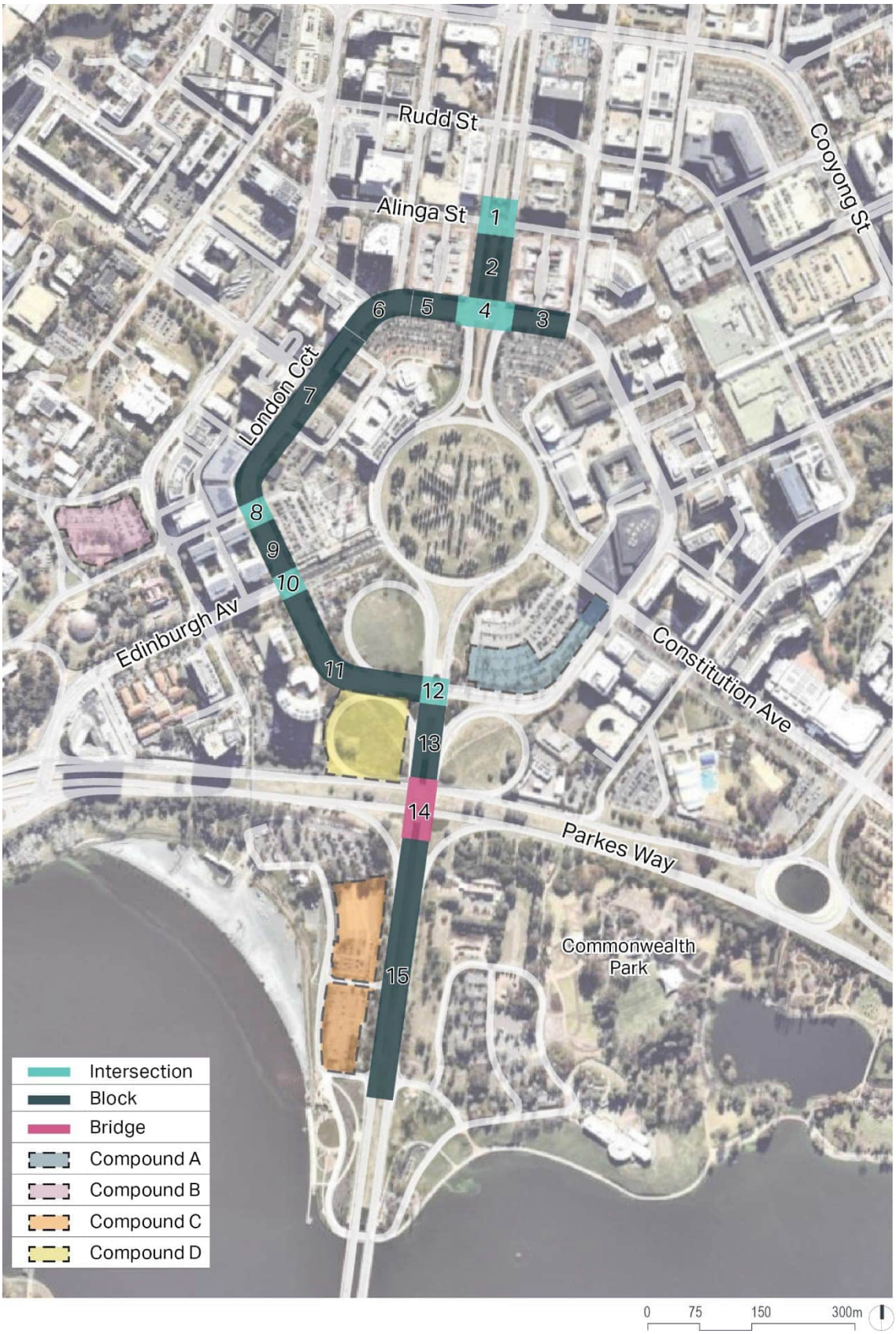


Figure 3-2 Works overview

3.2.2 Construction activities

Similar construction activities would occur within each zone, and the following sections describe each activity generally rather than by zone. While described separately, activities would occur concurrently within zones with the sequence determined by the delivery contractor. A summary of construction activities, and where they are described in this EA, is provided in **Table 3-3**. A summary of works occurring within each construction zone is provided in **Table 3-4**.

Table 3-3 Construction activities summary

Activity	Cross reference
Site compounds set-up	**Section 3.2.2.1**
Traffic management	**Section 3.2.2.2**
Utilities	**Section 3.2.2.3**
Stormwater drainage	**Section 3.2.2.4**
Track and combined services route (CSR)	**Section 3.2.2.5**
Stops	**Section 3.2.2.6**
Parkes Way bridge	**Section 3.2.2.7**
Pavement and kerbing	**Section 3.2.2.8**
Street lighting	**Section 3.2.2.9**
Traffic and LRV signals	**Section 3.2.2.10**
Signage and linework	**Section 3.2.2.11**
Landscape and hardscape	**Section 3.2.2.12**
Testing and commissioning.	**Section 3.2.2.13**

Table 3-4 Summary of scope of works

	Scope of works											
Zone no.	Traffic management	Utilities	Stormwater drainage	Track and CSR	Stops	Parkes Way bridge	Pavement and kerbing	Street lighting	Traffic and LRV signals	Signage and line work	Landscape and hardscape	Testing and commissioning
1	Yes	Yes	Yes	Yes			Yes	Yes	Yes	Yes	Yes	Yes
2	Yes	Yes	Yes	Yes			Yes	Yes		Yes	Yes	Yes
3	Yes	Yes	Yes	Yes			Yes	Yes		Yes	Yes	Yes
4	Yes	Yes	Yes	Yes			Yes	Yes	Yes	Yes	Yes	Yes
5	Yes	Yes	Yes	Yes			Yes	Yes		Yes	Yes	Yes
6	Yes	Yes	Yes	Yes			Yes	Yes	Yes	Yes	Yes	Yes
7	Yes	Yes	Yes	Yes			Yes	Yes	Yes	Yes	Yes	Yes
8	Yes	Yes	Yes	Yes			Yes	Yes	Yes	Yes	Yes	Yes
9	Yes	Yes	Yes	Yes	Yes		Yes	Yes		Yes	Yes	Yes
10	Yes	Yes	Yes	Yes			Yes	Yes	Yes	Yes	Yes	Yes
11	Yes	Yes		Yes			Yes			Yes	Yes	Yes
12	Yes	Yes	Yes	Yes			Yes	Yes	Yes	Yes	Yes	Yes
13	Yes	Yes	Yes	Yes	Yes		Yes	Yes		Yes	Yes	Yes
14	Yes	Yes	Yes	Yes		Yes	Yes	Yes		Yes	Yes	Yes
15	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes

3.2.2.1 Site compound set-up

Four major compound sites are proposed and would be in place for the duration of construction. Three of these compounds have been occupied for the construction of the Raising London Circuit (RLC) project, and it is proposed that they would be repurposed and would continue to be used as construction compound sites for the Project. The location of proposed construction compound sites are listed below and shown on **Figure 3-1**:

- Site Compound A – Constitution Avenue Carpark, RLC compound, occupying part of the carpark currently in City Block 1, Section 116
- Site Compound B – Marcus Clarke Street Carpark, RLC compound, occupying the carpark currently in City Block 2 and City Block 3, Section 20
- Site Compound C – Acton Waterfront Central and Southern Carparks
    - RLC compound, occupying the carpark currently in Acton Block 24 Section 33
    - New compound, occupying the carpark currently in Acton Block 1 Section 95
- Site Compound D – Parkes Way/Southwest cloverleaf, new compound, occupying the former southwest cloverleaf removed during the RLC project.

The major compounds would be connected to the electricity, telecommunications, water, and sewer networks, and would cater for the following:

- Office and meeting rooms for the site teams
- Storage of site vehicles, delivery trucks, shuttle buses and plant
- Shipping containers that would be used for storage units
- Ablution blocks
- Separate skips to allow segregation of waste
- Covered areas for shade and weather protection at all crib areas
- Outdoor site lighting on walkways and carparks
- Environmental controls to manage erosion and sedimentation
- Storage of bulk material
- Harvesting of rainwater for site use
- Onsite storage of gas cylinders, lubricants, weld equipment and fuel.

Several shorter-term construction compounds, stockpile sites and laydown areas would also be required as part of the Project within the delivery phase area. Along the alignment, there are sections where the median is wide enough to accommodate some minor site facilities and storage. These areas would be required to store equipment and small quantities of spoil and materials for day-to-day use and meals and toilet facilities for construction personnel. These would be established for shorter periods typically up to six months while the major construction works progress, and would be subject to site management and environmental controls. These minor compounds would be required where the access to a major compound is limited.

Upon completion of the works all established site compounds would be cleared of temporary site infrastructure, materials, and equipment and would be reinstated to their original states prior to handing back to the respective landowners.

3.2.2.2 Traffic management and mitigation measures

Traffic management procedures would be required for the duration of construction. Traffic management arrangements would include full and partial road closures and would introduce necessary traffic detours to direct the travelling public around work sites and construction access and egress points. Notification of these closures would be advertised in advance and sufficient time to deliver written notice would be required for the local businesses and residents. All temporary traffic management arrangements and

diversionary routes would be agreed and approved by TCCS (RoadsACT) and the NCA as part of a separate Works Approval (where required) prior to implementation.

The following lane closures and speed restrictions would be required to minimise road safety risks associated with construction (increased risk of collision with a heavy vehicle):

- Full road closure of blocks along London Circuit to minimise the interaction between road users and the active construction site and internal heavy vehicle activity
- Barriers to be provided between Commonwealth Avenue traffic lanes and Parkes Way traffic lanes and the adjacent work sites
- 40 km/h road works speed zone to be posted on Commonwealth Avenue between Vernon Circle and Parkes Way for the duration of the works
- All other works take place in 40 km/h traffic environment.

The alignment and stop works along London Circuit would occur using block closures. During each block closure, the full London Circuit carriageway would be closed to traffic. However, emergency vehicles, rubbish collection vehicles and some delivery vehicles that require access to the respective blocks would be permitted, using vehicle escorts under coordination by the Project contractor. A minimum of two traffic lanes, in each direction, would be maintained at all times, while alignment and stop works occur on Commonwealth Avenue and Northbourne Avenue.

Wherever possible, construction works at major intersections would be carried out during normal working hours, within the confines of a protected worksite. Traffic management would be in place to safely manage vehicles, pedestrians and cyclists around the worksites, while maintaining access.

Approved temporary signage would be erected to safely direct traffic around the localised minor worksites in the most efficient and effective manner. Accredited traffic controllers would be onsite to manage localised site traffic movement that requires temporary traffic control to complete site operations.

During the delivery phase of the Project, other foreseeable changes associated with traffic management would include:

- Minor closures of cycling and pedestrian paths and associated detours
- Modifications to bus routes and relocation of stops
- Temporary impacts to the currently operational existing light rail operations between Gungahlin and the City
- Travelling LRVs during testing, commissioning and drivers' training.

Potential impacts associated traffic management are discussed in **Chapter 9.0 Traffic and transport**.

3.2.2.3 Utilities

There are existing utilities within the delivery phase area which are affected to various degrees by the Project, including along London Circuit and Commonwealth Avenue to the southern abutment of Commonwealth Avenue, within Commonwealth Park

Depending on the nature of each utility, its location and extent of impact during construction, and the outcomes of consultation with the relevant utility provider, each utility may be subject to:

- Do nothing (subject to assessments)
- Temporary protection during construction
- Permanent protection
- Relocation
- Provision of spare conduits or sleeving.

Most protection, decommissioning and removal of utilities would be completed early in the Project construction period, but may also be staged during the construction period depending on construction planning requirements.

In addition to activities required to relocate or protect existing utilities, the Project includes the provision of new utilities, such as electricity supply to LRVs and lighting. These are described in subsequent sections.

The presence of an existing Icon water main within the inner verge of London Circuit, generally between University Avenue and Edinburgh Avenue, has been identified. While the Project does not propose the replacement of this water main, consideration has been given to the consequences of replacing this asset in the future, given the space constraints of the London Circuit corridor, and the implications of a nearby operating Light Rail system. If this asset was to be replaced in its current location in the future (following completion of the Project), it is likely that extended impacts to Light Rail operations, residents and the road network would be experienced throughout the duration of construction activities to replace this asset. A review has been completed of an alternative alignment for a future replacement of the watermain along the Marcus Clarke St corridor, concluding that such an alignment would potentially offer benefits to the alternative of replacing the water main on London Circuit; including, limited if any impacts to future light rail operations, retention of existing important street trees along the London Circuit verge, and a less constrained arrangement compared to London Circuit which would afford greater compliance with Icon Water asset standards.

3.2.2.4 Stormwater drainage

Stormwater drainage would be installed within every construction zone, except zone 11 as this would have been completed as part of the RLC project. Stormwater drainage construction would be inclusive of drainage pipes and culverts installation. Existing services would be identified and located, and appropriate protection measures would be put in place. Affected existing pavement would be saw cut before installing stormwater drainage pipes, gullies, subsoil drains and precast drainage pits. This is inclusive of excavation, bedding, pipe laying and compaction. Backfilling, compaction and testing around drainage pits would then occur.

3.2.2.5 Track and combined services route

A track is a permanent form of rail infrastructure that provides a surface for rail vehicles to move. For this Project, the track is non-ballasted, meaning that the bed of the track is concrete and asphalt, rather than a traditional combination of sleepers and ballasts. A CSR would be installed typically located between or offset to the proposed tracks. The CSR contains provides a common cable containment system that houses communications, signalling and power cabling.

The construction of the track includes earthworks, installation of track drainage and CSR, welding and bonding of rail, pouring of concrete, and surface finishes such as cobbles, concrete, asphalt and grass.

3.2.2.6 Stops

The construction scope and sequence for the stops would include, but is not limited to:

- Demolition of existing pavement and median within the stop platform/s footprint
- Earthworks including excavation, as required
- Stormwater drainage and services installation (electrical, communications, water, CCTV, lighting)
- Platform construction
- Installation of footing, platform and ramps
- Roof and canopy installation
- Furniture installation and other finishes, such as benches, bins, bollards, bubblers, signs and handrails.

3.2.2.7 Parkes Way bridge

A new bridge would be built between the two road bridges on Commonwealth Avenue over Parkes Way (zone 14) in a north-south orientation. In appearance, the gap would be infilled to create a single surface. The new rail bridge would be supported on eight concrete piles (four piles for each bridge abutment) and concrete-walled abutments. A dedicated bridge crew is expected to deliver Parkes Way bridge. The general construction methodology of the Parkes Way bridge would be as follows:

- Implementation of approved temporary traffic management measures, including construction of temporary roads
- Removal of trees to facilitate temporary roads and establishment of a crane pad in the Parkes Way median
- Temporary removal of street lighting within the Parkes Way median
- Piling works to install eight piles (four piles for each bridge abutment). It is likely a bore piling methodology would be used
- Structural works, including the installation of pile caps, footings, abutment walls and piers
- Earthworks, including the demolition of the top 2.5 m of existing abutment walls and backfilling
- Installation of steel box girders using a crane
- Installation of deck and track slab, including deck slab reinforcement, CSR conduits, irrigation mains, the light rail alignment, green track and trench drains.

The existing Parkes Way lane configuration is three lanes eastbound (two through and one off ramp) and two lanes westbound. The construction of the new bridge would require the temporary closure of lanes on Parkes Way particularly during pile works. The construction of temporary roads, likely within the Parkes Way median, would allow for the continued movement of traffic during bridge construction activities. The exact configuration and location of temporary roads would be determined by the construction contractor, however **Table 3-5** provides the minimum conditions to be implemented in accordance with Roads ACT requirements.

Table 3-5 Minimum Parkes Way lane configuration requirements during construction

Timing	Minimum lane requirements
AM peak periods	• Maintain two lanes eastbound (one through and one off ramp) • Maintain one lane westbound.
PM peak periods	• Maintain two lanes eastbound (one through and one off ramp) • Maintain two lanes westbound.
Off-peak periods	• Maintain two lanes eastbound (one through and one off ramp) • Maintain one lane westbound.
Weekends (subject to review by Roads ACT pending special events)	• Maintain two lanes eastbound (one through and one off ramp) • Maintain one lane westbound • Full closures may occur, subject to approval, on nights and weekends to allow the construction of the bridge superstructure (including girders installation, deck concreting, and other associated works such has temporary edge protection and handrails installation)
Bridge deck installation	• Contraflow arrangements subject to Roads ACT approval.

The construction methodology and traffic arrangements for Parkes Way bridge is general only. The exact construction methodology and construction of temporary roads would be selected by the contractor in line with the Roads ACT and NCA requirements.

3.2.2.8 Pavement and kerbing

Pavement and kerbing works would occur within every construction zone. Pavement and construction works would involve the demolition of existing pavement, kerb and gutter. Excavation and boxing-out would then occur to the required formation level and spoil disposed. Unsuitable subgrade material would be removed if required. Concrete kerbs and gutters would then be installed. The asphalt base would be laid and compacted.

On sections where only pavement re-sheeting is required, construction activities would include milling existing asphalt pavement using a milling machine, then laying and compacting asphalt.

3.2.2.9 Street lighting

Street lighting works would occur within every construction zone, except zone 11 as this would have been completed as part of the RLC project. Street lighting works include installing required electrical conduits, and then drilling pile holes for street lighting foundations. Once the piles are drilled, steel pile cages embedded with electrical conduits would be installed, followed by a concrete pour on pile foundations for stability. Street lighting poles would then be prepared and erected. This would be followed by the installation of street lighting cabinets and street lighting cables within the already installed electrical conduits.

3.2.2.10 Traffic and light rail vehicle signals

Traffic and LRV signals would be installed within select construction zones where required as shown in **Table 3-4**. The required traffic and LRV signal conduits and pits would be installed and pile holes drilled for traffic and LRV signal foundations. Pile cages with embedded electrical conduits would be installed and concrete poured on pile foundations for stability. Traffic and LRV signals would be prepared and erected. The integrated traffic and LRV signal cabinets would then be installed, followed by the installation of traffic and LRV cables in the already installed conduits.

3.2.2.11 Signage and linework

To erect signage throughout the delivery phase area, first holes would be drilled, followed by the erection of signage poles and pouring of concrete for stability. Linework would occur through surveys and placement of thermoplastic and/or waterborne wayfinding and messaging line markings.

3.2.2.12 Landscape and hardscape

Landscape and hardscape would be installed within each construction zone. For plantings, holes would be drilled before securely setting large plantings and trees in place. Topsoil would then be laid, spread and compacted. Landscaping would be regularly sprayed with water for establishment and maintenance.

Hardscape elements to be installed include footpaths, shared paths, pedestrian ramps, retaining walls and benches. For hardscaping, demolition would first occur to remove unsuitable hardscape features. Excavation would occur, followed by installation of formwork, utility pits and footing infrastructure (if required) and concrete pouring for all hardscape elements.

3.2.2.13 Testing and commissioning

Testing and commissioning involves trial running of light rail infrastructure, including LRV movement, driver familiarisation, and the integration of the new power and signalling systems with the existing systems. Testing and commissioning of stops also includes lighting, help points, passenger information displays, ticket vending machines and validation scanners, CCTV, public address, precise clock, and audio frequency induction loops.

Successful completion of the testing and commissioning programme would allow the Project Contractor to obtain accreditation from the Office of the National Rail Safety Regulator (ONRSR). There would likely be a temporary charging facility required in Northbourne Place to keep Light Rail Gungahlin to City operational white testing and commissioning occurs. Once complete, the system would be ready to be handed over for operation.

3.2.3 Construction program and timing

Construction of the Project is anticipated to commence in 2024, with works being carried out in blocks to minimise disruption to residents, businesses and existing transport operations in the local vicinity. Works within a construction zone are likely to occur concurrently with other block closure works.

Main construction works are being planned for completion in 2026. However, the duration of the construction would be dependent on the final construction methodology and staging selected by the delivery contractor, as well as any efficiencies identified during the program.

Testing and commissioning would commence in the latter stages of construction and continue for a period of up to nine months following the conclusion of main works. Details of testing and commission are provided in **Section 3.2.2.13**.

Construction works have been separated into construction zones, as discussed in **Section 3.2.1**. The general timing of construction works to be carried out within each zone is summarised in **Figure 3-3**.

Zone no.	Works location	Construction type	Indicative construction program								
			2024	2025				2026			
			Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
11	London Circuit between Edinburgh Avenue and Commonwealth Avenue	Block									
2	Northbourne Avenue between Alinga Street and London Circuit	Block									
9	London Circuit between Gordon Street and Edinburgh Avenue	Block									
7	London Circuit between Knowles Place North and Gordon Street	Block									
14	Parkes Way Bridge	Bridge									
12	Commonwealth Avenue and London Circuit intersection	Intersection									
10	London Circuit and Edinburgh Avenue intersection	Intersection									
1	Northbourne Avenue and Alinga Street intersection	Intersection									
4	Northbourne Avenue and London Circuit intersection	Intersection									
8	London Circuit and Gordon Street intersection	Intersection									
6	London Circuit between West Row and Knowles Place North	Block									
13	Commonwealth Avenue between London Circuit and Parkes Way Bridge	Block									
15	Commonwealth Avenue between Parkes Way Bridge and Albert Street	Block									
5	London Circuit between Northbourne Avenue and West Row	Block									
3	London Circuit between Petrie Plaza and Northbourne Avenue	Block									

Figure 3-3 Indicative construction program

3.3 Operation

The operational alignment for the Project is shown on **Figure 1-1.** The following sections describe the operational Project, including operating hours, stops, track, LRVs, changes to the road network and active transport infrastructure, and maintenance activities.

3.3.1 Light rail track

Two tracks would be installed from the current Alinga Street southern terminus, southbound on the western side of London Circuit, continuing onto Commonwealth Avenue, before ceasing at a new southern terminus at Commonwealth Park. One track would operate northbound and the other southbound. A scissor crossover would be installed on Commonwealth Avenue to allow LRVs to change direction.

The rail corridor would be separated from the traffic lanes either by being raised or using physical measures such as kerbs, signalised intersections, landscaping or visual markers at intersections. This would reduce the ability for people to cross the road and track outside of designated crossing points.

A wire free track would be provided for the Project alignment with LRVs operating using onboard battery power supply between the current Alinga Street southern terminus and the new southern terminus at Commonwealth Park.

Green track is a feature which includes grass and/or vegetation between and along tracks. Locations of proposed green tracks is shown on **Figure 1-1**. Green track would be located on:

- Northbourne Place, between Alinga Street and London Circuit
- London Circuit, between Northbourne Avenue and West Row
- Commonwealth Avenue, between London Circuit and Albert Street.

Non-potable water would be used for the irrigation of the Commonwealth Avenue green track. The preferred source of water for this irrigation would be via a groundwater bore, nominally located in the Parkes Way road reserve south of Block 8 Section 8, City. The construction of the groundwater bore and associated infrastructure, including a holding tank, would be the subject of a separate Works Approval. Investigations into the sustainability of the yield from a groundwater bore are ongoing, however it is anticipated that approximately 100 kL/week of water would be required to meet the irrigation needs of the green track.

3.3.2 Light rail stops

Three stops would be located at key points along the alignment to provide access to the light rail where there is expected to be high demand. These are shown on **Figure 1-1** and comprise the following:

- Edinburgh Avenue Stop – located at London Circuit between Gordon Street and Edinburgh Avenue. The stop would be a side platform arrangement. A side platform is positioned to one side of a track. This stop would be accessed by signalised crossings
- City South Stop – located at Commonwealth Avenue, north of Parkes Way. This stop would comprise an island platform stop with a single central platform between the tracks. This stop would be accessed from a signalised crossing on Commonwealth Avenue
- Commonwealth Park Stop – located at Commonwealth Avenue, near Albert Street, Commonwealth Park. The stop would be an island platform. It would temporarily operate as a terminus when the Project is operational and prior to Light Rail to Woden. It is configured to allow extension of the network to the south as part of Stage 2B Commonwealth Park to Woden. This stop would be accessed from a signalised crossing on Commonwealth Avenue

All stops have been designed to meet *AS 1428 DDA and Disability Standards Accessible Public Transport* (DSAPT) requirements and would be fitted with infrastructure to ensure accessibility, including:

- Accessible supporting infrastructure, such as passenger ramps handrails and grab rails
- Facilities such as seating, drinking fountains and ticket machines.

3.3.3 Light rail vehicles

A minimum of five LRVs would be required for the expansion of the light rail network. These LRVs and modifications to the stabling yard at the Mitchell Depot would be complete prior to the operation of this Project. The new LRVs would be similar in appearance, size and performance to those that operate on the current the light rail network from City to Gungahlin, and each would have:

- A carrying capacity of 200 passengers
- Level boarding, priority seating and designated areas for those with impaired mobility, wheelchairs and prams
- Onboard spaces for four bicycles
- Wi-Fi
- A public address system for announcements.

The additional LRVs would be fitted with battery technology to allow wire-free operation. Current LRVs would be retrofitted with battery technology to also ensure wire-free operation. Battery storage capacity for additional and existing LRVs has been proposed to minimise visual impact in landscape and visual sensitive zones, such as Commonwealth Avenue. This would be charged from the overhead wires on the Gungahlin to City alignment and supplemented through the use of regenerative braking along the

alignment. Regenerative braking is where a motor acts as a generator during deceleration, and kinetic energy is stored to replenish the power supply.

The LRVs would be stabled and maintained at the existing depot at Mitchell.

3.3.4 Changes to the road network

Since the operational Project would run along Northbourne Avenue, London Circuit and Commonwealth Avenue, changes to the existing lane configurations of these roads would be required within the delivery phase area. Proposed changes to lanes and intersection configurations are shown on **Figure 3-4** to **Figure 3-6**.

The light rail network extension would run within a median between opposing vehicular traffic flows for the entire length of the Project. The median would be between 80-150 mm high between intersections to minimise the possibility of road vehicles straying into the light rail corridor. The median height would transition to be at grade just before each signalised intersection. This would allow vehicular and pedestrian movement across the light rail track within the intersection.

3.3.5 Active transport infrastructure

The Project would provide active transport infrastructure, including dedicated and separate pedestrian paths, 2.15 km of off street grade separated cycleways and 830 m of shared on street cycleways. Active transport infrastructure that is proposed to be provided as part of the Project and its connection with existing networks is shown on **Figure 3-4** to **Figure 3-6**, and includes:

- Two new cyclist protection islands at the Northbourne Avenue/London Circuit, Commonwealth Avenue/London Circuit
- Continuous footpath access across Hobart Place.

At each of the stops a number of cycle racks would be provided, including:

- Edinburgh Avenue stop - at least 40 bicycles. It is anticipated that these bike racks would be used by customers accessing the light rail as well as the wider community, who would benefit from bike parking being provided along London Circuit
- City South stop – at least 12 bicycles
- Commonwealth Park stop – at least 12 bicycles.

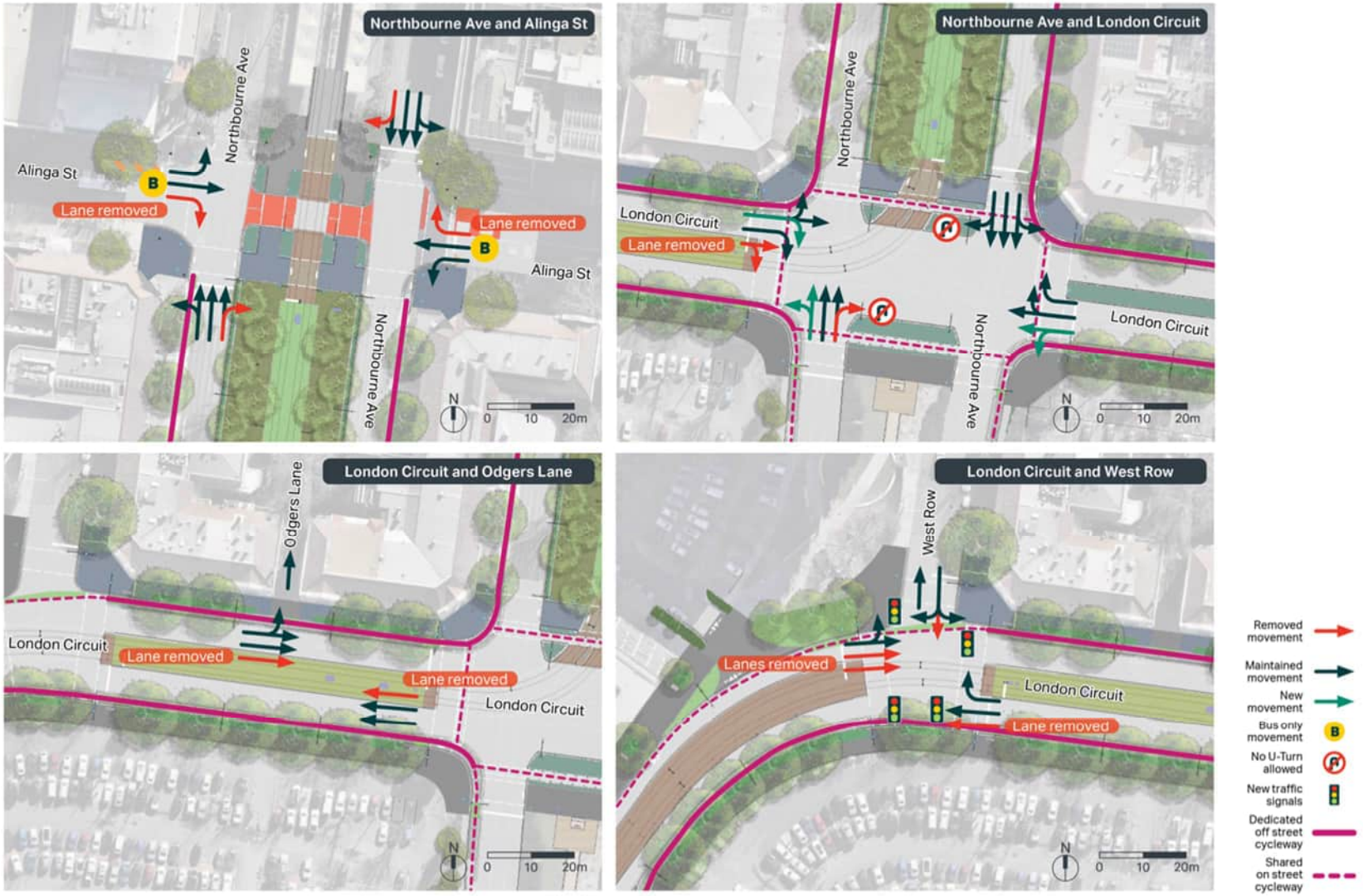


Figure 3-4 Proposed changes to lanes and intersection configurations -Northbourne Avenue to West Row

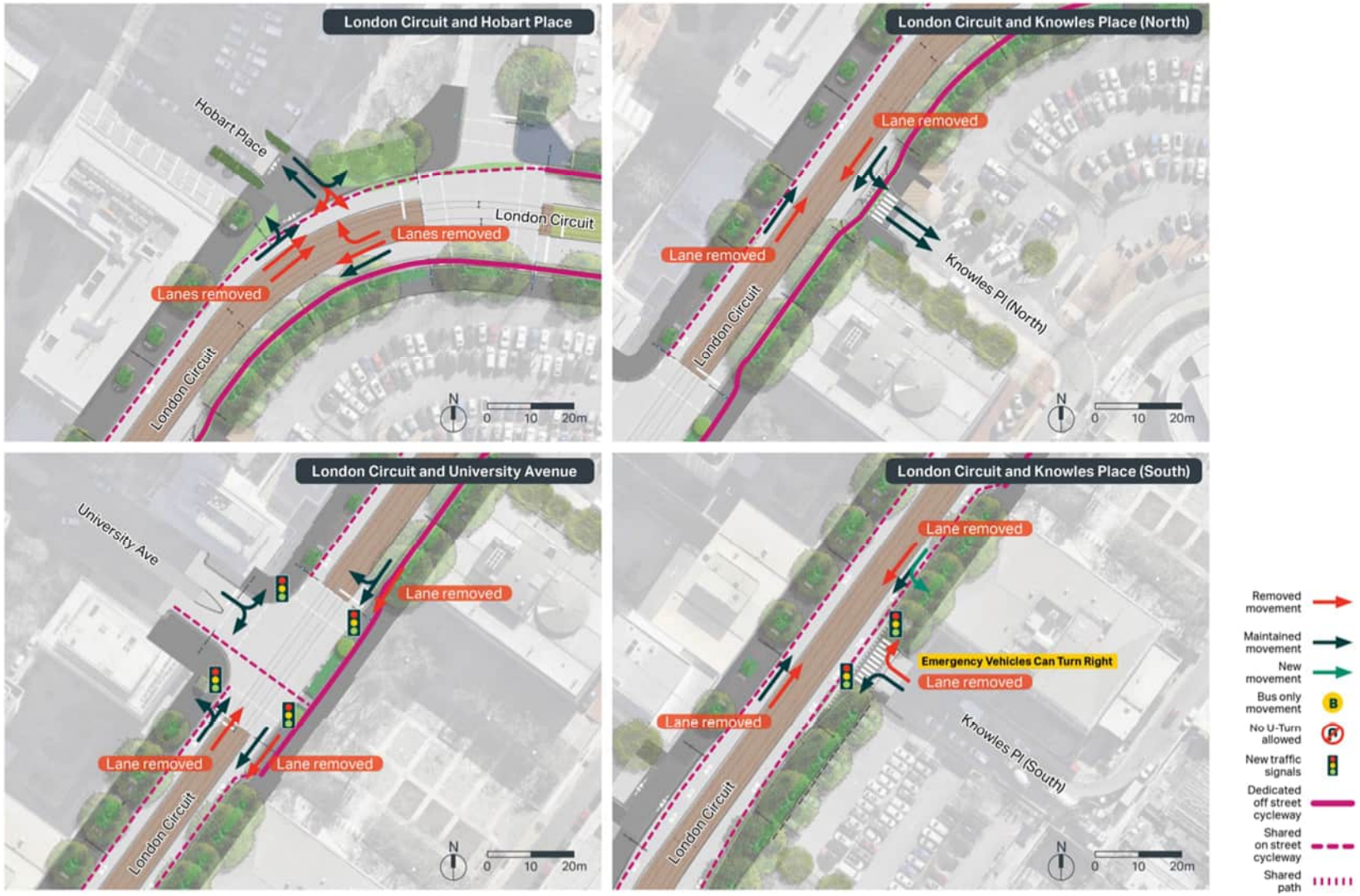


Figure 3-5 Proposed changes to lanes and intersection configurations -Hobart Place to Knowles Place

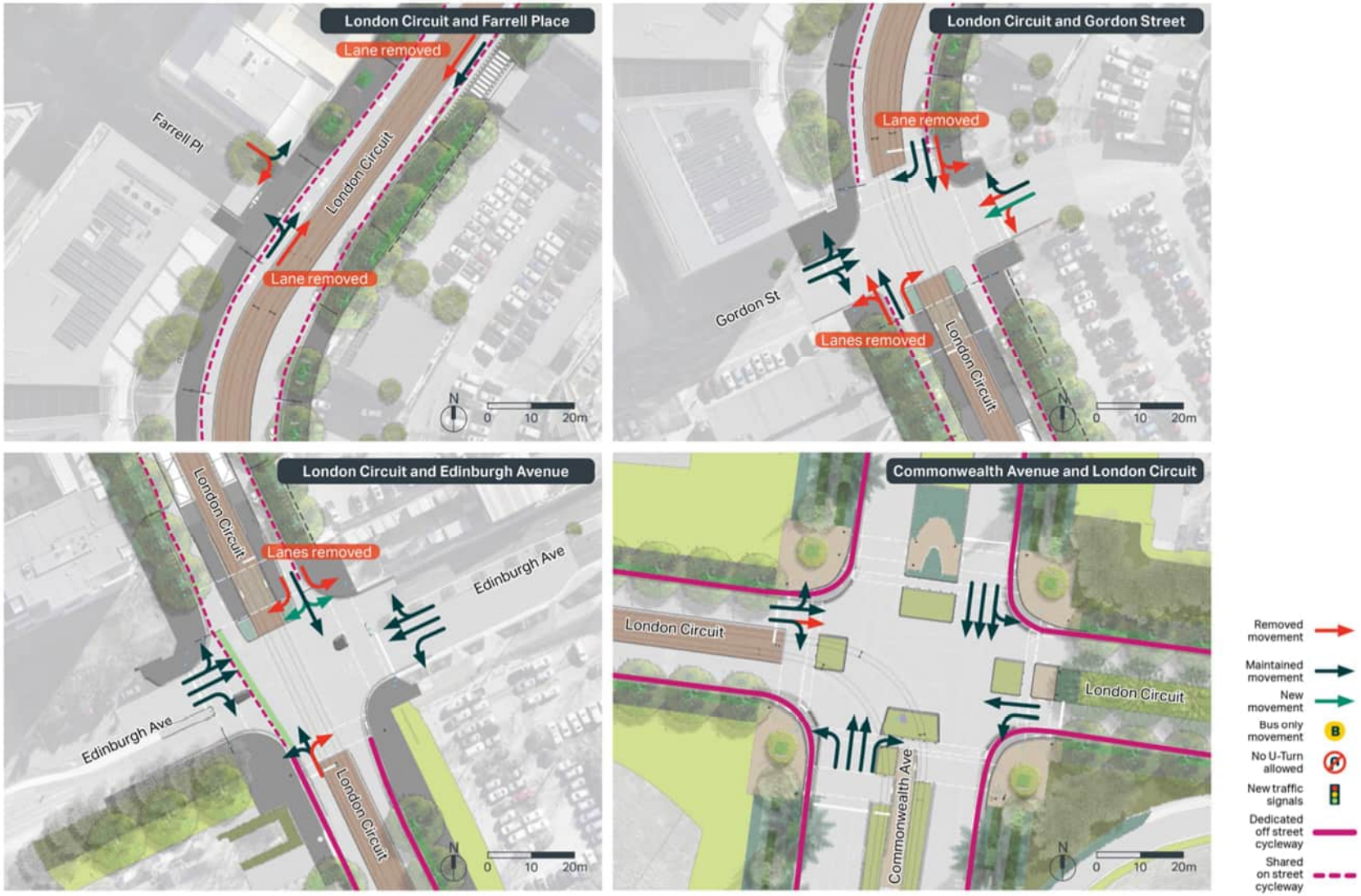


Figure 3-6 Proposed changes to lanes and intersection configurations – Farrell Place to Commonwealth Avenue

3.3.6 Operating hours and scheduling

The Project would be an extension of the Gungahlin to City service and would therefore have the same level of service (LoS) (frequency). the light rail operations are expected to achieve a frequency of at least 10 minutes on weekdays between the core hours of 7am and 6pm with up to every five minute frequencies in peak periods. Outside these hours on weekdays and all day on Saturdays, Sundays and public holidays, the frequency is anticipated to be at least every 15 minutes. It would take around nine minutes to travel between Alinga Street and Commonwealth Park.

3.3.7 Maintenance

The existing the light rail depot in Mitchell would be used to stable and maintain LRVs and operate as a base for the maintenance of the existing and proposed the light rail network. Minor works would be undertaken at the Mitchell depot to ensure that it is appropriate for stabling and maintaining the additional five LRVs that would be introduced into the network. Works to be undertaken at the Mitchell depot, being geographically separated from this Project, would be considered as part of a separate Development Application.

Maintenance activities would include maintenance of:

- LRVs
- Depot
- Track, communications, signalling, stops and associated infrastructure
- Substation equipment
- Landscaping
- Stop and vehicle cleaning.

3.4 Urban Design vision

The extension of the light rail from Alinga Street through to Commonwealth Park is a city shaping initiative across the whole of government that would assist in delivering the key strategic planning aspirations for the ACT Government and the NCA.

The 1.7 km extension and three new stops would greatly enhance the connection between the City and Lake Burley Griffin and realise the aspirations of the Griffin Legacy. The Project can be described in terms of three key precincts or places, each having a unique character and urban design aspiration. The urban design vision is summarised in **Table 3-6**, and character elements are shown on **Figure 3-7**.

Table 3-6 Urban design vision

Key precinct or place	Urban design vision
Northbourne Place	Enhancing the heritage setting of the space between the Melbourne and Sydney Buildings. Northbourne Place would provide a high amenity landscape design, that is beautiful, sustainable, resilient and engaging.
London Circuit	London Circuit would be a highly activated mixed use high street, tree lined with generous pedestrian verges and space for cyclists all focused on the stop between Edinburgh Avenue and Gordon Street.
Commonwealth Avenue	Commonwealth Avenue would be a place for people, a place that is both grand and intimate all at once. Flanked by rows of stately trees, serviced by a world class the light rail network and activated by vibrant new developments.

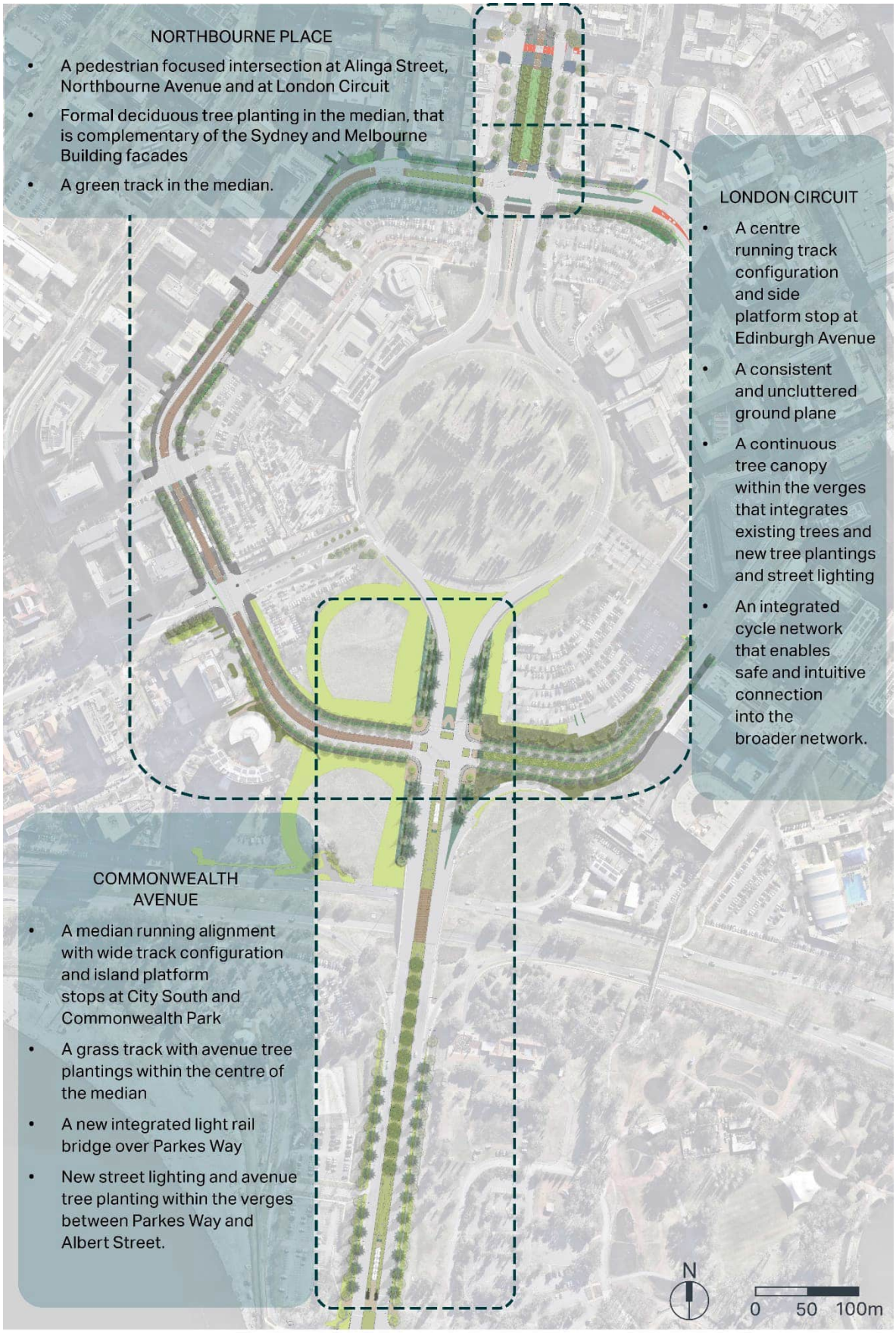


Figure 3-7 Urban design vision character elements

3.4.1 Gender sensitive urban design

Gender sensitive urban design (GSUD) is an emerging discipline which has further progressed many of the themes found in crime prevention through environmental design (CPTED). GSUD seeks to empower the participation of women, girls and gender diverse people in the utilisation of public spaces, including public transport spaces. These groups, especially individuals who have intersectional experiences of vulnerability such as being younger or older or culturally diverse, disproportionately experience violence in public spaces. As a result, they disproportionately feel unsafe in public spaces, particularly at night. Despite this, public spaces are not traditionally designed with these peoples' experiences in mind.

GSUD looks at how public spaces can be designed and planned to address the real risks experienced by women, girls and gender diverse people. It also addresses the increased fear and anxiety associated with these experiences which can influence an individual's use of a space, even resulting in them not using a space at all.

The Project has undertaken a mainstreaming process for gender sensitivity in the design. This included a review of the design regarding key elements of GSUD within the context of public transport, including:

- Footpath design
- Visibility
- Creating safe spaces to wait
- Lighting
- Continuing journeys
- Access.

This review allowed the Project to identify where it does well, such as in the high-quality urban realm associated with stop environments, as well as plan for how future design development can further improve outcomes from a gender sensitivity lens. Incorporating gender sensitivity into wider design thinking is an important equity outcome for the Project which would strengthen the potential to realise positive benefits of the Project and reinforce the right to the city for women, girls and gender diverse people.

3.4.2 Landscape strategy

A Landscape Strategy was developed for the Project to provide details of the hard and soft landscaping elements that would be included in the Project. Key objectives of the Strategy include:

- Targeting a tree canopy coverage of 30% within the delivery phase area
    - Retaining as many existing trees as possible and building upon the established street tree framework
    - Preliminary calculations show that the Project would increase canopy cover within the delivery phase area from approximately 14% to 31%
- Creating an attractive, and durable landscape to enhance the existing, rich diversity of the natural ACT environs
- Ensuring consistency and coordination with other hardscape features, such as street furniture and the street lighting layout.

A draft Tree Succession Plan for Commonwealth Avenue has been developed for the Project with reference to the Commonwealth Avenue Landscape Masterplan. The Weston plantings along Commonwealth Avenue are now 100 years old and many are in poor condition. The Succession Plan establishes a stepped approach to an incremental development of the heritage tree framework for Commonwealth Avenue. It could be adopted to guide succession plantings regardless of the light rail program.

In general, planting throughout the delivery phase area will be tailored to suit local soil-types, microclimate and development environment as appropriate. An overview of the indicative landscape strategy for the Project is shown on **Figure 3-8** and summarised in **Table 3-7**.

Table 3-7 Landscape strategy in key precincts or place

Key precinct or place	Landscape strategy
Northbourne Avenue	Between the Sydney and Melbourne Buildings, the existing raised median would be redeveloped to include green track flanked by landscaped areas and two narrow pedestrian footpaths. A double avenue of *Zelcovas* would be installed.
London Circuit	The upgrade of the London Circuit road corridor, particularly the rationalisation of street trees, would unify the road, providing an almost continuous ring of Plane Trees (*Platanus x acerifolius*) along its entirety. This would tie into the street trees already added to London Circuit due to the RLC project. An increase in tree canopy is an identified action in Canberra's Living Infrastructure Plan (EPSDD, 2019b) amongst other policy documents.
Commonwealth Avenue	The existing turf median would be replaced with green track, with two light rail stops positioned centrally within the median. Trees would be planted between tracks travelling in either direction.

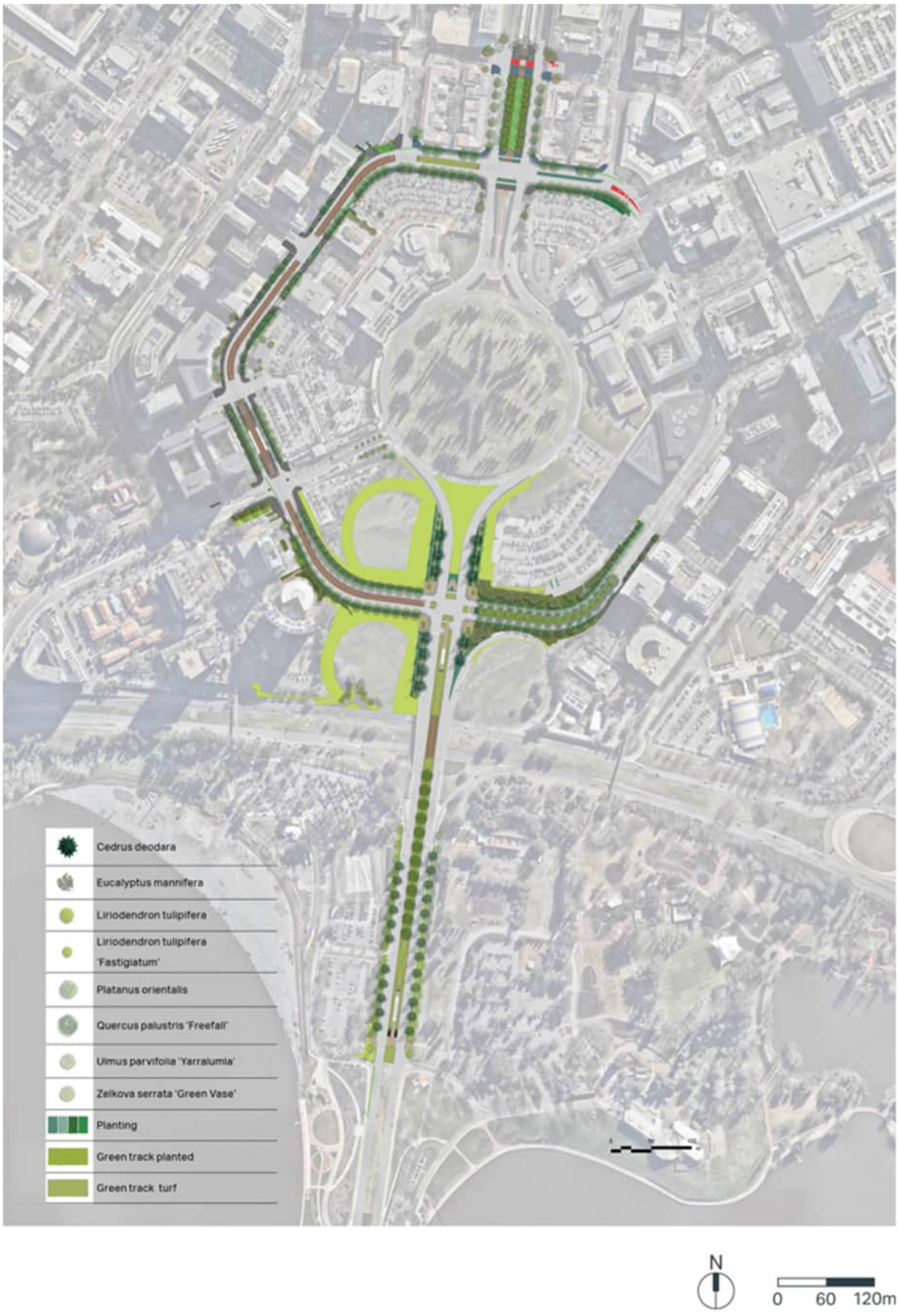


Figure 3-8 Indicative landscape strategy

4.0 Sustainability, resilience, climate change and greenhouse gas emissions

This Chapter outlines how the strategic directions taken to align with ecologically sustainable development (ESD) (**Section 4.1.1**), the commitments made to various sustainability principles and frameworks (**Section 4.1.2**), how the Project responds to climate change (**Section 4.1.3**) and reductions and risks associated with greenhouse gas emissions (**Section 4.1.4**).

4.1 Ecologically sustainable development

The United Nations Brundtland Commission has defined sustainability as "*meeting the needs of the present without compromising the ability of future generations to meet their own needs*"[3]. In turn, ESD comprises development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends.

As discussed in detail in **Chapter 6.0 Statutory approvals context**, the Project would be subject to a Development Application and a Works Approval. The Development Application would be assessed by the EPSDD under the PD Act. The PD Act defines sustainable development as:

> The effective integration of social, economic and environmental considerations in decision-making processes, achievable through implementation of the following principles:
>
> (a) the precautionary principle;
>
> (b) the inter-generational equity principle;
>
> (c) conservation of biological diversity and ecological integrity;
>
> (d) appropriate valuation and pricing of environmental resources.[4]

The Works Approval would be assessed by the NCA under the PALM Act and the associated provisions of the NCP. Under the NCP, sustainability includes considerations of:

- Ensure the development of a city that both respects environmental values and reflects national concerns with the sustainability of Australia's urban areas
- Protect the nationally significant open-space network, visual backdrop and landscape setting of the National Capital.

The PALM Act does not specify design or assessment requirements relevant to ESD principles.

The Project has therefore sought to align with ESD principles as detailed in the PD Act. ESD definitions and principles are also provided in a number of other relevant statutory planning documents, including in the *Protection of the Environment Administration Act 1991* (NSW) and the EPBC Act (**Chapter 6.0 Statutory approvals context**).

Table 4-1 provides a detailed definition of the four principles listed above and describes their applicability to the Project. Management and mitigation measures to meet the ESD principles outlined in the PD Act have been embedded throughout this EA.

[4] ACT Government, 2007, Accessed at: https://www.legislation.act.gov.au/View/a/2007-24/current/html/2007-24.html

Table 4-1 ESD principles, descriptions, and applicability

Principle	Description	Applicability
Precautionary principle	If there is a threat of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing management and mitigation measures to prevent environmental degradation.	This EA details any perceived impacts to the environment (if left unmanaged) as a result of the Project and during the Project design life. As the EA is developed during Project planning, a number of ESD assumptions have been made based on current knowledge of the Project. Where information is unavailable or unclear to determine environmental impacts, modelling has been used to determine projected outcomes. This is further detailed in the Climate and Natural Hazards Assessment (CNHA) (refer to **Section 4.1.3**)**Appendix K (CNHA)** using historic climate trends and scientific data to predict future climatic conditions.
Intergenerational equity principle	The present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.	This EA has been developed to provide an assessment of key environmental issues that may be impacted by the Project and outline management and mitigation measures that at least maintain, if not enhance the social, economic, and environmental outcomes for the community, through all stages of the Project-lifecycle, for the long-term benefit of future generations. A summary of all the management and mitigation measures provided for the Project is provided in **Chapter 20.0 Management and mitigation measures**.
Conservation of biological diversity and ecological integrity	Conservation of biological diversity and ecological integrity should be a fundamental consideration.	The EA outlines where biological diversity and ecological integrity may be impacted by the Project, and details techniques for management and maintenance, including habitat rehabilitation and offsetting. These management and mitigation measures are detailed in **Chapter 16.0 Biodiversity and ecology**.
Appropriate valuation and pricing of environmental resources	Environmental factors should be included in the valuation of assets and services.	The *City to Woden Light Rail: Stage 2A City to Commonwealth Park Business Case* (MPC, 2019) details the value of environmental factors that have been taken into consideration for decision making for the Project through qualitative or quantitative means. Furthermore, design development has sought to use a decision making framework to value environmental resources in decision making for the Project.

4.1.1 Statement of strategic directions

The PD Act requires that the Territory Plan, which provides the policy framework for planning in the ACT, must contain a statement of strategic directions which includes broad strategic principles to guide long term planning for the ACT. The statement of strategic directions includes principles for sustainable development, as well as urban design principles. The Project is consistent with relevant parts of the statement of strategic directions, which is summarised in **Table 4-2**. The principles for sustainable development have not been reproduced in this document, and can be found on the ACT legislation website[5]

To address the PD Act principles for sustainable development, the Project has considered environmental, social and economic sustainability measures (refer to **Table 4-2**). The general sustainability measures listed below have also been considered:

- The objectives of the Project include those that ensure environmental, social and economic benefit (**Section 2.1.2**). Future generations would benefit from the Project, as it would contribute towards easing traffic pressures, urban sprawl and improve connectivity and access to the City (**Chapter 2.0 Strategic need and context**).
- An economic analysis was undertaken as part of the Business Case for the Project, outlining Project costs and benefits (MPC, 2019). Community involvement has been recognised as an important input into Project development, and is detailed in the **Chapter 7.0 Consultation**. The EA has also considered environmental impacts, and management and mitigation measures to minimise the Project's impact on the environment (**Part B** and **Chapter 20.0 Management and mitigation measures**).
- The potential for cumulative impacts beyond those posed by the Project itself have been considered and taken into account as part of this EA (**Chapter 19.0 Cumulative impacts)**.

[5] ACT Government, 2010, Accessed at: https://www.legislation.act.gov.au/DownloadFile/ni/2008-27/copy/74258/PDF/2008-27.PDF

Table 4-2 Responses to PD Act principles for sustainable development

Environmental sustainability	Social sustainability	Economic sustainability
• The Project has been designed to ensure efficient use of resources and to reduce consumption of non-renewable resources (**Section 4.1.2.3**). The Project is also registered to pursue an Infrastructure Sustainability (IS) rating (**Section 4.1.2.4**). Management and mitigation measures have been identified to limit consumption and waste generation during construction (**Chapter 20.0 Management and mitigation measures**). The Project during operation would utilise the ACT's renewable energy. • The Project has responded to land capability constraints, and information on topography, soils, geotechnical factors, drainage, natural hazards, microclimate and the sensitivity of ecosystems has informed development of the Project design (**Chapter 11.0 Contamination and soil**). • Land and water resources have been considered, and the Project has been designed to reflect water sensitive urban design (WSUD) (**Chapter 17.0 Hydrology and water quality**). • The Project has been designed to maximise the integration of land use and transport planning, and would deliver road infrastructure including the light rail and active transport infrastructure and would integrate with existing public transport (**Chapter 3.0 Project description**). • The Project aligns with several policies that outline the need for ensuring amenity, minimising pollution and protecting public health and safety (**Chapter 2.0 Strategic need and context**).	• The Project would: - Provide connectivity between key locations (**Section 3.3.2**) - Ensure public spaces are safe and attractive (**Section 3.4**) - Provide and integrate with active transport infrastructure (**Section 3.3.5**) - Ensure accessibility for all (**Chapter 2.0 Strategic need and context**). • The urban design vision for the Project has been developed taking into account the principles of CPTED and GSUD. The Project meets applicable road design standards to provide a high standard of safety and to accommodate emergency services needs (**Section 3.4** and **Chapter 20.0 Management and mitigation measures**). • The Project has been designed to recognise the needs of people with disabilities • The Project would include separated network facilities for pedestrians and cyclists and has made provision for future connection with Stage 2B Commonwealth Park to Woden (**Chapter 3.0 Project description**). • Heritage and cultural values would be safeguarded. The distinctive qualities of residential areas and other places, as well as elements of community heritage, would be recognised and their conservation promoted (**Sections 10.2** and **10.5**). • The Project would avoid significant impacts on identified places of heritage significance (**Section 10.5**)	• The Project would enhance the ease of getting around the City. Project design has utilised safety in design principles, and measures are in place to ensure cleanliness during construction and operation (**Chapter 20.0 Management and mitigation measures**). Landscape design and the placement of the alignment would enhance the City and provide key connections to Civic a centre for social, cultural and business exchange (**Chapter 13.0 Landscape and visual realm and Section 3.4**). • The Project has been developed placing a particular emphasis on cost-effective provision and management of infrastructure, taking into account whole-of-life and whole-of-system costs (MPC, 2019).

4.1.2 Sustainability framework

4.1.2.1 Sustainability priorities

The Project has identified three key sustainability priorities, which were identified following sustainability visioning workshops held in October 2022. The sustainability priorities are defined in **Table 4-3**.

Table 4-3 Sustainability priorities

Sustainability priority	Vision statement	Alignment with key external documents
Sustainability leadership	The Project seeks to drive sustainability leadership across the ACT and the wider industry by promoting knowledge sharing, setting ambitious targets and embedding governance to support best practice sustainability outcomes.	• *Building Canberra's Circular Economy Draft ACT Circular Economy Strategy 2022-2025* (TCCS, 2022) • *Modern Slavery Act 2018* • *Urban Forest Strategy 2021–2045* (TCCS, 2021) • *Canberra's Living Infrastructure Plan: Cooling the City* (EPSDD, 2019b) • *ACT Transport Strategy* (TCCS, 2020a) • *ACT Planning Strategy 2018* (EPSDD, 2018) • *ACT Climate Change Strategy 2019-2025* (EPSDD, 2019a).
Ngunnawal engagement	The Project will seek to identify and implement opportunities to improve connection to Ngunnawal Country through Design and Ngunnawal engagement.	• *Caring for Dhawura Ngunnawal: A natural resource plan for the ACT 2022-2042* (ACT Government, 2022a) • *NSW Government Architects, Connecting with Country Draft Framework* (NSW Government Architect, 2020).
Measuring and reducing Scope 3 emissions	The Project has considered Scope 3 emissions (refer to **Section 4.1.4**) through defining a clear Scope 3 emissions boundary to allow measurement of material Scope 3 emissions. This would allow the Project to reduce Scope 3 emissions where feasible by: • Selecting materials with lower embodied energy values and for high embodied energy materials (such as concrete, steel and asphalt) reduce or substitute quantities • Selecting local materials or Australian materials over imported materials to minimise transport emissions. Selecting materials with lower embodied energy values. • Minimising construction waste.	• *Greenhouse Gas Protocol (GHG Protocol) Corporate Accounting and Reporting Standard* (World Business Council for Sustainable Development and World Resources Institute, 2001) • *ISO 14064.1:2018 Climate Active Standard* (International Organization for Standardization, 2018) • *The Scope 3 Greenhouse Gas Emissions in the ACT Investigation Report, September 2021* (Office of the Commissioner for Sustainability and the Environment, 2021).

4.1.2.2 Sustainability policy

An overarching Sustainability Policy has been developed for Light Rail to Woden. This policy sets the themes and key objectives for sustainability and resilience for development and operation of Light Rail to Woden, and consequently, the Project.

The Sustainability Policy aims to capture themes from ACT policies and best practice guidelines to underpin planning and design decision making. The Sustainability Policy has been endorsed by the Project Director and has been made available via the Project website[6].

The Sustainability Policy identifies commitments against sustainability themes to drive sustainable outcomes in Project development. The adoption of such commitments assists to successfully deliver targets and initiatives to address themes under the Sustainability Policy for the Project.

4.1.2.3 ACT Climate Change Strategy 2019-2025

The *ACT Climate Change Strategy 2019-2025* outlines the ACT Government's response to climate change and identifies the necessary steps to meet both interim targets, and also defines long-term aspirations to achieve the end goal of net zero by 2045 (EPSDD, 2019a). As part of the strategy, actions have been developed that are focused on a number of climate adaptation and mitigation options, most notably, building resilience to physical climate change impacts.

The Strategy outlines several key priorities. As outlined in **Section 2.2.3**, the Strategy specifically identifies the Project and Stage 2B Commonwealth Park to Woden as key objectives for increasing public transport use and reducing emissions. The strategy also outlines, under Action 5.6 that *"all new Government capital works with a budget of more than $10 million either seek or are consistent with an independent sustainability rating such as an IS rating from the Infrastructure Sustainability Council of Australia (ISCA), or a Greenstar rating from the Green Building Council of Australia (GBCA) or equivalent, and review ratings at least every five years"* (EPSDD, 2019a).

As discussed in more detail below, the Project is registered to pursue an IS rating under the IS Rating Scheme.

4.1.2.4 Infrastructure Sustainability Council

The *IS Rating Scheme* (ISCA, 2018) was developed and is administered by Infrastructure Sustainability Council (ISC) (formerly referred to as ISCA). ISC is a member-based, not-for-profit peak body operating in Australia and New Zealand with the purpose of enabling sustainability outcomes in infrastructure.

ISC seeks to promote infrastructure sustainability through the IS Rating Scheme. The ACT Government is a member of ISC.

Infrastructure sustainability is defined by ISC as *"Infrastructure that is designed, constructed and operated to optimise environmental, social and economic outcomes over the long term"* (ISCA, 2016).

The IS Rating Scheme facilitates the ratings of infrastructure projects and assets. The IS Rating Scheme is a comprehensive rating system for evaluating sustainability across planning, design, construction and operation phases of infrastructure projects.

[6] ACT Government, n.d., Accessed at: https://www.act.gov.au/__data/assets/pdf_file/0005/1844114/Light-Rail-Sustainability-Policy-1.pdf

The IS Rating Scheme encompasses the IS Rating Tool, a comprehensive evaluation of sustainability performance designed to help infrastructure meet its full sustainability potential across all Project stages. Points are gained through the achievement of IS credits, which cover numerous aspects of sustainability including governance and procurement, stakeholder engagement and community wellbeing, urban design, resource use, climate change, heritage and ecology.

4.1.3 Climate change

The *Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report* (IPCC, 2021) states with high confidence that Australia is already experiencing impacts from recent climate change, including a greater frequency and severity of extreme weather events, an increase in record hot days, a decrease in record cold days and increases in global greenhouse gas (GHG) concentrations.

As highlighted in the *State of the Climate* (CSIRO and BoM, 2020) report, it is noted that Australia's climate has warmed on average by 1.44^{o}C (+/- 0.24^{o}C) since 1910. It is noted that the Paris Climate Change Accord (effective 4 November 2016) seeks to limit climate change to under 2^{o}C with a target of 1.5^{o}C. Australia is likely to experience a range of ongoing changes into the future including:

- Continued increases in air temperatures, more heat extremes, and fewer cold extremes
- Continued decrease in cool season rainfall across many regions of southern and eastern Australia, likely leading to more time in drought, yet more intense, short duration heavy rainfall events
- A consequential increase in the number of dangerous fire weather days and a longer fire season for southern and eastern Australia.

A CNHA has been undertaken to understand and identify the potential effects and risks associated with climate change as well as the identifying treatment options and risk management measures to be incorporated throughout the design, construction and operation phases to build the resilience of the Project to changing climate conditions. The CNHA is provided in **Appendix K (CNHA)** of this EA.

Extreme rainfall, flooding and extreme heat are expected to pose the greatest risk to the Project in both the near (2030) and far (2070) future. Risks associated with these events include:

- The potential impacts due to extreme rainfall impacting on drainage infrastructure and surrounding areas resulting in nuisance flooding
- Reduced access to the Project and surrounding areas impacting on emergency response during extreme events (e.g., storms, bushfire)
- The consideration of drought, extreme heat and changes to rainfall impacting on landscaping, particularly in relation to green infrastructure and ongoing maintenance.

Management and mitigation measures to reduce the impacts of the identified construction and operation climate risks for the Project are as follows:

- Treatments and mitigation measures identified in the climate change technical report (**Appendix K (CNHA)**) would be incorporated into the detailed design and delivery of the Project
- Construction-related climate change risks (e.g., heatwaves or increased frequency and severity of extreme rainfall events) would be considered during the development of environmental management measures as part of the CEMP and other management plans, as relevant.

As part of the residual risk assessment undertaken in the CNHA, individual, specific adaptation measures have been applied to multiple risks to help reduce the potential risks to the Project. It is anticipated that as the Project develops, adaptation measures would continue to be tracked for compliance and progress to assist in reducing the risk exposure of the Project. With the implementation of the above management and mitigation measures, no residual 'extreme', 'very high' or 'high' risk ratings remain for the 2030 or 2070 scenario.

It is recognised that while there is uncertainty regarding the extent to which the climate will change beyond 2030, the adaptation actions identified within the CNHA would result in the lowering of residual risks across a range of future scenarios. Although not required to reduce all significant, very high and high risks for 2070 timeframe, the assessment was able to mitigate majority of these risks and no high risks remain.

As the Project design continues to be developed, there are opportunities to identify and explore additional treatment options to add value and support improved response to climate change. This could include:

- Exploring initiatives such as coordination/opportunities with other stakeholders for downstream augmentation to support better drainage outcomes as well as additional water capture options to improve response to extreme rainfall
- Communicating outcomes of Project investigations, such as sensitivity testing and shading constraints, to surrounding stakeholders to develop shared/collaborative responses
- Exploring additional options to improve to response to extreme heat through actions such as additional shading along the corridor, materials selections for Project elements (e.g., permeable pavements) and reviewing key specifications (such as pavement design) to ensure they can accommodate future increases in temperature.

4.1.4 Greenhouse gases

AECOM prepared a technical report to assess the GHG emissions for the construction and operation of the Project at the time of the WA/DA design (**Appendix J (GHG Assessment)**). The following GHG emissions were considered:

- Construction sources of GHG emissions:
  - Combustion of liquid fuels from stationary and mobile plant equipment and other vehicles, and international shipping from import of LRVs and steel rails
  - Power consumption from the electrical grid
  - Embodied[7] energy of:
    - Construction materials
    - Construction and demolition waste
    - LRVs and batteries
  - Vegetation clearing of urban street trees
  - Replanting of street trees (carbon sink)
- Operational sources of GHG emissions:
  - Power consumption from the electrical grid
  - Maintenance activities over the asset life including
    - Fuel combustion associated regular street sweeping of light rails
    - Embodied energy associated with replacement of LRVs and LRV batteries
    - Embodied energy of operational materials.

To quantify GHG emissions from the Project the 'boundary' of the assessment has been defined by which emission sources and activities are included in the technical report. Emissions are then further characterised by scope, determined by the origin of the emissions. Scope 1 emissions[8] are direct GHG emissions that are produced by activities that are controlled by the proponent, while Scope 2 and 3 emissions are indirect emissions that are a result of activities associated with the Project.

The total emissions generated from construction of the Project were estimated to be 17,242 t CO_2-e, inclusive of Scopes 1, 2 and 3. The majority (57%) of the emissions associated with construction of the Project are Scope 1. Diesel fuelled mobile equipment has the highest contribution to Scope 1 emissions, followed closely by diesel fuelled lighting. Scope 2 emissions equates to zero emissions due to the uptake of ACTs renewable energy. Scope 3 emissions account for 43% of the emissions

[7] Also known as Scope 3 emissions, which are indirect emissions, that have been created over the entire lifecycle of a material
[8] Scope 1 emissions are those that are emitted as a direct result of an activity. Scope 2 emissions are indirect GHG emissions as a result of activities associated with the Project. Scope 3 emissions are indirect emissions, that have been created over the entire lifecycle of a material **Appendix J (GHG Assessment)**.

associated with construction of the Project, in terms of offsite transport or greenhouse gas generation during the manufacture of materials and supplies. Emissions associated with construction of the Project is expected to represent approximately 0.0035% of Australia's total emissions and 1.6% of ACT's total emissions.

Estimation of operational GHG emissions have been limited to Scope 2 emissions from electricity consumption from lighting, signalling, bore pumping and battery charging of LRVs at stations. In the ACT, electricity is 100% renewable and therefore Scope 2 emissions are assumed to have an emission factor of zero t CO_2^{e-}/kWh. While the effective GHG emissions generated from renewable energy are considered negligible electrical consumption is reported for transparency. The total estimated annual electrical consumption from the Project is 1,224,065 kWh.

GHG emissions from the Project from regular maintenance have been limited to fuel consumption from street sweeping of rails once per month; with an estimated Scope 1 emissions of 0.03 t CO_2e- annually. In addition to regular maintenance, emissions for major preventative maintenance activities have also been estimated over a 50 year asset life, from fuel use (Scope 1 and Scope 3) as well as from embodied energy (Scope 3). Major preventative maintenance activities have been limited to key materials identified for construction works with a product life equal to or less than 50 years. Total emissions from maintenance of the Project over the assumed asset life is 7,606 tCO_2^{-e} which is comprised of approximately one third Scope 1 emissions and two thirds Scope 3 emissions.

Management and mitigation measures to reduce the construction and operational GHG emissions of the Project listed above, are as follows:

- Implement energy efficient guidelines for operational works such as a 'no-idling' policy for all construction vehicles and plant to switch of engines when not in use
- The following measures to manage greenhouse gas emissions would be implemented:
  - Only use petrol or diesel generators where mains power is not feasible
  - Keep vehicles and construction equipment operating onsite well maintained and turned off when not operating (minimise idling on the site)
  - Energy efficiency measures for fixed construction components such as site offices, including solar panels and timer-controlled lighting
  - Consider other appropriate methods for reducing diesel use such as use of biodiesel or ethanol blends where feasible
  - Use solar powered lights/message signs as appropriate.
- To reduce Scope 3 emissions where feasible:
  - Select materials with lower embodied energy values and for high embodied energy materials (such as concrete, steel and asphalt) reduce or substitute quantities
  - Select local materials or Australian materials over imported materials to minimise transport emissions
  - Minimise construction waste.
- Carbon offsets would be retired at the completion of construction to account for emissions associated with the construction of the Project to achieve a zero net carbon footprint for all Scope 1 and 2 emissions
- Development and implementation of a Carbon and Energy Management Plan to support the reduction of ongoing emissions associated with maintenance activities.

The above management and mitigation measures would help to reduce GHG emissions, however GHG emissions would still result as a part of the Project. The longer-term benefits of the Project once operational are expected to result in a net positive effect on GHG emissions by utilising the ACT's renewable energy to power the LRVs whilst also removing a portion of privately owned combustion fuelled cars from the road network.

5.0 Project development and alternatives

This Chapter outlines the strategic, delivery and construction options analyses that were undertaken in the development of the Project, and reason for selecting the preferred option. The objectives of the Project are set out in **Section 2.1.2**, which guided the Project development. This Chapter is divided into:

- Comparative options analysis: outlining the options analysis undertaken to select the next corridor extension and the Light Rail to Woden alignment (**Section 5.1**)
- Delivery options analysis: outlining the process used to determine the preferred delivery approach for the Project (**Section 5.2**)
- Construction staging options analysis: outlining the advantages and disadvantages for three construction staging options used to determine the preferred construction approach (**Section 5.3**).

5.1 Comparative options analysis

The ACT Government made a clear commitment in the *Canberra: A Statement of Ambition 2015* (ACT Government, 2016) and *The City Plan 2014* (ACT Government, 2014) to construct the light rail network over the coming years to help achieve its vision for Canberra (refer **Chapter 2.0 Strategic need and context** for further information on the strategic need for the Project).

The *Transport Canberra: Light Rail Network* plan identified seven potential future light rail alignment options (TCCS, 2015), as shown on **Figure 5-1**. The ACT Government selected Light Rail to Woden as the next stage of the light rail network, of which Stage 2A City to Commonwealth Park (the Project) is a key component. The Light Rail to Woden alignment was identified as a high priority due to its capacity to connect key residential, cultural, commercial and employment centres across Canberra City using an integrated public transport network.

Figure 5-1 Canberra's future light rail network

5.2 Delivery options analysis

Delivery options were considered to determine the preferred delivery approach for Light Rail to Woden. The delivery options analysis considered two options:

- Option 1: staged delivery approach where Light Rail to Woden is constructed in stages with an initial stage extending south and terminating adjacent to Commonwealth Park, and a second stage from the proposed Commonwealth Park terminus to Woden
- Option 2: single staged delivery approach such that Light Rail to Woden is constructed in one continuous build.

5.2.1 Evaluation of delivery options

The evaluation of delivery options is described in greater detail in the *City to Woden Light Rail: Stage 2A City to Commonwealth Park Business Case* (MPC, 2019). Key advantages and disadvantages for both delivery options were presented in the business case and are shown in **Table 5-1**.

Table 5-1 Key advantages and disadvantages assessed for delivery options

	Option 1: Staged delivery approach	Option 2: Non-staged delivery approach
Advantages	• Allows for construction to commence while complex planning requirements in the Parliamentary Zone are resolved and finalised. The timing of planning approvals, particularly given the need for the Commonwealth Joint Standing Committee on the National Capital and External Territories and Parliamentary approvals, was identified as a significant risk for the delivery of Light Rail to Woden • Aligns the timing for the delivery of light rail in Canberra City with planned urban revitalisation activities in and around City Hill, the Acton Waterfront and City West (Sydney and Melbourne Building upgrades, Acton Waterfront Boardwalk Extension and Park, and upgrades to Garema Place and City Walk) • Compared to Option 2, this option provides for the earlier delivery of improved connectivity to the Acton Waterfront and Commonwealth Park.	• Allows for the Project to be considered by the NCA as a standalone project, important to the strategic development of Canberra, with the resultant works able to be delivered by local industry • Noting uncertainties around planning approval timings, a non-staged approach potentially provides greater certainty on the timing for the delivery of the whole north-south public transport spine between Gungahlin and Woden • Reduces technical interfaces, with only one interface when the alignment is extended from Canberra City to Woden.
Disadvantages	• Potential construction inefficiencies from delivering Light Rail to Woden in two stages, noting both Stage 2A City to Commonwealth Park and Light Rail Commonwealth Park to Woden would be complex projects and therefore staging could assist in managing Project risks • Potentially longer construction disruption than would otherwise be the case. However, the earlier commencement of Stage 2A City to Commonwealth Park may limit disruption in certain parts of the alignment • Will create additional technical interface risk due to the need to integrate Light Rail City to Gungahlin with the extension to Commonwealth Park, and then again when light rail is extended to Woden • A risk was identified that the Commonwealth Government would not ultimately approve Light Rail Commonwealth Park to Woden or agree reasonable terms that would allow Light Rail Commonwealth Park to Woden to proceed.	• Requires a later construction commencement date • ‘Stretching’ of available resources (both ACT Government and the delivery partner) across a larger, more complex project with attendant risks • The later commencement date may result in local skills and capability used on the Light Rail City to Gungahlin project being lost to interstate projects, particularly given the demand for skilled labour and the constrained east coast construction market • Connectivity between Canberra City and Commonwealth Park is provided later (compared to Option 1) and is potentially misaligned with urban renewal and development activities in the area.

Based on the advantages and disadvantages listed in **Table 5-1**, a staged delivery approach (Option 1) was identified as the preferred delivery approach, with the first component, Light Rail City to Commonwealth Park (the Project), to be delivered from the existing southern terminus on Alinga Street to Commonwealth Park. The delivery approach would also be subject to detailed design and construction planning.

5.3 Construction staging options analysis

Constructability optioneering was conducted to determine the most efficient strategy (length of program) to be adopted for LRS2A delivery, particularly relative to critical major intersections and the London Circuit section of the alignment. Preference was given to the construction staging option that had the shortest program, as although it would have a condensed program of works with greater short term impacts, it would have the lowest cost and would cause a shorter period of disruption to the public. The construction staging options analysis considered three options:

- Option 1: two lanes (one in each direction) maintained open during construction on London Circuit
- Option 2: single lane maintained open during construction on London Circuit
- Option 3: block closures during construction on London Circuit.

The benefits of block closures on London Circuit (Option 3) were assessed to outweigh potential disadvantages (**Table 5-2**), and is therefore the preferred construction staging option. Traffic and transport impacts for this construction staging option is further discussed in **Chapter 9.0 Traffic and transport**.

5.3.1 Evaluation of construction staging options

Key advantages and disadvantages for construction staging options that were evaluated are shown in **Table 5-2**.

Table 5-2 Key advantages and disadvantages for construction staging options

	Option 1: two traffic lanes maintained	Option 2: single lane maintained	Option 3: block closures
Description	• This option is based on the premise that two lanes are maintained along London Circuit during construction, with one lane of traffic in each direction maintained.	• This option is based on the premise that one lane is maintained along London Circuit from Gordon Street to East Row during construction, maintaining southbound traffic flow	• Arrangement is to close off entire sections of carriageway within London Circuit, typically between blocks • This option is based on staged block closures of London Circuit from Commonwealth Avenue to East Row during construction (i.e., no traffic flow within block for duration of closure)
Advantages	• This option would have the least impact on traffic flow and cyclists • This option would have the least impact to bus services.	• This option would have less disruption to traffic flow and cyclists than Option 3 • This option would have less disruption to bus services than Option 3.	• This option is the shortest duration of all options considered • This option would provide maximum working area for construction workers, providing safety for construction workers and the general public, from oncoming traffic and have the least impact on plant and personnel movements, works coordination and interaction • This option would cause the least disruption to intersections.
Disadvantages	• This option would provide the smallest working space for construction works, limiting movement of plant and personnel • The length of this program was not considered further as it was deemed not feasible. However, this option would likely have had the longest duration of all the options considered as maintaining two lanes would limit work areas and plant and personnel movement	• This option has a longer program • Kerbside parking throughout London Circuit would be temporarily lost • Bus travel times would increase and require alternate local area traffic routes • This option requires additional traffic switches/traffic management costs, including periodic closure of the remaining open lane for road crossings (for example, as required for utilities	• Kerbside parking in small sections throughout London Circuit would be temporarily lost • Bus travel times would increase and require alternate local area traffic routes • This option would cause noise and vibration impacts to nearby sensitive receivers, with the potential for higher noise levels than Options 1 and 2 (with overlapping construction activities) however would be experienced over a

	Option 1: two traffic lanes maintained	Option 2: single lane maintained	Option 3: block closures
	• Limited construction work space poses safety risks by increasing interaction between construction workers and oncoming traffic • This option would cause disruption to intersections • Kerbside parking throughout London Circuit would be temporarily lost • Bus travel times would increase and require alternate local area traffic routes. • This option would cause prolonged noise and vibration/amenity and visual impacts to nearby sensitive receivers (over a longer period of time than Option 2 and 3) • This option was not progressed further primarily due to space restrictions creating constructability and quality issues (e.g., the introduction of a longitudinal construction joint along the track slab) as well as the associated program and cost implications.	and surface water drainage construction) • This option would entail a more restricted construction working area and would impact plant and personnel movements, works coordination • This option would cause prolonged noise and vibration/amenity and visual impacts to nearby sensitive receivers over a duration shorter than Option 1 but longer than Option 3 • May introduce potential quality issues, such as subsoil drainage installation, track drainage and cobble stones installation (for this option, the track slab cannot be constructed all at once, introducing joins in the track slab, which could lead to quality issues).	shorter duration than Option 1 and 2 (similarly for visual impacts) • This option would cause higher levels of air emissions (exhaust emissions, dust) in the short term due to the intensity of works • Risks around availability of resources, including fatigue management, with multiple work fronts pursued • Coordination is required with other concurrent projects, with multiple work fronts pursued.

6.0 Statutory approvals context

This Chapter outlines the various statutory and planning approvals required for the Project.

The Project would require or rely on the following statutory environmental and planning approvals:

- A 'Works Approval' from the NCA under the PALM Act to carry out certain works in Designated Areas under the NCP. The Works Approval application documents for the Project detail the Project's alignment with planning requirements and controls for the Designated Areas, and is supported by information presented in this EA
- 'Development Application' from the EPSDD under the PD Act, for works on Territory Land subject to the Territory Plan (refer **Section 6.2**). A Development Application for the Project would be supported by information presented in this EA
- Approval from the Commonwealth Minister for the Environment under the EPBC Act to carry out the Project, which has already been sought and obtained, and is subject to conditions (EPBC 2019/8582) ('EPBC Approval').

Each of these approvals is discussed in further detail in the following sections. A Planning Report has been prepared for the Works Approval and a statement against criteria has been prepared for the Development Application. Other legislative requirements are outlined in **Section 6.4**.

This EA is not a statutory requirement for the Project but has been prepared to provide a complete and consolidated assessment of its potential environmental impacts. It is intended to:

- Provide complete details of the Project to allow the community and other stakeholders to appreciate the Project and its impacts in a holistic way
- Support applications for statutory approvals required for the Project, particularly the Works Approval and Development Application
- Complement the future statutory and non-statutory environmental assessments for related projects, most notably Stage 2B Commonwealth Park to Woden.

6.1 Australian Capital Territory (Planning and Land Management) Act 1988

The PALM Act establishes the NCA and assigns it various functions and responsibilities relating to the Commonwealth Government's interest in the planning and development of the nation's capital. One of the NCA's key roles is the preparation and administration of the NCP, which aims to ensure that Canberra and the ACT are planned and developed in accordance with their national significance.

The NCP identifies a series of Designated Areas deemed to have special characteristics of the national capital, and sets out priorities and detailed conditions of planning, design and development for those areas. Under section 12 of the PALM Act the approval of the NCA (i.e., a 'Works Approval') is required to carry out works within a Designated Area. 'Works' include:

- Construction, alteration, extension or demolition of buildings or structures
- Landscaping
- Tree felling
- Excavations.

The Project would involve carrying out works in several Designated Area Precincts, as summarised in **Figure 6-1**.

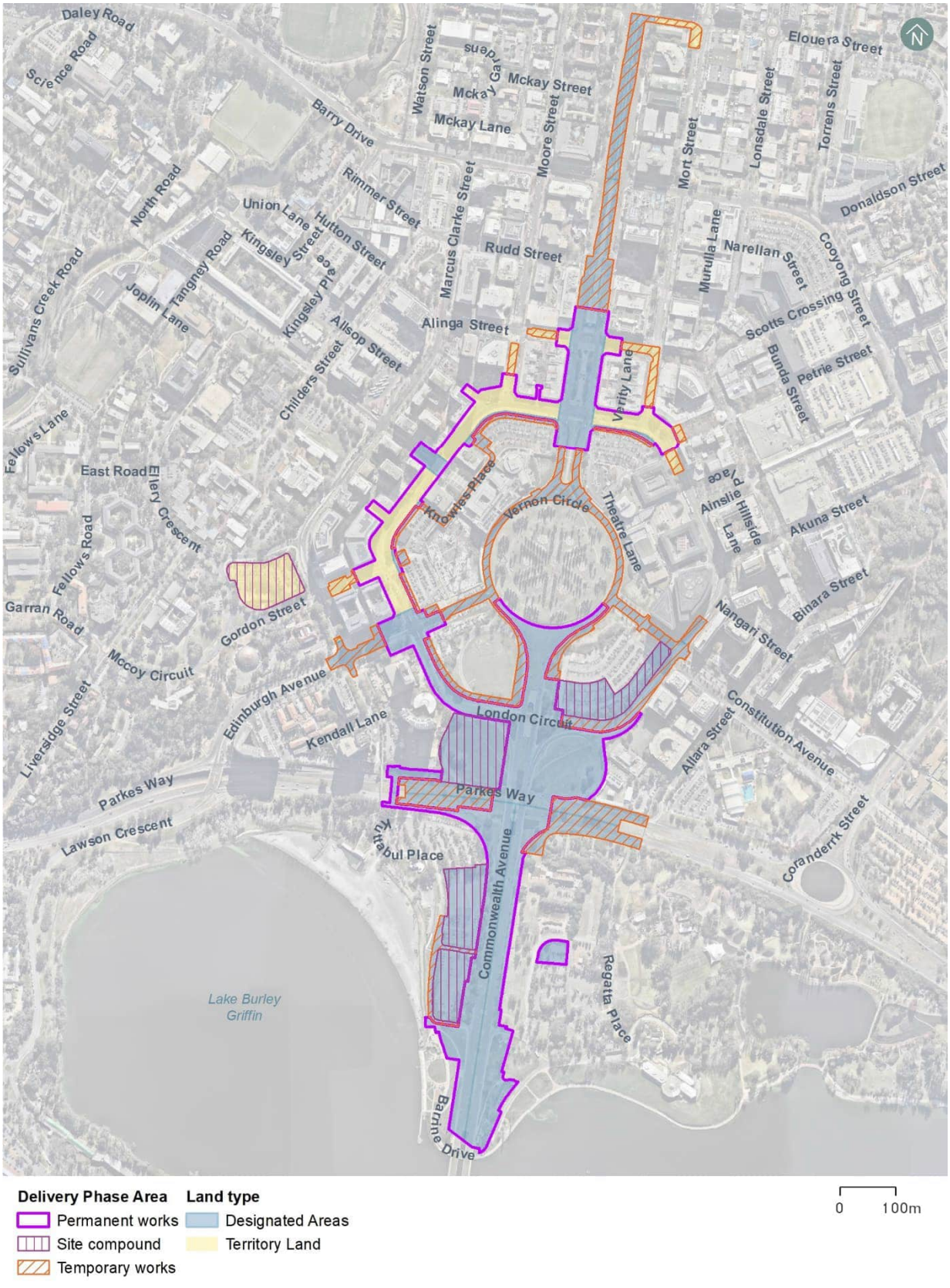


Figure 6-1 NCP Designated Area Precincts affected by key components of the Project

Further information on the NCP and other strategic planning policies is provided in **Chapter 2.0 Strategic need and context**.

Several Works Approvals have been obtained to permit early works required to allow commencement of construction of the Project. Construction timing and staging is detailed in **Section 3.2.3**.

The Project's alignment with the NCP is discussed in **Section 2.2.1**.

6.2 Planning and Development Act 2007

The PD Act meets the requirement of section 25 of the PALM Act to establish a planning authority and legal planning framework for the ACT, and the Territory Plan. The object of this Act (section 6) is "*to provide a planning and land system that contributes to the orderly and sustainable development of the ACT—(a) consistent with the social, environmental and economic aspirations of the people of the ACT; and (b) in accordance with sound financial principles*".

Chapter 5 of the PD Act sets out the requirements for the Territory Plan. The object of the Territory Plan (section 48) is "*to ensure, in a manner not inconsistent with the NCP, the planning and development of the ACT provide the people of the ACT with an attractive, safe and efficient environment in which to live, work and have their recreation*".

A Development Approval from the Minister for Planning and Land Management is required for the Project under the PD Act. The Development Application responds to the objectives and development codes for zones established under the Territory Plan. Relevant zones are shown on **Figure 6-2**.

The Project's alignment with the Territory Plan is discussed in **Section 2.2.2**.

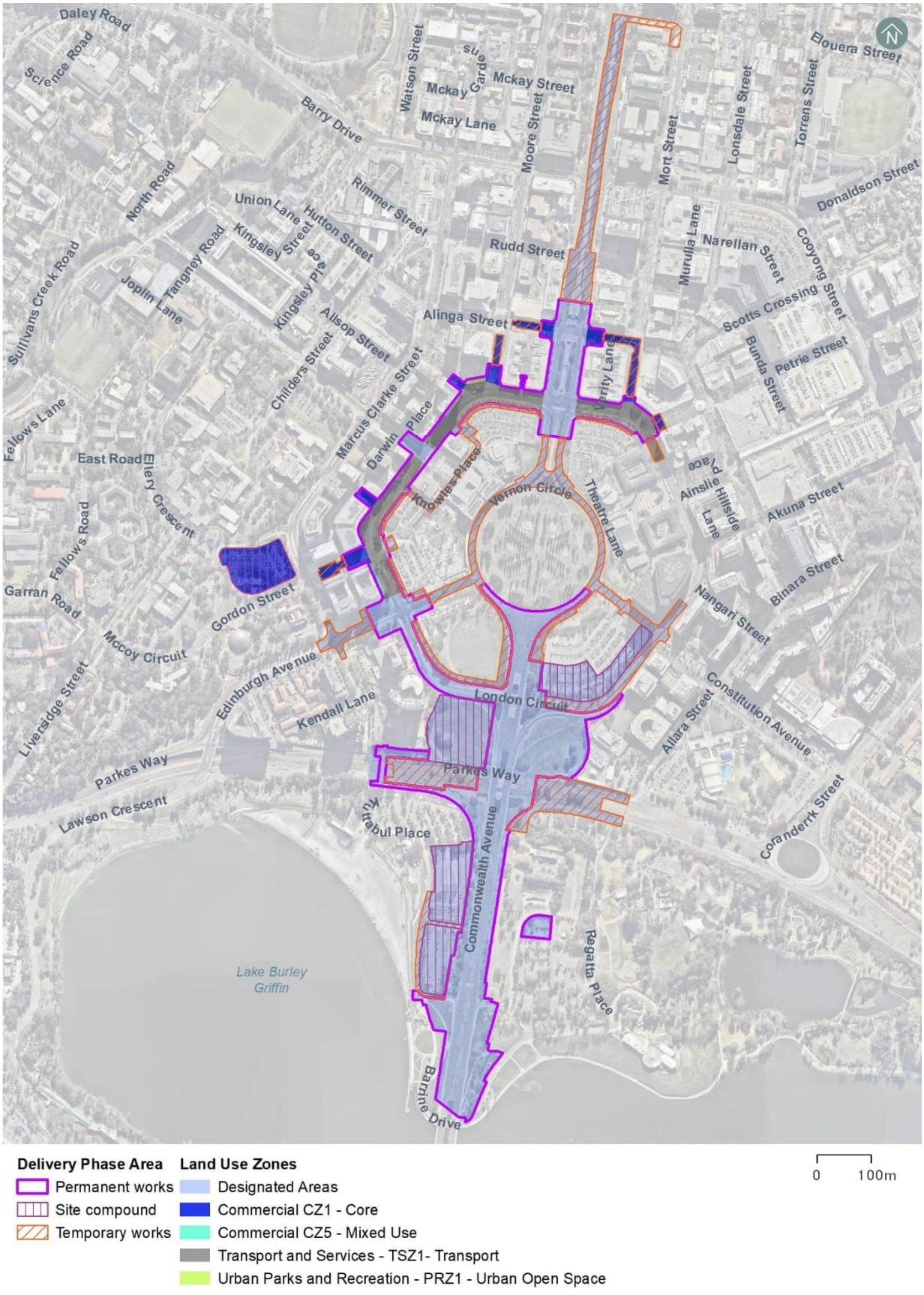


Figure 6-2 Territory Plan zones affected by key components of the Project

6.3 Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act establishes a framework for the protection of the environment, particular those aspects of the environment that are matters of national environmental significance (MNES). Assessment and approval is required under the Act for actions that have or would have a significant impact on a MNES. MNES include:

- World heritage properties
- National heritage places
- Wetlands of international importance (Ramsar wetlands)
- Listed threatened species and communities
- Listed migratory species
- Nuclear actions
- Commonwealth marine areas
- The Great Barrier Reef Marine Park
- Water resources affected by coal seam gas development or large coal mining development.

The Project was referred to the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) (formerly Department of Agriculture, Water and the Environment) under the EPBC Act for potential impacts to MNES.

MPC received Conditional Approval from DCCEEW on 2 February 2020 (EPBC 2019/8582). Conditional Approval included controlling provisions for Listed Threatened Species and Communities (*Synemon plana* (Golden Sun Moth)) in Section 18 and 18A and Commonwealth Land in Section 26 and 27A (refer to **Figure 6-3**). The approval was based on preliminary documentation which included the RLC project (subject to a separate EA and Works Approval), and the Project, and subsequently the EPBC approval applies to both of these projects. A variation to this approval, reflecting a change in location but not size or significance of impacts to MNES, was subsequently requested and was approved on 23 December 2021.

The approved footprint for impacts to MNES, as of 23 December 2021, and the location of Commonwealth Land is shown on **Figure 6-3**.

An assessment of the potential impacts of the Project on biodiversity values is provided in **Chapter 16.0 Biodiversity and ecology.**

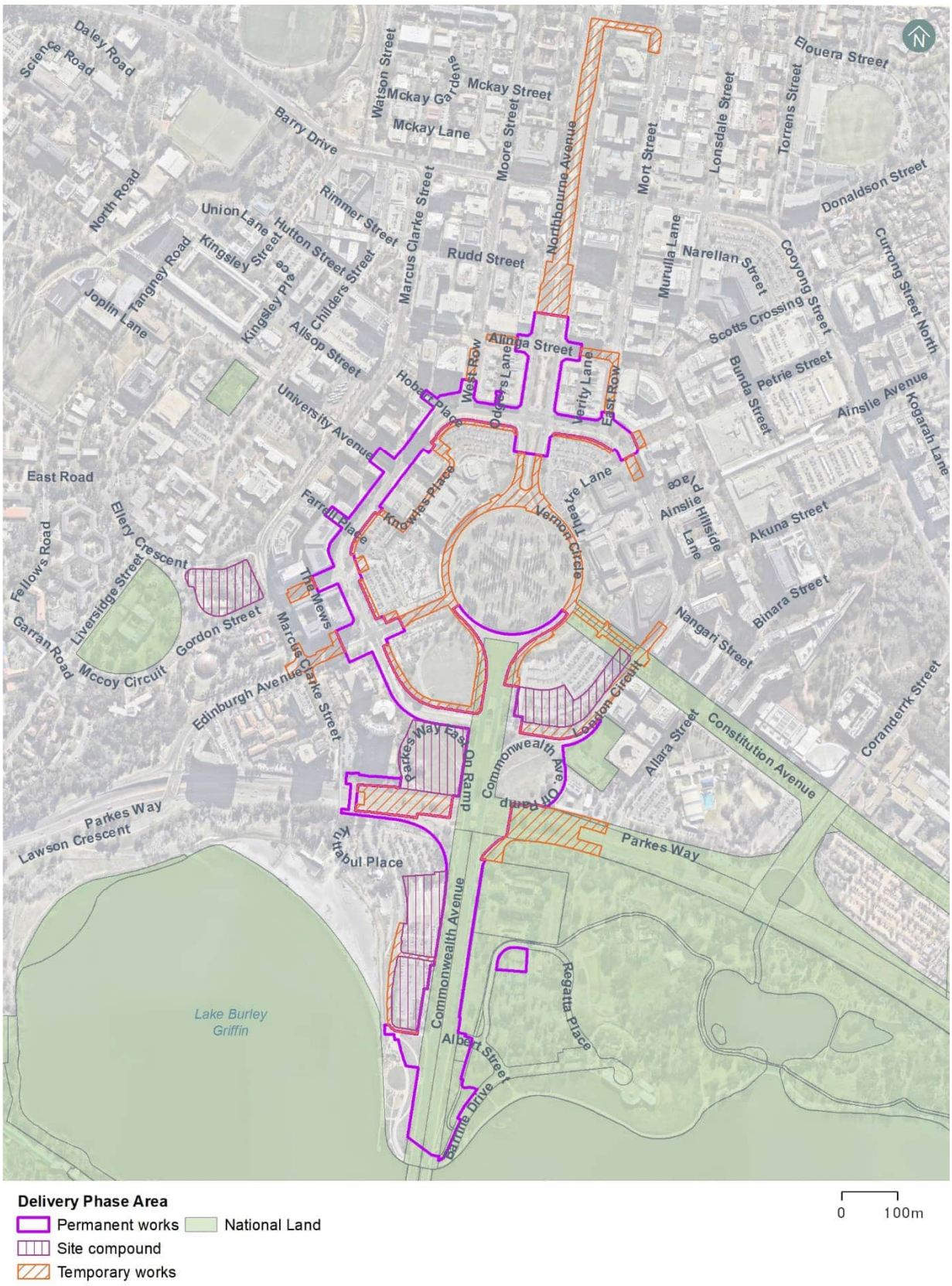


Figure 6-3 Commonwealth Land within the delivery phase area triggering conditional approval

6.4 Other legislation

Other legislation that has been considered in the development of the Project design and the assessment of its environmental impacts is summarised in **Table 6-1**.

Table 6-1 Other legislation considered in the design and EA of the Project

Legislation	Broad legislative focus	Relevance to the Project
Disability Discrimination Act 1992 (Cth)	Protects people with disabilities and defines the mechanisms to ensure public places can be made fully accessible.	The Project has been designed with consideration of Australian Standards including the provision of continuous accessible path, lighting, wayfinding, and designated waiting and seating areas at platforms and within LRVs.
Environment Protection Act 1997 (ACT) and *Environment Protection Regulation 2005*	Legislates with respect to all forms of pollution and waste. The Act sets out notification processes in the event of encountering or causing pollution. It includes associated provisions for: clean air; water quality control; noise control; contaminated land; and hazardous chemical and waste management. Key is the need to secure an agreement or authorisation for carrying out certain potentially polluting activities. The Act does not apply to operational noise and air pollutants from the light rail and motor vehicles unless it is causing environmental harm as defined in the Act.	This EA has been prepared to understand the potential environmental impacts associated with the Project, and to identify mitigation and management measures to minimise these impacts. The Project would be required to comply with the General Environmental Duty under the Act; that is take steps that are practicable and reasonable to prevent or minimise environmental harm or environmental nuisance caused, or likely to be caused, by the activity.
Heritage Act 2004 (ACT)	Provides for the protection and conservation of Aboriginal and non-Aboriginal places and objects through their listing on a register. The Act makes it an offense to harm any heritage value without permission, while involving Aboriginal peoples in planning decisions that affect objects and places.	The Act considers impacts to the heritage significance, and intrinsic features, of a listed place within the place boundary. There are several items listed on the ACT Heritage Register within or adjacent to the delivery phase area, including City Hill, Sydney Building and Melbourne Building, ANZ Bank Building (former ES&A Bank), Civic Square Precinct, Law Courts Precinct, Hotel Acton (Acton House) and Ian Potter House (Beauchamp House). The Project is anticipated to have minor to moderate impacts during construction and operation to some of these heritage items. Further information and assessment of heritage impacts is provided in **Chapter 10.0 Heritage**.
Nature Conservation Act 2014 (ACT)	Provides for ecological protection, conservation, enhancement, restoration and improvement of native species, ecological communities, biological	This EA has been prepared to understand the potential ecological and biodiversity impacts associated with the Project, and to identify

Legislation	Broad legislative focus	Relevance to the Project
	diversity, ecological connectivity and important habitat. The Act provides for the protection of threatened species, communities and associated habitat. It defines the key threatening processes to ecological values in the ACT and various licencing and management plan requirements. It also includes the mechanisms to ecologically offset impacts.	mitigation and management measures to minimise these impacts. The EA also details the ecological restoration works that the Project would undertake. The biodiversity assessment undertaken for the Project is summarised in **Chapter 16.0 Biodiversity and ecology.**
Road Transport (Safety and Traffic Management) Act 1999 (ACT)	Describes the requirements for traffic management and control in Canberra when carrying out works. It defines the need to operate under approved traffic management plans.	The Project has been designed with consideration of the Act. Where temporary traffic management is required for Project construction activities, traffic management plans would be developed and approved by TCCS prior to works.
Tree Protection Act 2005 (ACT)	Serves to protect certain trees and urban forests that hold exceptional amenity, natural or cultural value. The Act aims to value and protect trees in the design and planning of proposed developments. It defines the mechanisms for protecting and registering trees, while accounting for regulations and management measures in key areas, and the adoption of tree protection zones. It also defines the requirements for tree management plans and tree management precincts, and the means for creating specific tree protection directions.	There are no protected (regulated or registered) trees within the Project delivery phase area. However, a Tree Management Plan has been prepared for the Project by the Technical Advisory Landscape Team.
Waste Management and Resource Recovery Act 2016 (ACT)	Defines the waste hierarchy of avoidance, recovery and recycling over disposal while the supporting guidelines set out waste classification in the ACT.	The waste hierarchy would be applied to the management and disposal of waste associated with the Project, as outlined in **Chapter 18.0 Resource management and waste minimisation**.

7.0 Consultation

This Chapter provides an overview of the consultation approach for the Project. It also summarises the outcomes of consultation undertaken to date with the community, stakeholders, and agencies, and discusses feedback that has been received.

7.1 Background

Coordination, collaboration and engagement with stakeholders and the community is vital in all Project phases to ensure messaging about the Project is clear and consistent, to understand stakeholder and community concerns, and to analyse consultation results to shape Project outcomes.

Community and stakeholder engagement for the Project has been integrated with engagement undertaken for RLC and Light Rail to Woden. This integrated approach has been implemented to give the community a broader and holistic understanding of the Project, its benefits and possible impacts, and ensure the engagement process meets Project timeframes and maximises community participation.

7.2 Consultation objectives

The consultation and engagement objectives for the Project are to:

- Increase awareness and understanding of the Project goal to achieve a more sustainable and integrated transport network for Canberra
- Increase awareness and understanding of key Project benefits
- Listen and respond to key stakeholders and community issues (bring them along on the journey).

7.2.1 Consultation and engagement overview

A summary of the consultation and engagement activities undertaken for the Project is provided in **Table 7-1**.

Table 7-1 Summary of consultation and engagement undertaken

Year	Purpose	Summary
2017	Consultation and engagement activities to inform Project design and identify community interest issues	Consultation and engagement activities were undertaken to inform design, Project alignment, stop locations and community interest topics including visual amenity and cultural heritage. This engagement was undertaken via stakeholder meetings, community drop-in sessions, distribution of digital and print collateral, an interactive map, and formal written submissions.
2018	Inquiry by the Commonwealth's Joint Standing Committee on the National Capital and External Territories into the development of Light Rail to Woden	In May and June 2018, the Commonwealth's Joint Standing Committee on the National Capital and External Territories held an inquiry into the development of Light Rail to Woden (of which the Project is a part). To inform this inquiry, community and stakeholders shared their views and ideas by making formal submissions to the Inquiry and attending public hearings held by the Committee. The ACT Government made a formal submission and gave evidence at a public hearing on 28 June 2018. A full list of public submissions and transcripts of the public hearings are available on the Australian Parliament House website.
2019	Community and stakeholder consultation	Consultation and engagement activities were undertaken to build Project awareness and inform design development. Consultation methods used included: • Community information sessions and pop-up events • Stakeholder briefings

Year	Purpose	Summary
		• Phone calls • Letterbox drops • Distribution of printed and digital collateral. A workshop was held with community representatives who had expressed an interest in participating in a community reference group.
2020	Consultation with the community and stakeholders under the EPBC Act	Preliminary Documentation was prepared to support the EPBC Act referral in accordance with section 95A(3) of the EPBC Act (2019/8582). This documentation discussed the potential impacts of the Project, as part of Light Rail to Woden, on the habitat of Golden Sun Moth (*Synemon plana*). The referral documents were placed on public exhibition from Monday 17 August to Monday 14 September 2020, with feedback sought from the community and interested stakeholders over a period of 20 business days. During the public exhibition and submission period, a total of 44 submissions were received from the community and stakeholders, with 10 submissions directly relevant to matters outlined in the Preliminary Documentation. EPBC approval was issued in early 2021.
	Community and stakeholder consultation	Engagement in 2020 was limited due to the restrictions in place for the COVID-19 pandemic. The engagement in early 2020 demonstrated: • There is a genuine interest in Light Rail to Woden and the Project • The community needed more information about the timeframes and potential impacts of the Project • The community was unsure about what the Project would involve, what the benefits would be and what it would look like when complete. Engagement and consultation activities were adjusted to respond to these issues. As a result, additional information sessions, stakeholder briefings, letterbox drops, flyers, and Project updates were provided. The Community Reference Group (CRG) for the Project was also revived (refer to **Section 7.4.1**), and the Light Rail to Woden Project website (www.act.gov.au/lightrailtowoden) was launched.
2021	Community and stakeholder consultation	Communication and engagement activities were undertaken to inform the Socioeconomic Impact Assessment and continue to inform design development and build Project awareness. This engagement was undertaken via stakeholder meetings and doorknocking, community information sessions and pop-up events, stakeholder briefings, an online business forum, phone calls, letterbox drops, printed and digital collateral, and through a new virtual engagement room. The CRG was restarted in April, and a follow-up independent survey measured and compared Project awareness and sentiment from the 2019 survey.
2022	Community and stakeholder consultation	Consultation and engagement activities were undertaken to provide Project updates, foster existing stakeholder relationships and inform the EA. This engagement was

Year	Purpose	Summary
		undertaken via digital and printed consultation collateral, website updates, the online interactive map, stakeholder briefings and pop-up events.

7.3 Consultation design

The following Section outlines how the consultation and stakeholder engagement approach for the Project was developed and undertaken.

7.3.1 Stakeholder identification

As a first step in developing the consultation plan, stakeholders who may be impacted by the Project or interested in the Project were identified.

In consideration of other infrastructure projects being delivered in the same timeframe as the Project, a coordinated approach to consultation and engagement was taken to ensure messaging is consistent and to avoid consultation fatigue for stakeholders impacted by multiple projects.

In addition to the general community, specific stakeholder categories that have been identified include:

- Elected representatives – ACT Government and Commonwealth Government
- ACT Government directorates and agencies (including CRA, EPSDD, ACT Education Directorate, Health Directorate, Canberra Health Services (CHS), Chief Minister, Treasury and Economic Development Directorate (CMTEDD))
- Commonwealth Government agencies (including DCCEEW, Department of Infrastructure, Transport, Regional Development, Communications and the Arts (DITRDCA), Australian Federal Police (AFP))
- NCA
- TCCS
- Directly affected and adjacent landowners, tenants, developers, and business owners
- Road users
- Public transport and active travel users
- Peak bodies/representative groups
- Utility providers
- Emergency services
- Transport providers (taxi, Uber, rideshare)
- Schools and other educational institutions
- Sporting clubs, recreation groups and lake users
- Places of worship
- Tourism businesses and organisations including hotels, cultural institutions (such as museums and galleries) and other local attractions
- Traditional owners and Indigenous groups
- Culturally and linguistically diverse communities
- Unions
- Canberra Light Rail CRG
- Canberra community.

7.3.2 Consultation and engagement tools

A range of consultation and engagement tools have been developed to provide information about the Project and provide opportunities for feedback. These tools have been used throughout the development of the Project and would continue to be used in subsequent stages, and include the following:

- A dedicated Project hotline and email:
  - **Email:** lightrailtowoden@act.gov.au
  - **Phone:** 1800 956 409
- A dedicated Project website which includes information about the Project:
  - **Project website:** www.act.gov.au/lightrailtowoden
- Printed collateral including Project updates, letters, brochures, fact sheets, flyers, posters, signage and surveys. Printed collateral has been distributed in-person at engagement activities and via letterbox drops, as well as electronically via electronic direct mail (EDM) to a distribution list of over 6,100 subscribers
- Social media including ACT Government and Transport Canberra social media accounts, including Facebook and Twitter
- Works notifications including those for field investigations, early works and construction activities distributed to the delivery phase area and adjacent residents and businesses
- An interactive virtual engagement room available on the Project website to help the community visualise Project design and plans and provide an interactive way to give feedback:
  - **Virtual engagement room:** https://www.act.gov.au/lightrailtowoden/virtual-room
- YourSay online engagement platform featured on the ACT Government's website, including surveys for feedback
- Visualisations/flythroughs/artists impressions
- Pop-up events and community information sessions held at local venues or regularly scheduled events to inform the community about Project information, and provide an opportunity to give feedback in person
- Doorknocking with businesses impacted by or adjacent to the Project to inform them about Project information and provide an opportunity to give feedback in person
- One-on-one meetings with stakeholders directly impacted by the Project.
- CRG which provides a voice for Canberrans in the light rail planning and delivery process. The CRG meet regularly to give the ACT Government insights into the community's needs and priorities for the Project
- Briefings via meetings and email to elected officials, Government agencies and authorities
- Media for milestone events
- Advertising in the Canberra Times and The Australian.

7.4 Consultation implementation and results

The following Section outlines how consultation and stakeholder engagement plans for the Project have been implemented to date. It also describes the responses received from the community and stakeholders as a result of consultation activities.

7.4.1 Community reference group

In 2019 an advertisement was placed on the ACT Government's YourSay webpage (www.yoursay.act.gov.au) seeking expressions of interest from members of the community interested in

forming a CRG. Subsequently, in late 2019 a CRG was established for Light Rail to Woden and the Project with the aims of:

- Independently advocating for the needs of the community
- Requesting information from MPC to inform local residents, businesses, employees and visitors
- Providing ongoing feedback (two-way dialogue) about the Project design and environmental and planning approvals.

A list of the CRG meetings that have been held to date is provided in **Table 7-2**. At each of these meetings, information regarding the Project was presented for discussion. Feedback provided by the CRG was recorded.

Table 7-2 Summary of CRG meetings held to date

Date	Location	Number of attendees
17 December 2019	Office	23
25 June 2020	Online, via WebEx	13
22 April 2021	Mercure Hotel	Not recorded
29 July 2021	220 London Circuit	16
21 October 2021	Online, via WebEx	10
03 March 2022	Online, via WebEx	9
July 2022	Online, via WebEx	6
29 August 2022	Online, via WebEx	6

The outcomes of CRG meetings are summarised in **Table 7-3**.

Table 7-3 Feedback results from CRG engagement

Category	Feedback/Query
Design	The CRG showed considerable interest in the design of the Project. This included interest in the: • Alignment • Wireless vs wire LRVs • Safety and accessibility • Prioritisation of pedestrians, cyclists and public transport • LRV capacity • Consideration of people with disabilities.
Urban design	The CRG showed interest in the urban design of the Project, including landscaping and green spaces.
Environment	The CRG were interested in environmental impacts. Those included potential biodiversity impacts, especially to GSM. They were also concerned about heritage impacts. Potential traffic impacts were also raised, such as impacts to the wider public transport network and potential disruptions and delays.

7.4.2 Business engagement

In August 2019, engagement was undertaken with businesses within the proximity to the Project to inform future planning for the Project. Specifically, the purpose of this engagement was to raise awareness of the next stages of the Project (planning and development, construction and operation) and seek feedback on:

- General operational information including trading hours, logistics, staffing, and access

- Opportunities and challenges for construction planning
- Preferences and interest levels for future communication
- Existing awareness levels of the current and future stages.

This consultation included doorknocking, an online survey, a community information session, social media updates and an EDM newsletter.

The outcomes of this business-focused engagement are summarised in **Table 7-4**. The online survey captured a mix of qualitative and quantitative information to inform the planning of the Project.

Table 7-4 Feedback results from business-focused engagement

Category	Feedback/Query
Project information	In general, there was a high level of awareness of the light rail in general, but low awareness of the next stages and alignment selection. Businesses also indicated that the Project would benefit businesses by increasing accessibility, foot traffic and enhancing the amenity of the delivery phase area.
Construction	Stakeholders did not have a good understanding, or no experience of, construction within a built-up environment, so there was a lack of urgency to 'engage' with the Project.
Traffic and transport	Major issues that arose focused on: • Future parking provision for business staff and clients • Current changes to bus routes, which has negatively impacted some businesses. Pedestrian access to City East and the Magistrate law courts is critical for many of the service sector including both financial and legal businesses.

7.4.3 Community engagement tools

A range of consultation collateral has been distributed via EDM, at engagement activities and via doorknocking/letterbox drops. More than 6,100 people have subscribed to receive EDM updates regarding the Project. The key community and stakeholder engagement activities and issues that have been raised for the Project to date are summarised in **Table 7-5**.

Table 7-5 Stakeholder and community engagement results

Type	Description	Categories of issues raised	Description of issues raised
In-person engagement opportunities, including: stakeholder meetings, pop-up stalls, community information sessions and attendance at community events	More than 55 pop-up events and community information sessions were held at local venues to discuss Project information, distribute collateral and capture feedback.	• Timeline • Cost • Design • Approvals • Project justification • Operations • Construction • Environmental impacts • Consultation.	• Project information including: timeline and cost • Design such as alignment, future planning, connection to the wider transport network, LRV capacity and access to stops • Operations including MyWay, elderly seating, travel times, 'Park n Ride', active travel, • Consultation – future engagement activities • Environmental impacts, including traffic and transport, noise and dust, accessibility, landscape and visual realm, and tree removal.
Light Rail to Woden website: visualisations, videos, flythroughs, virtual engagement room and interactive map.	The Light Rail to Woden website provides a readily accessible portal for stakeholders to access information about the Project. This includes a range of visualisations, maps, videos and flythroughs containing information relating to the Project. It also includes a virtual engagement room and map for stakeholders to share any feedback or ask any questions they may have in relation to the Project. Between January 2021 and October 2022 the website has been viewed 119,583 times.	• Public transport • Environment • Pedestrians and cyclists • Traffic and road safety • Parking • Land use.	• There were concerns about environmental impacts such as landscaping • Some respondents were concerned about impacts to road user safety and public transport (buses).
Consultation collateral	A range of consultation collateral has been distributed via EDM, at engagement activities and via doorknocking/letterbox drops. More than 6,100 people have subscribed to receive EDM updates regarding the Project. More than 15 Project updates have been distributed via EDM to provide a snapshot of the	• N/A	• This consultation activity is passive and for the sole purpose of providing information. As such, no direct feedback has been recorded.

Type	Description	Categories of issues raised	Description of issues raised
	current Project status, upcoming works, design development, engagement opportunities and any other relevant Project information. Project updates are distributed electronically quarterly.		
Fact sheets	Fact sheets are available for download on the virtual engagement room: • GSM translocation fact sheet • Project Need fact sheet • Public Transport Integration and Accessibility fact sheet • Next Steps Timeline fact sheet • EA fact sheet • Stage 2A City to Commonwealth Park fact sheet.	• N/A	• This consultation activity is passive and for the sole purpose of providing information. As such, no direct feedback has been recorded.
Social media	ACT Government social media channels, including Facebook and Twitter, were used to distribute Project information and promote engagement activities. Posts related to the Project perform above average on the ACT Government channels, including both Project information and promotion of consultation posts.	• N/A	• N/A
YourSay Website	Active engagement opportunities are featured on the ACT Government's YourSay engagement platform. Since June 2018, the Project's webpage on this platform has had: • 38,226 views • 25,167 visits • 19,481 individual visitors	• Construction • Traffic and transport • Delivery.	• There were concerns around the potential impacts of construction including noise, traffic and public transport impacts and impacts to pedestrian and cycleways • Many respondents could agree that the operational Project would have a positive impact by providing public transport for the

Type	Description	Categories of issues raised	Description of issues raised
	• 876 contributions • 693 contributors.		City, and by potentially reducing traffic in the future • Respondents would like to see the Project delivered sooner.
1800 enquiry line	A dedicated 1800 enquiry line has been made available to the community, through which queries and concerns can be raised. 97 phone enquiries have been made to the Project hotline.	• Construction • Environmental impacts.	• There was interest in the location of construction compound sites, footpath accessibility, parking access and impacts from early utility works for the Project • The community showed concern in environmental impacts such as landscaping.
Project inbox	A dedicated Project email address has been made available to the community through which they can raise queries and concerns. 454 email enquiries were made to the Project Inbox.	• Construction.	• There were concerns about environmental impacts such as landscaping, the location of the alignment, stops and active travel amenities.
Business engagement through door knocking, online surveys, and community information sessions	Around 370 residents (door knocking), 160 online survey responders and 50 business representatives were consulted during business engagement.	• Operations • Design • Construction • Environmental impacts.	• There was general enthusiasm and support for the Project and future expansion of the light rail • There was low awareness of the alignment selected for the Project and future light rail expansions • There was a low level of understanding or experience with construction impacts • There was concern over future parking provision for staff and clients.
Email newsletters	The Project has two email lists for distributing Project and construction related content to more than 7,000 subscribers combined, and leverages email newsletters across government to share	• N/A	• N/A

Type	Description	Categories of issues raised	Description of issues raised
	Project milestones and initiatives. This includes the fortnightly 'Our Canberra' email newsletter distributed to more than 47,000 subscribers and has an average click-through rate of 51%.		
Door knocking	Face-to-face doorknocking was undertaken to deliver information and provide an opportunity for businesses along the Project alignment to ask questions and give feedback in person.	• N/A	• N/A

7.4.4 Socioeconomic impact assessment

A Socioeconomic Impact Assessment (SEIA) has been undertaken to inform this Environmental Assessment. The SEIA is summarised in **Chapter 14.0 Socioeconomic impacts** of this document and provided in full in **Appendix I (SEIA)**.

The socioeconomic impact assessment for the Project is based on a review of data and information, including targeted surveys of the surrounding community and semi-structured interviews with nearby stakeholders. This consultation with nearby residents, businesses and key stakeholders was undertaken to better understand perceptions relating to the Project and to provide insights into community identity, values, priority issues and goals.

The consultation for the SEIA specifically included the distribution of an online survey to stakeholders. was made available between 29 July 2022 and 19 September 2022, which collected qualitative and quantitative data through a series of open-ended and multiple choice questions.

The survey was completed by 455 respondents. Whilst the survey was distributed to a wide range of people, the outcomes of the survey are not necessarily representative of the broader Canberra population, and is not conclusive of the attitudes of the wider Canberra population towards the Project.

7.4.5 Where feedback has been addressed

Table 7-6 provides a summary of the categories of feedback received as a result of consultation undertaken to date (as described in the Section above), and where this feedback has been addressed in this EA.

Table 7-6 Matrix of where feedback has been addressed

Feedback category	Where this has been addressed
Project justification	**Chapter 2.0 Strategic need and context**
General Project information	**Chapter 3.0 Project description**
Design	**Chapter 3.0 Project description**
Utilities	**Chapter 3.0 Project description**
Surrounding developments	**Chapter 3.0 Project description**
Construction	**Chapter 3.0 Project description**
Timing	**Chapter 3.0 Project description**
Alternative or supplementary design options	**Chapter 5.0 Project development and alternatives**
Approvals	**Chapter 6.0 Statutory approvals context**
Environmental impacts	**Chapters 9.0 to 19.0**
Traffic and transport	**Chapter 9.0 Traffic and transport**
Heritage impacts	**Chapter 10.0 Heritage**
Socioeconomic (impacts to businesses)	**Chapter 14.0 Socioeconomic impacts**
Cost	As contractual arrangements for the delivery of the Project are yet to finalised, it would be premature to release the commercial aspects of the redacted business case for the Project, as this could prejudice value for money outcomes the Territory is seeking to achieve.

7.5 Ongoing approach

This EA would be placed on public exhibition in coordination with the applications made for Works Approval and the Development Application for the Project.

MPC would continue to engage with the community and stakeholders on the Project during the assessment and approvals process, and during the construction period. Future engagement would

continue to be integrated with Light Rail to Woden, to ensure consultation is timely and targeted, and to deliver engagement activities in a coordinated manner.

Engagement would build on what has been completed so far and would use feedback received to inform the construction approach and methodology.

At this stage in the Project timeline there are aspects of the Project that stakeholders and community can influence ('negotiable') and others where a particular path or outcome has been decided which can no longer be influenced ('non-negotiable'), as summarised in **Table 7-7**.

Table 7-7 Project negotiables and non-negotiables

Negotiables	Non-negotiables
• Aspects of urban design treatments, including wayfinding and signage • Approach to public art and culture strategy • Business and trader partnership activities • Multi-modal transport connections, bike and e-scooter parking • Site hoarding and fencing • Temporary traffic management arrangements during construction • Preferred consultation and engagement activities and channels • Construction related access and impact preferences	• Occupational Health and Safety • Project delivery • Alignment selection (initial consultation was undertaken on this pre-2021) • Compliance with relevant Australian Standards and Design Codes • Approved Tree clearing • Hours of work with occasional weekend and night works (standard hours are Monday to Friday, 7am to 6pm, and Saturday 7am to 1pm) • Utility services distributions during early works and construction • Protection and management of Golden Sun Moth.

The Project team is committed to communicating negotiables and non-negotiables to stakeholders and the community during ongoing consultation and engagement for the Project, to shape expectations about the level of influence over Project outcomes.

Tools to engage the community throughout the next phases of the Project would include:

- Project enquiry line and email
- Project website
- Communication collateral
- Social media
- Works notifications
- Virtual engagement room
- YourSay online engagement platform
- Visualisations/flythroughs/artist impressions
- Pop-up events and community information sessions
- Door knocking
- Community surveys
- Stakeholder meetings
- CRG
- Media.

8.0 Environmental risk analysis approach

This Chapter outlines the risk analysis approach undertaken to inform the environmental assessments undertaken for **Chapters 9.0** to **18.0**.

This is not a statutory requirement for the Project but has been prepared to provide a complete and consolidated assessment of its potential environmental impacts, and the management and mitigation measures proposed to manage those impacts. This Chapter introduces the approach taken to gathering baseline data, assessing impacts and determining the management and mitigation measures presented in this EA. The impact assessment for environmental issues is provided in **Chapters 9.0** to **18.0.**

8.1 Approach

This EA has been approached using best-practice methodology, despite such an assessment not being required, to provide the community and other stakeholders with complete and consolidated details of the Project. The general approach is provided below:

- Undertake a preliminary environmental risk assessment (PERA) based on early design to identify likely key issues for further assessment and appropriate level of assessment (**Section 8.2** and **Appendix C (PERA)**)
- With consideration of design progress, prepare EA documentation to:
  - Describe the impacting processes during construction and operation of the Project (**Chapter 3.0 Project description**)
  - Describe existing environmental conditions. This provides the baseline conditions of the study area, including anthropogenic, physical and biological elements, against which potential impacts of the Project can be assessed (refer to **Chapters 9.0** to **18.0**)
  - Identify and describe potential impacts, with reference to the baseline environment
  - Assess the significance of the potential impacts (**Section 8.2**)
  - Apply management and mitigation to lower the significance, frequency and/or risk of an impact occurring (**Chapter 20.0 Management and mitigation measures**)
  - Assess residual environmental risks (**Section 8.2**).

8.2 Preliminary environmental risk assessment

A PERA workshop was undertaken in March 2022 with the objective of determining the significance of potential environmental risks associated with the construction and operation of the Project prior to mitigation, and to identify which risks required further investigation. This workshop was attended by representatives from the Proponent, the EA team including technical specialists, and the design team.

The inputs and outputs of the PERA were based on design progression at the time of the workshop, with potential risks assessed in accordance with the methodology provided in **Section 8.3**. The results of the PERA workshop were documented and are included in this EA as **Appendix C (PERA)**.

Risks which were assessed in the workshop as ‘Medium’, ‘High’, ‘Very High’ and ‘Significant’ were referred for further assessment in a technical report. Risks which were assessed as ‘Negligible’, ‘Very Low’, and ‘Low’ are assessed in EA Chapters. In some case, subsequent changes to design have affected the preliminary risk ratings by either increasing or decreasing risk. The risk ratings documented in this EA reflect the design current at the time of publication of the EA.

8.3 Environmental risk assessment

The environmental risk assessment has been performed in accordance with the principles of *AS/NZS/ISO31000:2018 Risk Management – Principles and Guidelines*. Classifying the consequences of impacts and the likelihood of occurrence allows the ranking of potential impacts into one of eight risk levels. The probable effectiveness of proposed management and mitigation measures is then considered to determine the residual risk of each impact. This risk assessment process is outlined in **Figure 8-1** below.

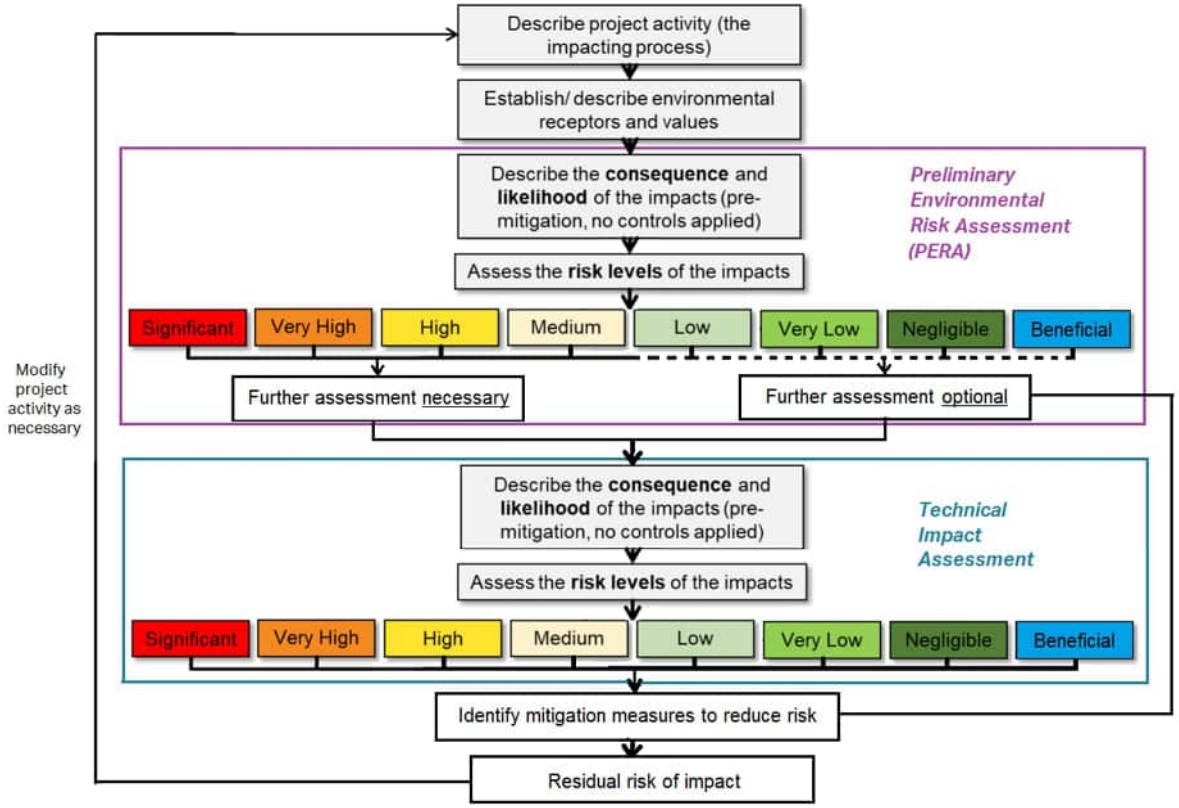


Figure 8-1 Risk assessment approach

8.3.1 Likelihood

The likelihood of an impact occurring is best described in terms of its associated probability. Typically, the probability of a particular outcome occurring is determined through qualitative assessment by experienced practitioners. However, in all qualitative assessments there is a degree of uncertainty associated with the ability for an accurate assessment to be made (i.e., reflecting the availability of knowledge, human error, etc.). Consequently, it is considered best practice to interpret potential risks assuming a reasonable worst-case scenario (i.e., overestimate the probability of impact occurrence) to account for the underlying uncertainty. **Table 8-1** illustrates the criteria used to determine the likelihood of an impact.

Table 8-1 Evaluating likelihood

Likelihood	Description
Remote	Extremely rare/unprecedented
Unlikely	Not expected to occur in most circumstances
Possible	Could occur
Likely	Probably would occur
Almost Certain	Expected to occur

8.3.2 Consequence

Assessing the consequences of an impact requires a degree of subjective assessment as the likely consequences of an impact may consist of several elements (i.e., environmental, economic, social). The consequence of an impact addressed in the risk assessment is assessed as being a reasonably foreseeable consequence. If there is a large amount of uncertainty, then the consequence may be

assumed to be worse. For the purpose of an inherent risk assessment (i.e., before the efficacy of mitigation measures is assessed), elements that could be considered are illustrated in **Table 8-2**. Environmental, economic, and social elements are usually interrelated and therefore, the consequence would be considered major (or higher) if any one of the associated elements has a predicted major impact.

Table 8-2 Evaluating consequence

Consequence	Environment	Economic	Social
Beneficial	Enhancing, improving, or positively impacting the environment, economy and/or society		
Insignificant	No environmental damage	Minimal losses	No noticeable change experienced by people in the locality
Minor	Minor instances of environmental damage that could be reversed (e.g., negative impact on a specific species)	Several thousand dollars lost revenue or remediation costs	Mild deterioration, for a reasonably short time, for a small number of people who are generally adaptable and not vulnerable
Moderate	Isolated but significant instances of environmental damage that might be reversed with intense efforts	Half million dollars lost revenue or remediation costs	Noticeable deterioration to something that people value highly, either lasting for an extensive time, or affecting a group of people
Major	Severe loss of environmental amenities and a danger of continuing	One million dollars lost revenue or remediation costs	Substantial deterioration to something that people value highly, either lasting for an indefinite time, or affecting many people in a widespread area
Catastrophic	Major widespread loss of environmental amenity and progressive irrecoverable environmental damage	Several million dollars in lost revenue or remediation costs	Substantial negative change experienced in community wellbeing, livelihood, amenity, infrastructure, services, and/or health, permanent displacement of at least 20% of a community

8.3.3 Risk assessment

The risks associated with the impacts are analysed as a function of the likelihood of the risk occurring and the consequences associated with this risk occurring. The risks and impacts identified are assigned likelihood and consequence ratings generally based on the definitions set out in the *Proponent's Guide to Environmental Impact Statements* (published by ACT Planning and Land Authority). These combine to identify the risk rating as set out in the matrix presented in **Table 8-3**.

Table 8-3 Risk rating matrix

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

The inherent environmental risks of a project are any potential environmental impacts that could arise without any management and mitigation measures in place. The residual environmental risks of a project are any potential environmental impacts that could arise despite management and mitigation measures being in place. Both risk types are assessed using an evaluation of the likelihood and the consequence of each impact as outlined in **Table 8-1** and **Table 8-2**.

8.4 Environmental issues assessment

The assessment of potential environmental issues associated with the Project is documented in **Chapters 9.0** to **19.0**, as outlined in **Table 8-4**. A number of these assessments are supported by technical reports which are appended to this EA. Each Chapter provides a summary of the existing environment, potential impacts, management and mitigation measures and an assessment of residual impacts.

Table 8-4 Environmental issues

Issue	Chapter	Technical Report
Traffic and transport	**9.0**	**Appendix D (TTIA)**
Heritage	**10.0**	**Appendix E (HIA)**
Contamination and soil	**11.0**	**Appendix F (Contamination Assessment)**
Noise and vibration	**12.0**	**Appendix G (NVIA)**
Landscape and visual realm	**13.0**	**Appendix H (LCVIA)**
Socioeconomic impacts	**14.0**	**Appendix I (SEIA)**
Air quality	**15.0**	**Appendix J (GHG Assessment)**
Biodiversity and ecology	**16.0**	N/A
Hydrology and water quality	**17.0**	N/A
Resource management and waste minimisation	**18.0**	N/A
Cumulative impacts	**19.0**	N/A

9.0 Traffic and transport

This Chapter provides a summarised assessment of the potential traffic and transport impacts associated with the Project.

9.1 Approach

A detailed Traffic and Transport Impact Assessment (TTIA) has been prepared for the Project and is included in **Appendix D (TTIA)**. The TTIA addresses key traffic and transport impacts and benefits that may be associated with the construction and operation of the Project.

9.1.1 Methodology overview

This Section documents the multi-modal assessment methodology undertaken to determine the traffic and transport impacts during construction, operation and the cumulative impacts of the Project.

The framework of the assessment methodology is presented on **Figure 9-1** and includes:

- Identify multi-modal assessment requirements
- Assess the baseline conditions for the delivery phase area
- Identify assessment criteria
- Predict and assess the transport impacts and benefits of the Project during construction and operations (post-construction)
- Identify management and mitigation measures that manage and minimise the risk of the identified impacts
- Assess the residual risk of the transport impacts.

As illustrated on **Figure 9-1**,the assessment methodology considered several components that required identification and assessment of traffic and transport impacts during the construction and operational stages of the Project.

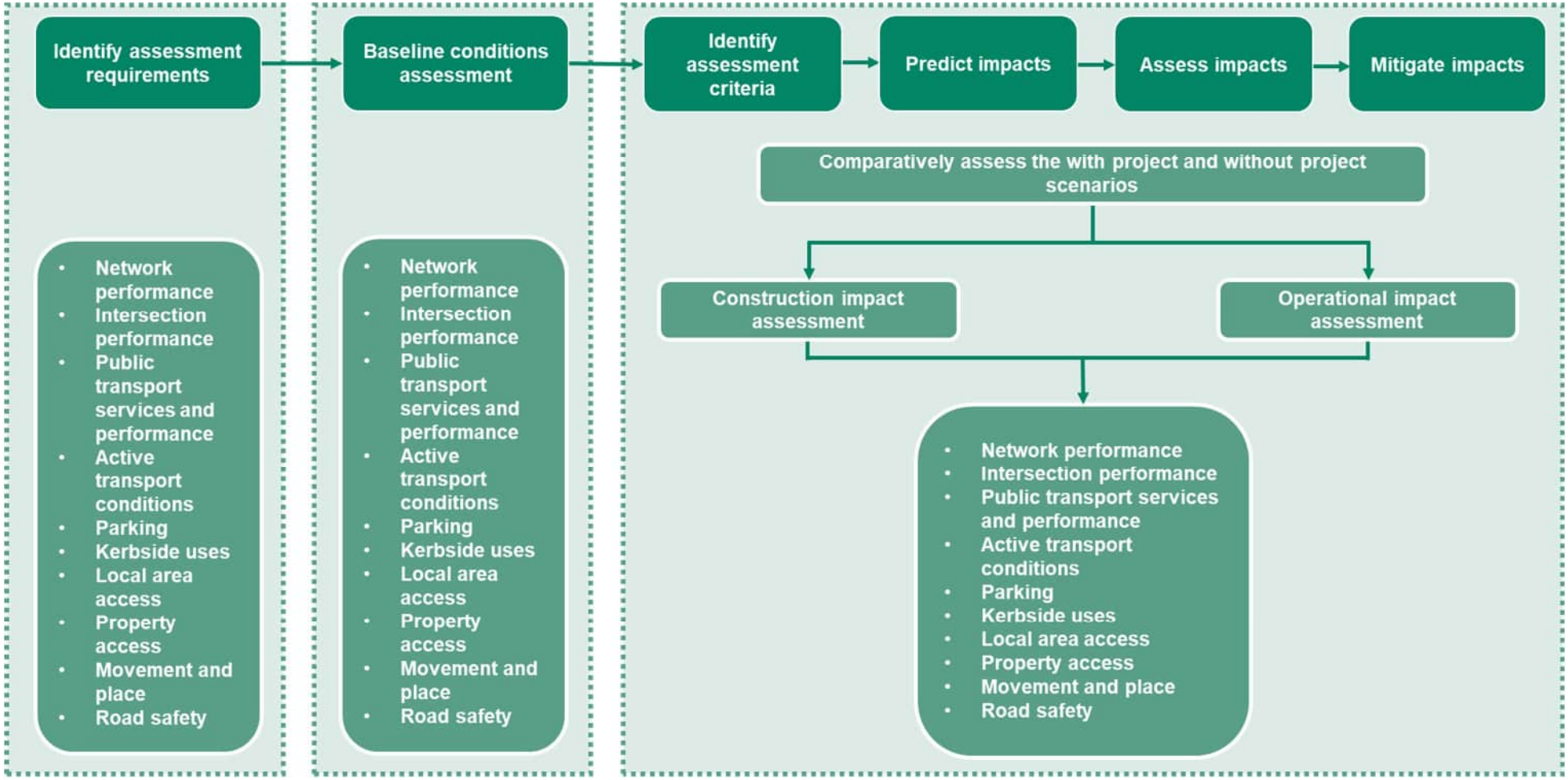


Figure 9-1 Transport impact assessment methodology overview

9.1.2 Transport modelling approach

A tiered, multi-modal transport modelling approach was used to assess the traffic and transport impacts of the Project including road network performance, public transport impacts (buses and light rail) and pedestrian performance at light rail stops and crossings.

The following traffic modelling tools were used:

- The Zenith strategic model was used to generate the future year travel demand including traffic and light rail patronage based upon employment and population distribution and determine mode choice
- An Aimsun mesoscopic model was used to assign forecast traffic volumes across the broader transport network and to determine network performance at a high level
- A VISSIM microsimulation model was used to provide a more detailed understanding of the forecast road network performance and light rail performance
- A series of microscopic pedestrian simulation models developed in Viswalk were used to determine pedestrian infrastructure requirements at the new light rail stops and assess the associated LoS provided to pedestrians at light rail stop platforms and crossings.

9.2 Existing environment

9.2.1 Overview

Figure 9-2 provides an overview of the existing and post-RLC baseline traffic and transport features within the delivery phase area. An overview of these existing traffic and transport features are summarised below and further addressed in the following Sections (refer **Appendix D (TTIA)** for more information).

Traffic surveys conducted in 2017 and 2019 highlight that Northbourne Avenue and Commonwealth Avenue carry the highest traffic volumes in the delivery phase area, with approximately 2,800 vehicles per hour and 7,000 vehicles per hour using Northbourne Avenue and Commonwealth Avenue in the AM peak hour in 2019, respectively. Along London Circuit, traffic volumes are highest at the southern end, where vehicles generally arrive and depart the area via Commonwealth Avenue, London Circuit East and Edinburgh Avenue.

The City Interchange is partially within the delivery phase area and caters for much of the CBD's public transport activity. Bus services travelling to/from the south generally use Commonwealth Avenue or Constitution Avenue and London Circuit East to access the City Interchange. Additionally, several bus services travelling from Belconnen and other locations in the inner north access the City Interchange via Marcus Clarke Street.

Commonwealth Avenue combined with Vernon Circle and Northbourne Avenue form a future principal cycling route. In the delivery phase area cyclist activity was highest along Northbourne Avenue, Marcus Clarke Street and Commonwealth Avenue. Separated cycleways are provided on Northbourne Avenue south of Alinga Street and along all of Marcus Clarke Street within the delivery phase area. At the intersection of Northbourne Avenue and London Circuit 85–90 cyclists were observed in the AM and PM peak hours. On Commonwealth Avenue nearly 100 cyclists were observed in the AM and PM peak hours.

Pedestrian activity within the delivery phase area is highest at the intersection of Northbourne Avenue and Alinga Street, which experienced nearly 1,800 pedestrian crossing movements in the AM peak hour and 2,570 movements in the PM peak hour. Pedestrian activity is lowest where there is limited land use activity fronting the street, in particular the intersection of London Circuit and Edinburgh Avenue and along Vernon Circle.

Parking within the delivery phase area is largely accommodated by off street car parks, however main and local streets within the delivery phase area have some on street parking and provision for other kerbside uses such as loading and taxis.

In terms of movement and place, all streets within the delivery phase area have high movement functions and low to medium place value. This means that the streets generally facilitate movement between places, but have limited desirable dwellable area available.

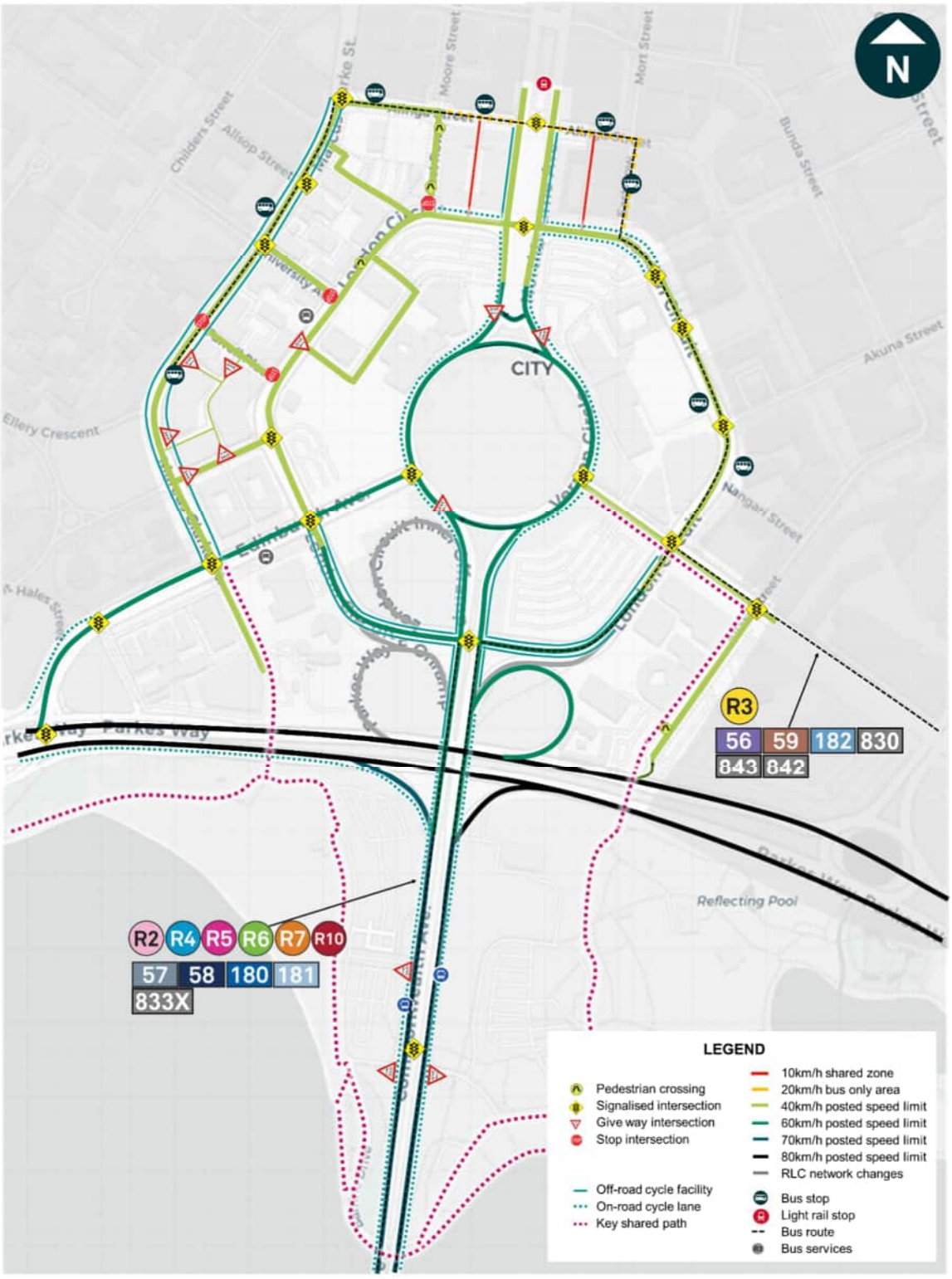


Figure 9-2 Existing transport conditions within the delivery phase area

9.2.2 Road network

Key features of the existing road network include the following:

- Northbourne Avenue, Vernon Circle and Commonwealth Avenue, which form part of a north-south arterial traffic route that runs through the centre of Canberra City and provides a link between north and south Canberra
- Parkes Way, which is an east-west arterial traffic route that traverses the northern side of Lake Burley Griffin. Access to the major north-south route, Commonwealth Avenue, is provided via a cloverleaf road
- London Circuit, which is a radial major collector road provides access between adjoining properties in Civic with surrounding arterial corridors
- Edinburgh Avenue, which is an arterial traffic route connecting Parkes Way to Marcus Clarke Street, and Vernon Circle
- West Row, Gordon Street, University Avenue and Farrell Street, which are local access streets providing access to local land uses via connections to London Circuit and Marcus Clarke Street
- Knowles Place, which is a one-way (generally) local access street providing access to the adjacent courts and police station
- Marcus Clarke Street, which is a major collector road that connects the arterials of Edinburgh Avenue and Barry Drive in the north, and provides access to the land uses in the west of Canberra City, such as ANU
- Constitution Avenue, which is an arterial road providing connectivity between the east of the city area and Vernon Circle, London Circuit and Canberra City.

9.2.2.1 Traffic volumes

Peak hour traffic volumes were similar in 2017 and 2019 at all survey locations except Northbourne Avenue. Southbound traffic volumes on Northbourne Avenue were approximately 900 vehicles lower in the 2019 PM peak hour when compared with the 2017 PM peak hour. The traffic volume reduction was likely due to the opening on the Light Rail Gungahlin to City in 2019.

The highest traffic demand occurs along Northbourne Avenue and Commonwealth Avenue, with approximately 2,800 vehicles and 7,000 vehicles observed in 2019 during the AM peak hour, respectively. Traffic volumes were similar during 2019 in the PM peak hour, with approximately more than 2,400 and nearly 6,700 vehicles along Northbourne Avenue and Commonwealth Avenue, respectively.

Along London Circuit, traffic volumes are highest at the southern end, where vehicles generally arrive and depart the area via Commonwealth Avenue, London Circuit East and Edinburgh Avenue. The two-way traffic volumes on London Circuit peak to the north of Edinburgh Avenue, with more than 1,000 vehicles during the AM peak hour and 900 vehicles during the PM peak hour.

Along Marcus Clarke Street the traffic volumes are highest at the northern end of the delivery phase area, at the Alinga Street intersection. The two-way traffic volumes on Marcus Clarke Street are more than 1,200 in the AM peak hour and 1,100 in the PM peak hour. At the Edinburgh Avenue and Marcus Clarke Street intersection the traffic volumes are lower in the AM peak hour with 450 vehicles.

9.2.2.2 Intersection performance

The existing LoS of the key intersections are shown on **Figure 9-3**, indicating that most of the assessed intersections operated satisfactorily in 2017 with a level of service C or better. The exception to this is the intersection and Northbourne Avenue and Alinga Street which operated at a level of service E in 2017.

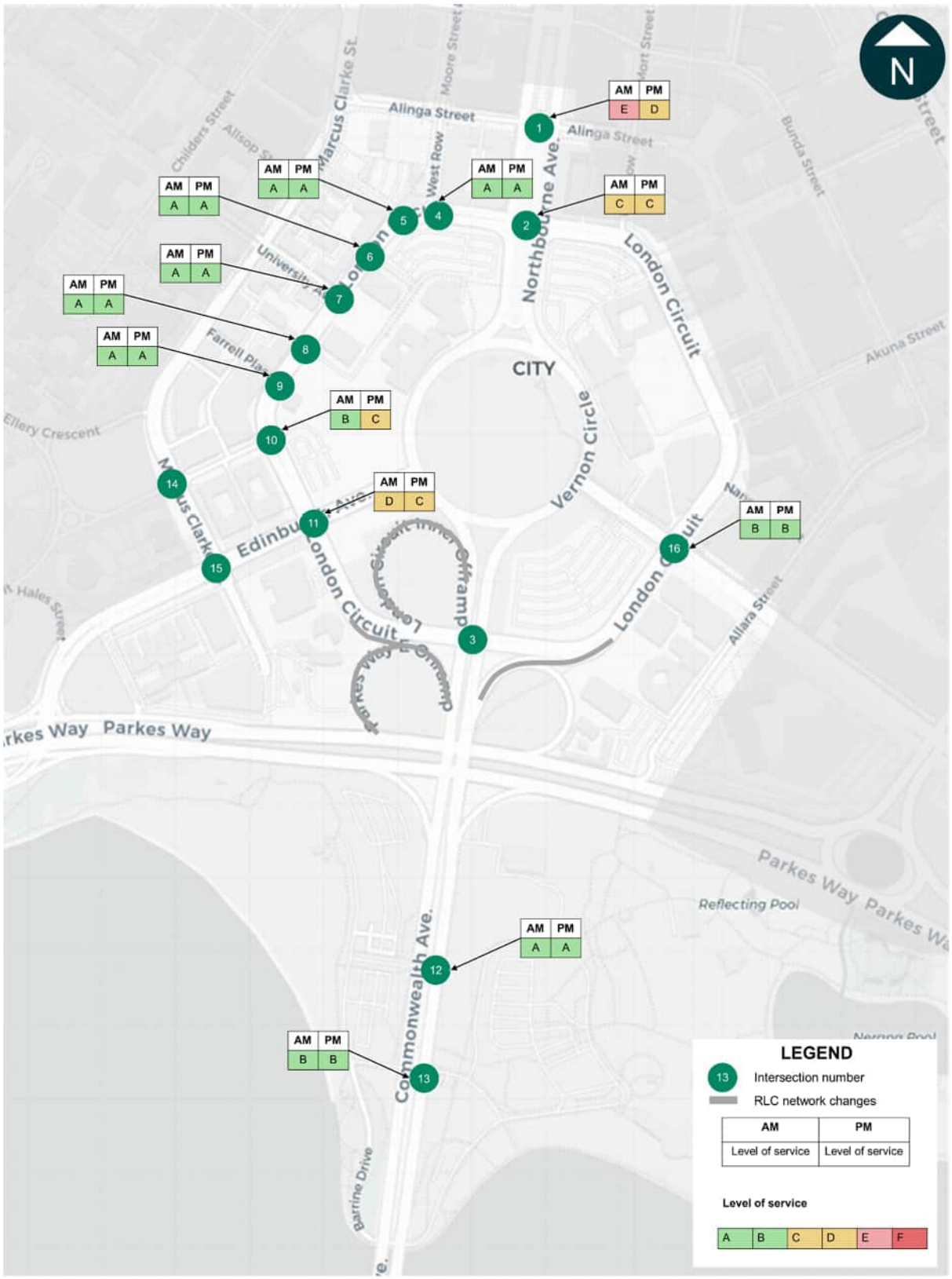


Figure 9-3 Existing intersection operation during the weekday AM and PM peak hours

9.2.3 Public transport

The City Interchange caters for most of the City's public transport. It includes bus stops along Alinga Street, and the Alinga Street light rail stop located on Northbourne Avenue.

The Alinga Street light rail stop is currently the southern terminus of the existing Gungahlin to City service. The existing light rail runs at a frequency of five minutes during peak hours, and 10 to 15 minutes in the off-peak hours.

Bus services travelling to/from the south generally use Commonwealth Avenue (10 routes) or Constitution Avenue (five routes) and London Circuit East to access the City Interchange. The Commonwealth Avenue bus routes currently use the northwest cloverleaf to access London Circuit East from Commonwealth Avenue south. However, once RLC is completed, these routes would instead use the Commonwealth Avenue and London Circuit signalised intersection.

9.2.3.1 Public transport patronage

The daily boardings for both bus services within the delivery phase area and the Alinga Street light rail stop between 2017 and 2022 are shown on **Figure 9-4**.

There was a decrease in the number of bus boardings between 2018 and 2019, which could be attributed to the opening of Light Rail City to Gungahlin. However, the number of public transport (total of bus and light rail) boardings increased in the delivery phase area in 2019 when compared to 2018 and 2017, indicating an increase in public transport usage as well as some modal shift to light rail.

The data shows around a 45% decrease in the number of bus boardings and a 40% decrease in light rail boardings per day at Alinga Street between December 2019 and December 2021. This decrease can largely be attributed to the impacts of COVID-19, including lockdowns within the ACT and associated changed travel behaviour.

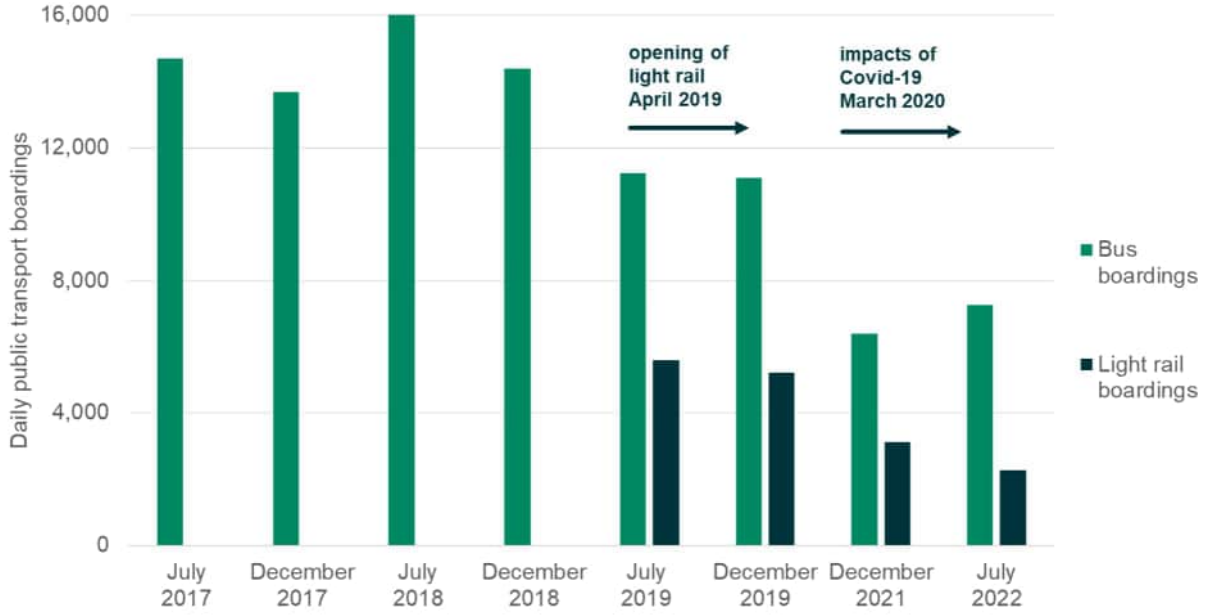


Figure 9-4 Daily public transport boardings in the delivery phase area

9.2.4 Active transport

Footpaths are provided on both sides of most roads within the delivery phase area, including Northbourne Avenue, London Circuit, Vernon Circle and Commonwealth Avenue. Bicycle parking facilities located throughout the City are short-stay, appropriate to the destination of users.

The narrowness of available footpaths compromises pedestrian amenity and/or safety, at the following locations:

- London Circuit, on the eastern side at Gordon Street
- Pedestrian crossings at on/off ramps between London Circuit and Parkes Way

- Commonwealth Avenue bridges across cross Parkes Way and London Circuit.

Cyclist infrastructure within the delivery phase area is generally limited to on-road cyclist lanes. In addition, cyclists are legally permitted to ride on footpaths in the ACT, though footpaths are generally not of sufficient width to accommodate cyclists and pedestrians comfortably, particularly when travelling in opposing directions.

Existing cycling infrastructure is shown on **Figure 9-5**, which includes:

- North-south on-road cycle lanes on Vernon Circle and Commonwealth Avenue and connecting to facilities in the north on Northbourne Avenue
- An eastbound on-road cycle lane along London Circuit between the northwest cloverleaf merge with London Circuit and about 80 m south of Constitution Avenue
- A westbound on-road cycle lane along London Circuit between the London Circuit westbound to Commonwealth Avenue southbound left turn slip lane diverge and the Commonwealth Avenue northbound to London Circuit westbound left turn slip lane merge.

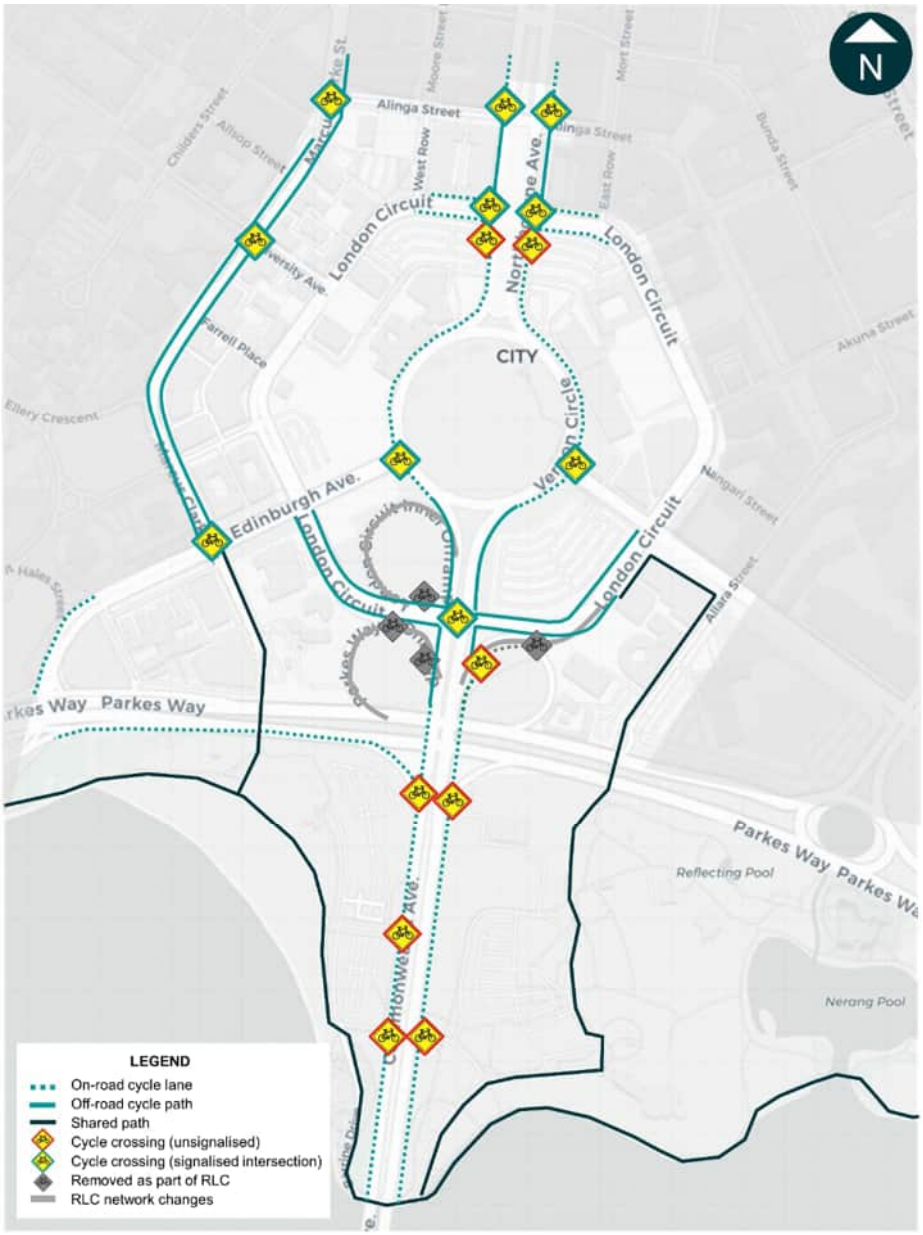


Figure 9-5 Existing cycling infrastructure (including planned changes due to RLC)

9.2.5 Coach operations

Coach services arrive and depart from two locations within and adjacent to the delivery phase area, at West Row and at the Jolimont Centre. These services include privately operated coaches, which operate between Canberra and Sydney, Melbourne or Thredbo, in addition to the following services:

- Route 701/703: Queanbeyan Bus Interchange to Wagga Wagga
- Route 702/704: Wagga Wagga to Queanbeyan Bus Interchange
- Route 771: Canberra Hospital to Eden
- Route 775: Canberra Civic to Bombala
- Route 783: Goulburn to Canberra
- Route 784: Canberra to Goulburn.

9.2.6 Micro mobility

There are several dockless shared micro mobility operations that operate within the ACT and the delivery phase area including e-scooters and e-bikes. These devices are located across the delivery phase area and are accessed by users who locate and pay for the hire through a mobile phone app.

Specific parking sites for these devices have been identified in Canberra City based on anticipated demand. Geofencing is used to enforce the appropriate use of the micro mobility devices. This includes the prevention of device parking in certain areas, restrictions on speed and prevention of travel.

9.2.7 Car parking, kerbside uses and access

9.2.7.1 Kerbside uses

The existing kerbside uses along the Project's alignment are shown on **Figure 9-6**. Locations that do not have any kerbside uses (such as Vernon Circle) have been excluded.

9.2.7.2 Off-street parking

Most buildings in the delivery phase area have dedicated basement car parking, which are generally accessed via local access roads within the delivery phase area. In addition, there are several public car parks located within and surrounding the delivery phase area, catering for a mix of short-term and all-day parking options with a total supply of approximately 3,840 parking spaces, as shown on **Figure 9-7**.

Based on parking count data from 2019 and provided by TCCS, many of the car parks within the delivery phase area typically reach capacity on weekdays. Some spare capacity is typically experienced on a weekday in the car parks at Constitution Avenue, which was 75% occupied, Allara Street, which was 60% occupied, and Acton Park South which was less than 5% occupied. Based on aerial imagery, it appears that the nearby Commonwealth Park car parks also typically have some spare capacity on a weekday. The Constitution Avenue car park is also frequently used by visitors to the adjacent Canberra Theatre, typically on weekends and weekday evenings.

As part of RLC, approximately 70 parking spaces would be permanently removed from the Section 116 long-stay car park. Further, the Section 63 car park, which has approximately 90 spaces, would be removed permanently as part of RLC.

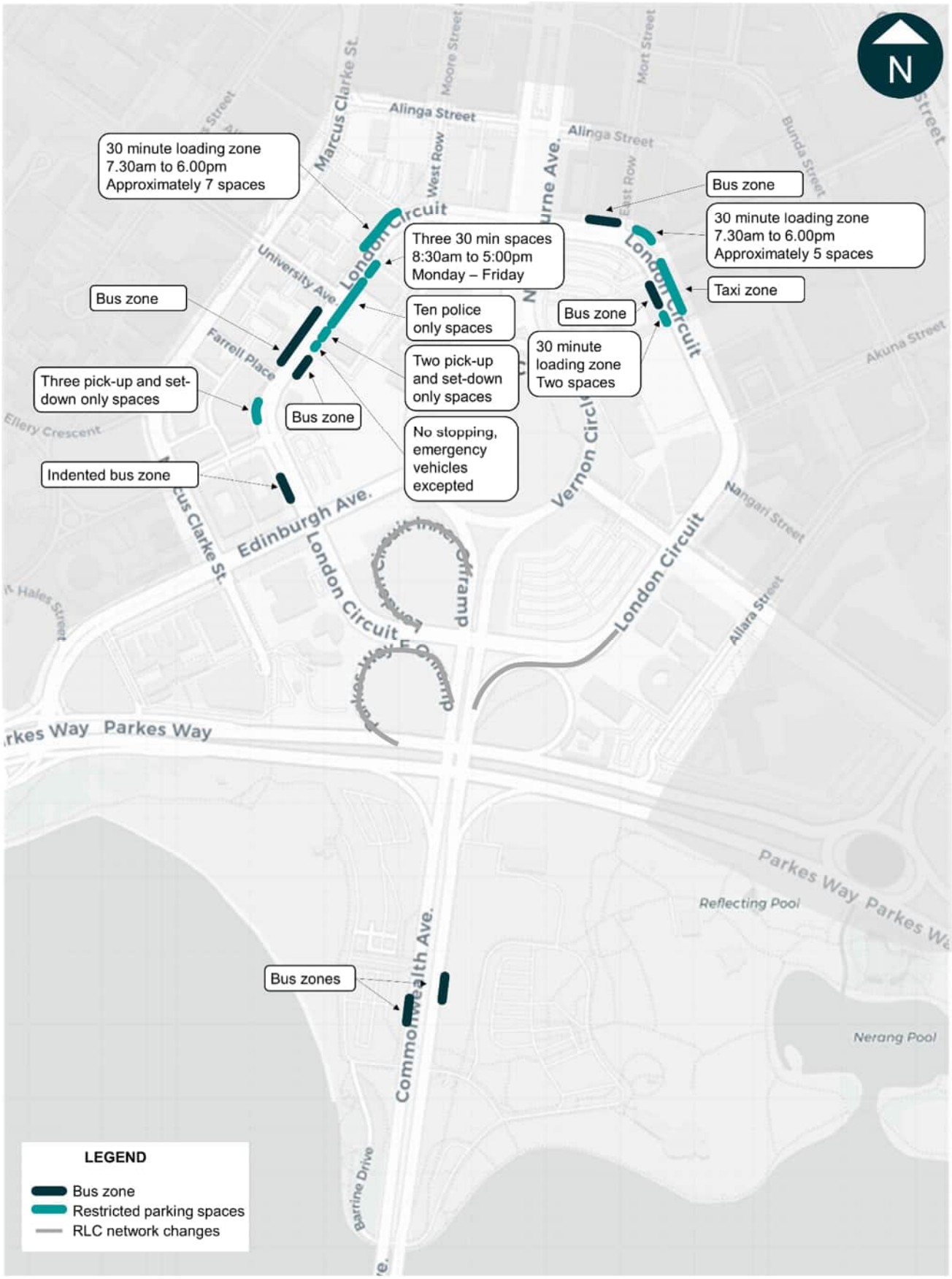


Figure 9-6 On-street parking and kerbside uses

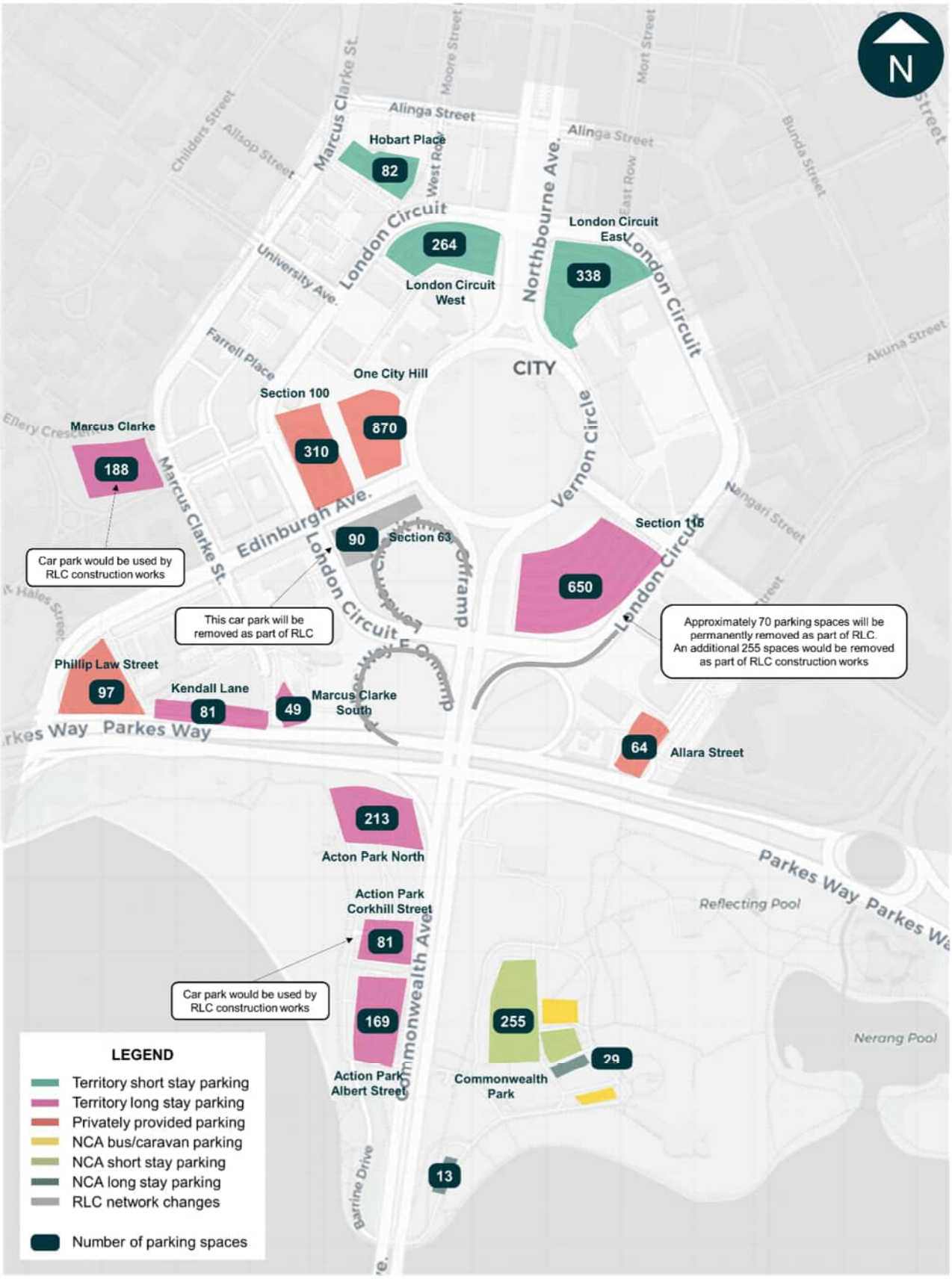


Figure 9-7 Off-street car parking locations and approximate parking supply

9.2.7.3 Property access

Minimal property access is directly provided along the Project's alignment including Northbourne Avenue, London Circuit and Commonwealth Avenue. Properties within and surrounding the delivery phase area are primarily accommodated via the roads adjoining London Circuit and the connecting access road network.

The QT Hotel fronts London Circuit to the southeast of Edinburgh Avenue and is the only property with a driveway access along the Project alignment. The QT Hotel access caters for the hotel entrance and some car parking. The QT Hotel entrance on London Circuit would be restricted to left-in/left-out as part of RLC.

In addition, a privately operated at-grade car park has a driveway access along London Circuit, directly opposite the QT Hotel driveway access. The Section 63 car park would be removed as part of RLC.

Vehicular access to Commonwealth Park and Acton Park car parks is provided by Corkhill Street and Albert Street which intersect with Commonwealth Avenue.

9.2.8 Movement and place

Adopting the functional class matrix shown on **Figure 9-8**, key streets within the delivery phase area have been classified in terms of their baseline movement and place functions (post-RLC). For these parts of the network both the existing classification and the baseline classification (post RLC) have been identified. The resultant classifications are shown visually on **Figure 9-8**.

Overall, most of the streets within the delivery phase area currently have higher movement functions and relatively low place value. They generally facilitate movement between places but have limited activated dwellable areas.

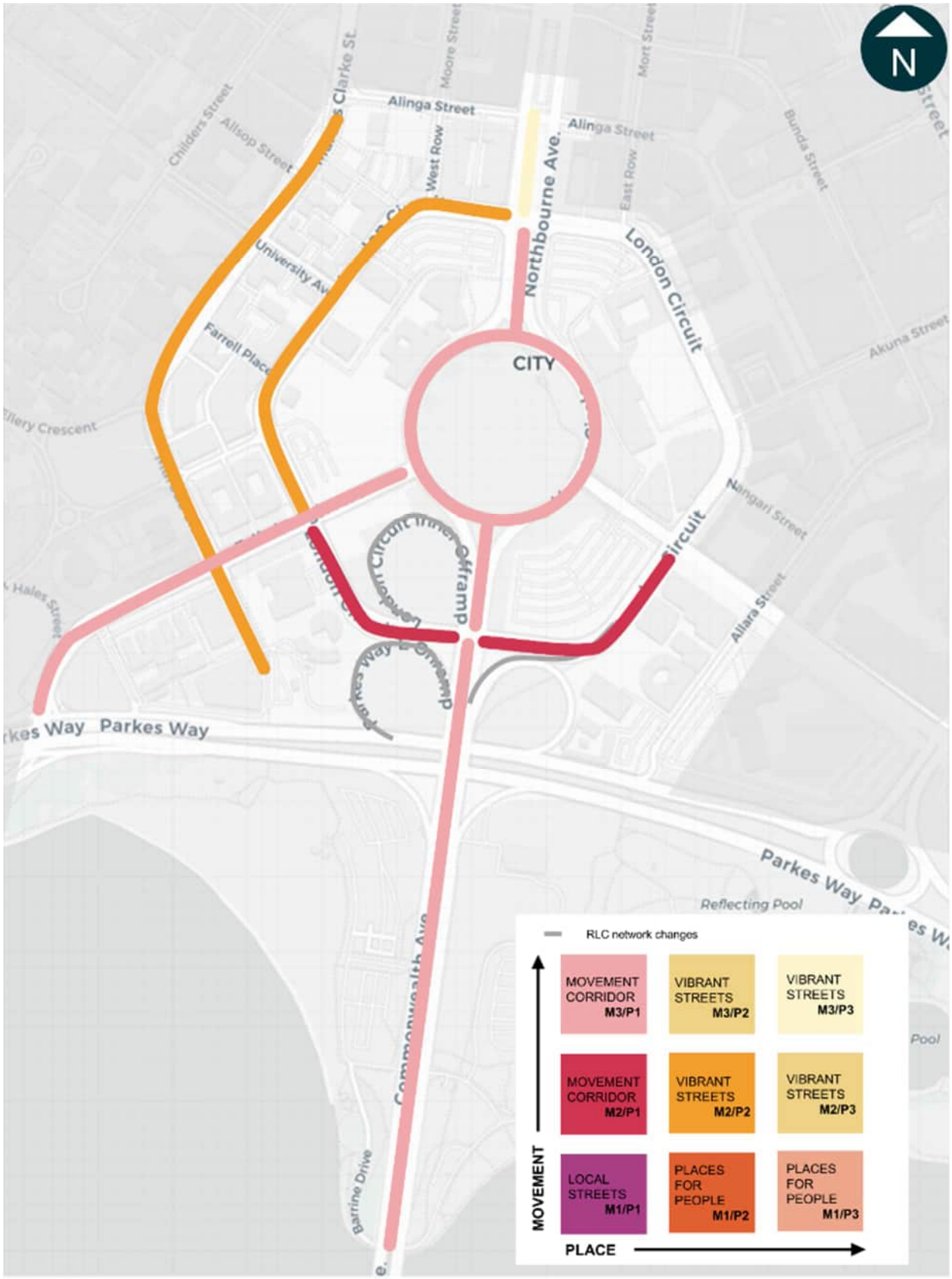


Figure 9-8 Existing movement and place classifications

9.3 Assessment of potential impacts

9.3.1 Construction

The construction of the Project is anticipated to have potential impacts on the road network, public transport, active transport, coach operations, parking and road safety. A summary of these potential impacts is provided below.

9.3.1.1 Road network performance

9.3.1.1.1 Construction traffic volumes

It is anticipated that the construction of the Project would generate up to 50 heavy vehicles and 100 light vehicles (generated by construction workers) per daygf. It is assumed that up to ten construction heavy vehicle movements (two-way) would be generated by the works during the AM and PM peak hours. Additionally, it is understood that workers would typically arrive to sites earlier than the weekday AM peak hour (before 8:00am) and would largely have left the sites before the weekday PM peak hour (before 5:00pm). Therefore, the additional heavy and light vehicle volumes would likely be manageable, given existing traffic volume and road network conditions.

9.3.1.1.2 Vehicle travel times

Vehicle travel times were modelled for eight key routes in the delivery phase area, as shown on **Figure 9-9**.

In the AM peak hour the Project's construction would impact the following vehicle travel times:

- Route 1 – between State Circle and Barry Drive via Commonwealth Avenue: two to four minute travel time increases in at least one direction
- Route 2 – between State Circle and Glenloch Interchange via Commonwealth Avenue: two to five minute travel time increases in at least one direction
- Route 5 – between State Circle and City via Commonwealth Avenue: three to five minute travel time increases in the northbound direction
- Route 7 – Glenloch Interchange from City: three to five minute travel time increases in the westbound direction
- Route 8 – between Barry Drive and City via Northbourne Avenue: three minute travel time increase for southbound traffic.

In the PM peak hour the construction of the Project would impact the vehicle travel time of key routes as follows:

- Route 3 – between State Circle and Glenloch Interchange via Kings Avenue: two to four minute travel time increases in the westbound direction
- Route 4 – State Circle to Limestone Avenue via Kings Avenue: three to four minute travel time increases in the northbound direction
- Route 7 – Glenloch Interchange from City: two to three minute travel time increases in the westbound direction.

Figure 9-9 Assessed general traffic travel time routes

9.3.1.1.3 Density

Density is a measure of how many vehicles are occupying a length of road i.e., it can be described as a measure of congestion (higher density represents more congestion). The following are key findings relating to the expected changes to density due to the Project's construction in the AM peak hour:

- Vehicle density may increase on Northbourne Avenue in the southbound direction due to the proposed loss of one traffic lane. Consequently, vehicle density would increase on West Row in the southbound direction, as some southbound traffic would use West Row instead of Northbourne Avenue
- Block closures on London Circuit may cause vehicle density to increase on the Parkes Way westbound exit ramp as more traffic would use Edinburgh Avenue to access Marcus Clarke Street instead of London Circuit. Vehicle density may also increase on Parkes Way due to the proposed loss of one lane in each direction on Parkes Way. The increased vehicle density would impact vehicles accessing Marcus Clarke Street via Parkes Way and Edinburgh Avenue
- There is the potential for vehicle density to increase on Commonwealth Avenue in both directions when one traffic lane in each direction is removed on Commonwealth Avenue. Additionally, vehicle density would increase on the Parkes Way eastbound to Commonwealth Avenue southbound cloverleaf ramp. Additionally, operating the Albert Street pedestrian crossing as a single stage crossing would increase the vehicle density on Commonwealth Avenue in both directions.

The following are key findings relating to the expected changes to density due to the Project's construction in the PM peak hour:

- Vehicle density may increase on Marcus Clarke Street in the southbound direction and Alinga Street due to the proposed loss of traffic lanes on Northbourne Avenue and traffic reassignment associated with the proposed block closures on London Circuit
- The proposed block closure on London Circuit between Edinburgh Avenue and Commonwealth Avenue may result in increased vehicle density on Constitution Avenue in the eastbound direction, Coranderrk Street in the southbound direction and Parkes Way in the westbound direction due to a redistribution of traffic.
- Vehicle density may increase on Akuna Street in the eastbound direction and Cooyong Street in the northbound direction due to traffic reassignment associated with the proposed block closures on London Circuit
- Vehicle density may increase on Commonwealth Avenue in both directions due to the loss of one traffic lane in each direction on Commonwealth Avenue.

9.3.1.2 Public transport impacts

9.3.1.2.1 Bus network

Inbound and outbound buses currently use roads and intersections within the delivery phase area that would be impacted by the construction works.

During construction works at the intersection of the Northbourne Avenue and Alinga Street, minor bus diversions may be required via London Circuit and Bunda Street. However, buses could make U-turns at the Northbourne Avenue and London Circuit intersection, if required. The bus stops located on Alinga Street between East Row and West Row would need to be temporarily relocated to another location within the City Interchange.

In the AM peak hour, buses (R2 (Aranda to Fyshwick and Fyshwick to Aranda) and R4 (Woden to Aranda, and Aranda to Woden) services) would likely experience increased travel times of between one and a half to four minutes as a result of the Project's construction due to increased congestion from the proposed road network changes and associated detours. In the PM peak hour, travel times would increase by between one and three minutes on some routes (R2 and R4 services).

9.3.1.2.2 Light rail

The Project needs to integrate into the existing light rail network. Therefore, the Project's construction would require some short-term temporary interruptions on the existing light rail. It is anticipated that

these works would occur outside the existing light rail hours of operation or during one of the planned operational shut down and maintenance periods to avoid additional service shut-down periods.

9.3.1.3 Active transport impacts

Safe routes for pedestrians and cyclists would be maintained during the construction works with minimal diversion from existing pedestrian paths. During block closures pedestrian paths would be allowed for to maintain connectivity. Therefore, the Project's construction is anticipated to have minimal impact to pedestrian and cyclist movements and travel times.

9.3.1.4 Parking and access impacts

9.3.1.4.1 Kerbside uses

On-street parking on London Circuit would be inaccessible during respective block closures. Therefore, all on street parking and kerbside uses that would be removed as part of the operational Project would occur at the start of construction.

9.3.1.4.2 Local area and property access

Several block and lane closures are proposed during the Project's construction. However, throughout construction, access to Verity Lane, Odgers Lane and the QT Hotel on London Circuit would be maintained. Additionally, access to/from Knowles Place North would also be continuously maintained, allowing access to key places including the Reserve Bank of Australia, the Magistrates Courts, Supreme Court of the ACT, Canberra City Police Station and the Australian Federal Police.

Parkes Way is a key east-west route that would require full closures during some nights and weekends to facilitate the construction of the Parkes Way bridge. During these closures, traffic would be diverted to use Edinburgh Avenue, Vernon Circle and Constitution Avenue as an alternate route. The full closure of the Edinburgh Avenue through lanes is not proposed to occur at the same time as the Parkes Way closure to allow for this detour.

9.3.1.4.3 Off-street carparking

The Project's construction compounds would result in the temporary loss of approximately 700 off street public long-stay car parking spaces at the following locations:

- Site compound A – Constitution Avenue car park: 255 parking spaces
- Site compound B – Marcus Clarke Street: 190 parking spaces
- Site compound C – Acton Waterfront Central and Southern car parks: 80 parking spaces in the central car park and approximately 170 parking spaces in the southern car park.

Additionally, the permanent loss of approximately 100 off street parking spaces in the two car parks located on the corner of Northbourne Avenue and London Circuit is planned the start of the Project's construction works. The delivery phase area currently has a total publicly available car parking supply of approximately 3,840 spaces. Therefore, nearly 20% of the current parking supply would be affected by the construction works.

Based on parking count data from 2019 and provided by TCCS, it is expected that some of the displaced vehicles could use alternative car parks on a typical weekday, such as the Commonwealth Park car park. Drivers that choose to use these alternative car parks would have longer walking distances to/from their destinations in the city, which would be commensurate with other Australian cities, where car parking supply is provided on the outer regions of a city centre. The surveys also suggest that the Acton Waterfront Southern car park is the least utilised in the delivery phase area and was less than 5% utilised at the time that the survey data was collected.

9.3.1.5 Road safety

The construction activities would generate additional heavy vehicle activity within the delivery phase area and along the adjoining road network. This could increase the risk of collisions involving a heavy vehicle, given the CBD environment and the high level of vulnerable road users in the area.

9.3.2 Operation

9.3.2.1 Transport integration

9.3.2.1.1 Road network and intersection arrangements

The Project would be provided within the median between opposing vehicular traffic flows for the entire alignment. The median would be raised to minimise the possibility of road vehicles entering the light rail corridor. The median would transition to grade before each signalised intersection to facilitate vehicular, cyclist and pedestrian movement across the track.

To accommodate the Project alignment and associated stops, several road network and intersection arrangement changes would be required, which are summarised in **Section 3.3.4**.

9.3.2.1.2 Public transport

No changes to the existing bus network including routes, services and frequency are proposed as part of the Project. There would be a minor relocation of the northbound and southbound bus stops on Commonwealth Avenue closer to the pedestrian access location for the Commonwealth Park Stop to facilitate an easier movement between bus and light rail services.

The Project would deliver light rail connecting Canberra's City south with the City north and on to Gungahlin. The extension of the light rail includes include three new stops which would improve access to public transport for existing and new residential and commercial activity in the City.

It is estimated that the light rail journey times between the existing Alinga Street stop and proposed Commonwealth Park stop would be around nine minutes, in each direction during the 2026 and 2036 AM and PM peak hours.

9.3.2.1.3 Stop access

The Project includes three new light rail stops, as summarised in **Section 3.3.2**.

The Project also includes minor changes to the existing stop at Alinga Street. The kerb at the southern end of the median at the Alinga Street stop would be extended to provide additional space for pedestrian movements. Signalised pedestrian crossings of the light rail track would be included within the medians to facilitate safe and convenient east-west pedestrian movements. The provision for other access modes at this stop is not within the scope of the Project.

9.3.2.2 Road network performance

Proposed road network changes associated with Project are expected to have a minor impact to the local road network in the short-term (2026). However, the cumulative impacts of Project and other planned proposals could result in notable increase in delays and congestion in the road network by 2036.

The impacts include increased congestion on London Circuit and to parts of Civic. This in turn, is expected to result in traffic redistribution in the network with increased travel times along several key routes.

By 2036, the road network operation would deteriorate in the AM and PM peak hours and in both the without Project and with Project scenarios due to traffic growth associated with land use densification. The capacity reductions and intersection modifications associated with the Project exacerbate the identified issues.

Notwithstanding the above, modelling assumes traffic growth and travel patterns based on historical conditions and does not consider any modal shift that could be expected with the future, potential introduction of Light Rail to Woden and other associated strategic transport initiatives. In particular, it could be considered that more trips generated by the nearby planned developments would take advantage of the high-quality public transport provided by the Project and future public transport initiatives.

Peak hourly traffic volumes have generally decreased since the light rail was opened in 2019. Providing a high-quality public transport alternative has encouraged transport users to travel to/from the north via public transport instead of using private vehicles.

It is therefore anticipated that similar outcomes would result from the future potential Light Rail to Woden. Therefore, the overall road network performance discussed in this report is considered a worst-case assessment that would be unlikely to eventuate should the planned public transport improvements proceed (subject to separate planning approvals).

9.3.2.3 Public transport impacts

The proposed modifications at Northbourne Avenue and Alinga Street would simplify the intersection phasing and operation, providing more time for buses to travel through the intersection, which could slightly improve bus reliability or result in shorter bus travel times.

9.3.2.3.1 Bus travel times

The TTIA assessed the peak hour bus travel time comparisons with and without the Project in 2026 and 2036, during the weekday AM and PM peak hours. Most of the assessed bus travel times would decrease with the Project due to traffic reassignment. However, the R4 travel time could increase by approximately 3.5 minutes in the AM peak in 2036.

9.3.2.4 Active transport impacts

The operational Project would mostly benefit pedestrians and cyclists. Whilst the addition of signalised pedestrian crossings could increase the wait time at certain intersections, safety, walkability and cycling connectivity within the delivery phase area would improve due to the addition and enhancement of active transport facilities.

9.3.2.5 Parking and access impacts

9.3.2.5.1 Kerbside uses

All parking, loading and other kerbside uses would be removed along the Project alignment, which is limited to changes to kerbside uses on London Circuit West. Affected kerbside uses on London Circuit West include:

- Ten police only bays located outside the Canberra City Police Station
- Seven loading zone spaces located south of West Row
- Nine bus zones
- Three short-term parking spaces located south of Knowles Place North
- Two pick-up/set-down bays located north of Knowles Place South
- One No Stopping (emergency vehicles excepted) space located north of Knowles Place South.

9.3.2.5.2 Off-street parking

The road network changes along London Circuit between East Row and West Row require some loss of parking in the two off street car parks located on either side of the Northbourne Avenue and London Circuit intersection.

Approximately 40 car parking spaces would be removed in the car park bounded by Northbourne Avenue, London Circuit and Theatre Lane to the east of Northbourne Avenue.

Approximately 55 car parking spaces would be removed in the Block 40, Section 100 car park which is bounded by Northbourne Avenue, London Circuit and Knowles Place.

9.3.2.5.3 Local area and property access

The overall impacts to local area access are considered to be minor given that short alternative access routes are available. Most of the alternative routes would be via Marcus Clarke Street or alternatively via Vernon Circle. This is consistent with the Project's intent for Marcus Clarke Street to be a detour route for London Circuit, which would function as a key public transport route.

There would be no direct changes to any property accesses as a result of the Project.

9.3.2.5.4 Emergency access

The Project includes several new turn bans and intersection modifications. However, emergency vehicles could continue to turn right out of Knowles Places South, by using lights and sirens, which provides access from the Police Station.

Emergency vehicles could use the light rail alignment during emergency situations. Therefore, the Project is expected to have only a minor impact on restricting emergency vehicle access.

9.3.2.6 Road safety

The proposed new signalised intersections along the Project's alignment create new intersection related conflicts. However, the intersections would be designed in accordance with the appropriate Australian and ACT standards and guidelines and would be reviewed through formal road safety assessments to minimise road safety risks.

The proposed introduction of a light rail vehicle within the roadway would increase the severity of any possible vehicular, pedestrian or cyclist crash with the light rail vehicle. However, several aspects have been included in the design to reduce the likelihood of a crash occurring with the LRVs, and/or reduce the severity if a crash was to occur (see **Appendix D (TTIA)**).

The Project would have the following road safety benefits:

- Providing separated off-road cycleways, and two protected intersections, would likely reduce the frequency of cyclist crashes by separating cyclist movements from vehicles
- Providing improved footpath facilities and separating cyclists from pedestrians, where possible, would likely reduce the frequency of a cyclist and pedestrian crash.

9.3.2.7 Movement and place assessment

Overall, most of the streets within delivery phase area would have higher movement functions and relatively low place value with the Project. Movement and function would improve along:

- Northbourne Avenue, London Circuit and Commonwealth Avenue due to the construction and installation of the Light Rail alignment
- London Circuit due to:
  - The installation of off-road cycling lanes and the reallocation of two vehicle lanes
  - An increased number of trees, installation of furniture, bicycle racks and drinking fountains
  - The proposed light rail stop on London Circuit.

9.3.2.8 Special event considerations and impacts

The planned stop and terminus at Commonwealth Park is located adjacent to surrounding parklands and facilities that are used for special events. There are a number of events, both large and small, which require transport planning and service delivery consideration.

The Commonwealth Park stop has not been primarily designed as an event operation stop and has lower forecast patronage demands than other stops in the network. It is anticipated that the light rail operator would be required to prepare and implement a management plan to manage people accessing events.

9.4 Preliminary risk assessment

A preliminary risk assessment of potential traffic and transport impacts, without mitigation measures, for construction and operation are presented in **Table 9-1** and **Table 9-2**, respectively. The risk has been calculated using the methodology detailed in **Chapter 8.0 Environmental risk analysis approach**.

Table 9-1 Preliminary risk assessment for traffic and transport during construction

Category	Description	Likelihood	Consequence	Rating
Road network	Increased congestion on local roads during road and lane closures including on Parkes Way, Marcus Clarke Street, Commonwealth Avenue and Northbourne Avenue.	Likely	Moderate	High
	Increased travel times on Commonwealth Avenue of between two and three minutes in the AM peak hour when Commonwealth Avenue would be reduced from three lanes to two lanes.	Likely	Moderate	High
	Additional construction related light and heavy vehicles using the local road network.	Likely	Minor	Medium
Public transport	Bus travel time increases of between one and four minutes for bus routes in the study area in the AM and PM peak hours.	Likely	Moderate	High
	Bus route and temporary stop relocations and detours required during intersection closures.	Possible	Minor	Low
Coach operations	Coaches may not be able to access the West Row during some construction works requiring temporary relocation of stop location.	Likely	Minor	Medium
Pedestrians	Short pedestrian detours during block and intersection closures.	Likely	Insignificant	Low
Cyclists	Short cyclist detours during block and intersection closures.	Likely	Minor	Low
Kerbside uses	All parking, loading and other kerbside uses would be removed along London Circuit West.	Likely	Insignificant	Low
Property access	All property access maintained but some alternative routes may be required during block and intersection closures.	Likely	Minor	Medium
Off-street parking	Temporary loss of approximately 700 long-stay parking spaces in the delivery phase area.	Likely	Moderate	High
Road safety	Additional heavy vehicles within the area, conflicting with pedestrians and cyclists.	Possible	Moderate	Medium

Table 9-2 Preliminary risk assessment for traffic and transport during operation

Category	Description	Likelihood	Consequence	Rating
Road network	Increased weekday peak period vehicle travel times due to the cumulative impacts of the Project, other planned projects and traffic growth in 2026 and 2036.	Possible	Moderate	Medium
	Cumulative impacts of the Project, other planned projects and traffic growth on weekday peak period traffic congestion (density) in 2026 and 2036.	Possible	Moderate	Medium
	Cumulative impacts of the Project, other planned projects and traffic growth on weekday peak period performance of the Commonwealth Avenue and London Circuit intersection, London Circuit and University Avenue intersection and London Circuit and Gordon Street intersection in 2026 or 2036.	Possible	Moderate	Medium
	The road network changes to London Circuit within the delivery phase area would result in the network not being able to accommodate heavy vehicles that are allowed on PBS Level 1 routes. London Circuit within the delivery phase area would need to be delisted as a PBS Level 1 route.	Likely	Insignificant	Low
Public transport	Increased weekday peak period bus travel times due to the Project in 2036.	Possible	Moderate	Medium
Pedestrians and cyclists	Providing signalised pedestrian crossings for all legs of any new signalised intersection could result in delays for pedestrians waiting at the proposed intersections.	Possible	Insignificant	Very low
	The combined active transport treatments and upgrades would improve the walkability and cycling connectivity within the delivery phase area and along the Project alignment.	N/A	N/A	Beneficial
Kerbside uses	All parking, loading and other kerbside uses would be removed along London Circuit West.	Likely	Insignificant	Low
Local area traffic access	Removal of some existing right turn and U-turn movements at intersections along the Project's alignment requires traffic to use alternative routes.	Likely	Insignificant	Low
Road safety	Proposed signalised intersections along the Project's alignment could create new intersection related conflicts.	Possible	Moderate	Medium
	The proposed introduction of a LRV within the roadway would increase the severity of any possible vehicular,	Possible	Moderate	Medium

Category	Description	Likelihood	Consequence	Rating
	pedestrian or cyclist crash with the LRV.			
	Providing off-road cycling facilities along London Circuit, combined with wider footpaths and the protected intersection treatments would improve safety for vulnerable users, by separating cyclists, pedestrians, and traffic.	N/A	N/A	Beneficial

9.5 Management and mitigation measures

Management and mitigation measures have been proposed to reduce the potential traffic and transport impacts of the Project identified in the assessment.

Management and mitigation measures and safeguard protocols adopted for the Project are provided in **Table 9-3**, and have been prepared with the following objectives:

- Holistically consider traffic implications of proposed construction activities.
- Minimise the potential strain on the road network during construction.
- Through the Disruption Taskforce, adopt a whole of Government approach to citywide transport planning and management throughout construction that considers vulnerable users
- Maintain appropriate vehicular access to directly impacted neighbours.
- Ensure that accessible parking provisions are not impacted from construction.
- Minimise the impacts to parking facilities from the construction workforce.
- Optimise the performance of the transport network.
- Raise public awareness on changes to the transport network, and how people move around the city
- Plan special equipment deliveries to reduce impacts on community.

Table 9-3 Management and mitigation measures – traffic and transport

Ref	Management and mitigation measure	Timing	Reference
T1	A Traffic and Transport Liaison Group (TTLG) would be established to oversee and review traffic and multi modal implications of proposed construction activities and network arrangements. TTLG would include representation from: • TCCS • MPC • ESA • NCA • AFP • CRA • Project delivery teams of adjacent developments.	Prior to and during construction	
T2	Prior to implementation, **Temporary Traffic Management** (TTM) Plans must be endorsed by the Traffic and Transport Liaison Group and have all other necessary approvals in place.	During construction	*Planning and Land Management Act 1988; AS1742 Part 3; Traffic Control at Worksites Manual* (RMS, 2012);

Ref	Management and mitigation measure	Timing	Reference
			Austroads Guide to Temporary Traffic Management
T3	A Disruption Management Strategy would be developed and widely socialised, to reduce the private vehicle trip generation and parking demand, particularly during weekday AM and PM peak hours, generated by local residents and employees of the broader CBD and surrounding area.	Prior to construction	ACT Transport Strategy 2020 ACT Transport Recovery Plan 2021 ACT Climate Change Strategy 2019
T4	In consultation with relevant stakeholders, appropriate vehicular access would be maintained to the Sydney & Melbourne Buildings, Reserve Bank of Australia, Canberra City Police Station, ACT Courts, and 1 & 7 London Circuit at all times during construction.	During construction	
T5	A **Construction Transport Management Plan** (CTMP) would be developed to manage the impacts of the construction activities on the transport network and local parking.	Prior to construction	
T6	Construction vehicle movement arrangements (Temporary Traffic Management Plans) would be developed in consultation with the Traffic and Transport Liaison Group (TTLG) to minimise impacts on the city generally, with specific regard to: • Bus movements, and bus priority measures • Peak hour traffic in Canberra City • Coordination of material deliveries • Key pedestrian movements and activity areas • Other construction projects in the locality • Local traffic movement requirements and peak traffic volumes, including long weekends and holiday periods • Crime prevention through environmental design principles • Special events.	Prior to and during construction	Hea-2 ISC IS Rating Tool 1.2
T7	No net loss of accessible parking within the delivery phase area.	During construction and operation	
T8	Consideration would be given to providing shuttle services to transport site workers. If shuttle services are not provided as part of the Project, parking restrictions around work zones would be considered to reduce the impact on public parking facilities by site workers. This must be included in the CTMP and approved by TCCS.	During construction	
T9	Continue to investigate measures to optimise the performance of key intersections (e.g., adjusted signal phasing). Refinement of intersection signals phasing to improve light	Prior to operation	

Ref	Management and mitigation measure	Timing	Reference
	rail, traffic and pedestrian movement efficiency		
T10	Complete a public awareness campaign of possible disruption to the transport network, and alternatives for travel.	During construction	
T11	Clear and safe pedestrian and cyclist signage and wayfinding mechanisms would be in place prior to works commencing that would change access and movement arrangements through the Project delivery phase area.	Prior to and during construction	IAP2 Spectrum of Public Participation ('Inform'); Hea-2 ISC IS Rating Tool 1.2
T12	Public awareness campaigns will be undertaken to increase understanding of new arrangements and interactions between cars, bicycles and pedestrians with light rail.	Prior to operation	
T13	Detailed planning of special equipment deliveries (rail etc.) to reduce impacts on local communities.	Prior to construction	

9.6 Residual risk assessment

A residual risk assessment was undertaken to assess potential traffic and transport impacts after the proposed management and mitigation measures are applied for construction and operation, is presented in **Table 9-4** and **Table 9-5**, respectively. No significant residual impacts on traffic and transport are anticipated.

Table 9-4 Residual risk assessment for traffic and transport during construction

Category	Description	Likelihood	Consequence	Rating
Road network	Increased congestion on local roads during road and lane closures including on Parkes Way, Marcus Clarke Street, Commonwealth Avenue and Northbourne Avenue.	Possible	Moderate	Medium
	Increased vehicle travel times on Commonwealth Avenue of between four and five minutes in the AM peak hour when Commonwealth Avenue would be reduced from three lanes to two lanes.	Possible	Moderate	Medium
	Additional construction related light and heavy vehicles using the local road network.	Likely	Minor	Medium
Public transport	Bus travel time increases of between one and four minutes for bus routes in the delivery phase area in the AM and PM peak hours.	Possible	Moderate	Medium
	Bus route and temporary stop relocations and detours required during intersection closures.	Possible	Minor	Low
Coach operations	Coaches may not be able to access the West Row during some construction works requiring temporary relocation of stop location.	Likely	Minor	Medium

Category	Description	Likelihood	Consequence	Rating
Pedestrians	Short pedestrian detours during block and intersection closures.	Likely	Insignificant	Low
Cyclists	Short cyclist detours during block and intersection closures.	Likely	Minor	Low
Kerbside uses	All parking, loading and other kerbside uses would be removed along London Circuit West.	Likely	Insignificant	Low
Property access	All property access maintained but some alternative routes may be required during block and intersection closures.	Likely	Minor	Medium
Parking	Temporary loss of approximately 700 long-stay parking spaces in the delivery phase area.	Likely	Minor	Medium
Road safety	Additional heavy vehicles within the area, conflicting with pedestrians and cyclists.	Possible	Moderate	Medium

Table 9-5 Residual risk assessment for traffic and transport during operation

Category	Description	Likelihood	Consequence	Rating
Road network	Increased weekday peak period travel times due to the cumulative impacts of the Project, other planned projects and traffic growth in 2026 and 2036.	Possible	Minor	Low
	Cumulative impacts of the Project, other planned projects and traffic growth on weekday peak period traffic congestion (density) in 2026 and 2036.	Unlikely	Moderate	Low
	Cumulative impacts of the Project, other planned projects and traffic growth on weekday peak period performance of the Commonwealth Avenue and London Circuit intersection, London Circuit and University Avenue intersection and London Circuit and Gordon Street intersection in 2026 or 2036.	Unlikely	Moderate	Low
Public transport	Increased weekday peak period bus travel times due to the Project in 2036	Possible	Minor	Low
Pedestrians and cyclists	Providing signalised pedestrian crossings for all legs of any new signalised intersection could result in delays for pedestrians waiting at the proposed intersections.	Possible	Insignificant	Very low
	The combined active transport treatments and upgrades would improve the walkability and cycling connectivity within the study area and along the Project alignment.	N/A	N/A	Beneficial
Kerbside uses	All parking, loading and other kerbside uses would be removed along London Circuit West.	Likely	Insignificant	Low

Category	Description	Likelihood	Consequence	Rating
Local area traffic access	Removal of some existing right turn and U-turn movements at intersections along the Project's alignment requires traffic to use alternative routes.	Likely	Insignificant	Low
Road safety	Proposed signalised intersections along the Project's alignment could create new intersection related conflicts.	Possible	Minor	Low
	The proposed introduction of a LRV within the roadway would increase the severity of any possible vehicular, pedestrian or cyclist crash with the LRV.	Possible	Minor	Low
	Providing off-road cycling facilities along London Circuit, combined with wider footpaths and the protected intersection treatments would improve safety for vulnerable users, by separating cyclists, pedestrians, and traffic.	N/A	N/A	Beneficial

10.0 Heritage

This Chapter provides a summarised assessment of the potential heritage impacts associated with the Project.

10.1 Approach

The Preliminary Environmental Risk Assessment identified risks relevant to heritage, including three construction risks and four operational risks. In accordance with the methodology provided in **Chapter 8.0 Environmental risk analysis approach**, this Chapter has been prepared to further document and assess heritage risks with consideration of subsequent design development.

This Chapter is based on information from the Heritage Impact Assessment (HIA) prepared by GML Heritage Pty Ltd in December 2022 (refer **Appendix E (HIA)**) as part of this EA. The HIA relied on existing heritage listings, nominated heritage information and consultation with the four recognised Representative Aboriginal Organisations[9] (RAOs) in the ACT, and does not contain any new heritage assessments of historic heritage values against the Commonwealth or ACT Heritage criteria for places on Commonwealth or Territory land located within or adjacent to the delivery phase area. A survey was undertaken to consider community nominated heritage values, however, no heritage values were returned outside of those that were already considered in the HIA.

The potential heritage effects of the Project on the heritage significance of the Melbourne and Sydney Buildings and other extrinsic features were also considered in separated Statement of Heritage Effects (SHE). The SHEs were prepared in response to s61G 1(d) of the ACT *Heritage Act 2004*, which requires documentation of measures to reduce the risk of diminishing the heritage significance of, or damage to, a heritage place. The SHEs also consider the measures adopted by the Project to reduce heritage effects and provides additional measures for consideration.

10.1.1 Methodology

The study area used in the HIA matches the delivery phase area of the Project. The HIA used the following methodology:

- An overview of the statutory heritage context relevant to the Project
- Identification of known and recorded historic, Indigenous and natural heritage values and places within or adjacent to the study area
- Reference to relevant heritage management documents/guidelines, including Conservation Management Plans (CMPs) and Heritage Management Plans (HMPs)
- Assessment of the Project for potential heritage impacts on the identified heritage values with reference to the EPBC Act and its guidelines. The HIA also fulfils the requirements of the SHE under the ACT Heritage Act
- Recommended mitigation measures to inform the design development and to mitigate identified impacts
- Consultation with the four RAOs in the ACT[10].

The HIA notes that the impact severity does not necessarily indicate a significant or adverse impact on the overall heritage values of a place. For example, the Central National Area of Canberra contains many individual heritage places which contribute to the heritage value of the location holistically. This means that localised impacts to heritage may be severe, but not significant to the overall heritage value of the place.

[10] The four recognised RAOs in the ACT are:
- Buru Ngunawal Aboriginal Corporation
- King Brown Tribal Group
- Mirrabee
- Ngarigu Currawong Clan.

10.2 Existing environment

10.2.1 Historic heritage

The HIA identified 11 historic heritage places located within or immediately adjacent to the delivery phase area, as shown in **Table 10-1** and on **Figure 10-1**. These heritage places are either listed or nominated for listing on the National Heritage List (NHL), Commonwealth Heritage List (CHL), or ACT Heritage Register. A summary of the key attributes and associated management policies implemented to protect the heritage values of these heritage places is provided in **Appendix E (HIA).**

Table 10-1 Historic heritage places on the ACT Heritage Register, CHL and NHL

Place name	Register (and status/ID)
Lake Burley Griffin and Adjacent Lands	CHL (Listed/105230)
Australian Academy of Science Building	NHL (Listed/105741)
Parliament House Vista	CHL (Listed/105466)
Reserve Bank of Australia	CHL (Listed/105396)
City Hill	ACT Heritage Register (Registered/20002)
Sydney and Melbourne Buildings	ACT Heritage Register (Registered/20032)
ANZ Bank Building (former ES&A Bank)	ACT Heritage Register (Registered/20150)
Civic Square Precinct	ACT Heritage Register (Registered)
Law Courts Precinct	ACT Heritage Register (Nominated)
Hotel Acton (Acton House)	ACT Heritage Register (Registered)
Ian Potter House (Beauchamp House)	ACT Heritage Register (Registered/20091)

10.2.2 Historical archaeology

No historical archaeological sites have been previously recorded within or in the immediate area of the delivery phase area. Evidence of the historical agricultural land use within the delivery phase area was likely removed or heavily impacted during the development of the City. Although unlikely, evidence of early agricultural land use such as remnants of outbuildings, fence posts or agricultural equipment could be present. If evidence is present it would likely be found within a highly disturbed context.

The delivery phase area is considered to have low archaeological potential and the Project is not anticipated to have an impact on historical archaeological values. As a result, no further assessment for historical archaeological sites has been undertaken in relation to the Project. If historical archaeological remains were to be unexpectedly encountered, an unexpected finds protocol would be implemented for the construction works (refer **Section 10.5**).

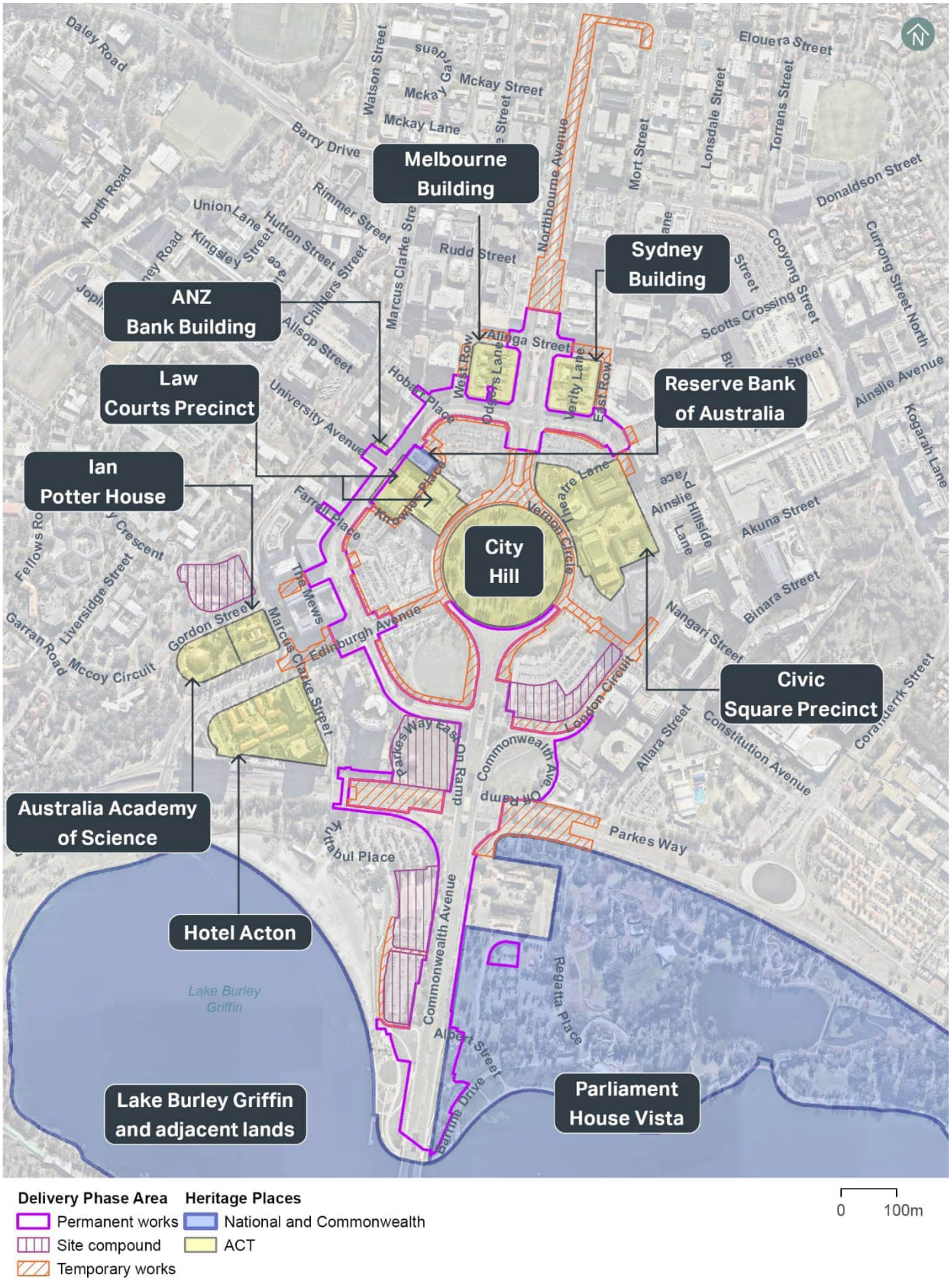


Figure 10-1 Areas of heritage significance

10.2.3 Indigenous heritage values

Consultation with the Aboriginal community has confirmed that the general landscape was, and continues to be, of significance to them (**Appendix E (HIA)**).

The Project would be situated between Black Mountain, Mount Ainslie and Mount Pleasant. Aboriginal heritage sites have been recorded within the vicinity of these landscape features, as well as at the Australian National University around Sullivans Creek, on Acton Ridge and along the banks of the Molonglo River prior to the establishment of Lake Burley Griffin. These landscape features are part of Aboriginal culture and have been previously identified as significant Aboriginal places.

The assessment of the Indigenous heritage values relevant to the Project is outlined in **Appendix E (HIA)** and found low potential for the likely existence of Aboriginal archaeological sites. Although the area is within a landscape of cultural significance to the local Ngunnawal People, the Project would not impact those values any more than they have already been affected. Indigenous heritage values are not discussed further in this Chapter.

10.2.4 Natural heritage values

The HIA (**Appendix E (HIA)**) concludes that there are no vegetation communities or individual flora species with natural heritage value within the delivery phase area.

Chapter 16.0 Biodiversity and ecology notes the presence of low-quality GSM habitat within and around the delivery phase area. The GSM is listed as endangered under the *Nature Conservation Act 2016* (ACT) and vulnerable under the EPBC Act, with GSM identified as a MNES. While MNES matters can be indicators of natural heritage value, they do not automatically constitute natural heritage against Commonwealth Heritage criteria. The HIA considers the presence of GSM in grassed areas as having natural heritage value, although of lower comparative value than areas where the biodiversity is intact.

Additional information on the occurrence, potential impact and mitigation measures relevant to the GSM is provided in the **Chapter 16.0 Biodiversity and ecology**. This information should be referred to for further discussion on the potential impact on potential natural heritage values of the delivery phase area. No further assessment has been undertaken for natural heritage values in relation to the Project.

10.3 Assessment of potential impacts

No heritage provisions were determined under the EPBC Act Referral and Approval (2019/8582), however potential impacts to heritage features protected under the EPBC Act have been included in this Section for completeness. **Table 10-2** provides a summary of the potential impacts on the nominated and listed Commonwealth, National and ACT Heritage places.

For the purposes of this assessment, operation refers to new infrastructure or modifications to existing infrastructure, such as light rail tracks, light rail stops, pedestrian footpaths and crossing modifications. The movement of LRVs has been assessed as having no potential impact to the heritage values of the Commonwealth or ACT Heritage places.

Refer to **Appendix E (HIA)** for the full impact assessment.

Table 10-2 Summary of potential heritage impacts during construction and operation

Heritage place	Potential heritage impact	
	Construction	Operation
Lake Burley Griffin and Adjacent Lands	Construction works, including compound sites may obstruct the 'presence of Lake Burley Griffin in views of and within central Canberra' and the 'availability of views from publicly accessible locations to Lake Burley Griffin'. The visual impacts would be temporary. Construction works are unlikely to impact the 'quiet, peaceful and reflective qualities' of Lake Burley Griffin.	City South Stop, Commonwealth Park Stop and other elements of vertical infrastructure may obstruct 'open views to the water from roads and other public use areas'. To minimise the impact of these new structures, the stops have been designed with low, flat rooflines and extensive glazing, and the use of an island stop rather than two side platforms would also reduce visual impacts. The installation of the track and the Parkes Way bridge would be unlikely to have an impact on views or the appreciation of Lake Burley Griffin landscape due to their linear nature, similar to the alignment of the current road.
Australian Academy of Science Building	A construction compound would be established to the north of the Australian Academy of Science Building across Gordon Street. The proposed compound would be physically separated from the heritage place and is unlikely to obstruct visibility of the heritage place from the public domain. The visual impacts would be temporary. Construction works along Edinburgh Avenue and Marcus Clarke Street may be visible from the heritage place but are unlikely to impact its heritage values as they would be physically and visually separated from the heritage place by intervening development, plantings and distance. The visual impacts would be temporary.	Proposed permanent works are unlikely to impact on the Australian Academy of Science Building as they would be physically and visually separated from the heritage place by intervening development, plantings and distance.
Parliament House Vista	Construction works along Commonwealth Avenue have the potential to introduce new elements or alter existing elements of the vista's immediate setting. The visual impacts would be temporary. Protection of views to the surrounding forested hills and significant views to and from Parliament House Vista would not be impacted.	Proposed permanent works along Commonwealth Avenue and other road modifications would introduce new elements or alter existing elements of the Parliament House Vista's immediate setting. Changes to the immediate setting would not interfere with the 'underlying geometry of the area nor obstruct significant views to and from the Vista'.

Heritage place	Potential heritage impact	
	Construction	Operation
Reserve Bank of Australia	Construction works along London Circuit have the potential to obstruct and alter views toward the Reserve Bank from the Public domain. This visual impact would be temporary.	Proposed utility works would involve modification to the existing red-brick paving installed along the western side of the Reserve Bank. In the 2019 Reserve Bank HMP, it is noted that the red-brick planter beds existing on the north and west sides of the building are not original and that the red-brick paving was replaced in 2010-2011 as part of drainage upgrade works. Therefore modification of the red-brick paving is unlikely to have an impact on the heritage values of the Reserve Bank. Other infrastructure works proposed in the vicinity of the Reserve Bank, including the new tracks, are unlikely to have an impact on its heritage values.
City Hill[1]	Construction works have the potential to obstruct and alter views to and from City Hill, impacting its significance as 'a generating point for the major avenues' and its aesthetic significance as 'an important topographical element of the city'. The visual impacts would be temporary.	The proposed stops along Commonwealth Avenue have the potential to diminish/obstruct views to and from City Hill. The stops would introduce new elements where there are currently none and the existing 'urban' landscape/environment is currently open. To minimise the impact of these new structures, the stops have been designed with low, flat rooflines and extensive glazing, and the use of an island stop rather than two side platforms would also reduce visual impacts. Other infrastructure works proposed in the vicinity of City Hill, such as the new light rail tracks, an infill bridge over Parkes Way, and tree removal/planting, are unlikely to have an impact on the heritage significance of City Hill.
Melbourne and Sydney Buildings	The construction of the Project would likely have visual impacts by partially obscuring views to and from the Melbourne and Sydney Buildings, detracting from the visibility and 'landmark quality' of the buildings. The potential visual impact would be temporary and limited to the duration of the construction period because fencing and machinery would be removed on completion.	The proposed widening of the verge on London Circuit, and incorporation of a cycleway, would provide a high-quality surface and consistency across the immediate area, which has degraded over time with numerous ad hoc surfaces currently visible. Widening the verge would not have a detrimental impact on the heritage significance of the Melbourne or Sydney Buildings. It is proposed that the verge (footpath) in front of the Melbourne and Sydney Buildings be raised to the colonnade level to achieve equitable access and compliance with standards for accessibility and urban design. Although raising the verge would be considered a permanent impact on the physical and visual heritage fabric of the

Heritage place	Potential heritage impact	
	Construction	Operation
		Melbourne and Sydney Buildings, the step currently divides the space and limits opportunity to access to the colonnade. The proposed planting of four trees with potentially large mature canopies along London Circuit, the only remaining frontage to the Melbourne Building without street trees would have a visual impact. The proposed planting pattern is in keeping with the CMP, and as such, the landscaping concept is supported by ACT Heritage, subject to the use of root barriers for trees. The proposed tree locations are outside of the heritage curtilage of the Melbourne Building, and as such there are no specific heritage requirements in relation to this area. Setting and views to and from buildings are not included in the heritage citation. The proposed lighting poles are unlikely to have an impact on the heritage significance of the Melbourne Building. Their modest scale and design would not detract from the character of the buildings, and they would be a sufficient distance from the buildings that their lighting pattern would not interfere with the original lighting concepts.
ANZ Building (former ES&A Bank)	Construction works have the potential to detract from the 'setting and appreciation; of the ANZ Bank Building from the public domain of London Circuit and University Avenue'. This potential visual impact would be temporary.	The Project would provide an opportunity to implement a consistent finish along the eastern and southern side of the building, positively contributing to its setting.
Civic Square Precinct	Construction works would not generally be visible in significant views to and from the Precinct, namely along the City Hill-Mount Ainslie axis, and would be unlikely to have an impact on heritage significance.	No new infrastructure works are proposed to occur within the boundaries of the Civic Square Precinct, therefore it is unlikely there would be a direct, physical impact on the Precinct's intrinsic features. Some elements of proposed permanent infrastructure may be partially visible in some secondary views to and from the Precinct, however they would not obstruct these views nor dominate the Precinct.
Law Courts Precinct	Construction works have the potential to obstruct and alter views of the views of the Precinct from London Circuit and the significant 'vista along University Avenue'. This potential visual impact would be temporary.	The brick paving within the Precinct is in poor condition and in need of urgent restoration. The proposed removal of fabric/materials along the Precinct boundary provides the opportunity to replace the current pavers with paving that is consistent with and complementary to the Law Court Precinct.

Heritage place	Potential heritage impact	
	Construction	Operation
Hotel Acton (Acton House)	Construction works along Marcus Clarke Street, associated with potential stormwater modifications, have the potential to impact six oak trees which are identified as significant elements of the Hotel Acton landscape. Visually, construction works are unlikely to obstruct and alter views to and from the heritage place, with works visually separated by a multistorey contemporary building, distance, roadways and landscaping.	Proposed permanent works would be limited to potential stormwater modification along Marcus Clarke Street and would not impact the historic building of Hotel Acton.
Ian Potter House (Beauchamp House)	A construction compound is proposed to be established north of Ian Potter House, across Gordon Street. The proposed compound is unlikely to have an impact on the identified features intrinsic of the heritage place or its visibility from the public domain. Construction works along Edinburgh Avenue and Marcus Clarke Street, namely hoardings may obstruct the visibility of Ian Potter House and its setting from the public domain. This potential visual impact would be temporary, with works limited to the duration of the construction period and hoardings to be removed on completion of construction.	Proposed permanent works in the vicinity of Ian Potter House would be limited to potential stormwater modifications along Edinburgh Avenue and Marcus Clarke Street. They would be unlikely to have an impact on the building or its setting as the works would be largely underground and once completed would not be highly visible within the landscape.

Notes:

1 Note that City Hill has heritage value both as an integral part of the heritage landscape, and intrinsic value as a heritage feature in itself. While the Project is likely to have a visual landscape impact on City Hill, it would not impact on City Hill's intrinsic features included in the ACT Heritage Register place boundary.

10.4 Preliminary risk assessment

A preliminary risk assessment of potential heritage impacts, without management and mitigation measures, for construction and operation are presented in **Table 10-3** and **Table 10-4**, respectively. The risk has been calculated using the methodology detailed in **Chapter 8.0 Environmental risk analysis approach**. It should be noted that the impact terminology below differs from the HIA which applies language from the EPBC Act *Significant Impact Guidelines 1.2* (Department of Sustainability, Environment, Water, Population and Communities, 2013).

Table 10-3 Preliminary risk assessment for heritage during construction

Risk	Likelihood	Consequence	Rating
Lake Burley Griffin	Likely	Minor	Medium
Parliament House Vista	Possible	Minor	Very Low
Reserve Bank of Australia	Likely	Minor	Medium
Australian Academy of Science Building	Unlikely	Minor	Very Low
City Hill	Likely	Minor	Medium
Melbourne and Sydney Buildings	Likely	Minor	Medium
ANZ Bank Building (former ES&A Bank)	Likely	Minor	Medium
Civic Square Precinct	Rare	Minor	Negligible
Law Courts Precinct	Likely	Minor	Medium
Hotel Acton (Acton House)	Likely	Minor	Medium
Ian Potter House (Beauchamp House)	Unlikely	Minor	Very Low

Table 10-4 Preliminary risk assessment for heritage during operation

Risk	Likelihood	Consequence	Rating
Lake Burley Griffin	Likely	Minor	Medium
Parliament House Vista	Possible	Minor	Very Low
Reserve Bank of Australia	Unlikely	Minor	Very Low
Australian Academy of Science Building	Unlikely	Minor	Very Low
City Hill	Likely	Minor	Medium
Melbourne and Sydney Buildings	Likely	Minor	Medium
ANZ Bank Building (former ES&A Bank)	Likely	Minor	Medium
Civic Square Precinct	Rare	Minor	Negligible
Law Courts Precinct	Likely	Minor	Medium
Hotel Acton (Acton House)	Unlikely	Moderate	Low
Ian Potter House (Beauchamp House)	Unlikely	Minor	Very Low

10.5 Management and mitigation measures

Management and mitigation measures have been proposed to reduce the potential heritage impacts of the Project identified in the assessment.

Management and mitigation measures and safeguard protocols adopted for the Project are provided in **Table 10-5**, and have been prepared with the following objectives:

- Celebrate the heritage values of Canberra, the Parliament House Vista, Commonwealth Avenue, Sydney and Melbourne Buildings, ANZ Building, Law Courts Precinct and Hotel Acton
- Document the heritage values of the delivery phase area for future generations
- Strengthen the landscape character of Commonwealth Avenue
- Minimise potential for impacts (destruction/damage) to unexpected heritage items
- Contribute to urban realm quality without impacting ability to appreciate heritage features.

Table 10-5 Management and mitigation measures - Heritage

Ref	Management and mitigation measure	Timing	Reference
H1	Develop project strategies to identify, interpret and communicate the history and heritage values of Canberra, the Parliament House Vista, Commonwealth, Sydney and Melbourne Buildings, ANZ Building, Law Courts Precinct and Hotel Acton, from early site establishment, throughout the construction phase and in the final completed landscape design.	Prior to and during construction	See also LV1; Her-1 ISC IS Rating Tool 1.2
H2	Complete a general photographic archival recording of heritage values within the delivery phase area, and make provision for these recordings to be made publicly available.	Prior to construction	Photographic Recording of Heritage Items Using Film or Digital Capture (NSW Heritage Office, 2006)
H3	In consultation with key stakeholders and technical specialists, develop detailed designs that are consistent with the Light Rail Commonwealth Avenue Masterplan.	Prior to construction	Commonwealth Avenue Landscape Heritage Advice (GML, 2021); EPBC Act Approval 2019/8582; Urb-2 ISC IS Rating Tool 1.2; Light Rail Commonwealth Avenue Masterplan (AECOM, 2022)
H4	Implement an unexpected heritage finds protocol which includes: • Measures to enable all personnel working onsite to receive awareness training relating to heritage matters • Cessation of all activity in the vicinity of the find and consultation with Representative Aboriginal Organisations and the ACT Heritage • Clear mechanisms to enable relevant clearance to be obtained and works to recommence.	During construction	**Appendix E (HIA)**
H5	In consultation with ACT Heritage, the 'Canberra Tracks' sign in the median between the Sydney and Melbourne Buildings would be relocated to an appropriate location	Prior to construction	

Ref	Management and mitigation measure	Timing	Reference
H6	Trees within the median of Northbourne Avenue and adjacent to the Sydney and Melbourne building would be managed to enable the canopy to sit above the height of the colonnade	During operation	

10.6 Residual risk assessment

The HIA and SHE found that the Project would have a potential impact on the historic heritage values of the places within or immediately adjacent to the study area. Although management and mitigation measures have been proposed relevant to heritage values, these are not considered to alter the residual risk rating.

11.0 Contamination and soil

This Chapter provides a summarised assessment of the potential contamination and soil impacts associated with the Project.

11.1 Approach

This Chapter draws information from the Contamination Assessment prepared by Environmental Resources Management Australia Pty Ltd (ERM) in December 2022 (ERM, 2022). The full version of the Contamination Assessment is provided in **Appendix F (Contamination Assessment)**.

The following approach was adopted to assess potential contamination and soil impacts associated with the Project:

- Review of background information relating to the delivery phase area, including:
  - Previous contaminated site investigations
  - ACT Environment Protection Authority (EPA) contaminated land database
  - Historical aerial photographs
  - Registered groundwater bore information
  - Relevant government databases
  - Published soil, geology and topographic maps.
- Development of a preliminary conceptual site model identifying contaminants of potential concern (CoPC) associated with current and historical land uses within and around the delivery phase area, potential exposure pathways and potentially affected receivers.
- Risk assessment of potential contamination and soil issues associated with construction and operation of the Project.
- Recommendation of management and mitigation measures to reduce, avoid, and manage identified contamination and soil risks.

11.2 Existing environment

11.2.1 Study area history

Aerial photographs have shown the delivery phase area has been utilised as a roadway with the current alignment since 1951. No significant changes to the roadway have occurred since 1975 when the cloverleaf ramps were constructed to connect London Circuit, Commonwealth Avenue and Parkes Way. Land around the Project is currently used for a mix of road infrastructure and commercial developments along London Circuit, with land immediately adjacent to the London Circuit-Commonwealth Avenue interchange undeveloped (other than for the presence of the cloverleaf ramps) or occupied with temporary carparking (to the northeast).

Given the historical use of land within and around the delivery phase area for road infrastructure and commercial developments, there is a possibility for potential contamination of soils and fill materials associated with historic filling/landforming activities, service corridors or infrastructure (bridges and buildings), however, this is considered limited in magnitude.

Further details of the history of the delivery phase area is presented in the Contamination Assessment provided in **Appendix F (Contamination Assessment)**.

11.2.2 Geology and soil landscapes

Geology mapping indicates that the delivery phase area is underlain by the Canberra formation comprising Palaeozoic aged mudstone, siltstone dacitic ignimbrite and volcaniclastic sediments. The soils local to the delivery phase area are described as:

- Moderately deep, moderately well-drained Yellow Chromosols (Yellow Podzolic Soils) on Red and Brown Kandosols (Red and Yellow Earths) on upper rises and fan elements

- Moderately to very deep, poorly to imperfectly drained Sodosols (Solodic Soils and Solodized Solonetz Soils) on lower rises and fan elements.

Fill materials have been identified in the delivery phase area, in particular where ground levels have been previously raised such as beneath the cloverleaf ramps and Commonwealth Avenue, as well as around underground service corridors (as bedding and backfill material).

11.2.3 Acid sulfate soils and soil salinity

Acid sulfate soils contain sulfides, predominantly iron sulfide. If these soils are exposed to oxygen, the iron sulfides react with oxygen to form sulfuric acids, which can cause metals in the soil such as iron to mobilise creating a potential contamination risk.

According to the Atlas of Australian Acid Sulfate Soils and the eSPADE spatial viewer, there is an extremely low probability of acid sulfate soils and a low probability of salinity occurring in the delivery phase area.

11.2.4 Groundwater

One groundwater bore (bore ID 473) is located within the delivery phase area, south of Parkes Way. No data is available as to the purpose of the bore. Drillers logs for the bore recorded moderately to highly weathered mudstone and shales present between 1.8 m below ground level (BGL) and the maximum extent of the bore at 15 m BGL.

Groundwater near the delivery phase area is likely to be present within shallow discontinuous perched water lenses above claystone deposits, or within deeper regional aquifers within the underlying fractured bedrock.

11.2.5 ACT EPA registers of contaminated sites

A search of contaminated site registers kept by the ACT EPA under the *Environment Protection Act 1997* (EP Act) was undertaken as part of the Contamination Assessment.

One notified contaminated site has been registered with the ACT EPA on the Notified Contaminated Sites Register within 1 km of the delivery phase area (refer to **Table 11-1**). Although the nature of the contamination and its exact location are not identified in the ACT EPA register, the general location of the site described as the Canberra Metro audit area on Northbourne Avenue indicates that the contamination is a significant distance from the delivery phase area and it is unlikely that a contamination hazard at such a distance would affect, or be affected by, the Project.

Table 11-1 ACT EPA register of notified contaminated sites

District	Location	Notified Under Section	Description	Distance from site	Direction
Canberra Central	-	76A(1)	Capital Metro audit area - Northbourne Avenue within the District of Canberra Central	Not mapped. Capital Metro is situated north of the delivery phase area.	-

Three contaminated sites have been registered with the ACT EPA on the Register of Contaminated Sites (refer to **Table 11-2**). Each of these sites are located within 100 m of the delivery phase area, however, these sites are unlikely to pose an unacceptable risk to the delivery phase of the Project due to the:

- Isolated occurrences of low levels of contaminated materials
- Low risk of contaminant migration through surface water and groundwater as a result of construction activities
- Ability for contamination to be managed through a CEMP and Unexpected Finds Protocol.

Table 11-2 ACT EPA register of contaminated sites

ID Number	Block/Section	Address	Details
HCP393	Block 12 Section 3 Canberra Central	Tamar House, 25 London Circuit	Potential hydrocarbon contamination associated with fuel storage.
HCP88	Block 1 Section 18 Canberra Central	20 - 22 London Circuit (Reserve Bank)	Potential hydrocarbon contamination associated with fuel storage.
OTP226	Block 1 Section 5 Canberra Central	3 University Avenue	Dry cleaning chemicals (trichloroethene, TCE), (perchloroethene, PCE), etc.

11.3 Assessment of potential impacts

11.3.1 Construction

The following activities relevant to potential contamination and soils impacts would be undertaken in construction of the Project:

- Establishment of site compounds for storage, parking, offices, amenities and facilities for construction personnel
- Protection, removal and/or relocation of affected existing service utilities
- New stormwater drainage and pits installation and decommissioning and/or removal of existing redundant drainage lines
- Within the median areas, installation of below ground drainage and CSR by trenching methods
- Track construction, and finishing works within the track slab consist of kerbing, track drainage connections, topsoil and green track, granite paver installation and localised reinstatement
- Installation of rail systems such as power and communications
- Civil works consisting of footpath and verge modifications, pavement preparation, drainage, kerbs and gutters, pavers and surfacing
- Construction of stops and Parkes Way bridge.

Potential contamination and soil impacts associated with these works are summarised in **Table 11-3**.

The generation and management of stockpiles and non-contaminated waste during construction is considered separately in **Chapter 18.0 Resource management and waste**.

Table 11-3 Summary of unmitigated risk assessment for Project construction activities

Item	Description
Fill materials of poor quality	There is a potential for encountering buried hazardous building materials in fill soils within the Southwest cloverleaf compound site. No asbestos-containing materials (ACM), heavy metals, or petroleum hydrocarbons were found during field sampling undertaken for the Project; however, unexpected contamination may still be encountered. In addition, construction activities may encounter ACM in service pits and conduits materials.
Materials Management	If not appropriately managed, uncontrolled soil loss may occur from scour erosion of exposed soils from compound site establishment (including vegetation clearing, grubbing, and levelling of the compound site), stockpiled materials at compound sites, and during bulk earthworks. Vehicle movements,

Item	Description
	vegetation removal, landscaping and importing fill materials may also result in uncontrolled soil erosion if not appropriately controlled.
Leaks and spills	There is a risk of accidental spills and leaks of various chemical products, such as oils, fuels, lubricants, vehicle oil changing or refuelling, and cleaning agents during construction of the Project. Such spills and leaks may occur during transport of materials to construction sites, during use of those materials during construction, or during storage of the materials at construction compound sites. Improper methods of storing, transferring, and handling of these products can result in spills to the ground and subsequent soil contamination. Furthermore, dispersion of contaminated soils following rain events, dust dispersion and inadequate sediment barrier installation would result with direct impact to soils and nearby ecological communities.

11.3.2 Operation

The potential for contamination and soil impacts during operation of the Project would be low and generally consistent with existing conditions. There would be negligible operational contamination potential once vegetation becomes established, around six months after construction is complete.

11.4 Preliminary risk assessment

A preliminary assessment of potential contamination impacts, without management and mitigation measures, is presented in **Table 11-4** and **Table 11-5** below. The risk has been calculated using the methodology detailed in **Chapter 8.0 Environmental risk analysis approach**.

Table 11-4 Preliminary risk assessment for contamination and soil during construction

Category	Description	Likelihood	Consequence	Rating
Fill materials of poor quality	There is the potential for asbestos and other contaminants to be present in fill that requires excavation and interaction during construction. Materials requiring offsite management may require assessment for waste classification.	Likely	Moderate	High
Materials management	Imported fill materials would require strict controls to ensure suitability for use for the Project. This would also include Site Auditor and EPA approvals. Where materials are brought to site that have not been appropriately screened, materials may require assessment onsite or removal from site resulting in delays to the Project and potential limitations due to excess stockpiles of soils. Existing bitumen may require assessment, disposal, and/or treatment.	Likely	Moderate	High
Leaks and spills	Leaks and spills during storage and refuelling of plant and vehicles.	Unlikely	Minor	Very Low

Table 11-5 Preliminary risk assessment for contamination and soil during operation

Category	Description	Likelihood	Consequence	Rating
Leaks and spills	Leaks and spills during storage and refuelling of maintenance plant and vehicles.	Unlikely	Minor	Very Low

11.5 Management and mitigation measures

Management and mitigation measures have been proposed to reduce the potential contamination and soil impacts of the Project identified in the assessment.

Management and mitigation measures and safeguard protocols adopted for the Project are provided in **Table 11-6**, and have been prepared with the following objectives:

- Minimise disturbance to landform, geology and soils and prevent erosion and sedimentation.
- Ensure that material handling and general construction activities manage the potential for contamination consistent with established polices and requirements.
- Minimise potential for contamination due to failure in storage mechanisms for hazardous materials onsite during construction.

Table 11-6 Management and mitigation measures – Contamination and soil

Ref	Management and mitigation measure	Timing	Reference
CS1	**A Soil and Water Management Plan** (SWMP) would be prepared and implemented as part of the CEMP. The SWMP would at a minimum: • Assess erosion and sedimentation risks and impacts, include a process for developing detailed designs for major erosion and sedimentation control measures • Outline a process for the development, EPA approval and implementation of detailed erosion and sediment control plans • Document procedures for managing pollution associated with spillage or contamination on the site and adjoining area.	Prior to and during construction	
CS2	Detailed Erosion and Sediment Control Plans are to be developed prior to construction and implemented for the duration of construction activities and until disturbed areas are stabilised or revegetated. Erosion and sediment control measures will be inspected and maintained regularly and in particular prior to, during and following rain events.	Prior to construction	*Managing Urban Stormwater - Soils and Construction*, Volume 2D – Main Road Construction *Environment Protection Guidelines for Construction and Land Development in the ACT (draft), 2019*
CS3	Soil stockpiles would be managed in accordance with the EPBC Act Approval (2019/8582), employing effective erosion and sediment controls to minimises the risk of pollution, pests, and risk to human health, property and the environment.	During construction	ACT Guideline for Stockpile Management

Ref	Management and mitigation measure	Timing	Reference
CS4	A **Contamination and Material Management Plan** (CMMP) would be prepared and implemented as part of the CEMP. The CMMP would at a minimum: • Detail specific requirements for the importation of any material onto the site including environmental properties, tracking requirements, reporting/record keeping requirements • Detail specific requirements for the reuse of any material onsite, including where practical topsoil remediation and reuse • Document material tracking and reporting mechanisms for import and export of material • Provide for ongoing compliance inspections and record keeping • Include an Unexpected Finds Protocol that outlines the roles and responsibilities where unexpected finds of potential contamination are identified during any works within the delivery phase area • Identify the steps needed to be taken in the event that hazardous materials are identified (in particular, asbestos) • Describe procedures to enable the review and endorsement of the CMMP by the Project Independent Contaminated Sites Auditor • A Sampling Analysis and Quality Plan (SAQP) would be prepared to guide any additional investigative works to determine site condition, and the further assessment of residual fill soils within the delivery phase area that may require management during construction. • Procedures for post-construction validation reporting detailing compliance with all approved plans and procedures implemented during works	Prior to and during construction	Contaminated sites environment protection policy and relevant Information Sheets (various) Environment Protection Authority (Access Canberra)
CS5	A site-specific emergency spill procedure is to be developed. Emergency wet and dry spill kits would be kept in the delivery phase area. All construction personnel are to be made aware of spill kit locations and trained in how to respond to a spill.	Construction	
CS6	Refuelling and storage of fuels, chemicals and liquids are to be within an impervious bunded area within the construction compound.	Construction	

11.6 Residual risk assessment

A residual risk assessment was undertaken to assess the remaining contamination issues after the proposed management and mitigation measures for construction and operation are applied, presented in **Table 11-7** and **Table 11-8**, respectively. No significant residual contamination or soil impacts are anticipated.

Table 11-7 Residual risk assessment for contamination and soil during construction

Category	Description	Likelihood	Consequence	Rating
Hazardous former building materials	There is the potential for asbestos and other contaminants to be present in fill that requires excavation and interaction during construction. Materials requiring offsite management may require assessment for waste classification.	Unlikely	Minor	Very Low
Soil disturbance	Imported fill materials would require strict controls to ensure suitability for use for the Project. This would also include Site Auditor and EPA approvals. Where materials are brought to site that have not been appropriately screened, materials may require assessment onsite or removal from site resulting in delays to the Project and potential limitations due to excess stockpiles of soils. Existing bitumen may require assessment, disposal, and/or treatment.	Unlikely	Minor	Very Low
Leaks and spills	Leaks and spills during storage and refuelling of plant and vehicles.	Rare	Minor	Negligible

Table 11-8 Residual risk assessment for contamination and soils during operation

Category	Description	Likelihood	Consequence	Rating
Leaks and spills	Leaks and spills during storage and refuelling of maintenance plant and vehicles.	Rare	Minor	Negligible

12.0 Noise and vibration

This Chapter provides a summarised assessment of the potential noise and vibration impacts associated with the Project.

12.1 Approach

The Preliminary Environmental Risk Assessment (**Appendix C (PERA)**) identified risks relevant to noise and vibration, including five construction risks and two operational risks. In accordance with the methodology provided in **Chapter 8.0 Environmental risk analysis approach**, this Chapter has been prepared to further document and assess noise and vibration risks with consideration of subsequent design development.

This Chapter is based on information from the Noise and Vibration Impact Assessment (NVIA) prepared for the Project. The full version of this assessment is provided in **Appendix G (NVIA)**.

Key steps in the development of the NVIA included:

- Identify sensitive receivers near the Project that are likely to be impacted by construction and operational noise and vibration
- Conduct noise monitoring and attended noise measurements to determine relevant noise criteria, where applicable
- Assess noise and vibration impacts to nearby sensitive receivers using relevant guidelines and policies, and compare against relevant criteria
- Provide indicative noise management measures, mitigation options or treatments where applicable.

The methodology for the noise and vibration assessment are provided in **Section 12.3.1** (construction) and **Section 12.3.2** (operation).

12.2 Existing environment

The existing noise environment is typically urban in nature, with road traffic and urban 'hum' dominant throughout the delivery phase area. Noise sensitive receivers surrounding the delivery phase area were identified using aerial photography. The uses of all buildings within the study area were determined through a ground-truthing site survey exercise. This, in conjunction with cadastral information, was used to determine the classification of residential, commercial, recreational and other land uses within the noise assessment study area for the Project. Notable sensitive receivers within the noise assessment study area are presented in **Table 12-1**.

Table 12-1 Notable sensitive receivers within Project noise assessment study area

Receiver	Address	Receiver Type
Sydney Building	101-103 London Circuit, Canberra	Commercial
Melbourne Building	59-81 London Circuit, Canberra	Commercial
Metropolitan	1-3 Gordon Street, Canberra	Residential
Reserve Bank of Australia	20-22 London Circuit, Canberra	Commercial (alarms are noise and vibration sensitive)
Canberra City Police Station	16-18 London Circuit, Canberra	Commercial
7 London Circuit	7 London Circuit, Canberra	Commercial
Law Courts and Justices Precinct	4-6 Knowles Place, Canberra	Commercial
Corrective Services	249 London Circuit, Canberra	Commercial

Receiver	Address	Receiver Type
Canberra Theatre Centre	Civic Square, London Circuit, Canberra	Community Centre
Archbishop residence	1 Regatta Place, Canberra	Residential
QT Tower	1 London Circuit, Canberra	Residential
BreakFree Capital Tower	2 Marcus Clarke St, Canberra	Residential
Australian Medical Council	4 Marcus Clarke St, Canberra	Commercial
Zoo Bar	17 London Circuit, Canberra	Commercial
The Cupping Room	1-13 University Avenue, Canberra	Commercial
ANU School of Music – Building 100	William Herbert Place, Canberra ACT 2601	Education
KU Canberra City AMEP Child Care Centre	34 East Row, Canberra	Childcare
AK Education	Within 1-13 University Avenue, Canberra	Education
Pilgrim House	69 Northbourne Avenue, Canberra	Place of Worship
Church of Scientology	Within Sydney Building	Place of Worship
Divergent Church	Within Sydney Building	Place of Worship
Canberra Museum and Gallery	180 London Circuit, Canberra	Community Centre
City Hill Park	City Hill Park, Canberra	Passive Recreation
Henry Rolland Park	Barrine Drive, Parkes	Passive Recreation
Acton Waterfront	5 Kuttabul Place, Acton	Passive Recreation
Metropol Apartments	81 Cooyong Street, Reid	Residential
The Avenue Apartments	20 Moore Street, Turner	Residential

Unattended noise monitoring was carried out at five locations, as identified in **Table 12-2**. The locations were determined through examination of aerial photography and site inspections, and in consultation with relevant stakeholders in order to determine the local noise environment throughout the study area.

A noise logger measures the noise level over a 15-minute sample period and then determines L_{A1}, L_{A10}, L_{A90}, L_{Amax} and L_{Aeq} levels of the noise environment. The L_{A1}, L_{A10} and L_{A90} levels are the levels exceeded for 1%, 10% and 90% of the sample period respectively. The L_{Amax} level is the maximum noise level due to individual noise events. The L_{A90} level is taken as the background noise level. The L_{Aeq} level is the energy averaged noise level over the 15-minute period.

Weather data recorded during the noise monitoring periods were obtained from the BoM weather station, located at Canberra Airport (ID: 070351). Periods which were affected by noise from extraneous wind and rain were omitted from the results.

The unattended background noise monitoring results are presented in **Table 12-2**.

Table 12-2 Noise logging locations, measurement periods and results

ID	Address	Measurement period	Rating background level (L_{A90}), dB(A)			Ambient noise level (L_{Aeq}), dB(A)		
			Day	Evening	Night	Day	Evening	Night
NL1	Archbishops House, Parkes	26/07/2021-09/08/2021	57	54	39	63	61	56
NL2	QT Hotel, 1 London Circuit, Canberra	26/07/2021-09/08/2021	53	50	45	61	58	54
NL3	Police Station and RBA, Canberra	26/07/2021-09/08/2021	52	49	44	57	55	54
NL4	255 London Circuit, Canberra	10/08/2021-24/08/2021	43	40	34	58	55	53
NL5	ANU School of Art, 61 Marcus Clarke Street, Canberra	5/08/2021-19/08/2021	48	48	43	57	54	50

Notes:
- The measurement period at all locations was for 14 days.
- dB(A) represents A-weighted decibels, the relative frequency response used in sound measuring instruments.
- In accordance with the NSW EPA's Noise Policy for Industry, time of day is defined as follows: day – the period from 7 am to 6 - pm Monday to Saturday or 8 am to 6 pm on Sundays and public holidays; evening – the period from 6 pm to 10 pm; and, night – the remaining periods.
- A portion of the noise monitoring period for these locations occurred during 2021 Covid-19 lockdown, therefore measured background noise levels are likely to be lower than usual and therefore considered conservative.

Noise catchment areas (NCAs), as presented in **Figure 12-1**, have been defined based on the unattended noise monitoring locations where receivers with a similar acoustic environment, as determined by ambient noise levels, form an NCA. Background noise levels defined by each noise monitoring location are considered representative for the entire NCA.

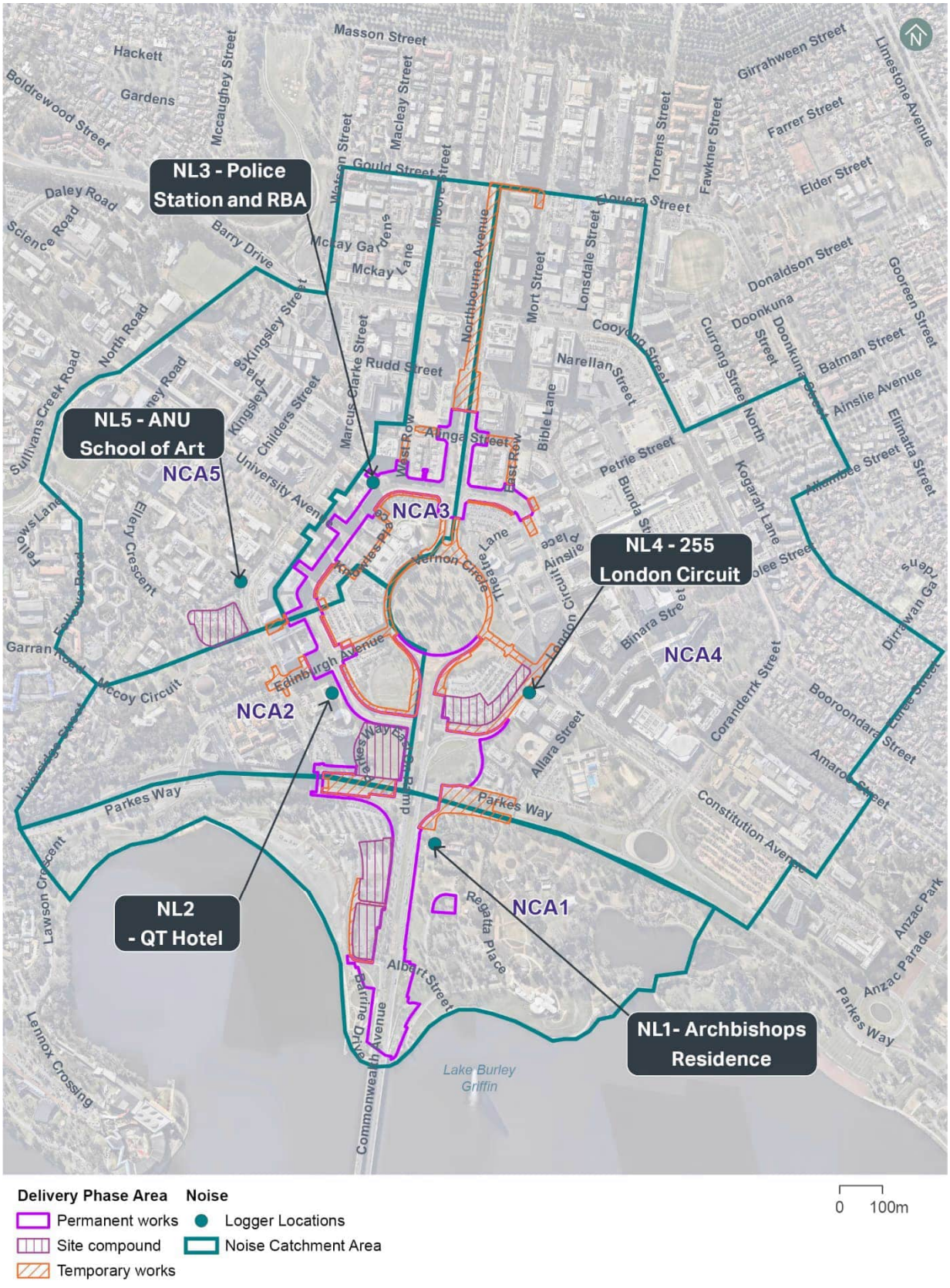


Figure 12-1 Noise logger and noise catchment locations relative to the delivery phase area

12.3 Assessment of potential impacts

12.3.1 Construction

The following potential impacts associated with construction have been assessed:

- Noise modelling and prediction: noise impacts associated with construction activities (**Section 12.3.1.1**)
- Road traffic noise: The addition of light and heavy construction vehicle traffics into the local road network (**Section 12.3.1.2**)
- Vibration: generated due to the vibration intensive equipment proposed to be used during some stages of work (**Section 12.3.1.3**).

12.3.1.1 Noise modelling and prediction

Five construction scenarios were modelled using SoundPLAN version 8.2 noise modelling software. The five scenarios included:

- Mobilisation and establishment of construction compound sites
- Decommissioning and treatment of utilities
- Construction of tracks and civil works
- Construction of stops
- Construction of Parkes Way bridge.

Noise levels due to construction activities have been assessed for each scenario with consideration of the following factors:

- Construction equipment used. It has been assumed that all equipment is modern and in good working order. Typical construction equipment for Project activities has been identified, with associated sound power levels obtained from:
  - Construction Noise and Vibration Guideline (TfNSW, 2022)
  - Australian Standard AS 2436-2010*, Guide to noise control on construction, demolition and maintenance sites*
  - British Standard BS 5228: Part 1 2009 *Code of Practice for Noise and Vibration Control on Construction and Open Sites Part 1: Noise.*
- Location of works in relation to sensitive receivers: Construction works would be generally undertaken between 7am – 6pm for weekdays and 7am – 1pm Saturdays. To minimise disruption to daily traffic and disturbance to surrounding landowners and businesses, it would be necessary to carry out some work outside of standard construction work hours.
- Duration of activities.

Any out of hours work would require justification, assessment, and more detailed management. This would be completed in accordance with the Construction Noise and Vibration Management Plan (CNVMP) developed for the Project during detailed design.

In accordance with Section 29 and Item 16 of Schedule 2 Table 2.3 of the ACT *Environment Protection Regulation 2005*, construction of light rail or major roads do not require noise to be assessed against specific numerical noise limits as they are not taken to cause environmental harm. Item 16 of Table 2.3 places no conditions on the “Noise emitted in the course of constructing or maintaining a major road, a dedicated bus way, a railway or light rail.” This is the clause under which light rail construction does not require noise assessment in the ACT. However, as the Project would occur within a relatively close proximity to noise sensitive receivers, a quantitative assessment, based on the worst-case construction scenario, has been carried out for construction works. The NSW DECC *Interim Construction Noise Guideline* has been adopted in the absence of Territory specific quantifiable criteria.

Noise assessment levels (NALs) for each NCA have been developed for residential receivers (**Table 12-3**), based on *the Interim Construction Noise Guideline* noise management levels. In addition to the

NALs, where construction noise levels at a residential receiver reach 75 dB(A), residential receivers are considered to be 'highly noise affected'. **Table 12-4** presents the NALs applicable to other noise sensitive receivers such as educational facilities and places of worship and to commercial receivers. While an assessment of construction noise generated by the Project is not required to be assessed against specific numerical noise limits, the derived assessment levels provide an indication of potential noise impacts to assist in the identification of appropriate mitigation and management measures.

Table 12-3 Construction noise assessment levels – Residential receivers L_{Aeq}

Noise catchment Area	Noise Assessment Level (NML) $L_{Aeq,15min}$, dB(A)			
	Standard hours (RBL + 10)	Outside standard hours (RBL + 5)		Highly noise affected level
	Day	Evening	Night	
NCA1	67	59	44	75
NCA2	63	55	50	
NCA3	62	54	49	
NCA4	53	45	39	
NCA5	58	53	48	

Table 12-4 Construction noise assessment levels – Other receivers

Land use	Noise assessment level, dB(A)
Places of worship	55 dB(A)[1]
Classrooms at schools and other educational institutions	55 dB(A)[1]
Passive recreation	60 dB(A)
Active recreation	65 dB(A)
Commercial premises (including offices, retail outlets)	70 dB(A)
Industrial premises	75 dB(A)
Community centres	Depends on the intended use of the centre[2]

Notes:

1. *These external assessment levels are based upon a 45 dB(A) internal noise assessment level and a 10 dB reduction from outside to inside through an open window.*)
2. *Based on recommended 'maximum' internal levels in AS2107:2016. In this case, "Art galleries" and "Concert and recital halls" were utilised.*

The predicted noise level for the sensitive receivers identified in **Table 12-1**, and comparison against NALs, are provided in **Appendix G (NVIA)**. The modelling identified that receivers near to construction activities would experience elevated noise levels. A summary of modelling results is provided in **Table 12-5** for each scenario. The quantitative results of each assessment is further included in **Table 12-6**.

A sleep disturbance assessment has also been carried out and is applicable where construction work is planned to extend over more than two consecutive nights. The screening level used to assess potential sleep disturbance is 15 dB(A) above the background level, in accordance with the guidance in the NSW *Road Noise Policy.*

It is important to consider that the Project construction noise assessment is representative of the worst case 15-minute period of construction activity, while the construction equipment is at the nearest location to each sensitive receiver location. The assessed scenario does not represent the ongoing day to day noise impact at noise sensitive receivers for an extended period of time.

While most construction activities are expected to occur at distinct scheduled times and at different locations, it is possible that noisy construction activities for the Project may occur at the same time in close proximity to each other. In these cases, it is possible that an increase of up to 3 dB(A) of the highest noise level predicted for any construction stage may occur (assuming that at any one location equal noise levels from two stages of works are experienced).

Noise from use of the construction compound sites may also contribute to construction noise at receivers, however it is likely that the other construction stages would dominate cumulative noise levels, and any increase in the overall noise level from the Project would be less than 3 dB(A).

Overlapping construction stages and identification of any receivers subject to increased noise levels would be determined during detailed design. Any additional mitigation measures subsequently required would also be identified during detailed design.

Table 12-5 Summary of noise modelling results

Scenario	Summary of results
Mobilisation and establishment of construction compound sites	• Approximately 15 receivers during works in standard construction hours may experience noise levels above the noise assessment levels. • One residential receiver is expected to be highly noise affected (Breakfree Capital Tower). • Noise levels would be considered moderately intrusive (i.e., 21-30 dB(A) above background level) at up to five receivers and highly intrusive (i.e., >30 dB(A) above background level) at up to three receivers across the delivery phase area in the daytime. • No sleep disturbance is anticipated.
Decommissioning and treatment of utilities	• Approximately 28 receivers during works in standard construction hours and 12 receivers during works outside of standard construction hours across the delivery phase area may experience noise levels above the associated noise assessment levels. • Three residential receivers may be highly noise affected (Archbishop's Residence, QT tower and BreakFree Capital Tower). • Noise levels would be considered moderately intrusive at up to 25 receivers across the delivery phase area in the daytime. • There is the potential for sleep disturbance to occur at some receivers in the event of out of hours activity.
Construction of tracks	• Approximately 26 receivers during works in standard construction hours and 12 receivers during works outside of standard construction hours across the delivery phase area may experience noise levels above the noise assessment levels. • Three residential receivers may be highly noise affected (Archbishop's Residence, BreakFree Capital Tower and QT Tower). • Noise levels would be considered moderately intrusive at up to 22 receivers across the delivery phase area during standard construction hours. • As track construction is expected to be staged and therefore the actual number of affected receivers would be limited at any single point in time. • There is the potential for sleep disturbance to occur at some receptors in the event of out of hours activity.
Construction of stops	• Approximately 20 receivers during works in standard construction hours across the delivery phase area may experience noise levels above the noise assessment levels. • One residential receiver is expected to be highly noise affected (QT Tower).

Scenario	Summary of results
	• Noise levels would be considered moderately intrusive at up to 13 receivers and highly intrusive at up to nine receivers across the delivery phase area in the daytime. • No sleep disturbance is anticipated.
Construction of Parkes Way bridge	• Approximately ten receivers during works in standard construction hours across the delivery phase area may experience noise levels above the noise assessment levels. • Three residential receivers may be highly noise affected (Archbishop's Residence, BreakFree Capital Tower and QT Tower). • Noise levels would be considered moderately intrusive at up to three receivers and highly intrusive at up to two receivers across the delivery phase area in the daytime. • No sleep disturbance is anticipated.

Table 12-6 Quantitative assessment of noise level at each receiver during standard hours for five construction scenarios

Receiver	Noise Assessment Level (db(A))	Predicted noise level during each construction scenario during standard hours (dB(A))				
		Mobilisation and establishment of construction compound sites	Decommissioning and treatment	Construction of tracks	Construction of stops	Construction of Parkes Way bridge
Noise Catchment Area (NCA) 1						
Acton Waterfront	60	81	68	68	63	69
Archbishops Residence	67	71	85	75	62	88
Henry Rolland Park	60	76	>95	>95	87	60
NCA2						
Australian Medical Council	70	85	>95	>95	77	87
Breakfree Capital Tower	63	94	92	82	70	95
QT Tower	63	72	94	95	91	76
The Metropolitan East	70	69	>95	>95	>95	68
The Metropolitan West	70	77	>95	91	87	65
NCA3						
7 London Circuit	70	73	>95	>95	>95	64
Canberra City Police Station	70	58	>95	>95	67	58
Law Courts and Justices Precinct	70	62	78	81	71	63
Melbourne Building East	70	54	>95	>95	>95	56

Receiver	Noise Assessment Level (db(A))	Predicted noise level during each construction scenario during standard hours (dB(A))				
		Mobilisation and establishment of construction compound sites	Decommissioning and treatment	Construction of tracks	Construction of stops	Construction of Parkes Way bridge
Melbourne Building West	70	53	>95	>95	>95	56
Pilgrim House	55	52	91	73	67	53
Reserve Bank Australia	70	53	>95	>95	66	56
The Avenue Apartments	62	47	65	61	56	49
The Cupping Room	70	55	>95	>95	62	59
Zoo Bar	70	53	>95	>95	63	56
NCA4						
Canberra Museum and Gallery	55	50	>95	72	72	51
Canberra Theatre Centre	50	66	82	71	68	64
Capital Hill Park	60	67	77	65	61	65
Corrective Services	70	81	>95	67	61	70
KU Canberra City AMEP Child Care Centre	55	52	>95	75	80	53
Metripol Apartment Building 1	53	32	45	41	33	40
Metripol Apartment Building 2	53	35	50	48	43	49
Metripol Apartment Building 3	53	35	46	46	40	39

Receiver	Noise Assessment Level (db(A))	Predicted noise level during each construction scenario during standard hours (dB(A))				
		Mobilisation and establishment of construction compound sites	Decommissioning and treatment	Construction of tracks	Construction of stops	Construction of Parkes Way bridge
Sydney Building East	70	52	>95	89	>95	57
Sydney Building West	70	56	>95	>95	>95	57
NCA5						
ANU School of Music	55	71	75	75	58	53
Llewellyn Hall	50	71	75	75	58	53
ANU Peter Karmel Building	55	64	73	74	48	52

12.3.1.2 Road traffic noise

The road traffic noise assessment considers the addition of construction vehicles into the local road network to identify the potential impact associated with noise and vibration. For the purposes of the construction road traffic noise assessment, the following assumptions have been made:

- The existing traffic flows were based on traffic count data modelled for the 2026 base case model.
- All construction compound facilities would be operational at the same time
- All construction vehicles would be on the road network at the same time (presenting a worst-case cumulative impact)
- Hourly construction vehicle movements would be evenly distributed across all construction routes
- Existing volumes have been determined based on the morning peak hour, and afternoon peak hour (Monday to Friday) hourly traffic movements

Indicative heavy vehicle haulage routes have been identified which would mainly be related to earthworks or spoil movement, but would also include other movements such as materials delivery and plant delivery. Haulage routes would be facilitated by the existing arterial road network including to and from the north via Northbourne Avenue and Vernon Circle, and to and from the east via Parkes Way and Edinburgh Avenue. During peak construction periods, it is expected that approximately 10 heavy vehicle movements per hour would be generated, and when broken down across each haulage route, on average there would be an additional two heavy vehicle movements per route per hour in both directions. Truck movements would occur at any time during the work shift, but would not be continuous, i.e., there would be times when no trucks are travelling to or from work sites. Refer to **Appendix G (NVIA)** for detailed information in relation to the proposed haulage routes and traffic counts.

Light vehicle movements are associated with workers moving within the delivery phase area, including to and from construction compounds. Conservatively it is estimated that an additional 20 light vehicles may be generated per hour.

The road traffic assessment considered the addition of heavy and light vehicles during the most affected hour during the AM and PM peak periods. Based on the current proposed construction vehicle numbers, no increases in road traffic noise of greater than 2 dB(A) have been identified along any of the proposed haulage routes during the AM peak hour. During the PM peak hour, no increases in road traffic noise of greater than 2 dB(A) have been identified along the proposed haulage routes except for eastbound along Edinburgh Avenue (2.9 dB(A)). Existing hourly traffic volumes along Edinburgh Avenue, between London Circuit and Vernon Circle, indicate that there is no existing heavy vehicle movement along this route during the PM peak hour. As such, an increase of just one heavy vehicle per hour will exceed the 2 dB(A) construction traffic noise screening level. However, as the neighbouring land uses along this section of Edinburgh Avenue are commercial premises and recreational areas only, the increase is not predicted to negatively impact any noise sensitive receivers during the PM peak hour.

12.3.1.3 Construction vibration

Table 12-7 outlines the standards and guidelines used to assess vibration associated with construction of the Project.

Table 12-7 Standards/guidelines used for assessing construction vibration

Item	Standard/guideline
Structural damage	• Heritage structures – German Standard DIN 4150 – Part 3 – Structural Vibration in Buildings – Effects on Structures (DIN 4150)[1] • Non-heritage structures – Evaluation and Measurement for Vibration in Buildings Part 2, (British Standard (BS) 7385: Part 2-1993) (BS 7385)[1].
Human comfort (tactile vibration)	*Assessing Vibration: A Technical Guideline* (AVATG)[2] (DEC, 2006).
Human comfort (ground-borne noise)	*Interim Construction Noise Guideline* (ICNG) (DECC, 2009).

Notes:

1 There is a lack of Australian Standards for the assessment of building damage caused by vibration, these standards were used as they provided recommended maximum levels of vibration to reduce the likelihood of building damage caused by vibration

2 This document is based upon the guidelines contained in British Standard 6472:1992, "Evaluation of human exposure to vibration in buildings (1-80 Hz)". This British Standard was superseded in 2008 with BS 6472-1:2008 "Guide to evaluation of human exposure to vibration in buildings – Part 1: Vibration sources other than blasting" and the 1992 version of the Standard was withdrawn. Although a new version of BS 6472 has been published, the NSW Environment Protection Authority still requires vibration to be assessed in accordance with the 1992 version of the Standard at this point in time.

Construction vibration may be generated due to the vibration intensive equipment proposed to be used during some stages of work. Recommended minimum working distances for these items of equipment from offsite receivers are shown in **Table 12-8**. The recommendations are based on the *Construction Noise and Vibration Guideline* and AECOM's previous project experience. If these minimum working distances are complied with, no adverse impacts from vibration intensive works are likely in terms of human response or cosmetic damage. Equipment size would be selected by the construction contractor and would take into account the minimum working distances and the distance between the area of construction and the nearest receiver. If vibration intensive works are required within these minimum working distances, mitigation measures to control excessive vibration would be implemented.

Table 12-8 Recommended minimum working distances for vibration intensive plant

Plant item	Rating/Description	Minimum working distance		
		Cosmetic damage (BS 7385) Light-framed structures	Cosmetic damage (DIN 4150) Heritage and other sensitive structures	Human response (EPA's Vibration guideline)
Vibratory Roller	< 50 kN (Typically 1-2 t)	5 m	14 m	15 m to 20 m
	< 100 kN (Typically 2-4 t)	6 m	16 m	20 m
	< 200 kN (Typically 4-6 t)	12 m	33	40 m
	< 300 kN (Typically 7-13 t)	15 m	41	100 m
	> 300 kN (Typically 13-18 t)	20 m	54 m	100 m
	> 300 kN (> 18 t)	25 m	68 m	100 m
Small Hydraulic Hammer	(300 kg - 5 to 12 t excavator)	2 m	5 m	7 m
Medium Hydraulic Hammer	(900 kg – 12 to 18 t excavator)	7 m	19 m	23 m

Plant item	Rating/Description	Minimum working distance		
		Cosmetic damage (BS 7385) Light-framed structures	Cosmetic damage (DIN 4150) Heritage and other sensitive structures	Human response (EPA's Vibration guideline)
Large Hydraulic Hammer	(1600 kg – 18 to 34 t excavator)	22 m	60 m	73 m
Vibratory Pile Driver	Sheet piles	20 m	50 m	100 m
Pile Boring	≤ 800 mm	2 m (nominal)	4 m	4 m
Jackhammer	Hand held	1 m (nominal)	2 m	2 m

Note:
More stringent conditions may apply to heritage or other sensitive structures. Any heritage property would need to be considered on a case by case basis and assessed in accordance with DIN4150:3 Structural vibration - Effects of vibration on structures.

12.3.2 Operational noise

Light rail noise

The ACT does not have relevant light rail specific noise guidelines. In the absence of these guidelines and in accordance with the Scope and Performance Requirements (SPR) for the Project, the assessment of operational noise has been undertaken in accordance with the NSW EPA *Rail Infrastructure Noise Guideline (RING)* (NSW EPA, 2013). The RING provides the applicable noise trigger levels for the assessment of airborne and groundborne noise of light rail developments (**Table 12-9** and **Table 12-10**). These trigger levels are non-mandatory and represent a point at which reasonable and feasible noise mitigation should be considered.

Table 12-9 Airborne heavy rail noise trigger levels for residential land uses

Type of development	Noise trigger levels dB(A) (External)	
	Day (7am to 10pm)	Night (10pm to 7am)
All light rail line developments	60 $L_{Aeq(15hour)}$ or 80 L_{AFmax}	50 $L_{Aeq(9hour)}$ or 80 L_{AFmax}

Table 12-10 Airborne rail noise trigger levels applicable to heavy and light rail developments for sensitive land uses other than residential

Other sensitive land use	New rail line development
	Resulting rail noise levels exceed:
Schools, educational institutions and child care centres	40 $L_{Aeq(1hr)}$ (internal)
Places of worship	40 $L_{Aeq(1hr)}$ (internal)
Open space – Passive use	60 $L_{Aeq(15hr)}$ (external)

Railway noise levels have been calculated using SoundPLAN v8.2 software, incorporating the Nordic Prediction Method (Kilde Report 130) algorithm. Detailed noise contours are presented in in **Appendix G (NVIA)**.

Given the current modelling inputs, the operation of LRVs along the Project would be compliant with trigger levels at all sensitive receiver locations. The closest residential receivers are located approximately 20 m from the alignment on London Circuit. With the proposed maximum speed of 40 km/h in this section, RING trigger levels would be complied with at all locations.

There is the potential for wheel squeal to occur at locations where the track curves at the corner of Northbourne Avenue and London Circuit, the corner of London Circuit and Commonwealth Avenue, and at the three 70 m curve radii along London Circuit itself. The SPR requires the consideration of all feasible and reasonable noise mitigation to address any noise issues, and options to further reduce wheel squeal would be included in detailed design (for example, the design of resilient tracks or lubrication around tight corners).

Road traffic noise

The assessment of road traffic noise has been completed in accordance with Roads ACT Noise Management Guideline (NMG) (TCCS, 2018b). To assess the potential impact of the Project on noise sensitive receivers, future road traffic noise levels have been modelled for two scenarios: 'no build' (without the Project) (2026), and 'build' for the design year (2036).

Road traffic noise levels were calculated using SoundPLAN v8.2 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.

Road traffic noise levels have been predicted across the extent of the Project for the two scenarios. Road traffic noise levels are predicted to exceed the noise criteria at a total of five noise sensitive receivers in both scenarios, as detailed in **Table 12-11,** however, road traffic noise levels are not anticipated to increase by a significant amount due to the Project at these receivers. Exceedance of the noise criterion at these receivers is predominantly caused by existing road traffic on Parkes Way. As a result, no further consideration of operational road traffic noise mitigation is required.

Table 12-11 Road traffic noise level at noise sensitive receivers.

ID	Address	Road traffic noise level, $L_{Aeq,15hr}$, dB(A)				Notes
		Criterion	Predicted noise level, 2026 'No Build'	Predicted noise level, 2036 'Build'	Change	
12	19 Marcus Clarke, Street, Canberra (Low-rise)	65	68	68	-0.1	No noise increase due to Project
14	19 Marcus Clarke, Street, Canberra (High-rise)	65	67	66	-0.3	No noise increase due to Project
19	2 Edinburgh Avenue, Canberra (High-rise South)	65	66	66	0.1	Insignificant increase due to Project
95	2 Edinburgh Avenue, Canberra (High-rise North)	63	63	64	0.4	Insignificant increase due to Project
20	1-3 Gordon Street, Canberra	65	66	66	-0.1	No noise increase due to Project

12.4 Preliminary risk assessment

A preliminary assessment of potential noise and vibration impacts, without Project-specific management and mitigation measures, is presented in **Table 12-12** and **Table 12-13** below. The risk has been calculated using the methodology detailed in **Chapter 8.0 Environmental risk analysis approach**. It is important to consider that this assessment is representative of the worst case scenario.

Table 12-12 Preliminary risk assessment for noise and vibration during construction

Category	Description	Likelihood	Consequence	Rating
Intrusive noise associated with construction activities experienced at sensitive receivers	A number of receivers may experience noise levels above the noise assessment levels during works in standard construction hours in the worst-case scenario. One receiver (Archbishop's Residence) may be highly noise affected during utilities works and construction of tracks.	Almost certain	Moderate	Very High
Intrusive noise associated with construction vehicle movements experienced at sensitive receivers	Based on the current proposed construction vehicle numbers, no increases in road traffic noise of greater than 2 dB(A) have been identified along any of the proposed haulage routes during the AM or PM peak hour, except for PM eastbound along Edinburgh Avenue (2.9 dB(A)).	Likely	Minor	Medium
Construction vibration results in compromised human comfort or cosmetic damage to buildings	Recommended minimum working distances for vibration intensive equipment have been identified. If these minimum working distances are complied with, no adverse impacts from vibration intensive works are likely in terms of human response or cosmetic damage.	Unlikely	Moderate	Low

Table 12-13 Preliminary risk assessment for noise and vibration during operation

Category	Description	Likelihood	Consequence	Rating
Noise impacts from operation of LRVs experienced at sensitive receivers	Given the current modelling inputs, the operation of LRVs along the Project would be compliant with trigger levels at all sensitive receiver locations.	Unlikely	Minor	Very Low
Noise impacts from road traffic experienced at sensitive receivers	Road traffic noise levels have been predicted across the extent of the Project. Road traffic noise levels are predicted to exceed the noise criteria at a total of five noise sensitive receivers, however, road traffic noise levels are not anticipated to increase by a significant amount due to the Project at these receivers.	Unlikely	Minor	Very Low

12.5 Management and mitigation measures

Management and mitigation measures have been proposed to reduce the potential noise and vibration impacts of the Project identified in the assessment.

Management and mitigation measures and safeguard protocols adopted for the Project are provided in **Table 12-14**, and have been prepared with the following objectives:

- Minimise impacts on the amenity of adjacent land users due to noise and vibration during construction and operation.

Table 12-14 Management and mitigation measures – Noise and vibration

Ref	Management and mitigation measure	Timing	Reference
NV1	Implement controls on construction equipment and activities in accordance with Australian Standards and manufacturer specifications. Regularly inspect, test and maintain all stationary and mobile plant equipment to ensure that emission levels do not deteriorate over the life of the Project.	During construction	AS 2436-2010 Guide to Noise and Vibration Control
NV2	Orientate noisy/vibration generating equipment as far as possible from receivers, and implement a 'no-idling' policy by shutting down construction equipment and vehicles when not in use	During construction	
NV3	As part of monthly construction updates, receivers that could be highly noise affected by upcoming works would be notified, prior to the commencement of those works. The notification would include details of: • The construction activities likely to have noise or vibration impact • Construction period and construction hours • Any proposed mitigation measures for noise and vibration • Contact information for the Project, including out of hours contact • Complaint, corrective action, and incident procedures and how to obtain further information	During construction	
NV4	As necessary, undertake condition surveys on buildings and structures within the potential radius of effect, prior to commencement of demolition and heavy earthworks activities.	During construction	
NV5	Construction activities for the Project would be undertaken between the hours of 7.00 am and 6.00 pm Monday to Friday and 7am to 1pm Saturdays (normal hours), with no work on Sundays and Public Holidays unless otherwise approved through an Out of Hours Works Plan request.	During construction	MPC Out of Hours Works Request (**refer Appendix G (NVIA)**)
NV6	Construction works proposed to take place outside 'normal' construction hours would require individual assessment and approval on a case-by-case basis. In general, this process would include: • Identification of the duration, location, type of activities construction equipment involved • Assessment of the potential noise and vibration impact associated with the proposed construction activities and determination of the number and type of sensitive receivers potentially impacted	During construction	MPC Out of Hours Works Request (**refer Appendix G (NVIA)**)

Ref	Management and mitigation measure	Timing	Reference
	• Identification of any reasonable and feasible mitigation measures to be implemented • Consultation with the potentially impacted receivers to inform them of the proposed out of hours works, and providing an opportunity for impacted receivers to provide feedback • Minimising out of hours works as much as practicable (e.g., deliveries of equipment and materials could be made, or disposal of construction waste may be delayed until on the following day) • Inclusion of scheduled respite for the community for extended periods of night work		
NV7	A **Construction Noise and Vibration Management Plan** (CNVMP) would be developed to identify: • Potentially major noise and vibration generating activities associated with the Project, including delivery activities • Noise and vibration sensitive receivers • Measures to be implemented during construction to minimise noise and vibration impacts. • A monitoring program that obtains noise data that is representative of construction activities, and in response to complaints will be developed to assess performance against relevant noise and vibration criteria and will be used to inform continuous improvement to the CNVMP. • Methods for assessment and review of impacts associated with Out of Hours Works as part of continuous improvement	Pre-construction and during construction	
NV8	When establishing work areas, site compounds and laydowns consideration would be given to arranging the site to limit the need for reversing associated with regular/repeatable movements, where safe and space permits.	During construction	
NV9	Vibration generating activities would be managed, and construction equipment would be selected, to avoid working within the structural damage minimum working distances. The use of less vibration intensive methods of construction or equipment would be considered where feasible and reasonable.	During construction	
NV10	Minimise operational noise through ongoing maintenance of LRV wheels and tracks.	During operation	

12.5.1 Future noise monitoring

It is proposed that noise monitoring be conducted during the construction and pre-operation stages to verify noise emissions from the Project to nearby sensitive receivers. The purpose of monitoring would be to verify the operational noise generated by the light rail systems at multiple locations, accounting for different track types, speed limits, and alignment. Additionally, construction noise would be monitored in order to verify the noise predictions provided in this EA and determine if any further noise mitigation measures are required.

12.6 Residual risk assessment

A residual risk assessment was undertaken to assess the potential noise and vibration impacts after the proposed management and mitigation measures are applied for construction and operation, presented **Table 12-15** and **Table 12-16**, respectively. There remains a high residual risk of construction noise impacts affecting nearby sensitive receivers during a worst case scenario.

Table 12-15 Residual risk assessment for noise and vibration during construction

Category	Description	Likelihood	Consequence	Rating
Intrusive noise associated with construction activities experienced at sensitive receivers	A number of receivers may experience noise levels above the noise assessment levels during works in standard construction hours in the worst-case scenario. One receiver (Archbishop's Residence) may be highly noise affected during utilities works and construction of tracks.	Likely	Moderate	High
Intrusive noise associated with construction vehicle movements experienced at sensitive receivers	Based on the current proposed construction vehicle numbers, no increases in road traffic noise of greater than 2 dB(A) have been identified along any of the proposed haulage routes during the AM or PM peak hour, except for PM eastbound along Edinburgh Avenue (2.9 dB(A)).	Possible	Minor	Low
Construction vibration results in compromised human comfort or cosmetic damage to buildings	Recommended minimum working distances for vibration intensive equipment have been identified. If these minimum working distances are complied with, no adverse impacts from vibration intensive works are likely in terms of human response or cosmetic damage.	Unlikely	Moderate	Low

Table 12-16 Residual risk assessment for noise and vibration during operation

Category	Description	Likelihood	Consequence	Rating
Noise impacts from operation of LRVs experienced at sensitive receivers	Given the current modelling inputs, the operation of LRVs along the Project would be compliant with trigger levels at all sensitive receiver locations.	Unlikely	Minor	Very Low
Noise impacts from road traffic experienced at sensitive receivers	Road traffic noise levels have been predicted across the extent of the Project. Road traffic noise levels are predicted to exceed the noise criteria at a total of five noise sensitive receivers, however, road traffic noise levels are not anticipated to increase by a significant amount due to the Project at these receivers.	Unlikely	Minor	Very Low

13.0 Landscape and visual realm

This Chapter provides a summarised assessment of the potential landscape and visual realm impacts associated with the Project.

13.1 Approach

The Preliminary Environmental Risk Assessment (**Appendix C (PERA)**) identified risks relevant to landscape and visual realm, including four low construction risks and five operational risks. In accordance with the methodology provided in **Chapter 8.0 Environmental risk analysis approach**, this Chapter has been prepared to further document and assess landscape and visual realm risks with consideration of subsequent design development.

This Chapter provides a summary of the Landscape Character and Visual Impact Assessment (LCVIA) prepared for the Project. A full copy of the assessment report is provided in **Appendix H (LCVIA)**.

Key steps in the development of the LCVIA included:

- Environmental and planning baseline – an analysis of the regional and local context of the Project. This includes a thorough review of background documents, including policy and planning instruments
- Design review – a summary of urban and landscape, and sustainability design outcomes
- Impact assessment, including:
    - Landscape character impact assessment – an assessment of the anticipated impact of the Project on landscape character as a result of the final design outcome (**Section 13.1.1**)
    - Visual Impact Assessment – an evaluation of the impact of the Project on existing views and visual amenity within the study area (**Section 13.1.2**)
- Mitigation – design outcomes and mitigation measures to avoid, reduce or mitigate adverse impacts associated with the Project.

The methodology for the assessment generally followed the approach in *Environmental Impacts Assessment Practice Note – Guideline for Landscape Character and Visual Impact Assessment EIA-N04* (TfNSW, 2020), with more detailed guidance taken from *Guidelines for Landscape and Visual Impact Assessment, Third Edition* (Landscape Institute and Institute of Environmental Management UK, 2013).

13.1.1 Landscape character impact assessment

A landscape character assessment was undertaken to identify features and elements relevant to the Project. Landscape Character Zones (LCZ) were identified within the broad landscape setting. LCZs are an area of landscape with similar properties or strongly defined spatial qualities, distinct from areas immediately nearby.

The assessment of landscape effects considered the change due to the Project on the landscape as a resource in its own right. The assessment was based on the sensitivity to change and the magnitude of the change that is likely to occur. The sensitivity of a LCZ considered the susceptibility to change, the ability of the landscape to accommodate the Project without undue consequences, and the value of the landscape. Landscape effects were assessed at the commencement of operation of the Project, and only LCZs deemed likely to be impacted by the Project were assessed. Additional information regarding the assessment of impacts on the landscape character is provided in Section 4.3 of **Appendix H (LCVIA)**.

The degree of sensitivity of each LCZ and magnitude of change resulting from the Project provided an overall impact rating as per **Table 13-1**. The rating did not consider if the impact would be beneficial or adverse.

Table 13-1 Landscape character and visual impact assessment matrix (TfNSW, 2020)

		Magnitude			
		High	Moderate	Low	Negligible
Sensitivity	High	High	High to Moderate	Moderate	Negligible
	Moderate	High to Moderate	Moderate	Moderate to Low	Negligible
	Low	Moderate	Moderate to Low	Low	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible

13.1.2 Visual impact assessment

A series of viewpoints (VPs) were selected from which to assess the visual impact of the Project. VPs were chosen to assess the changes due to the Project from publicly accessible locations, although some VPs were used to approximate these changes when seen from private locations such as residences or community facilities.

The visual impact assessment considered both the sensitivity of an existing VP to change and the magnitude (scale, character and distance) of the change of view. Visual impacts were assessed during construction and at the commencement of operation of the Project. The sensitivity of each VP and magnitude of change resulting from the Project were evaluated using **Table 13-1**.

13.2 Existing environment

Land use in the region surrounding Northbourne Avenue and London Circuit is characterised by commercial and business flanked by urban and suburban development reducing in density as it radiates from the road corridor. In the broader Canberra region surrounding the Project, vegetation includes open forest on the peaks and upper slopes of Black Mountain to the northwest of the delivery phase area and Mt Ainslie to the northeast, as well as some areas of open woodland on the western slopes of Mt Ainslie. Lake Burley Griffin (LBG) dominates the landscape south of City Hill. This land use setting forms the basis to describe the existing environment of the LCZs and VPs used in this assessment.

13.2.1 Landscape character zones

Seven LCZs were identified within the detailed study area (refer to **Figure 13-1**). These are:

- LCZ 1: Parliamentary Zone and Cultural Triangle
- LCZ 2: Major Avenues and Axes
- LCZ 3: LBG and Foreshores
- LCZ 4: London Circuit
- LCZ 5: Parkes Way
- LCZ 6: Commercial/Civic
- LCZ 7: Commercial/City East.

As outlined in **Table 13-2,** the Project lies predominantly within LCZ 4: London Circuit, but also lies within small portions of LCZ 2: Major Avenues and Axes, LCZ 3: LBG and Foreshores and LCZ 5: Parkes Way. For details related to the other LCZ's, refer to **Appendix H (LCVIA)**.

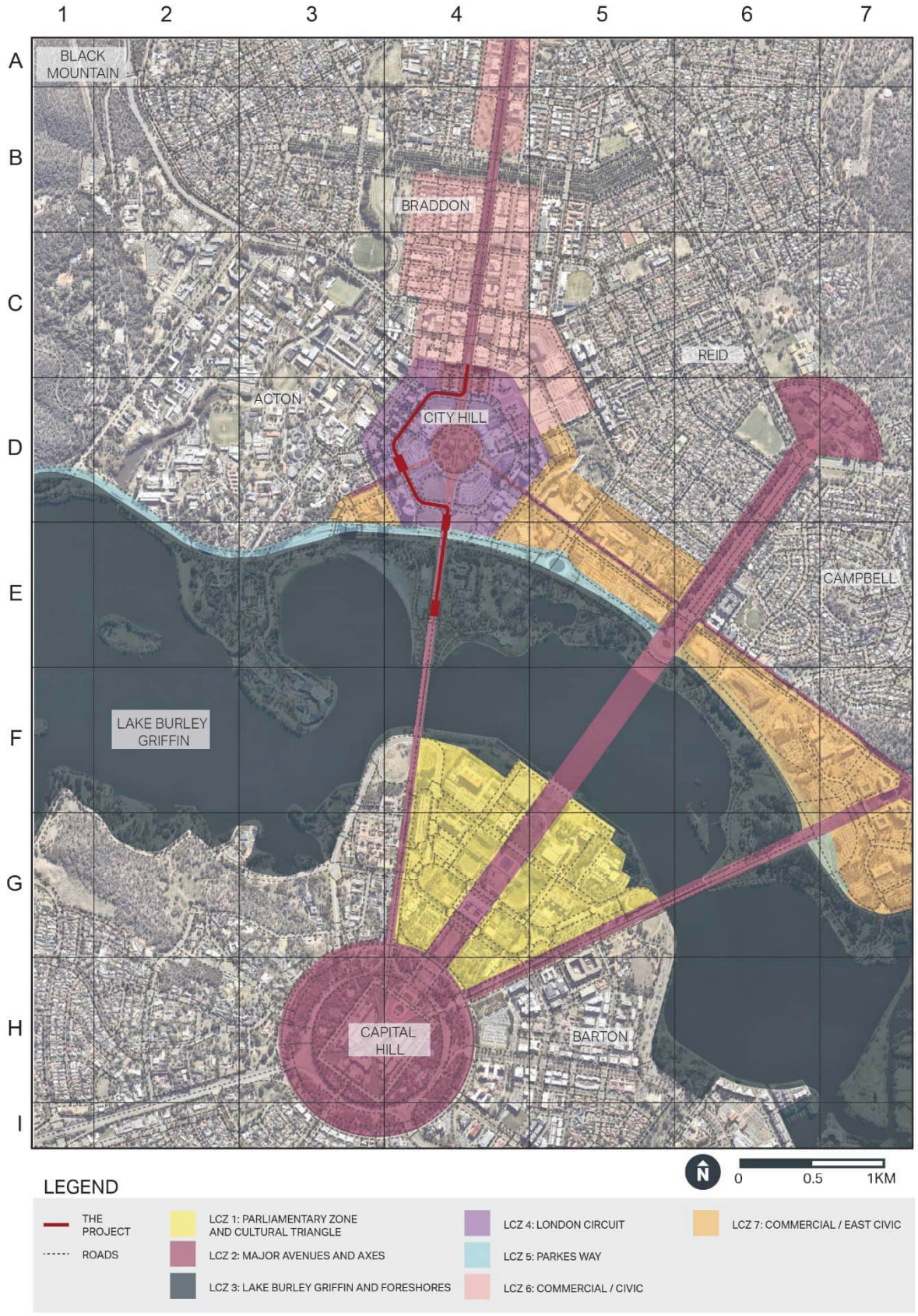


Figure 13-1 LCZs

Table 13-2 Details of LCZs that the Project lies within

LCZ	Description
LCZ 2: Major Avenues and Axes	LCZ 2 comprises a series of linear corridors with focal points including Parliament House, Old Parliament House and the Australian War Memorial. The strong linear elements are a major design feature of Canberra and assists with orientation and highlighting landmarks. This is further assisted with focal points being built on raised landforms. Vegetation is planted along the linear corridors. When planted along the central median, the width of the avenue allows views along the corridor to be maintained. Commonwealth Avenue forms part of the National Triangle and connects the major topographic landforms of Capital Hill and City Hill. The symbolic weight of the Land Axis, the geometric axis connecting Mount Ainslie to Capital Hill, makes this an important space for cultural functions. The Aboriginal Tent Embassy is located within the Land Axis. Transport is the predominant land use within LCZ 2 with the exception of the Land Axis, which comprises public open spaces.
LCZ 3: LBG and Foreshores	LCZ 3 is comprised of the large, open expanse of water of LBG and the parkland foreshore areas. The topography of this LCZ is relatively flat and low lying. The views across the lake and landscape beyond are visible from most locations. Views include Black Mountain, Mount Ainslie and landmark buildings which surround the lake.
LCZ 4: London Circuit	The Project predominantly lies within LCZ 4. The land is predominantly commercial and civic with some minor open air spaces and areas for accommodation. The immediate vicinity is occupied by medium to tall commercial building and large parking lots. The LCZ is designated for development and is currently undergoing rapid changes. The topography falls from the highest point at Vernon Circle to the lower London Circuit, Marcus Clarke Street and Allara Street. The LCZ is characterised by its concentric roads radiating outwards to a hexagonal shape with avenues radiating beyond that. Vegetation within the LCZ comprises predominantly avenues of street trees and some formal plazas, such as the plaza within the Law Courts Precinct. Trees within the streetscape include predominantly exotic deciduous species, with some newer plantings referencing the Cypress trees on City Hill.
LCZ 5: Parkes Way	The Parkes Way is a wide, linear roadway. The topography undulates varyingly with steeper hills, embankments and retaining walls located along the interface with adjacent LCZs. These embankments and retaining walls often act as screens typically keeping the views within the roadway. Vegetation within the LCZ is sparse with the medium being turfed and the occasional planted tree, typically native.

13.2.2 Viewpoints

Fourteen VPs were selected for assessment and are presented in **Figure 13-2** and **Figure 13-3**. A detailed description, including images of the VPs, is presented in Section 6 of **Appendix H (LCVIA)**.

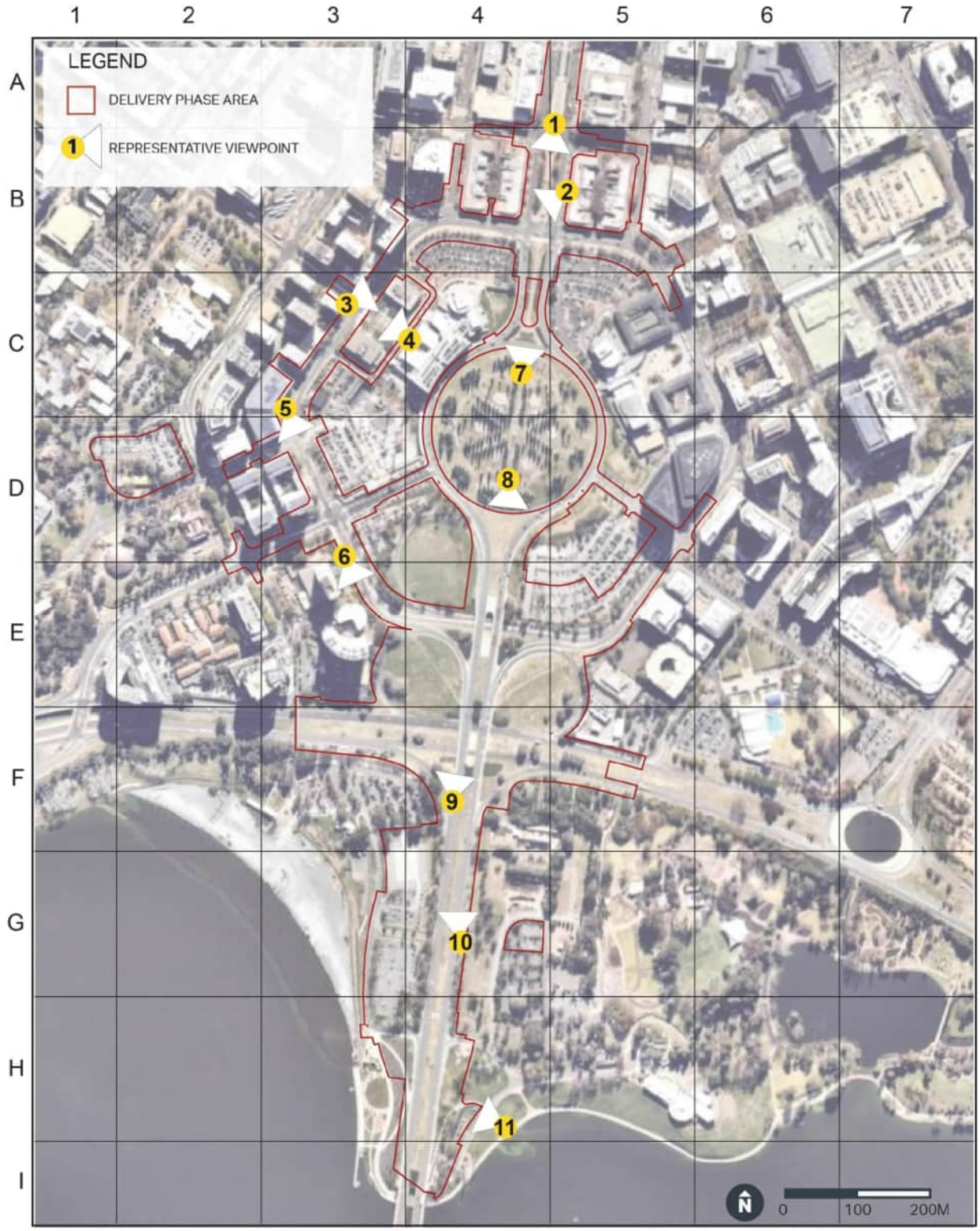


Figure 13-2 Near locations considered and selected for visual impact assessment

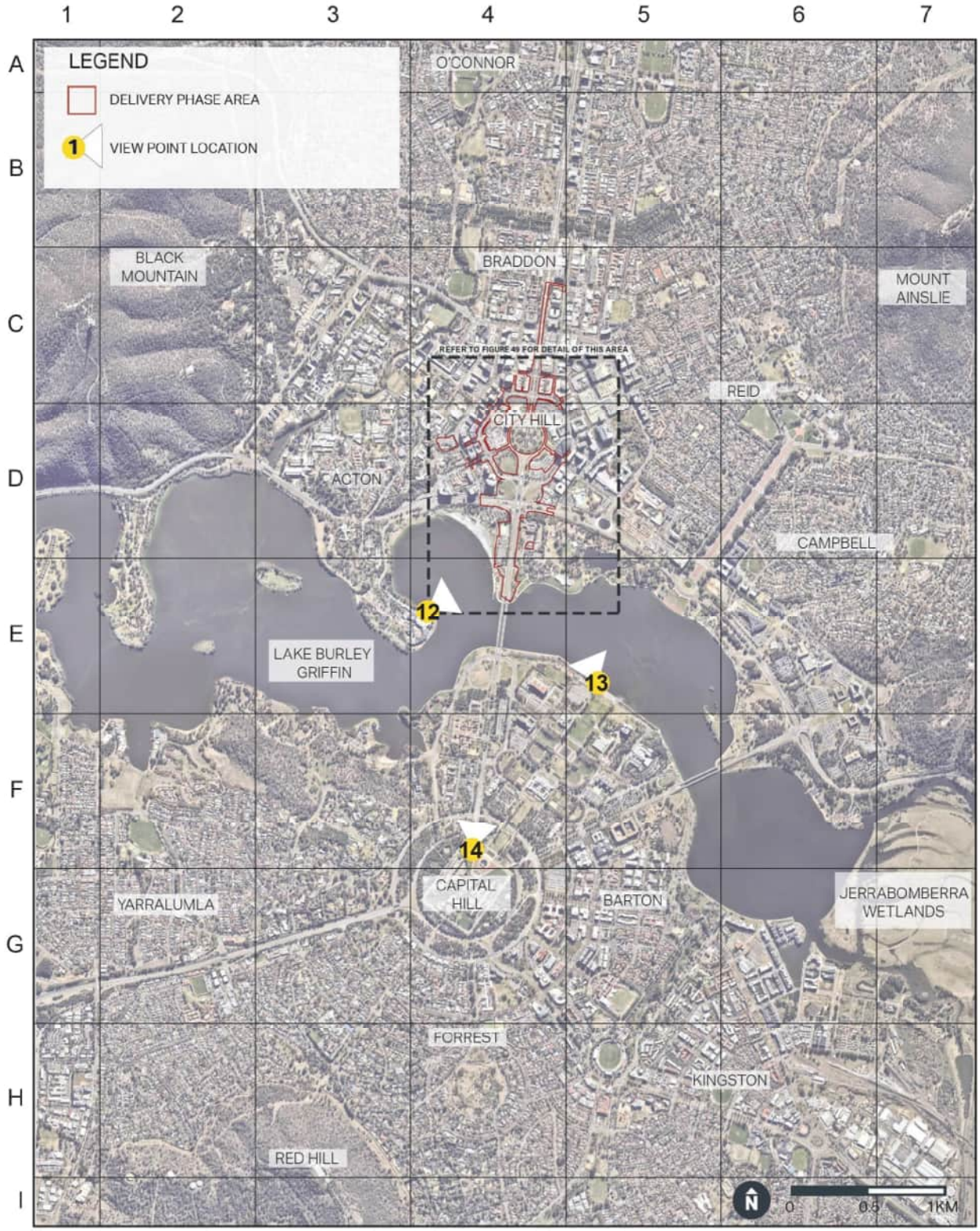


Figure 13-3 Distant locations considered and selected for visual impact assessment

13.3 Assessment of potential impacts

13.3.1 Construction

Landscape character and visual impacts associated with construction of the Project would be temporary.

13.3.1.1 Landscape character zones

Assessment of impact on landscape character considers the impact of change due to a project on the landscape as a resource in its own right. Impacts on landscape character are assessed at operation only as it is assumed that the landscape outside the Project's operational footprint would be restored to its original condition after construction.

13.3.1.2 Visual impact assessment

The visual impact assessment considered both the sensitivity of an existing VP to change and the magnitude (scale, character and distance) of the change of view. A description of the anticipated change during construction, and the associated potential impact is summarised in **Table 13-3**.

Construction of the Project would be seen predominantly from closer locations rather than distant ones. The construction would typically comprise the addition of the 'visual clutter' of equipment, activity and changes to traffic. Typical construction activities and equipment visible at VPs in proximity to the Project would include:

- Fencing, hoarding, signage, and traffic safety equipment
- Changes to utilities, including new drainage infrastructure
- Bulk earthworks and construction of tracks
- New kerb alignments and verge upgrades
- Installation of lighting, signage and landscaping, including planting of street trees.

The visual impact of the Project on all VPs is considered to be Adverse, including ten VPs with a 'High' or 'High to Moderate' impact rating, two VPs with a 'Moderate' impact rating, and two VPs with 'Moderate to Low' impacts. The potential impacts on several locations are elevated through VP sensitivity due to heritage and planning importance.

Table 13-3 VPs construction impact summary

VP	Anticipated change in view	Impact summary
VP 1: Northbourne Avenue	No change in view is anticipated as it is assumed that this VP would not be accessible during construction.	Sensitivity: High
		Magnitude: High
		Overall impact: High
		Qualitative rating: Adverse
VP 2: Sydney Building	The Project would introduce visual clutter associated with construction activity and result in an adverse effect on the view from this location. The anticipated changes would be temporary and seen over a short term.	Sensitivity: Moderate
		Magnitude: High
		Overall impact: High to Moderate
		Qualitative rating: Adverse
VP 3: Intersection of London Circuit and University Avenue	Construction activities would be seen in the fore and middle ground of the view and over a large proportion of the view, partially screening	Sensitivity: Moderate
		Magnitude: High
		Overall Impact: High to Moderate

VP	Anticipated change in view	Impact summary
	views to the Reserve Bank building and the Law Courts Precinct. The anticipated change would contrast with the existing view.	Qualitative rating: Adverse
VP 4: Law Court	Construction activities would be seen along the focal viewing corridor along University Avenue, introducing visual clutter. The visual depth of the area affected would predominantly be screened by buildings on either side of the plaza and trees, and be limited to London Circuit. The anticipated change would contrast with the existing view.	Sensitivity: Moderate Magnitude: Low Overall Impact: Moderate to Low Qualitative rating: Adverse
VP 5: 7 London Circuit	Construction activities, including construction of a light rail stop, would be seen from a close distance and in a high amount of detail within most of the view. The anticipated change would contrast with the existing view.	Sensitivity: Moderate Magnitude: High Overall Impact: High to Moderate Qualitative rating: Adverse
VP 6: 1 London Circuit	Construction activities would be seen from a close distance and in a high amount of detail within most of the view. The anticipated change would contrast with the existing view.	Sensitivity: Moderate Magnitude: High Overall Impact: High to Moderate Qualitative rating: Adverse
VP 7: City Hill North	Construction would be limited to the central median and the lanes directly adjacent to it, seen in middle to background of the view and framed between the row of Cypress trees that focus the view from this location along Northbourne Avenue. While the distance of viewing would limit the amount of detail discernible of the construction, the works would be seen within the focal point of the view along Northbourne Avenue. The anticipated change would be in contrast to the existing view.	Sensitivity: High Magnitude: Moderate Overall Impact: High to Moderate Qualitative rating: Adverse
VP 8: City Hill South	Construction activities would be seen in the middle ground of the view framed between trees planted to focus the viewer's attention on the view along Commonwealth Avenue to Parliament House. The anticipated change would be in high contrast to the existing view.	Sensitivity: High Magnitude: High Overall Impact: High Qualitative rating: Adverse
VP 9: Commonwealth Avenue	No change in view is anticipated as it is assumed that this VP would not be accessible	Sensitivity: Moderate Magnitude: High

VP	Anticipated change in view	Impact summary
	during construction due to the changes that would occur to the footpath and verge next to the bridge over Parkes Way.	Overall Impact: High to Moderate Qualitative rating: Adverse
VP 10: Commonwealth Avenue	Construction activities would be seen with a majority of the view in the foreground, middle and background and would be in contrast to the existing view.	Sensitivity: High Magnitude: High Overall Impact: High Qualitative rating: Adverse
VP 11: Commonwealth Park	This view is within the National Triangle, on the shore of Lake Burley Griffin and within a highly valued recreational space visited by locals and tourists alike. Construction activities would be visible, however, will be mostly screened by tree canopy (especially in Summer) and seen against a dark backdrop and from a long viewing distance. The anticipated change would contrast with the existing view.	Sensitivity: High Magnitude: Low Overall Impact: Moderate Qualitative rating: Adverse
VP 12: National Museum of Australia	There are important items within the view including Mount Ainslie, LBG and part of the National Triangle. Construction activities would be difficult to see against a dark backdrop and from a long viewing distance, with the exception of larger elements such as cranes that may be visible when extended. The change would be in contrast to the existing view.	Sensitivity: High Magnitude: Low Overall Impact: Moderate Qualitative rating: Adverse
VP 13: LBG/Land Axis	The Project would be mostly screened from view by built form and vegetation within Commonwealth Park. Taller construction elements, such as cranes, may be seen within a small portion of the view. The anticipated change would be in contrast to the existing view.	Sensitivity: Moderate Magnitude: Low Overall Impact: Moderate to Low Qualitative rating: Adverse
VP 14: Parliament House	While limited construction activity is likely to be seen in detail, the activity is likely to result in the visual shortening of the view along Commonwealth Avenue, with a disruption in the continuity of the avenue leading up to City Hill. The anticipated change would be in contrast to the existing view.	Sensitivity: High Magnitude: Moderate Overall Impact: High to Moderate Qualitative rating: Adverse

13.3.2 Operation

13.3.2.1 Landscape character impact assessment

The assessment of landscape effects considered the change due to the Project on the landscape as a resource in its own right. The assessment was based on the sensitivity to change and the magnitude of the change that is likely to occur. A description of the anticipated change, and the associated potential impact, for the seven identified LCZs is summarised in **Table 13-4**.

Three LCZs returned an overall impact greater than negligible, with impacts assessed to be beneficial or neutral:

- LCZ 2: Major Avenues and Axes
- LCZ 4: London Circuit
- LCZ 5: Parkes Way.

LCZ 4 returned a High to Moderate impact rating on landscape character due to the larger proportion of the LCZ affected by the Project and the high sensitivity of the LCZ due to its landscape value, importance as Designated areas and multiple heritage items. Overall, the impact of the Project on landscape character is considered to be Moderate to Low (Neutral).

Table 13-4 Landscape character operation summary

LCZ	Anticipated change	Impact
LCZ 2: Major Avenues and Axes	On Northbourne Avenue, between the Sydney and Melbourne Buildings, the existing raised median would be redeveloped to include green track flanked by landscaped areas and two narrow pedestrian footpaths. A double avenue of *Zelcovas* would be installed. On Commonwealth Avenue the existing turf median would be replaced with green track, with two light rail stops positioned centrally within the median. Trees would be planted between tracks travelling in either direction. The new bridge over Parkes Way would be similar to existing, however, the light rail would result in the proposed bridge being solid rather than having a gap separating the two carriageways. The Project would preserve key spatial characteristics within the LCZ and considers heritage elements, including the visual relationship between the Sydney and Melbourne Buildings at Northbourne Place and the view corridors along Commonwealth Avenue, resulting in a series of positive changes within the LCZ.	Sensitivity: Moderate Magnitude: Moderate Overall Impact: Moderate Qualitative rating: Beneficial
LCZ 4: London Circuit	This LCZ is inherently sensitive given its central location, unique character and heritage items. The upgrade of the London Circuit road corridor, particularly the rationalisation of street trees, would unify the road, providing an almost continuous ring of Plane Trees (*Platanus x acerifolius*) along its entirety.	Sensitivity: High Magnitude: Moderate Overall Impact: High to Moderate

LCZ	Anticipated change	Impact
	This would tie into the street trees already added to London Circuit due to the RLC project. An increase in tree canopy is an identified action in Canberra's Living Infrastructure Plan (EPSDD, 2019b) amongst other policy documents. An improvement in the quality of the public realm, including verges with footpaths, planting and cycleways fulfil key strategic direction of policy and planning documents, including the ACT Planning Strategy and ACT Transport strategy. The inclusion of well thought-out public transport, in conjunction with the simple, bold design of streetscape elements fulfil key principles in the NCP for London Circuit.	Qualitative rating: Beneficial
LCZ 5: Parkes Way	The Project would intersect with Parkes Way, with a new bridge that would result in the gap between the carriageways on the Commonwealth Avenue bridge crossing Parkes Way filled in to allow the light rail to travel along the median strip of Commonwealth Avenue. The batters on either side of Parkes Way at Commonwealth Avenue would be cleared and planted with turf. Street trees would be planted to the south of Parkes Way on either side of Commonwealth Avenue between Commonwealth Avenue and the entry/exit ramps to Parkes Way. While addition of light rail over Parkes way (thereby consolidating the carriageways of the Commonwealth Avenue bridge) would comprise a small change within the LCZ, the Project has a characteristic 'fit' within the LCZ, being the addition of public transport infrastructure crossing a transport infrastructure corridor.	Sensitivity: Low Magnitude: Low Overall Impact: Low Qualitative rating: Neutral

13.3.2.2 Visual impact assessment

A description of the anticipated change for VPs during operation, and the associated potential impact, is summarised in **Table 13-5**.

Five VPs returned an overall impact rating during operation of 'High' or 'High to Moderate'. Of these, one VP returned an adverse impact on the quality of the change in the view, while the other four returned a beneficial or neutral change in the quality of the view. The beneficial aspects of the changes were typically related to the 'tidying up' of built elements and ground plane design (e.g., signage, lighting, paving details) within the views and the planting of continuous street trees, which would visually strengthen the views along the road corridors. The one adverse rating was where a shade structure for a light rail stop would be seen against a backdrop of City Hill. This rating is likely to reduce as street trees within the median mature and reduce the visual prominence of the structure within the view.

Table 13-5 VPs operation impact summary

VP	Anticipated change	Impact summary
VP 1: Northbourne Avenue	The extension of the light rail tracks south along Northbourne Avenue would comprise a substantial change to the composition of the view, drawing the eye south along Northbourne Avenue and accentuating the focus of the view towards City Hill. However, the use of green track and soft landscaping would preserve the view to the 'green median' between the Sydney and Melbourne	Sensitivity: High Magnitude: High Overall impact: High

VP	Anticipated change	Impact summary
	Buildings in the middle ground of the view. The larger elements that compositionally anchor the view (the Sydney and Melbourne Buildings) remain unchanged. The Project would result in a lengthening of the view along Northbourne Avenue towards City Hill (reducing the visual prominence of the horizontal alignment of Alinga Street and elements within the existing median).	Qualitative rating: Beneficial
VP 2: Sydney Building	The Project would be more visually recessive than that where a view along the length of the tracks is seen (e.g., from Viewpoint 1), as the soft landscape elements partly screen views to the static infrastructure. Passing light rail vehicles would be a new addition to the view. The Project would revitalise a somewhat tired looking median within the road corridor, including a simplification of signage and structures positioned within it. The proposed median would be as 'green' (if not more so), than the existing median, due to the large amount of planting on the ground plane and the use of green track. However, due to the staggered spacing, the increased tree numbers may partly obscure the view to the Melbourne Building on the other side of the road.	Sensitivity: Moderate Magnitude: High Overall impact: High to moderate Qualitative rating: Neutral
VP 3: Intersection of London Circuit and University Avenue	While the addition of light rail infrastructure within the view is a substantial change, the major elements of the view remain unchanged. The Project results in a 'refreshing' of the ground plane and structures within the view (including lighting, signage and street furniture). The addition of the cobblestone track to the centre of the road reduces the visual prominence of the vehicular road area within the view, along with the upgrade of surface finishes.	Sensitivity: Moderate Magnitude: Moderate Overall Impact: Moderate Qualitative rating: Beneficial
VP 4: Law Court	The Project ground plane is only just visible from this viewpoint due to the distance, screening by built form and vegetation, and change in levels. The two additional trees within the view would be predominantly screened during summer by existing deciduous trees within the plaza. Passing light rail vehicles, while a new element within the view, would be similar in character to passing buses or other larger vehicles, and would not alter the quality of the view.	Sensitivity: Moderate Magnitude: Low Overall Impact: Moderate to Low Qualitative rating: Neutral
VP 5: 7 London Circuit	The Project results in a 'refreshing' of the ground plane and structures within the view (including lighting, signage and street furniture). The addition of the cobblestone track to the centre of the road reduces the visual prominence of the vehicular road area within the view, along with the upgrade of surface finishes.	Sensitivity: Moderate Magnitude: Moderate Overall Impact: Moderate Qualitative rating: Beneficial
VP 6: 1 London Circuit	The changes to the ground plane within the road (the replacement of the turf median with tracks) would not alter the quality of the existing view. Passing light rail vehicles would be a new addition to the view, but would be similar in scale to buses or other large vehicles within the road corridor and be a temporary addition to the view as they passed.	Sensitivity: Moderate Magnitude: Moderate Overall Impact: Moderate Qualitative rating: Neutral

VP	Anticipated change	Impact summary
VP 7: City Hill North	While visual receptors at this viewpoint are likely to be sensitive to changes to views from within City Hill Park, the changes due to the Project along Northbourne Avenue would be predominantly visually recessive, given the replacement of elements within the view (namely the avenue of street trees and the green, landscaped median). The extension of the light rail from the Alinga Street light rail stop would increase the amount of light rail infrastructure within the road corridor, but would not comprise a new or uncharacteristic element within the view.	Sensitivity: High Magnitude: Low Overall Impact: Moderate Qualitative rating: Neutral
VP 8: City Hill South	The addition of light rail within the median of Commonwealth Avenue is considered a visually acceptable change given the identification of this avenue as appropriate for public transport. The change in avenue tree species from only deciduous to a mix of coniferous and deciduous is a calculated one, identified in planning documents to emphasise the avenue effect of Commonwealth Avenue throughout the seasons. The use of green track preserves the visual aesthetic of the turf median leading up to Parliament House. The placement of trees, while matching those planted in the median on the southern side of LBG, would also decrease the open 'runway' of turf within the median leading up to this focal point within the view. They also reduce the visual prominence of light rail infrastructure within the view, including passing light rail and light rail stops.	Sensitivity: High Magnitude: Moderate Overall Impact: High to Moderate Qualitative rating: Neutral
VP 9: Commonwealth Avenue	The Project would be seen by a high number of passers-by on a Main Avenue. Changes include the addition of street trees to either side of Commonwealth Avenue, as well as within the median. While the median would be 'clear' of structures and planting as Commonwealth Avenue passed over Parkes Way, the gap between the carriageways would be filled in and light rail infrastructure placed within the median. This would visually increase the seen width of the road pavement locally within this area. Street trees and the light rail stop to the north would visually 'split' the carriageways in a more dominant fashion, and partly screen the lower area of City Hill.	Sensitivity: Moderate Magnitude: High Overall Impact: High to Moderate Qualitative rating: Adverse
VP 10: Commonwealth Avenue	The addition of light rail within the median of Commonwealth Avenue is a visually acceptable change given the identification of this avenue as appropriate for public transport. The use of green track would preserve the visual aesthetic of the turf median within the road corridor, visually softening the road within the view. With the addition of tree plantings, this further softens the view and reduces the visual prominence of the opposite carriageways and passing light rail vehicles. The change in avenue tree species from only deciduous to a mix of coniferous and deciduous is identified in planning documents to emphasise the avenue affect of Commonwealth Avenue throughout the seasons.	Sensitivity: High Magnitude: High Overall Impact: High Qualitative rating: Beneficial

VP	Anticipated change	Impact summary
	The simultaneous replanting of the entire avenue would be a negative outcome at first opening, as the mature avenue would be replaced with small trees. However, over time as the double avenue of trees matured, they would visually create a green, continuous frame along the length of the corridor.	
VP 11: Commonwealth Park	The addition of street trees and some visually recessive light rail infrastructure within the background of the view and mostly screened by existing street trees (particularly in summer when the trees are in leaf) would not affect the quality of the existing view.	Sensitivity: High Magnitude: Low Overall Impact: Moderate Qualitative rating: Neutral
VP 12: National Museum of Australia	There would be no change in the quality of the view due to the Project. The largest element seen would be street trees, which would visually comprise a replacement of trees removed to construct the Project.	Sensitivity: High Magnitude: Low Overall Impact: Moderate Qualitative rating: Neutral
VP 13: LBG/Land Axis	It would be difficult to see the Project from this viewpoint, with the Project elements blending into the visual clutter of the background. There would be no change in the quality of the view due to the Project.	Sensitivity: Moderate Magnitude: Negligible Overall Impact: Negligible Qualitative rating: Neutral
VP 14: Parliament House	The quality of the view would not be affected by the Project as the construction activity would not be seen in any detail.	Sensitivity: High Magnitude: Low Overall Impact: Moderate Qualitative rating: Neutral

13.4 Management and mitigation measures

Management and mitigation measures have been proposed to reduce the potential landscape and visual realm impacts of the Project identified in the assessment.

Management and mitigation measures and safeguard protocols adopted for the Project are provided in **Table 13-6**, and have been prepared with the following objectives:

- Minimise the visual impacts of construction activities
- Enhance visual amenity within the delivery phase area
- Contribute to urban realm quality without impacting ability to appreciate existing local art and commemorative features.

Table 13-6 Management and mitigation measures – landscape and visual realm

Ref	Management and mitigation measure	Timing	Reference
LV1	Wherever possible, high quality construction hoarding would be used with consideration given to the potential for local public art or heritage interpretation, subject to all other necessary approvals. The design of the hoarding should consider visually recessive, natural colours and images, and where	Prior to and during construction	

Ref	Management and mitigation measure	Timing	Reference
	possible be developed with input from local schools or artists.		
LV2	Storage of materials and equipment at worksites and compounds would be planned to reduce visual impacts	During construction	
LV3	Lighting associated with the Project would be designed to limit spill into non-target areas and up-lighting would be capped by structures. Light colour would be designed to complement the adjacent area and public safety cameras would be selected to function without unnecessary lighting.	Detailed design	NCA Outdoor Lighting Policy
LV4	Wherever practicable, combine above-ground street elements (lighting, traffic signals, traffic signs) on common use poles to reduce visual clutter and to reduce potential conflict with landscape elements, in consultation with TCCS and NCA.	Detailed design, prior to construction	
LV5	Advanced trees would be procured for landscaping activities completed as part of the Project	Detailed design, prior to construction	
LV6	Trees removed for construction would be replaced in accordance with the Street Tree Masterplan.	Prior to construction	
LV7	Within the delivery phase area, green track areas would be monitored by an active irrigation system with an appropriate control system to monitor and provide optimum growing conditions for planted and turf grass areas, without unnecessarily overusing water	During operation	
LV8	In consultation with relevant authorities, the ‘Queen Elizabeth II’ commemorative plaque and the public artwork ‘Dream Lens to the Future’ would be relocated to an appropriate location	Prior to Construction	

13.5 Residual risk assessment

13.5.1 Residual landscape character impacts

There are no adverse impacts anticipated on landscape character during operation, with beneficial impacts identified at LCZ 2: Major Avenues and Axes and LCZ 4: London Circuit. the beneficial impact rating has been based on the scale and range of the Project within the LCZs, with details considered within the design process already minimising the impact of the Project on the landscape character. Therefore, no further mitigation of impact is considered to be required.

13.5.2 Residual visual impacts during construction

Construction of the Project would be seen predominantly from closer locations rather than distant ones typically as ‘visual clutter’ of equipment, activity and changes to traffic that would result in adverse, temporary impacts on views.

Table 13-7 presents the ten VPs which returned an overall unmitigated impact rating during construction of High or High to Moderate. The mitigation measures outlined in **Table 13-6** were adopted, and the visual impact at each of these VPs was reassessed. While the mitigation measures would not lower the level of impact on the views, they would result in a slight 'tidying up' of the view, even though the rating would remain the same.

Table 13-7 Residual adverse visual impact assessment for construction

VP	Sensitivity	Unmitigated impact		Mitigated impact		Qualitative rating
		Magnitude	Overall rating	Magnitude	Overall rating	
VP 1: Northbourne Ave	High	High	High	High	High	Adverse
VP 2: Sydney Building	Moderate	High	High to Moderate	High	High to Moderate	Adverse
VP 3: Intersection of London Circuit and University Avenue	Moderate	High	High to Moderate	High	High to Moderate	Adverse
VP 5: 7 London Circuit	Moderate	High	High to Moderate	High	High to Moderate	Adverse
VP 6: 1 London Circuit	Moderate	High	High to Moderate	High	High to Moderate	Adverse
VP 7: City Hill North	High	Moderate	High to Moderate	Moderate	High to Moderate	Adverse
VP 8: City Hill South	High	Moderate	High to Moderate	Moderate	High to Moderate	Adverse
VP 9: Commonwealth Avenue	Moderate	High	High to Moderate	High	High to Moderate	Adverse
VP 10: Commonwealth Avenue	High	High	High	High	High	Adverse
VP 14: Parliament House	High	Moderate	High to Moderate	Moderate	High to Moderate	Adverse

13.5.3 Residual visual impacts during operation

Table 13-8 presents the five VPs which returned an overall unmitigated impact rating during operation of High or High to Moderate. Only one VP returned an adverse impact on the quality of the change in the view, while the other four returned a beneficial or neutral change in the quality of the view.

The proposed mitigation measures of combining above-ground street elements to reduce visual clutter, and the use of high quality materials in finished landscaping would seek to reduce the impact on views along Commonwealth Avenue (VP9). No mitigation measures are proposed for a beneficial change to views.

Table 13-8 Residual adverse visual impact assessment for operation

VP	Sensitivity	Unmitigated impact		Mitigated impact		Qualitative rating
		Magnitude	Overall rating	Magnitude	Overall rating	
VP 1: Northbourne Avenue	High	High	High	High	High	Beneficial
VP 2: Sydney Building	Moderate	High	High to Moderate	Moderate	Moderate	Neutral
VP 8: City Hill South	Moderate	Moderate	High to Moderate	Moderate	High to Moderate	Neutral
VP 9: Commonwealth Avenue	Moderate	High	High to Moderate	High	High to Moderate	Adverse
VP 10: Commonwealth Avenue	High	High	High	High	High	Beneficial

14.0 Socioeconomic impacts

This Chapter provides a summarised assessment of the socioeconomic impacts and benefits associated with the Project.

14.1 Approach

The Preliminary Environmental Risk Assessment (refer **Appendix C (PERA)**) identified socioeconomic risks associated with construction and operation of the Project. In accordance with the methodology provided in **Chapter 8.0 Environmental risk analysis approach**, this Chapter has been prepared to further document and assess socioeconomic risks.

Given that some medium to high preliminary risks were identified, a technical impact assessment was required. A socioeconomic and economic impact assessment (SEIA) was prepared by bd infrastructure (refer **Appendix I (SEIA)**), to understand the socioeconomic impacts that the Project may generate.

The approach for the SEIA has been adopted from the *International Association for Impact Assessment's Social Impact Assessment: Guidance for assessing and managing the social impacts of projects* (the IAIA Guidance document) (IAIA, 2015) and other industry leading frameworks, including the *NSW Department of Planning and Environment's Social Impact Assessment Guideline* (DPE Guideline) (DPE, 2021).

14.1.1 Social impact categories

Social impacts are defined in the IAIA Guidance document as "*anything that affects people*", and have been broadly defined as eight overarching categories, which have been assessed in the SEIA. These categories include way of life, culture, community, political systems, environment, health and wellbeing, personal and property rights, and fears and aspirations.

For the purpose of this SEIA a qualitative assessment of community resilience or adaptive capacity has been used to review and analyse relevant indicators and other primary and secondary data sources. This has been achieved by using the sustainable livelihoods approach (Department for International Development (DFID), United Kingdom,1999). The sustainable livelihoods approach involves profiling communities according to the five 'community capitals'. This approach is harmonious with the international standard for socioeconomic impact assessment as established through the IAIA Guidance document. The five community capitals include:

- Natural capital (natural resources, ecosystems, beauty of nature)
- Physical capital (built infrastructure, accessibility to services and infrastructure, information accessibility, remoteness/isolation)
- Economic capital (economic resources, key industry sectors, wealth of individuals, households and organisations)
- Social capital (family and neighbours, community networks and inter-relationships, governance, sense of community, history and heritage)
- Human capital (skills, health, education, abilities, vulnerable/at risk groups).

This approach also provided an opportunity to ensure that the SEIA was tailored to the ACT by considering the relationship between the community capitals and the ACT Wellbeing Framework, an accepted framework which the ACT community has shaped. For the purposes of the SEIA, the domains highlighted in **Table 14-1** have been deemed as relevant to the Project.

Table 14-1 Wellbeing Framework domains relevant to the Project

Domain	Description
Access and connectivity	Getting around to places we value and accessing the services we need
Economy	We share in our city's economy
Social connection	Being connected with family, friends and community
Education and life-long learning	Gaining the skills and education needed at all stages of life
Housing and home	Having a place to call home
Time	Having time to live life well
Environment and climate	The environment sustains all life now and into the future

14.1.2 Determining the social baseline

A key component in the development of the social baseline for the SEIA was the collation and analysis of demographic data as relevant to the social area of influence.

For the purpose of this assessment, the unit of analysis considered most reflective of the study area includes:

- Analysis of ABS Census data (2016 and 2021, where available and relevant) to prepare community profiles for the social areas of influence, based on data for ABS Census Statistical Area level 2 (SA2s). SA2s have been chosen as the closest approximation of each of the social area of influence with construction and operational impacts of the Project
- The regional context is the ACT (Greater Capital City Statistical Area), and this has been used, where possible, for comparative purposes.

Following the consideration of social indicators, a desktop-based review was undertaken of a range of documents and data sources to inform the context and understanding of the study area characteristics, including community character, values, concerns, and social infrastructure. Finally, the baseline was also informed by information obtained directly from potentially affected community stakeholders to further understand community values and concerns (refer to **Section 14.2**).

14.1.3 Scoping potential impacts

To understand the potential socioeconomic impacts of the Project, a review was undertaken of the technical reports that informed the Project EA. This included technical reports/chapters for noise and vibration, transport and traffic and access, air quality, heritage, contamination, climate change, greenhouse gas, landscape and visual amenity and cumulative impacts. The potential impacts were also determined based on a background review of documentation and engagement with MPC to obtain additional insights.

14.1.4 Assessment of potential impacts

The SEIA includes the assessment of potential positive and negative social impacts and the evaluation of residual impacts following the implementation of mitigation and management measures. The assessment process for this SEIA followed three key steps, as follows:

1. Determining the consequence and likelihood of impacts (unmitigated): First, the worst-case (but reasonable) consequence of an aspect of the Project, without mitigation was determined. Some impacts were a negative consequence, while others were a positive consequence.

   For the purpose of the SEIA's approach to risk, the risk, consequence and likelihood definitions were adopted from the DPE Guideline (2021). These are considered industry leading and provide a clear framework for identifying risk.

2. Considering and developing appropriate mitigation and management measures: The management of other predicted environmental impacts that interrelate with socioeconomic impacts (such as noise and vibration, traffic, etc.) was assumed to contribute to the management of socioeconomic impacts. Measures were identified in this EA that were of relevance to the management of socioeconomic impacts considered. Socioeconomic specific measures were recommended to either mitigate or enhance the socioeconomic impacts of the Project.
3. Assessing the residual impacts (mitigated): After the application of both socioeconomic and broader environmental mitigation and management measures the residual impacts were assessed.

As part of this SEIA, consideration was given to:

- The likely population to be affected
- Impact characteristics (timing, extent, duration, scale, sensitivity)
- The potential level of significance of the potential impact, taking into consideration the likelihood and magnitude of the potential social impact.

Further detail of the assessment methodology and risk assessment process undertaken for the SEIA is provided in **Appendix I (SEIA)**.

14.2 Stakeholder engagement

14.2.1 Engagement to date

Stakeholder engagement has been carried out by MPC through a variety of tools (**Chapter 7.0 Consultation**). Key stakeholder engagement and reports that informed the preparation of the SEIA include but are not limited to:

- Results from a survey of 161 London Circuit (east) businesses – 2019
- Engagement with businesses in City West, including outcomes of door knocking and business specific information sessions – 2019
- Minutes from three Community Reference Group meetings – 2020 – 2021
- Results from StollzNow qualitative and quantitative research undertaken by MPC – 2021
- Feedback gathered from pop-up community survey of more than 6,000 people for the Raising London Circuit project – 2021.

14.2.2 Socioeconomic engagement

An online survey to inform the SEIA was made available between 29 July 2022 and 19 September 2022, which collected qualitative and quantitative data through a series of open-ended and multiple-choice questions. The survey was distributed to more than 120,000 people and was completed by 455 respondents.

Key themes that arose from the survey are summarised in **Table 14-2**.

Table 14-2 SEIA survey themes

Category	Discussion
Community values	Many community members commented that they are proud of Canberra as a city and enjoy living, working, and playing in it. It was noted that the need to regularly develop and enhance the City, such as through the development of the Project, needs to be considered against ensuring there are sufficient resources and funds for other policy sectors like crime prevention, education and justice. Projects also need to consider how they can better connect people and places with other areas, local businesses and services, important landmarks and open spaces. Many community members suggested that they would be happy to live with short- to medium-term negative Project impacts while the Project is constructed, because they know that the positive benefits of being able to use the Project once complete will be significant and long-term.
Safety and security	Respondents suggested that it is important the stops and LRVs are safe from several perspectives, including the following: 1. Safe access to and from light rail stops in terms of crossing roads, vehicle traffic and any other obstacles 2. Stops have good lighting, are patrolled, and CCTV and signage is in place 3. LRVs are clean, regularly maintained and do not deteriorate quickly 4. Ability to safely move equipment (such as bikes, prams and luggage) onto and off LRVs 5. Safety and security measures are enforced 6. Safe access and egress for people with less mobility.
Green and open spaces	Green places and recreation spaces are highly valued by community members and were identified as desirable community characteristics. Places which facilitate a sense of community, lifestyle and access to local services, buildings and venues are also highly valued by community members. Respondents discussed the importance of community cohesion and social relations over and/in conjunction with the importance of the built environment. Community members commented that people and how they interact with each other are key community strengths when those interactions are positive and well-intended. Having an improved ability for many Canberra residents and visitors to access and/or visit important landmarks by using the light rail is also viewed as being a significant benefit of the Project by many community members. From an exercise and recreation point of view, some community members suggested that a benefit of the Project would be the ability to access new or different cycleways and tracks, walking tracks, Lake Burley Griffin, and/or other parts of Canberra City they may not visit regularly or experience. Reducing the number of vehicles on Canberra's roads (particularly during peak hour traffic) by encouraging vehicle drivers to use public transport alternatives, including the light rail, more regularly would also contribute to how people use and experience open spaces in the future.
Travel and transport	Community members suggested that several factors contribute to the regular use of public transport, including the ease of use, regularity of services (including connecting services), distance to and from public transport stations and/or stops and the intended final destination, costs of using public transport as opposed to driving (and potentially paying for parking), and the nature of their travel. More than half of the community members surveyed agree that Canberra Light Rail will make it easier for them to use public transport for social and recreational purposes. Respondents suggested that the top five benefits of the Project to Canberra would be: 1. The delivery of better public transport for Canberra City

Category	Discussion
	2. Reduced harmful climate emissions from transport 3. Improved access for public events and the national institutions 4. Less traffic on the roads to prevent future gridlock experienced 5. The activation of parts of the city that are not well utilised.
Project perceptions	Overall many respondents believe the Project would provide tangible benefits for Canberra. Others do not believe they would benefit from the Project, many of these people expressed strong opinions on the matter. It is important to note that negative perceptions may change over time as more knowledge is gained about the Project, its aspects, proposed risks and impact mitigation strategies and/or when they have an opportunity to experience it in person. As a result, it is noted that it is important to regularly consult and engage with different groups who may be impacted by and/or benefit from the Project regardless of whether the impacts or benefits are real or perceived.

14.3 Existing environment

14.3.1 Social area of influence

The social area of influence encompasses the geographical extent of a project's potential impacts on people, including how positive and negative impacts may be reasonably perceived or experienced by different people. The way in which a SEIA defines the social area of influence takes into consideration those who are not within the immediate geography, offering room for those who are connected via an array of networks. This is premised on the idea that socioeconomic impacts may be experienced by people who are not necessarily located close to a project.

The assessment has considered the following in defining the social area of influence for the Project:

- ***Locality***: This term is applied to the catchment around the delivery and operational phase areas. This is identified as the area in which people are most likely to experience both construction and operational socioeconomic impacts from the Project, or a level of direct impact. These people could for example be from businesses, developers, workers, residents, or visitors to the area. These people could also be transient, most notably commuters.
- ***Suburb***: This term has been applied where the spatial extent of socioeconomic impacts on people is generally broader than the area immediately around the delivery and operational phase areas of the Project. 'Suburb' refers to a conceptual geography not necessarily aligned to actual suburb boundaries.
- ***Region:*** In some instances, the social area of influence is extended to a 'region' to reflect broader potential social impacts, as distinct from the narrower concepts of 'locality' and 'suburb'. This term has been applied where a project is within or proximate to a social area of influence frequented by regional populations, for example a key employment centre, or a locality in which there is regional or national infrastructure or services (i.e., Canberra City).

To provide statistical analysis, the primary areas of interest have been aligned with the Australian Bureau of Statistics (ABS) Australian Statistical Geography Standard (ASGS) statistical areas (**Table 14-3**). These areas are shown on **Figure 14-1**

Table 14-3 Area of influence statistical analysis

Area	Statistical area name
Locality	Civic Statistical Area 2 (SA2)
Suburb	North Canberra Statistical Area 3 (SA3)
Region	ACT

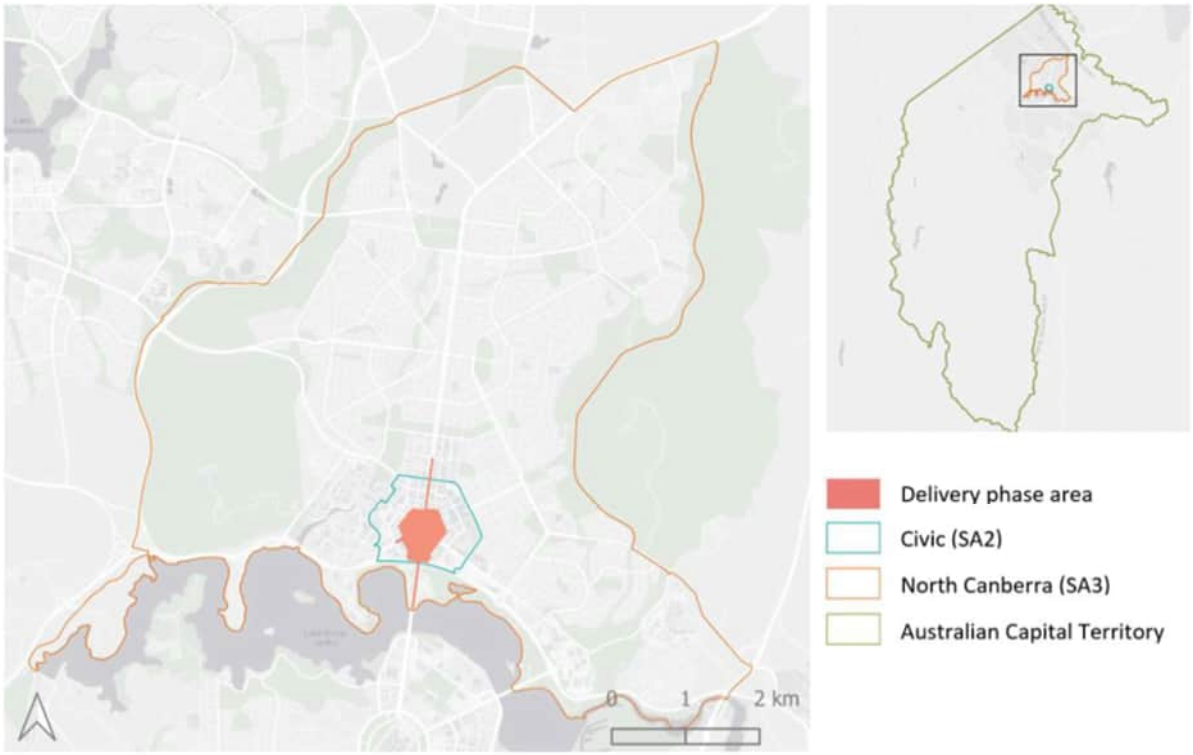


Figure 14-1 Indicative social areas of influence

14.3.2 Social baseline

This Section provides a summary of the social baseline for this Project and describes the social context without the Project. The social baseline provides a point of comparison; it can be used as a reference against which to measure the impacts of the Project as it develops, and/or to determine the adequacy or otherwise of existing facilities.

The SEIA draws on the sustainable livelihoods approach where community profiling is divided into five 'community capitals' or 'capital assets.' The worker baseline is also considered.

14.3.2.1 Natural capital

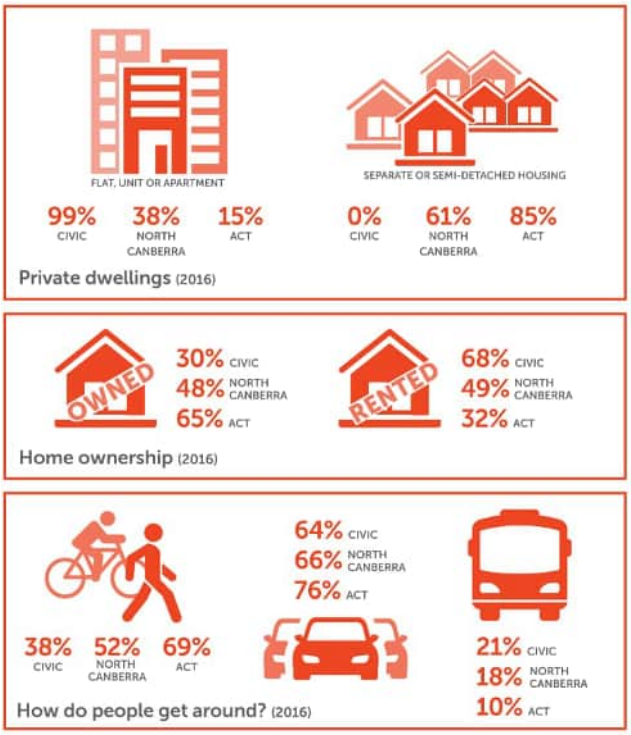
Natural capital refers to the natural assets and resources that contribute to community strength and sustainability. Natural capital can include resources which provide commercial and practical benefit to the community or other environmental assets that generate tourism or provide other social, cultural, and recreational value, such as waterways or lakes.

The social area of influence has strong natural capital. Key examples of strong natural capital around the social area of influence includes:

- Lake Burley Griffin and foreshores
- Black Mountain Nature Reserve
- Molonglo River.

Collectively these spaces provide a range of experiences and opportunities for people. The ACT is well positioned for short trips either southwest to the Kosciuszko National Park or east to the South Coast Region.

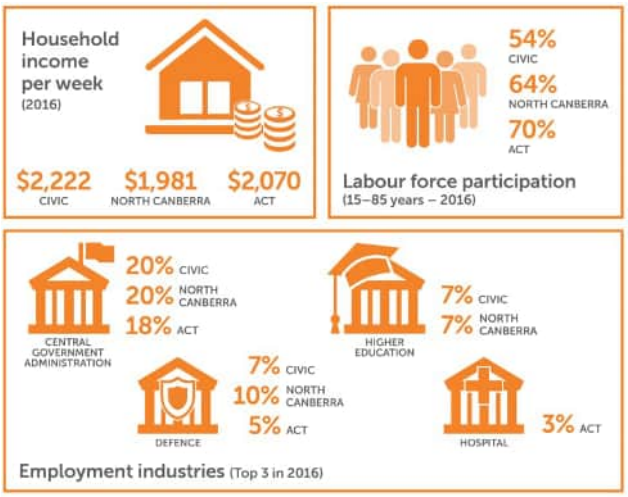
14.3.2.2 Physical capital



The locality (Civic SA2) is a high-density community predominantly made up of renters rather than homeowners. Residents tend to live in smaller dwellings. Households tend to be small and have a small number of cars and 21% use public transport. The locality is well serviced by social infrastructure, being located in close proximity to major regional facilities which serve the whole of the ACT, as well as local facilities and spaces designed for the community. Overall, the locality is well connected to public transport, however it has limited housing choices. A summary of physical capital is shown in **Figure 14-2**.

Figure 14-2 Physical capital overview

14.3.2.3 Economic capital



Overall, the locality has strong economic capital, but it also possesses an economically diverse resident community made up of young workers and students with differing earning capabilities, which is reflected in personal income. A summary of economic capital is shown in **Figure 14-3**.

Figure 14-3 Economic capital overview

14.3.2.4 Social capital

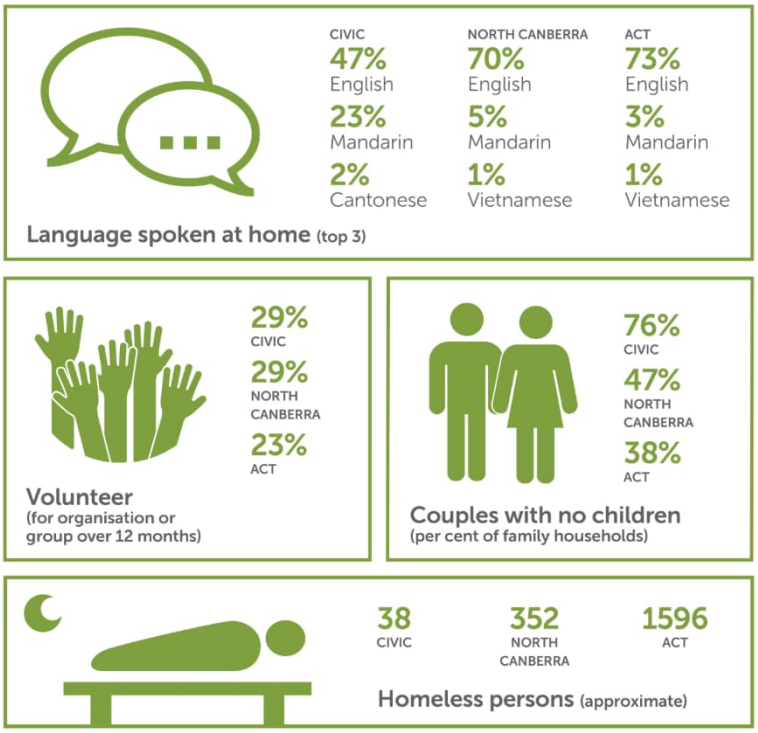


Figure 14-4 Social capital overview

The locality is notably more culturally diverse than the suburb in which it is located and the ACT with a significantly higher proportion of households speaking a language other than English at home in Civic. Based on the top languages spoken at home and country of birth, the locality has a large Chinese community. The locality also has low proportions of households with children, reflecting the areas young adult demographic profile. A summary of social capital is provided in **Figure 14-4**.

14.3.2.5 Human capital

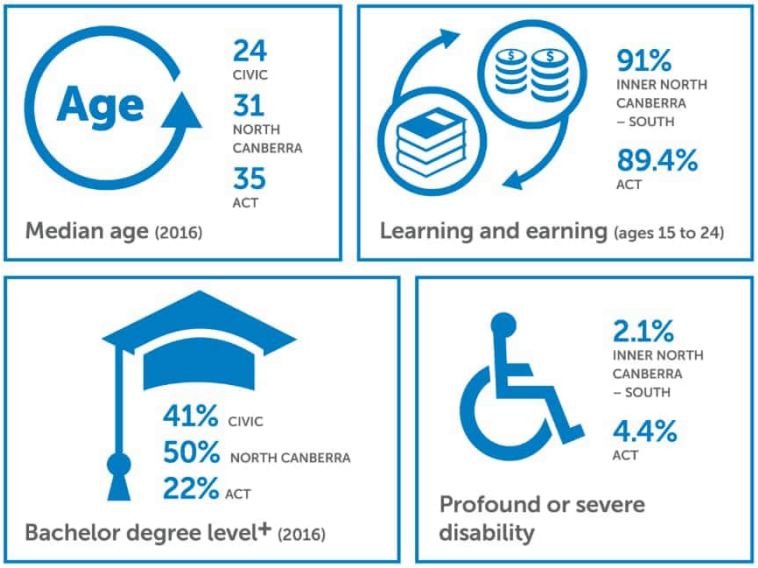
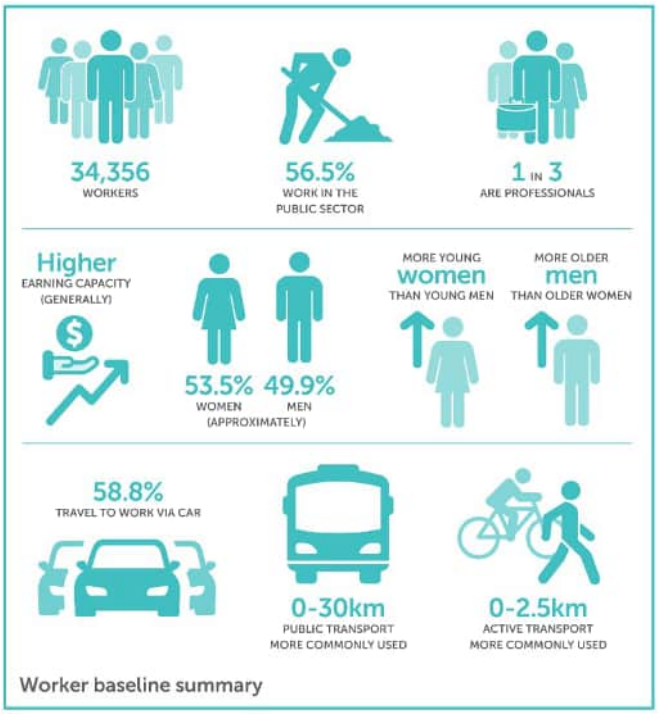


Figure 14-5 Human capital overview

The locality has a very low proportion of vulnerable residents. It has a young resident population, who either study and/or work. The area has relatively high levels of tertiary educational attainment and a low proportion of residents who have a profound or severe disability. Collectively this indicates that the locality has strong human capital. A summary of human capital is shown on **Figure 14-5**.

14.3.2.6 Worker baseline



Civic is a major employment hub for Canberra, representing more than half of all employment opportunities in North Canberra and 15.6% of all employment opportunities within the ACT. The majority of workers in Civic live outside of Civic, reflecting the areas role as an employment hub which people travel to. Regardless of where people live, most workers travel to work via private vehicle, however, public transport utilisation was higher for workers who live closer/within Civic. The worker baseline is summarised in **Figure 14-6**.

Figure 14-6 Worker baseline summary

14.4 Assessment of potential impacts

The SEIA identified potential and perceived socioeconomic impacts (both positive and negative) on stakeholders across the social area of influence without the application of management and mitigation measures. This included socioeconomic impacts associated with other potential construction and operational environmental impacts, which are assessed in **Chapters 9.0** to **19.0**.

The potential socioeconomic impacts were grouped by themes that arose from community engagement as well as desktop research. These themes included:

- Changes to the road network
- Access to and use of social infrastructure and services
- Health and wellbeing
- Economic contributions, employment and partnerships
- Visual landscapes and heritage
- Intergenerational equity

These potential impacts are discussed further in the following Sections. Cumulative socioeconomic impacts are discussed in **Chapter 19.0 Cumulative Impacts**.

14.4.1 Construction

14.4.1.1 Changes to the road network

Temporary impact to users on the existing road network

Construction of the Project would result in temporary and staged impacts to the existing road network in the local area. A number of traffic changes would be implemented including temporary road closures, traffic detours, a reduction of speed limits, as well as changes to signage.

Traffic congestion would be experienced as a result of construction traffic from the Project. Construction of the Project would generate on average 50 heavy vehicles and 100 light vehicles per day, and that increased travel times across key routes in the AM and PM peak hours are likely, with these increases modelled between one to five minutes (refer **Chapter 9.0 Traffic and transport** for further details).

Disruptions to traffic during construction and impacts to travel times around Canberra City were the two biggest concerns raised by community members (in multiple choice questions). Respondents expressed concern that the Project would further decrease the ability to move freely within Canberra City, impacting on their commute to work and services such as education. It is likely that the Project would impact road users' ability to access the general area and potentially lead to an increase in travel times during construction.

14.4.1.2 Access to and use of social infrastructure and services

Decline in accessibility

The locality is positioned within the service and business hub of Canberra, with many Government departments, legal services, education facilities, community and wellbeing services clustered in a small area. Temporary disruptions to parking and changes to pedestrian and motorist access may impact people's ability to access these businesses and services.

Around two thirds of survey respondents believed that temporary road and footpath changes during construction would potentially disrupt how they access local businesses and services. Around half of the respondents also believed that temporary changes to parking during construction would impact how they access businesses and services.

The Project is anticipated to have some potential impacts on parking, however the impact to pedestrian and cyclist movements and travel times is expected to be minimal (refer **Chapter 9.0 Traffic and transport** for further details). Parking and access impacts would include changes to kerbside and off street parking availability, as well as local area and property access. It is estimated that around 700 long-stay parking spaces would be temporarily removed in the delivery phase area during construction. Most of the off street parking loss due to construction compounds would occur in car parks that would be used as part of the RLC project. Therefore, most of the off street car parking impacts would be a continuation of the impacts associated with the RLC project. While it is anticipated that all property access would be maintained, unless in agreement with the property owner, alternative routes may be required during temporary road closures.

The loss of parking during construction and changes to access (although minimal) would potentially represent a temporary disruption to people's daily routines. This would mean that people would need to continue to adjust to the changing construction environment. These impacts could have a negative flow on effect to businesses. These impacts would potentially be experienced more greatly by those people who may be elderly, disabled or generally less mobile, and who may then avoid travel to the CBD. The risk assessment for this potential impact has been based on vulnerable users who would experience a greater impact than others in the community.

Delays and changes in public transport

Disruptions to public transport resulting from the construction of the Project could reduce the community's ability to access other areas and potentially increase traffic-related stress by increasing travel times.

Public transport users accessing social and community services, specifically support and legal services within the locality are most vulnerable to these disruptions. Respondents to the online survey expressed concern that the construction of the Project would impact their commute to work and access to educational services.

The Traffic and Transport Impact Assessment found that the Project would have a temporary impact on existing public transport routes in the area during construction. Inbound and outbound buses currently use roads and intersections within the delivery phase area that would be impacted by construction work. Construction work at key intersections within the delivery phase area would affect existing bus routes, with detours and closures required at different stages during construction. Bus stops located on Alinga Street between East Row and West Row would also need to be temporarily relocated to another location within the City Interchange.

Changes to the bus network could impact bus routes travelling in and out of the City Interchange and travel times are likely to increase due to increased congestion, road network changes and detours. However, bus travel time increases would be limited to around one to four minutes. In terms of those more vulnerable users that may have mobility constraints, they may avoid making trips that have increased travel times or prove to be challenging for them to access. The risk assessment for this potential impact has been based on vulnerable users who would experience a greater impact than others in the community.

The Project would also require short-term interruptions to the existing light rail to integrate with the existing network, however these interruptions are likely to occur outside of existing light rail hours to minimise impacts.

14.4.1.3 Health and wellbeing

Decline in health and wellbeing

The construction of any development can generate a range of amenity impacts such as increased noise and dust emissions which can negatively impact on community health and wellbeing. These impacts can be compounded when communities experience ongoing construction with minimal relief, or prolonged periods of high intensity works.

There was a perception that the health and wellbeing of the community could be impacted by congestion and traffic delays, noise and dust emissions. Impacts to health and wellbeing are considered at risk of long term and sustained impact within the context of the SEIA. This means that impacts have been considered over the duration of construction, and not necessarily as one-off, isolated incidents.

Mitigated air quality impacts from construction of the Project would be low (refer to **Chapter 15.0 Air quality** for further detail). This is primarily due to the existing baseline environment and the moderate sensitivity of commercial receptors, which form the dominant surrounding land use. Despite the low risk of air quality impacts, dust and other air pollutants can tend to be a perceived issue, especially in the context of health and wellbeing. It is therefore expected that the issue of air quality could cause the local community, especially those who are walking or cycling past the construction compounds, a degree of anxiety or concern.

Without mitigation, nearby receivers would experience elevated noise levels due to a range of construction related activities (refer to **Chapter 12.0 Noise and vibration** for further detail). Pending the activity, between eight and 25 receivers during works in standard construction hours and up to 10 receivers during works outside of standard construction hours across the delivery phase area may experience noise levels above the applicable noise assessment levels. It is possible that noisy construction activities for the Project may occur at the same time in close proximity to each other, increasing noise levels. Noise mitigation measures have been recommended to address these potential amenity impacts.

Pedestrian/cyclist and commuter safety

Pedestrian and commuter safety during construction is a key consideration, particularly given that, prior to the COVID-19 pandemic, almost 40% of the locality use active transport such as walking or cycling to get to work. The *National Road Safety Strategy 2021-30* (Office of Road Safety, 2021) acknowledges that pedestrians and cyclists are among the most vulnerable road users, as they have little or no protection in the event of a collision.

Construction impacts such as noise, reduced lines of sight, increased vehicle movements, dust, pedestrian and cyclist detour routes, poor wayfinding, and the introduction of temporary uneven surfaces could increase the safety risks to pedestrians and cyclists and impact on the way they access both the built and natural environment in proximity to the Project.

14.4.1.4 Economic contributions, employment and partnerships

Employment and training opportunities

Canberra Light Rail Stage 1 demonstrated that light rail construction increases local job opportunities in the Canberra Region. During peak construction period, Canberra Light Rail Stage 1 generated approximately 4,750 direct construction related jobs. The Project would therefore also provide increases in construction related job opportunities within the Canberra Region. Additional indirect jobs would also

be created through the supply chain and employee's expenditure on goods and services occurs largely within their local communities.

The ACT Government has a highly responsive approach to workforce development and industry participation opportunities, including a specific plan for Aboriginal and Torres Strait Islander participation and procurement. These policies and plans drive stimulus for workforce opportunities including for vulnerable and underrepresented populations.

The positive opportunities associated with the Project were raised only by a small number of stakeholders during engagement. In this regard, it was suggested that economic activity associated with the Project should have maximum benefit for locals, with as much employment and commercial opportunity as possible retained within Canberra.

Lack of trust in decision making

A theme that emerged from engagement activities undertaken for the SEIA was the perception that the Project was not worth the financial investment, and that the Project budget would be better spent elsewhere. The Project need is discussed further in **Chapter 2.0 Strategic need and context**.

14.4.1.5 Visual landscapes and heritage

Changes to the aesthetic value of the area

Changes to the visual landscape, ensuring the design is sympathetic with the vistas towards Parliament House in the south and City Hill in the north, and the inclusion of greenery that was native and easily maintained were raised by a small number of respondents during the engagement.

Construction activities are likely to temporarily change the aesthetic value of the existing surroundings. This is due to the visual intrusion on the landscape including associated plant, equipment and ancillary facilities, removal of existing street furniture and vegetation, as well as the installation of temporary environmental treatments such as un-landscaped batters, silt socks, and sandbags. These impacts would be typically felt by people close to the construction activity, for example, around Northbourne and Commonwealth Avenue, London Circuit and within City Hill Park. During construction, changes to views from surrounding areas due to the Project are considered acceptable primarily due to the temporary nature of the changes (noting that regardless of the temporary nature of impacts, changes to the visual character of the area will still lead to some changes to how people experience their surroundings) (refer to **Chapter 13.0 Landscape and visual realm** for further detail).

14.4.2 Operation

14.4.2.1 Changes to the road network

Helping to prevent future traffic congestion

By facilitating more sustainable transport choices, improving the convenience of connectivity, and supporting affordable transportation for all, the operation of the Project would likely increase use of public transport due to the convenience of the network. This would contribute significantly towards a broader goal of preventing traffic congestion and improving how people move around the city.

In the short term however, traffic modelling indicated congestion would slightly increase with population growth, changes to the road network, traffic demand and the loss of one traffic lane in each direction on London Circuit (**Appendix D (TTIA)**).

Respondents to the survey noted that the ability to use the Canberra Light Rail to attend special events in Canberra City or at Lake Burley Griffin or to avoid the need of having to worry about parking their car while in Canberra City were the two most popular ways in which respondents considered how they might use the light rail. Other ways in which respondents suggested they might use the Project were to access other public transport connections and/or facilities and venues or use it in the future once further extensions have been designed and constructed.

14.4.2.2 Access to and use of social infrastructure and services

Increased access to jobs, businesses, services and social facilities

The Project would improve access to the City and surrounds, and provide an opportunity to combine light rail travel with other travel modes when accessing activity centres, services and social facilities. At

a regional level, access to improved public transport options is likely to provide benefits for community cohesion and improve equity, particularly for groups that currently experience transport or mobility difficulties such as the elderly, youth, people experiencing disability, non-drivers or people without access to a private vehicle.

The Project would also facilitate active transport through incorporation of bicycle and pedestrian facilities and infrastructure. This infrastructure would facilitate access to major attractions such as the lakefront and provide access to future development sites.

During engagement, survey respondents suggested multiple ways in which the benefits of the Project could be enhanced, including ensuring accessibility for many different types of people such as the elderly and young, people with bicycles, shopping trolleys, prams or children. Respondents also noted the importance of consultation and engagement to better understand their needs as a key part of the design process. The Project would improve access by providing more convenient, accessible and reliable transport options for people on the southside of the City. The Project has been designed in accordance with relevant accessibility guidelines and standards (including Australia Standards and Disability Standards for Access to Public Transport 2002). Customers of all abilities would be well serviced through elements such as access and onboard spaces for wheelchairs, hearing induction loops, auditory announcements, digital information displays, accessible ramps and other accessibility features, near level boarding to LRVs and tactile elements.

14.4.2.3 Health and wellbeing

Enhanced commuter safety

While the Project would contribute to the physical public transport network and create environments which allow for safe interactions between road user types, the concept of access needs to expand into the realm of personal safety. If public transport routes and waiting areas are not safe spaces, or are not perceived as safe spaces, safety becomes a barrier to access. In most cities around the world, women, young and older people, First Nations people, culturally and/or linguistically diverse groups, gender diverse people and the wider LGBTIQ+ community (collectively recognised as a vulnerable user group), experience barriers to accessing public transport associated with personal safety or perceptions of personal safety. Despite this, public spaces, including public transport spaces, are traditionally not designed with the experiences of the groups listed above in mind. As a result, the public realm does not serve them equitably as members of these groups may consider changing their behaviours to avoid a real or perceived risk of harm, particularly at night.

Gender Sensitive Urban Design (GSUD) is an emerging discipline that contemplates the experiences of people more vulnerable to gendered violence in public space and seeks to identify how planning of these spaces can mitigate both unsafe conditions, as well as design spaces with qualitative factors which make a space feel comfortable and safe to be in.

Considering the high proportion of women who work in Civic (66.5%) (**Appendix I (SEIA)**) and the proximity of the Australian National University, which has a high proportion of young and culturally diverse groups, it is important that the Project responds to the social locality and broader understandings of transit safety domestically and internationally. The Project needs to design safe public transport spaces which supports these more vulnerable user groups in Civic as well as the general public.

The Project design and mitigation measures respond to this need. Crime Prevention by Environment Design (CPTED) principles have been integrated into the Project's urban design, and the Project has undertaken a process of mainstreaming GSUD principles in the urban design. Considerations for key design elements such as quality wayfinding, consideration for pedestrian movements and sight-lines, as well as night-time lighting at light rail stops and within the public realm, for example, have been incorporated into the design process. Consideration has also been given to creating light rail stop environments and a public realm which promotes a safe, comfortable experience for all users. Further development of GSUD would be investigated during detailed design of the Project.

The Project would also deliver better access to services, education and employment which also supports long term benefits that include direct linkages to reduced crime and improved social outcomes. However, it is recognised that environmental design cannot definitively eliminate opportunities for harm or prevent a determined perpetrator from committing crimes and that CPTED and GSUD strategies

should work in conjunction with other crime and harm prevention and social intervention strategies, as well as security and safety operations. It is noted that the adoption of GSUD strategies is considered to be above and beyond a project's business as usual approach in the ACT.

To support the safety and security of customers, CCTV cameras on board LRVs and at stops would also be installed to monitor activity which can be viewed by the light rail driver and Operations Control Centre (OCC). Emergency help points would also be installed at all stops and on LRVs which connect the user to the driver and then to OCC if the driver does not respond within a certain period.

14.4.2.4 Visual landscapes and heritage

Improvements to the aesthetic value of the area

Concerns regarding changes to the visual landscape were raised by a small number of respondents during engagement, including concerns about the removal of existing landscaping and also ensuring that the design is sympathetic with the vistas towards Parliament House in the south and City Hill in the north. The inclusion of greenery that is native and easily maintained was also suggested.

The Project would have a positive influence on visual amenity and that 'the proposed street trees, creating continuous avenues, and 'tidying up' of the ground plane (paving and road surfaces), signage and other structures seen within the road corridors would be considered beneficial outcomes to views from surrounding areas' (refer to **Chapter 13.0 Landscape and visual realm**).

There were only six viewpoints where the Project would affect the quality of the views. Of these, five would be beneficial changes to the view and one would be an adverse change. The one adverse rating would be where shade structure for the City South Stop would be seen against a backdrop of City Hill. The beneficial aspects of the changes would typically relate to the 'tidying up' of built elements within the views and the planting of continuous street trees, which would visually strengthen the views along the road corridors. In the areas near heritage buildings such as Sydney and Melbourne Building, the ANZ Building and the Law Courts Precinct, the landscaping design has responded to minimise any changes to the landscape character.

14.4.2.5 Intergenerational equity

Improved intergenerational equity as a result of sustainable development

Intergenerational equity is the notion that each generation has the right to inherit the same diversity in natural, cultural, health, and economic resources enjoyed by previous generations and to equitable access to the use and benefits of these resources.

The longer-term benefits for generations to come are likely to be a net positive effect on greenhouse gas emissions by utilising the ACT's renewable energy to power the LRVs whilst also removing a portion of privately owned combustion fuelled cars from the road network. This Project would contribute towards achieving an aspect of intergenerational equity – reducing greenhouse gas emissions that would otherwise exacerbate climate change.

14.5 Preliminary risk assessment

A preliminary risk assessment of potential socioeconomic impacts, without mitigation measures, for construction and operation are presented in **Table 14-4** and **Table 14-5**, respectively.

Table 14-4 Preliminary risk assessment for socioeconomic impact during construction

Category	Description	Likelihood	Consequence	Rating
Changes to road network	Temporary impact to road users on existing road network during construction due to increased traffic congestion and temporary traffic changes	Likely	Major	Very high
Access to and use of social infrastructure and services	Decline in accessibility to business and services due to temporary loss of parking during construction and changes to pedestrian and motorist	Likely	Major	Very high

Category	Description	Likelihood	Consequence	Rating
	access (assessed for vulnerable users)			
	Delays and changes to accessibility for users of public transport	Possible	Major	High
Health and wellbeing	Decline in health and wellbeing as a result of construction activities, particularly on those with a disability or chronic illness	Likely	Moderate	High
	Decrease in pedestrian/cyclist and commuter safety around construction activity due to interaction between construction vehicles and others when accessing/egressing construction sites, as well as due to aspects such as temporary diversions (e.g., surface quality of alternative detours)	Unlikely	Moderate	Low
Economic contributions, employment and partnerships	Employment and training opportunities	-	-	Beneficial
	Lack of trust in decision making, including the perceived lack of positive benefit/need	Likely	Moderate	High
Visual landscape and heritage	Temporary changes to the aesthetic value of the existing surroundings, due to the visual intrusion of plant, equipment and ancillary facilities	Possible	Minor	Low

Table 14-5 Preliminary risk assessment for socioeconomic during operation

Category	Description	Likelihood	Consequence	Rating
Changes to the road network	Helping to prevent future traffic congestion, improving how people move around Canberra City	-	-	Beneficial
Access to and use of social infrastructure and services	Increased access to jobs, businesses, education, services and social facilities by providing more convenient and reliable transport options	-	-	Beneficial
Health and wellbeing	Enhanced commuter safety	-	-	Beneficial
Visual landscapes and heritage	Improvements to the aesthetic value of the area by creating attractive and active public spaces that are reflecting the existing or desired future scale and character of local areas	-	-	Beneficial

Category	Description	Likelihood	Consequence	Rating
Intergenerational equity	Improved intergenerational equity as a result of sustainable development, including vulnerable and marginalised communities	-	-	Beneficial

14.6 Management and mitigation measures

Management and mitigation measures have been proposed to reduce the potential traffic and transport impacts of the Project identified in the assessment.

Management and mitigation measures and safeguard protocols adopted for the Project are provided in **Table 14-6**, and have been prepared with the following objectives:

- Work with the community to optimise construction activities and leverage identified opportunities wherever possible.
- Ensure effective management of complaints.
- Ensure employment opportunities for local and diverse people through provision of sustainable jobs.

Table 14-6 Management and mitigation measures - socioeconomic

Ref	Management and mitigation measure	Timing	Reference
SE1	Project materials will be displayed on a Project website, where appropriate, to support mitigations identified in this EA and enhance key benefits and opportunities for the Project.	Prior to and during construction	
SE2	The following communications channels and support would be available to manage community enquiries and complaints: • A 24-hour toll-free telephone number for the registration of complaints and enquiries about the Project (when Project works are occurring) • A postal address to which written complaints and enquires may be sent • An email address to which electronic complaints and enquiries may be transmitted • A mechanism for community members to make enquiries in common community languages of the area.	During construction	
SE3	A grievance process for the community to raise comments, questions and complaints must be established prior to construction commencing. The grievance process must be made publicly available and must include a feedback process through which the complainant is provided with information relating to how their concern has been assessed, considered, and where feasible, addressed.	During construction	
SE4	A register of complaints received would be maintained. This information would provide the basis for assessing whether the mitigation and enhancement measures specified in the EA have been successful, and if not identify opportunities for continuous improvement to be implemented.		
SE5	The Project would develop a Labour Relations, Training and Workplace Equity Plan, which details how contractors will support employment participation and address barriers to employment or career development of Aboriginal and Torres Strait Islander people, women, people with disability and	Prior to construction	Secure Local Jobs Code 2020

Ref	Management and mitigation measure	Timing	Reference
	people from a culturally and linguistically diverse background.		
SE6	Business engagement activities would seek to ensure that: Construction activities undertaken in proximity to businesses would maintain visibility of business frontage, associated signage, and access points, where possible. Temporary signage could be provided in the vicinity of a business if construction works obstruct views to the business During construction, wayfinding signage be implemented to assist customers in identifying parking opportunities to help them get to their destinations efficiently		

The SEIA also identified that management and mitigation measures implemented across other aspects would have beneficial flow-on effects regarding socioeconomic impacts. These management and mitigation measures have been detailed in the following Chapters:

- **Chapter 9.0 Traffic and transport**
- **Chapter 12.0 Noise and vibration**
- **Chapter 13.0 Landscape and visual realm**
- **Chapter 15.0 Air quality**.

14.7 Residual risk assessment

A residual risk assessment was undertaken to assess the remaining risk that the Project poses to socioeconomic values after the proposed management and mitigation measures are applied, presented in **Table 14-7** and **Table 14-8**.

Table 14-7 Residual risk assessment for socioeconomic impact during construction

Category	Description	Likelihood	Consequence	Rating
Changes to road network	Temporary impact to road users on existing road network during construction due to increased traffic congestion and temporary traffic changes	Possible	Moderate	Medium
Access to and use of social infrastructure and services	Decline in accessibility to business and services due to temporary loss of parking during construction and changes to pedestrian and motorist access (assessed for vulnerable users)	Likely	Moderate	High
	Delays and changes to accessibility for users of public transport	Possible	Moderate	Medium
Health and wellbeing	Decline in health and wellbeing as a result of construction activities, particularly on those with a disability or chronic illness	Likely	Minor	Medium
	Decrease in pedestrian/cyclist and commuter safety around construction activity due to interaction between construction vehicles and others when accessing/egressing construction	Unlikely	Minor	Very low

Category	Description	Likelihood	Consequence	Rating
	sites, as well as due to aspects such as temporary diversions (e.g., surface quality of alternative detours)			
Economic contributions, employment and partnerships	Employment and training opportunities	-	-	Beneficial
	Lack of trust in decision making, including the perceived lack of positive benefit/need	Possible	Minor	Low
Visual landscape and heritage	Temporary changes to the aesthetic value of the existing surroundings, due to the visual intrusion of plant, equipment and ancillary facilities	Unlikely	Minor	Very low

Table 14-8 Residual risk assessment for air quality during operation

Category	Description	Likelihood	Consequence	Rating
Changes to the road network	Helping to prevent future traffic congestion, improving how people move around the city	-	-	Beneficial
Access to and use of social infrastructure and services	Increased access to jobs, businesses, education, services and social facilities by providing more convenient and reliable transport options	-	-	Beneficial
Health and wellbeing	Enhanced commuter safety	-	-	Beneficial
Visual landscapes and heritage	Improvements to the aesthetic value of the area by creating attractive and active public spaces that are reflecting the existing or desired future scale and character of local areas	-	-	Beneficial
Intergenerational equity	Improved intergenerational equity as a result of sustainable development, including vulnerable and marginalised communities	-	-	Beneficial

15.0 Air quality

This Chapter provides an overview and assessment of the potential air quality impacts associated with the construction and operation of the Project.

15.1 Approach

The Preliminary Environmental Risk Assessment (**Appendix C (PERA)**) identified risks relevant to air quality, including four low construction risks and no operational risks. In accordance with the methodology provided in **Chapter 8.0 Environmental risk analysis approach**, this Chapter has been prepared to further document and assess air quality risks with consideration of subsequent design development.

The Section below describes the assessment methodology used to assess the potential air quality impacts from construction and operation of the Project.

15.1.1 Understanding the meteorological conditions

Baseline meteorological analysis was undertaken with reference to two of the Bureau of Meteorology's (BoM) automatic weather monitoring stations (AWS) located at the Canberra Airport and Tuggeranong.

The Computer Aided Learning in Meteorology (CALMET) model is a diagnostic meteorological model that reconstructs wind and temperature fields using a combination of regional meteorological observation data. A review of ten years of meteorological data from the BoM Canberra Airport AWS between 2011 and 2020 was carried out to determine a representative year of data for use in the CALMET modelling. 2018 was selected as a representative year, as conditions in this year were not adversely impacted by either an El Niño or La Niña event.

CALMET is unable to determine the localised effects of the built environment near the delivery phase area, however some wind tunnelling and blocking would be assumed due to high, multistorey nature of the buildings in the city. It is unlikely that these localised effects would have a large impact on air quality as relevant to the Project.

Meteorological analysis at the Project location has been undertaken using the results of the CALMET model outputs, referred to as the 'CALMET London Circuit 2018 data'. The meteorological conditions have been discussed in **Section 15.2.1**

15.1.2 Air quality assessment methodology

Potential air quality impacts during construction and operation for the Project are examined in this Chapter. Key air emission sources include:

- Construction dust from various stages of work, including site establishment, demolition, earthworks, construction activities and the movement of vehicles on the delivery phase area
- Construction plant engine exhaust emissions
- Vehicle emissions from staff vehicles and maintenance operations
- Fine dust emissions from ballast material during operation.

Pollutants of interest associated with potential sources of air emissions identified above include:

- Nitrogen dioxide (NO_2)
- Carbon monoxide (CO)
- Particulate matter less than 10 micrometres in diameter (PM_{10})
- Particulate matter less than 2.5 micrometres in diameter ($PM_{2.5}$)
- Volatile Organic Compounds (VOCs)
- Polycyclic Aromatic Hydrocarbons (PAHs).

A desktop assessment was undertaken to review baseline local air quality for the pollutants of concern using data gathered from a selection of three background air pollution stations between 2016 and 2021 within the Canberra area (**Section 15.2.2**), including:

- Civic, approximately 300 m to the southeast of the southern end of the Project
- Florey, approximately 10 km to the northwest of the Project
- Monash, approximately 15 km to the south of the Project.

Air quality standards or goals are used to assess the potential for ambient air quality to give rise to adverse health or nuisance effects. The air quality impact assessment uses criteria to assess the existing air quality in a region and provide an indication of the capacity of the airshed to receive additional air pollutants from a development or activity. The relevant air pollutant ground level criteria and corresponding averaging periods are taken from the *National Environment Protection (Ambient Air Quality) Measure* (NEPM) as varied (National Environmental Protection Council, 2021), and are shown in **Table 15-1**. This NEPM provides guidance relating to air in the external environment, which does not include air inside buildings or structures. These standards were used in the preparation of the baseline for this assessment to understand the existing air quality environment.

Table 15-1 Air Quality impact assessment criteria (NEPM Ambient Air Quality Standards as Updated 18 May 2021)

Pollutant	Averaging period	Maximum concentration standard	
		ppm	µg/Nm^3
Particulate matter as PM_{10}[1]	1 day 1 year	N/A	50 25
Particulate matter as $PM_{2.5}$ *	1 day 1 year	N/A	25 8
NO_2 *	1 hour 1 year	0.08 0.015	164 31
CO *	8 hours	9.0	11,250

[1] Main particulate emissions expected on the site during construction
* Very low levels of these pollutants expected from combustion engine machinery and vehicles used onsite
ppm = parts per million
µg/Nm^3 = micrograms per normal cubic metre (under standard temperature and pressure).

In addition to the current standards in **Table 15-1** reductions of the 24-hour and annual average $PM_{2.5}$ standards are proposed from 2025. Proposed changes to the AAQ NEPM standards for 2025 are provided in **Table 15-2**.

Table 15-2 NEPM proposed changes for Ambient Air Quality Standards scheduled for 2025.

Item	Pollutant	Averaging Period	Maximum Concentration Standard	
			ppm	µg/Nm^3
7	Particles ≤ 2.5 microns in diameter ($PM_{2.5}$)	1 day	N/A	20
		1 year	N/A	7

ppm = parts per million
µg/Nm^3 = micrograms per normal cubic metre (under standard temperature and pressure).

Exhaust emissions from onsite mobile and stationary equipment as well as construction traffic are unlikely to make a significant impact on local air quality (Holman et al, 2014). Therefore, quantitative assessment of combustion emissions using dispersion modelling from construction of the Project has not been undertaken for air quality impacts. As such, the comparison of potential emissions from the Project with NEPM criteria has not been undertaken. Potential impacts from combustion emissions from construction of the Project have been qualitatively assessed in **Section 15.3.2.** The qualitative

assessment of combustion emissions from construction plant and onsite traffic takes into consideration the estimated daily vehicle movements (refer **Section 9.3.1.1.1**) and type of plant equipment required during construction (refer Appendix A of **Appendix J (GHG Assessment)**).

Potential impacts from dust generation during construction have been assessed using the UK Institute of Air Quality Management (IAQM), 2014 *Guidance on the assessment of dust from demolition and construction* (Holman et al, 2014). This document provides a qualitative risk assessment process for the potential unmitigated impact of dust generated from demolition, earthmoving and construction activities. The IAQM methodology assesses the risk of impacts, without the application of any mitigation measures, on people and property, and on human health. Assessment using the IAQM guidance provides a classification of the risk of dust impacts which then allows the identification of appropriate mitigation measures commensurate with the level of risk.

The Project is designed to increase public transport uptake in the area reducing both vehicle numbers and connection on the road network. Combustion emissions associated with the operation and maintenance associated with operation of the light rail would be minor in nature; therefore, quantitative assessment of operational emissions has not been undertaken. Similarly potential dust emissions (including respirable crystalline silica) from operation of the light rail from sandboxes and ballast material is highly unlikely to make a significant impact on local air quality.

15.2 Existing environment

15.2.1 Meteorological conditions

As discussed in **Section 15.1.1** the meteorological model CALMET was used to create a site-specific meteorological data set for the delivery phase area using 2018 data from the BoM stations at Canberra Airport Tuggeranong and prognostic upper air data from TAPM. The CALMET London Circuit 2018 data set showed good correlation with Canberra Airport Data between 2011 and 2020 and is therefore considered representative of the delivery phase area. A summary of the CALMET London Circuit 2018 data is provided below:

- On an annual basis the dominant wind direction is from the east with winds from the northwest also commonly occurring. The average wind speed for the delivery phase area is a moderate 3.4 m/s. Calm wind speeds less than 0.5 m/s occur around 8.1% of the time. Calm conditions result in poor dispersal of air pollutants. Local meteorological is locally affected by terrain influences including the nearby hills of Mount Ainslie, Black Mountain and Mount Pleasant.
- During the warmer months from October through to March the dominant wind direction is from the east. From April through to August north westerlies are common, similarly for the month of November. Mean monthly wind speeds vary from approximately 3.0 m/s to 4.1 m/s in August. Calm conditions occur more frequently during the cooler months and are highest in July occurring 14.5% calm conditions occur less frequently during the warmer months and are lowest in January at 2.4% of the time.

It is noted that recent meteorological years (2020 to 2022) have experienced a higher-than-average annual rainfall due to a high occurrence of La Niña conditions that generally result in higher-than-average rainfall conditions over the spring and summer. The selected meteorological year 2018 is considered more representative of long-term climate conditions and is considered more conservative than more recent meteorological data sets. This is because higher rainfall results increase wet deposition rates; removing pollutants such as dust out of the atmosphere. Higher rainfall years also generally result in higher soil moisture contents that reduce the potential for windblown dust.

15.2.2 Existing air quality

As discussed in **Section 15.1.2** a review of six years of ACT Government air quality monitoring data between 2016 and 2021 was undertaken and summarised in **Table 15-3**.

The maximum 8-hour CO concertation at Florey is generally well below the NEPM criterion of 11,250 µg/m^3. The exception is two exceedances of the criterion that occurred on 1 and 5 January 2020 that were attributed to bushfire smoke during the 2019-2020 black summer bushfires (EPA, 2021).

Similarly, for NO_2 at Florey the maximum 1-hour concentration between 2016 and 2021 was below the NEPM criterion of 164 µg/m^3 with exception to two exceedances that were attributed to bushfire smoke

on 4 and 5 of January 2020 (EPA, 2021). Annual NO_2 concentrations at Florey were well below the NEPM criterion of 31 µg/m^3 for all years examined. The 2020 and 2021 annual averages were around 2 µg/m^3 lower on average than previous years and this decrease may be attributed to lower vehicle numbers resulting from the response to the COVID-19 pandemic.

The following observations were made for PM_{10} concentrations at the Civic monitoring station:

- The maximum 24-hour concentrations (when compared with the NEPM standard of 50 µg/m^3) were:
  - 2016 and 2021 concentrations were all below the standard
  - 2017 concentrations showed one exceedance of the standard, which occurred on 30 August due to hazard reduction burns
  - 2018 concentrations showed six exceedances of the standard occurred due to dust storms in March, April and December
  - 2019 and 2020 concentrations showed 29 and 27 exceedances respectively. These were attributed to the black summer bushfire period and high frequency of widespread dust storms
- The annual average concentration (when compared with the NEPM standard of 25µg/m^3) was below the standard for all years
- The annual average concentration was below the ACT Policy position standard (20 µg/m^3) for all years with the exception to 2019 and 2020. Both 2019 and 2020 annual averages were higher than other years due to the high occurrence of exceptional events (bushfires and dust storms).

The following observations were made for recorded $PM_{2.5}$ concentrations at the Civic monitoring station:

- The maximum 24-hour concentrations (when compared with the NEPM standard of 25 µg/m^3) were:
  - 2016 and 2021 concentrations were all below the standard
  - 2017 concentrations showed one exceedance of the standard occurred on 30 August due to hazard reduction burns
  - 2018 concentrations showed one exceedance of the standard, which occurred during a dust storm on 15th December 2018
  - 2019 and 2020 concentrations showed 29 and 21 exceedances respectively. These were attributed to the black summer bushfire period and high frequency of widespread dust storms
- The annual average concentration was below the NEPM standard of 8 µg/m^3 with exception to 2019 and 2020. Both 2019 and 2020 annual averages were higher than other years due to the high occurrence of exceptional events (bushfires and dust storms).

Table 15-3 Air quality monitoring data summary for 2016 to 2021

Pollutant	Averaging period	Concentration (µg/m^3)					
		2016	2017	2018	2019[1]	2020[1]	2021
CO	8 hour maximum	2,250	2,250	1,875	10,750	**18,250**	1,500
	1 hour criterion exceedances	0	0	0	0	2	0
NO_2	1 hour maximum	68	68	80	127	**351**	70
	1 hour criterion exceedances	0	0	0	0	2	0
	Annual average	10.3	10.3	10.3	10.3	8.2	8.2
PM_{10}	24 hour maximum	36.6	**53**[3]	**179.8**	**390.2**	**994.9**	28.6
	24 hour criterion exceedances	0	1	6	29	27	0

Pollutant	Averaging period	Concentration (µg/m^3)					
		2016	2017	2018	2019[1]	2020[1]	2021
	Annual average	10.1	9.7	13.5	22.9	21.7	8.7
$PM_{2.5}$	24 hour maximum	22.1	**53.8**[2]	**36.1**	**275.5**	**872.6**	21.8
	24 hour criterion exceedances	0	1	1	29	21[3]	0
	Annual average	5.5	5.8	6.5	**12.8**	**12.8**	5.0

Notes:

1. 2019 and 2020 data were adversely affected by bushfires from later September 2019 and averages and maxima should be treated with caution as they are not representative of long-term conditions.
2. The reported maximum 24-hour $PM_{2.5}$ value on 30 August 2017 was higher than the reported PM_{10} value of 53µg/m^3. A review of the PM_{10} 24-hour rolling average data on this date suggests that the maximum 24-hour average on this date was 54µg/m^3
3. Number of exceedances of $PM_{2.5}$ at Civic for 2021 determined from Civic hourly data set containing 24 hour rolling averages. Reported number of exceedances have been based on the 24-hour rolling average recorded at 23 hours for each day.
4. Bold entries denote exceedances of the AAQ NEPM Standard for that pollutant.

In summary air pollutant concentrations recorded at Civic and Florey are generally well below the NEPM standard for CO, NO_2, PM_{10}, and $PM_{2.5}$. Recorded exceedances were generally only found to occur during extreme events such as bushfire periods and dust storms. This is particularly evident during 2019 and 2020 during which a high occurrence of exceedances occurred attributed to both bushfires and dust storms; and are not considered representative of typical background concentrations.

15.2.3 Terrain and land use

Terrain is unlikely to affect the Project on a local scale and is only expected to affect air quality through region-wide influences from valleys and mountains distant from the Project.

The Project is located within the CBD and surrounded by high density urban development; primarily commercial land use; carparks servicing the area and parkland. Generally, highly urbanised environments have the potential to influence local wind flows, particularly due to the presence of multistorey buildings where height aspects ratios are high forming urban canyons channelling winds along roads. These micro meteorological effects influence the dispersion of air pollutants, generally leading to higher concentrations of pollutants close to the source due to poor dispersal conditions.

There are several multistorey buildings surrounding the delivery phase area which have the potential to alter local wind flows, with potential blocking effects in some areas, and wind tunnelling in other areas, dependant on the direction and strength of the winds. It is important to note though that while there are a number of multi storey buildings surrounding the delivery phase area there are also a number of open areas including parkland and carparks, which would promote better dispersal of air pollutants.

Sensitive receptors in the surrounding area would primarily be commercial in nature; i.e., places of work where people are likely to reside for eight hours a day or more or transient receptors where limited exposure to air pollution is assumed such as parks, recreational areas and footpaths. Notable sensitive receptors in the area are provided in **Chapter 12.0 Noise and vibration**.

15.3 Assessment of potential impacts

15.3.1 Construction

Assessment of potential construction impacts of the Project followed these key steps:

Step 1. A screening assessment to identify the presence of human and ecological receptors

Step 2. A dust assessment to define:

- The scale and nature of the construction works, which were defined as either small, medium or large

- Sensitivity of the surrounding area to dust
    - Separate assessments were conducted for ecological and human receptors

Step 3. Determining overall potential risk ratings for dust impacts.

15.3.1.1 Dust assessment

Construction of the Project is anticipated to take around three years; covering an estimated delivery phase area of around 28.7 ha. Potential dust impacts during the construction period have been determined based on the IAQM construction dust assessment guidance documentation and the expected scale of the of construction activities outlined in **Section 3.2**.

Step 1 Screening assessment

An initial screening assessment was undertaken for the delivery phase area to identify whether there were any:

- Human receptors within a 350 m of the delivery phase area boundary
- Ecological receptors within 50 m of the delivery phase area boundary
- Human or ecological receptors within 50 m of the routes used by construction vehicles on public roads up to 500 m from the delivery phase area boundary.

Screening lines of 50 m and 350 m drawn around the Project delivery phase area shows there are several human receptors within 350 m (**Figure 15-1)**, and as such a dust risk assessment was deemed necessary.

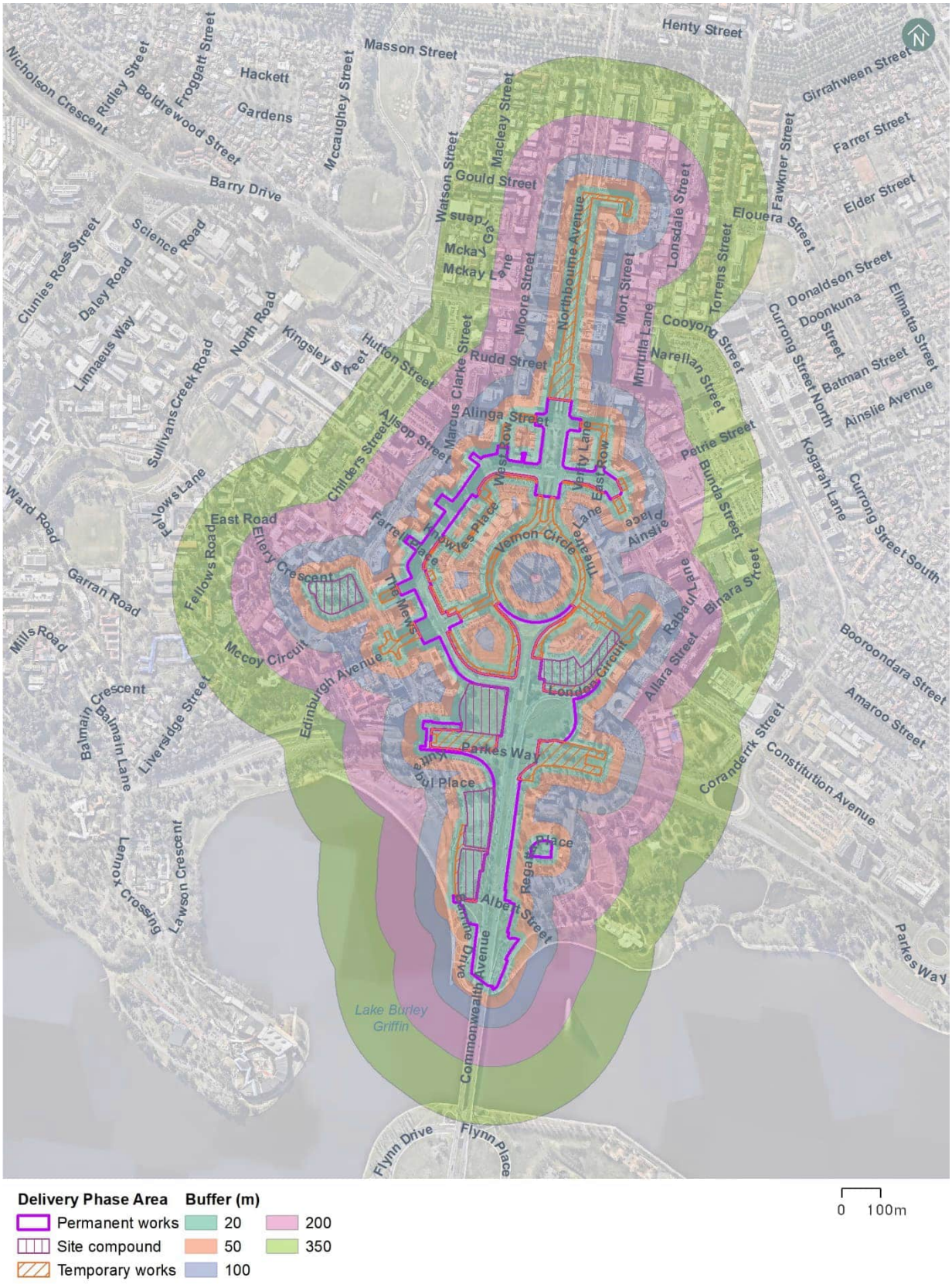


Figure 15-1 Buffer distances for Construction Footprint

Step 2 dust risk assessment

The screening assessment (Step 1 of the IAQM assessment) above identified the need for a dust risk assessment (Step 2 of the IAQM assessment). The key components of the risk assessment involve defining:

1. The scale and nature of the construction works, which then determined the dust emission magnitudes
2. The sensitivity of the surrounding area to dust
3. Combining these in a risk matrix to determine a potential risk rating for dust impacts on surrounding receptors.

The risk assessment was applied to the Project delivery phase area shown on **Figure 15-1** and assessed the potential for dust impacts due to unmitigated dust emissions from the Project.

Construction activity magnitudes

Dust emissions were estimated according to the scale and nature of works being undertaken. Construction activities (demolition, earthworks, construction and trackout) were defined as either small, medium or large according to the examples presented in the IAQM guidance (refer **Section 15.1.2**).

Construction activity magnitudes for construction of the Project is presented in **Table 15-4**. In defining the scale and nature of construction activities, the following assumptions were applied:

- Demolition dust magnitude has been rated medium. Between 20,000 m^3 and 50,000 m^3 of demolition materials would be handled, including dusty material largely attributed to removal of existing surfaces including road pavements, footpaths, medians and kerb and gutters
- Earthworks would be large in magnitude due to excavation of base layer material and backfilling with imported engineering fill, and topsoil for landscaping. An estimated 47,000 tonnes of excavated material from site clearance and earthworks would be transported offsite. Approximately 5,000 tonnes of engineering fill and topsoil would also be imported onsite
- Construction works would be extensive for the Project. Dust emissions magnitude has been rated large due to the following:
  - The delivery phase area would cover an area of 28.7 ha
  - The requirement for construction compounds and temporary ancillary facilities
  - Construction of three stops
  - Road infrastructure works including installation of drainage infrastructure, pavement works, surface finishing works, kerb and guttering and installation of road furniture and wayfinding
  - Rail alignment works including construction of Parkes Way bridge, track formwork and installation, signals, rail systems, lighting and CCTV installation
- Trackout for construction works were rated large based on an estimated average of 10 heavy vehicle movements per hour during peak construction periods; and conservatively estimated an additional 20 light vehicles per hour.

Table 15-4 IAQM assessment construction activity magnitudes

Construction activity magnitudes			
Demolition	**Earthworks**	**Construction**	**Trackout**
Medium	Large	Large	Large

Sensitivity to dust emissions

The IAQM guidance defines a sensitive receptor as a location that may be affected by dust emissions during demolition and construction. Human receptors include locations where people spend time and where property may be impacted by dust. Ecological receptors are habitats that might be sensitive to dust. The “sensitivity” component of the risk assessment is determined by defining the surrounding

areas sensitivity to dust soiling, human health effects and ecologically important areas. Factors used to determine the sensitivity of an area are:

- Land uses (for individual receptors in the area)
- Number of receptors of each land use/sensitivity type in the area
- Distance from source
- Annual mean PM_{10} background concentration (only applicable to human health impacts).

Sensitivity to dust soiling

Sensitivity to dust soiling risks have been examined within each of the construction buffer distances shown in **Figure 15-1**, with the results summarised in **Table 15-5**. Dust sensitivity ratings were determined by the highest sensitivity rating attributed to a construction buffer distance and surrounding land use as discussed in **Section 15.2.3**.

Table 15-5 Assessment of sensitivity of the area to dust spoiling

Receptor sensitivity	Construction buffer distance			
	< 20 m	20 - 50 m	50 -100 m	100 - 350 m
High	No receptors identified	No receptors identified	No receptors identified	10-100 (Low)
Medium	>1 (Medium)	>1 (Low)	>1 (Low)	>1 (Low)
Low	>1 (Low)	>1 (Low)	>1 (Low)	>1 (Low)

Overall, the sensitivity rating for dust soiling is medium based on the number of sensitive receptors located within 20 m and 50 m of the delivery phase area boundary.

Sensitivity to exposure to dust for human receptors

An assessment of receptor sensitivity to health risk from PM_{10} emissions are reported in **Table 15-6**. Dust sensitivity ratings for human health receptors were determined by the highest sensitivity rating attributed to a construction buffer zone and have been estimated based on IAQM guidance and an annual average background PM_{10} of less than 19 $\mu g/m^3$ and surrounding land use.

From **Table 15-6** it has been concluded that the health risk from PM_{10} emissions is low due to the low PM_{10} background concentrations and moderate sensitivity of commercial receptors, which form the dominant surrounding land use (refer to **Section 15.2.3**).

Table 15-6 Assessment of the sensitivity of the area to health impacts from PM_{10}

Receptor sensitivity	Distance from delivery phase area boundary				
	< 20 m	< 50 m	< 100 m	< 200m	< 350 m
High	No receptors identified	No receptors identified	No receptors identified	No receptors identified	10-100 (Low)
Medium	1-10 (Low)	>10 (Low)	>10 (Low)	>10 (Low)	>10 (Low)
Low	≥1 (Low)	≥1 (Low)	≥1 (Low)	≥1 (Low)	≥1 (Low)

Sensitivity to exposure to dust for ecological receptors

Ecological risks are linked to the presence of sensitive ecological receptors that may be affected by dust deposition. Ecological receptors are defined as habitats that may be sensitive to dust. As discussed in the **Chapter 16.0 Biodiversity and ecology** for the Project, beyond the boundaries of the delivery phase area is predominantly a built urban environment, road network and some parklands.

Chapter 16.0 Biodiversity and ecology notes the presence of low-quality Golden Sun Moth (GSM), *Synemon plana* habitat. The GSM is listed as vulnerable under the *Environment Protection and*

Biodiversity Conservation Act 1999 (Cth) and endangered under the *Nature Conservation Act 2016* (ACT) within the delivery phase area and surrounds. **Chapter 16.0 Biodiversity and ecology** notes that indirect disturbance of GSM habitat may occur as a result of dust emissions from construction however these impacts would be temporary and unlikely to result in ongoing disturbance to GSM habitat. A CEMP would be developed for the Project which would include measures for the management and minimisation of dust at the source. Given the minimal biodiversity within and around the delivery phase area and the implementation of appropriate management at the source, dust impacts on ecological receptors are not anticipated to be significant.

Overall dust risk ratings

The potential unmitigated risks for the overall Project were found to range from Low to Medium, as summarised in **Table 15-7**.

Table 15-7 Summary of unmitigated risk assessment for the Project activities

Activity	Step 2A: Potential for dust emissions	Step 2B: Sensitivity of area			Step 2C: Risk of unmitigated dust impacts		
		Dust soiling	Human health	Ecological Impact	Dust soiling	Human health	Ecological Impact
Demolition	Medium	Medium	Low	Low	Medium	Low	Low
Earthworks	Large	Medium	Low	Low	Medium	Low	Low
Construction	Large	Medium	Low	Low	Medium	Low	Low
Trackout	Large	Medium	Low	Low	Medium	Low	Low

Specific activity mitigation measures have been recommended to further reduce risk, as described in **Section 15.5**.

15.3.1.2 Combustion emissions assessment

Combustion emissions during construction of the Project would be due to the combustion of petrol and diesel fuel by light and heavy vehicles traveling to and from the delivery phase area, onsite, mobile construction equipment and stationary plant such as generators. Emissions would depend on the nature of the emissions source (i.e., size of the equipment, usage rates, duration of operation etc). Pollutants emitted by construction vehicles, plant and equipment would include CO, particulate matter (PM_{10} and $PM_{2.5}$), NO_2, SO_2, VOCs, and PAHs.

Construction access is expected to primarily occur from London Circuit and the adjoining road network including Commonwealth Avenue, Edinburgh Avenue and Northbourne Avenue. Some temporary modifications to the existing road network would be required during construction of the Project, to maintain the functionality of surrounding roads.

Heavy vehicle movements would include material delivery and waste removal. Construction traffic is expected to fluctuate over the course of the three-year construction program with daily average vehicle movements estimated at 10 per hour for heavy vehicles and 20 for light vehicles.

Given the existing volumes of traffic utilising Canberra CBD roads, combustion emissions from construction traffic generated by the Project are unlikely to result in a notable increase in total vehicles emissions. Any road detours due to construction works are expected to result in some minor localised changes to ground level pollutant concentration distribution patterns.

Combustion emissions from diesel operated mobile equipment, as listed in Appendix A of **Appendix J (GHG Assessment)**, would also result in air pollutant emissions. This would include the use of diesel generators to provide onsite power to construction ancillary facilities and equipment where access to the electrical grid may not be readily available.

Construction traffic emissions, as well as mobile and stationary plant equipment exhaust emissions, are unlikely to have a significant impact on local air quality. Typical mitigation and maintenance measures

for operation of construction vehicles and plant equipment are discussed in **Section 15.5** and when applied notable air quality impacts from construction vehicles and plant equipment are not expected.

15.3.2 Operation

Operational vehicle emission

Only minor vehicle emissions are expected from operation and maintenance of the Project and would be associated with workers travelling to and from work by light vehicles and combustion emissions from maintenance vehicles and equipment.

Proposed road network changes associated with Project are expected to have a minor impact to the local road network in the short-term (2026). However, the cumulative impacts of Project and other planned proposals could result in notable increase in delays and congestion in the road network by 2036. The impacts include increased congestion on London Circuit and generally across the City. This in turn, is expected to result in traffic redistribution in the network. The redistribution of traffic onto existing surrounding city roads as a result of the Project is not anticipated to result in significant air quality impacts.

However, the Project has been designed with the goal to improve active transport connections and would facilitate the delivery of the Light Rail to Woden Project. Through the delivery of the Project and Light Rail to Woden, MPC seeks to improve active and public transport uptake, and in turn reduce vehicle movements in the Canberra CBD.

As such, the potential air quality emissions attributed to the operation of the Project would be negligible and would be unlikely to have any significant air quality impacts.

Dust from light rail vehicles

Operation of the light rail may result in minor fine dust emissions from ballast material and operation of sandboxes. Sandboxes on LRVs are generally fitted close to the wheels, and release sand to improve traction in adverse conditions, as required. However, significant accumulation of sand along the alignment and surrounding area associated with braking is not expected to occur, since the alignment would be regularly maintained using a modified street sweeper (street sweeper fitted with a special purpose rail brush system and high-pressure water blaster jets). Furthermore, a proportion of the alignment would be green track, which would increase surface roughness of the track and surrounding area. Surface roughness would promote deposition, capture and settlement of dust, removing it from the air. Overall, the potential dust impacts during operation are considered very low.

15.4 Preliminary risk assessment

A preliminary risk assessment of potential air quality impacts, without mitigation measures, for construction and operation are presented in **Table 15-8** and **Table 15-9**, respectively. The risk has been calculated using the methodology detailed in **Chapter 8.0 Environmental risk analysis approach**.

Table 15-8 Preliminary risk assessment for air quality during construction

Category	Description	Likelihood	Consequence	Rating
Dust generation during site clearance and delivery phase area establishment	Dust may be generated through vegetation and soil removal, excavation, construction traffic, exposed soil and stockpiles, and trucking materials to, from and around the delivery phase area. This may impact the local air quality.	Possible	Minor	Low
Dust generation during construction activities	Dust generation from construction activities (e.g., earthworks, spoil management and vehicle movements). This may impact the local air quality.	Possible	Minor	Low

Category	Description	Likelihood	Consequence	Rating
Dust generation resulting from climatic conditions	During dry and/or windy periods, dust can be generated at the delivery phase area from exposed surfaces. This may impact the local air quality.	Possible	Minor	Low
Combustion emissions	Construction activities would produce emissions from the combustion of fuel, oil and/or gas which have the potential to impact on the local air quality. This may impact the local air quality.	Possible	Minor	Low

Table 15-9 Preliminary risk assessment for air quality during operation

Category	Description	Likelihood	Consequence	Rating
Combustion emissions	The Project is not expected to generate additional traffic or to result in a significant redistribution of traffic on the surrounding road network, and as such, no material increases in vehicle emissions relative to existing conditions are anticipated. Conversely, the Project has been designed with the goal of improving active transport connections and public transport use and would facilitate the extension of the Light Rail from Commonwealth Park to Woden. Therefore, the Project would contribute to improved air quality.	N/A	N/A	Beneficial
Dust from operation of LRVs and general maintenance activities	Minor fine dust emissions are anticipated from operation of the light rail from ballast material and operation of sandboxes LRVs. Sandboxes on LRVs are generally fitted close to the wheels, limiting dispersal. Significant accumulation of sand in the light rail line and surrounding area associated with breaking is not expected to occur.	Remote	Major	Low

15.5 Management and mitigation measures

Management and mitigation measures have been proposed to reduce the potential air quality impacts of the Project identified in the assessment.

Management and mitigation measures and safeguard protocols adopted for the Project are provided in **Table 15-10**, and have been prepared with the following objectives:

- Minimise generation of dust through effective construction planning and day to day management.
- Minimise direct greenhouse gas emissions that also impact local air quality
- Minimise impacts from exposure to potentially poor air quality.

Table 15-10 Management and mitigation measures – Air quality

Ref	Management and mitigation measure	Timing	Reference
AQ1	Plan site layout such that machinery and dust causing activities are located as far away from sensitive receivers as possible. Daily construction activities would be planned to consider the expected weather conditions for each workday, ensuring works zones are manageable.	Prior to and during construction	
AQ2	The CEMP would include a procedure for ongoing visual monitoring and recording of dust release by a nominated representative(s) regularly surveying the site for evidence of dust release from vehicle movements, stockpiling or demolition, or track out of material and remobilisation on access routes to the site. Where necessary the following actions would be implemented: • Restrict vehicles to stabilised areas, and where necessary remove mud and dirt tracked on to road surfaces • Establish and enforce appropriate onsite vehicle speed limits • Place gravel on surfaces where there would be significant vehicle movement (e.g., construction access and egress points) • Implemented suitable controls for exposed stockpiles and unsealed construction areas as appropriate, including the stabilising of long-term stockpiles and exposed areas • Cover vehicle loads involving loose materials • Use water assisted dust sweepers on access and local roads. Avoid dry sweeping of large areas • Ensure cement and fine materials are delivered in enclosed tankers and stored in silos to prevent material escape. For smaller supplies reseal bags after use.	During construction	UK Institute of Air Quality Management (IAQM), *Guidance on the assessment of dust from demolition and construction* (Holman et al, 2014) ISC IS Rating Tool Version 1.2 (Dis-4)
AQ3	Implement energy efficient guidelines for operational works such as a ‘no-idling’ policy for all construction vehicles and plant to switch of engines when not in use	During construction	
AQ4	The following measures to manage greenhouse gas emissions would be implemented: • Only use petrol or diesel generators where mains power is not feasible • Keep vehicles and construction equipment operating onsite well maintained and turned off when not operating (minimise idling on the site) • Energy efficiency measures for fixed construction components such as site offices, including solar panels and timer-controlled lighting • Consider other appropriate methods for reducing diesel use such as use of biodiesel or ethanol blends where feasible.	During construction	

Ref	Management and mitigation measure	Timing	Reference
	• Use solar powered lights/message signs as appropriate.		
AQ5	Where battery or solar power equipment is not feasible, locate fixed equipment (e.g., generators, or light towers) away from sensitive receivers	During construction	

15.6 Residual risk assessment

A residual risk assessment was undertaken to assess potential air quality impacts after the proposed management and mitigation measures are applied, presented in **Table 15-11** and **Table 15-12**. No significant residual impacts on air quality are anticipated.

Table 15-11 Residual risk assessment for air quality during construction

Category	Description	Likelihood	Consequence	Rating
Dust generation during site clearance and delivery phase area establishment	Dust may be generated through vegetation and soil removal, excavation, construction traffic, exposed soil and stockpiles, and trucking materials to, from and around the delivery phase area. This may impact the local air quality.	Unlikely	Minor	Very Low
Dust generation during construction activities	Dust generation from construction activities (e.g., earthworks, spoil management and vehicle movements). This may impact the local air quality.	Unlikely	Minor	Very Low
Dust generation resulting from climatic conditions	During dry and/or windy periods, dust can be generated at the delivery phase area from exposed surfaces. This may impact the local air quality.	Unlikely	Minor	Very Low
Combustion emissions	Construction activities would produce emissions from the combustion of fuel, oil and/or gas which have the potential to impact on the local air quality. This may impact the local air quality.	Unlikely	Minor	Very Low

As the risks associated with construction of infrastructure is well known and generally well managed using standard mitigation measure and safeguards the potential risks to the Project are considered to be low.

As indicated in the IAQM guidance, "*For almost all construction activity, the aim should be to prevent significant effects on receptors through the use of effective mitigation. Experience shows that this is normally possible. Hence the residual effect will normally be 'not significant'*". With the implementation of management and mitigation measures, the risks indicated above are expected to produce a residual effect which is not significant.

Table 15-12 Residual risk assessment for air quality during operation

Category	Description	Likelihood	Consequence	Rating
Combustion emissions from maintenance and staff vehicles	The Project is not expected to generate additional traffic or to result in a significant redistribution of traffic on the surrounding road network, and as such, no material increases in vehicle emissions relative to existing conditions are anticipated. Conversely, the Project has been designed with the goal of improving active transport connections and public transport use and would facilitate the extension of the Light Rail from Commonwealth Park to Woden. Therefore, the Project would contribute to improved air quality.	Unlikely	Minor	Very Low
Dust from operation of LRVs and general maintenance activities	Minor fine dust emissions are anticipated from operation of the light rail from ballast material and operation of sandboxes LRVs. Sandboxes on LRVs are generally fitted close to the wheels, limiting dispersal. Significant accumulation of sand in the light rail line and surrounding area associated with breaking is not expected to occur.	Remote	Major	Very Low

16.0 Biodiversity and ecology

This Chapter provides an overview and assessment of the potential biodiversity and ecology impacts and benefits associated with the construction and operation of the Project.

16.1 Approach

The Preliminary Environmental Risk Assessment (**Appendix C (PERA)**) identified risks relevant to biodiversity and ecology, including four very low to medium construction risks and no operational risks. In accordance with the methodology provided in **Chapter 8.0 Environmental risk analysis approach**, this Chapter has been prepared to further document and assess risks to biodiversity and ecology with consideration of subsequent design development.

This Chapter considers species protected under Commonwealth and ACT legislation. This Chapter uses ACT databases, ecological survey data and information from the EPBC Act Preliminary Documentation (MPC, 2020). The EPBC Act Preliminary Documentation was prepared to inform the assessment of the Stage 2A City to Commonwealth Park component of the Light Rail to Woden project under the EPBC Act. The EPBC Act Preliminary Documentation comprises a preliminary environment assessment for biodiversity through a desktop assessment and ecological surveys. The Preliminary Documentation is specifically focused on the assessment of impacts on two controlling provisions:

- Section 18 listed threatened species and communities GSM (*Synemon plana*)
- Section 26 Commonwealth land.

The Project was approved by the Australian Government Department of Agriculture, Water and Environment (now the Department of Climate Change, Energy, the Environment and Water (DCCEEW) on 2 February 2021 (2019/8582) ('EPBC Approval'). The EPBC Approval is subject to several conditions ensuring appropriate management of the GSM. One of the key conditions was to develop a GSM Management Plan (the GSM Plan). The current version, GSM Plan 2.1, was approved by the Federal Environment Minister on 1 December 2022. The GSM Plan is discussed in more detail in **Section 16.3.2.2**.

This Chapter addresses general biodiversity and ecology impacts from construction and operation of the Project and highlights impacts to the identified GSM population associated with the construction activities, and operation of the Project outlined in **Chapter 3.0 Project description**. For more information on other species that were considered, refer to Section 3.3.2 and Appendix A of the EPBC Act Preliminary Documentation.

16.2 Existing environment

The Project delivery phase area is characterised as an urban environment, with low-moderate ecological value. It is primarily comprised of road reserves that are predominantly deciduous exotic species with some native species, interspersed with maintained grasslands dominated by exotic grasses (refer to **Figure 16-1**). The grasses occur mainly within the three circular areas identified as 'cloverleaves'. The remainder of the delivery phase area contains hard surfaces, including footpaths, Commonwealth Avenue bridges, and asphalt sealed car parks. However, the vegetation within the delivery phase area still provides suitable habitat for a suite of common native flora and fauna which remain important to natural ecological processes of the region.

The existing habitat connectivity within and surrounding the delivery phase area is low. Exotic and non-local native trees and shrubs within the delivery phase area are typically isolated (refer to **Figure 16-1**), do not provide important habitat for threatened species and are not part of large-scale links between conservation reserves. Publicly available mapping of connectivity values in the delivery phase area were reviewed using the ACT Government spatial data portal (ACTmapi, ACT Government, 2022). Habitat connectivity layers within ACTmapi, identified that trees along Parkes Way have low connectivity value and functional connection. With some restoration, the area would form part of a regional link to core habitat areas. No areas within the delivery phase area contained areas contributing to moderate or high quality connectivity at a local or regional scale.

According to site surveys and the RLC Landscape Plan (where existing vegetation will have been replaced prior to the Project), vegetation within the of the delivery phase area is predominantly

Eucalyptus species, Elm (*Ulmus* species), London Plane (*Platanus x acerifolia*), Pin oak (*Quercus palustria*), Deodar cedar (*Cedrus deodara*), Oriental Plane (*Platanus orientalis*), *Calitris* species, *Cupressus* species, and other ornamental and deciduous exotic species. The estimated life expectancies for the trees ranged from 1 to 40 years. Some Elms showed signs of Elm Leaf Beetle (*Xanthogaleruca luteola*) damage. The Elm Leaf Beetle is considered a significant pest in the ACT, and is the greatest threat to the Australian Elm tree population. The existing vegetation within the delivery phase area is presented in **Figure 16-1**.

No Threatened Ecological Communities (TECs) listed under the *Nature Conservation Act 2014* (ACT) (NC Act) and EPBC Act were identified within the delivery phase area (Biosis, 2019), and no trees are listed on the ACT Tree Register. The closest registered trees occur within Vernon circle, Verity Lane and Odgers Lane and would be retained. Threatened species and communities relevant to this assessment are limited to GSM, as determined by the ecological surveys undertaken for the EPBC Act Preliminary Documentation (Biosis, 2019). GSM inhabits grassed areas within and adjacent to the delivery phase area, and is discussed further in **Section 16.2.1.**

During ecological surveys undertaken for the EPBC Approval, six declared pest plant species, listed under the *ACT Pest Plants and Animals (Pest Plants) Declaration 2015 (No 1)*, were identified within the delivery phase area (EPSDD, 2022b), which included two species that are Weeds of National Significance under the *Australian Weeds Strategy 2017 – 2027* (Invasive Plants and Animals Committee, 2017). These are: Serrated Tussock (*Nassella trichotoma*), and Chilean Needle Grass (*Nassella neesiana*). Ecological surveys to identify GSM habitat confirmed that the grassed areas are dominated by Chilean Needle Grass. However, Chilean Needle Grass also provides habitat for the critically endangered GSM within and around the delivery phase area, although it is considered to be low value habitat. Additionally, according to the interactive portal for the *2021-22 Invasive Plants Annual Report* (EPSDD, 2022a), Fireweed (*Senecio madagascariensis*) was noted to occur in Commonwealth Park approximately 200 m from the delivery phase area. There are European Rabbits (*Oryctolagus cuniculus*) present within the delivery phase area, and there are rabbit warrens along the Commonwealth Avenue median and adjacent to the Parkes Way bridge. Rabbits are a serious environmental pest in the ACT, adversely affecting a number of native and threatened species, including GSM.

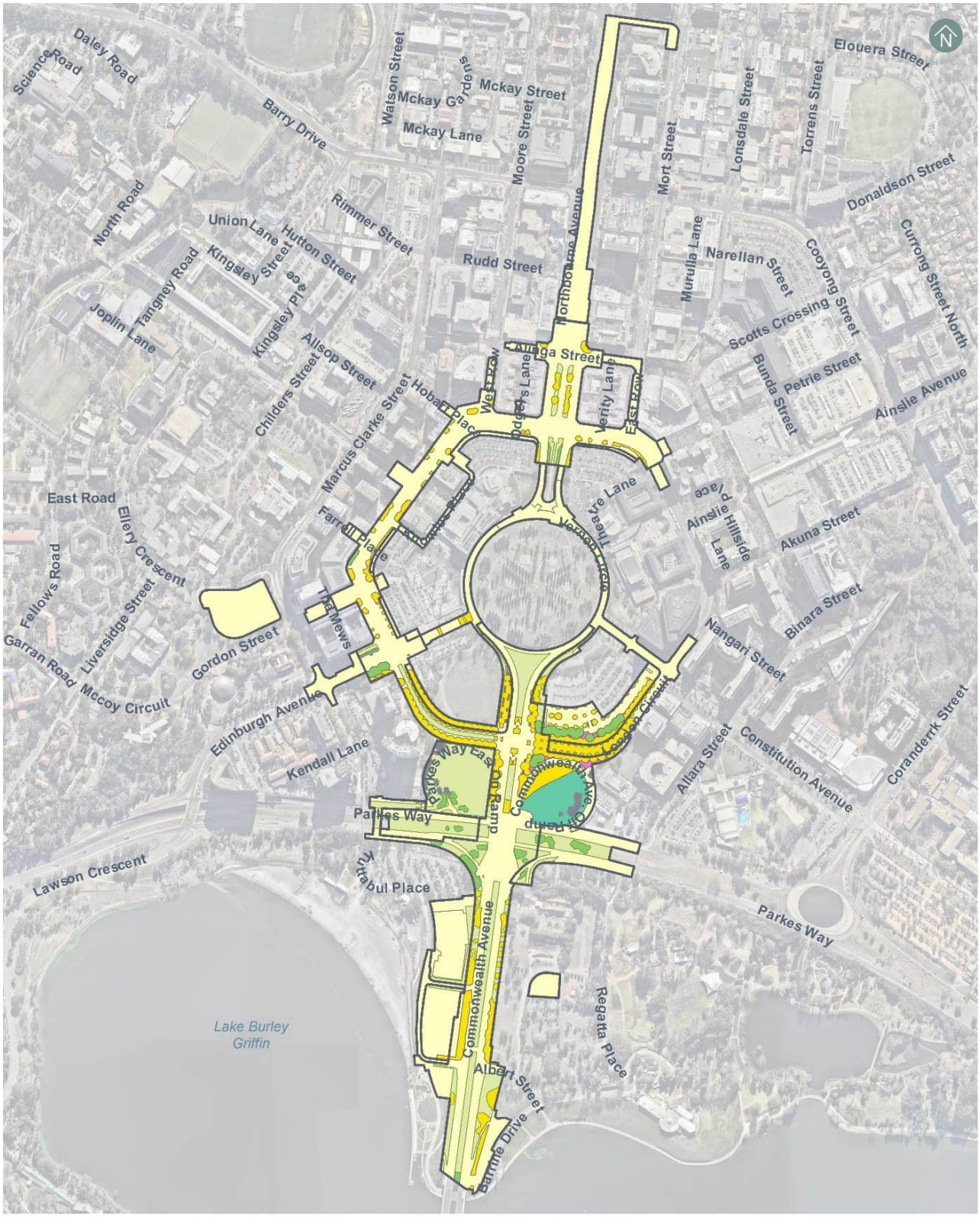


Figure 16-1 Existing land types within the delivery phase area (assuming Raising London Circuit is complete)

16.2.1 GSM habitat

The GSM is a medium-sized day-flying moth which gets its name from the golden colouring found on the hindwings of the female moth. It is listed as vulnerable under the EPBC Act and endangered under the NC Act. This Section provides a summary of the previously approved disturbance as it relates to the Project.

Habitats within and adjacent to the delivery phase area comprise maintained grassed areas dominated by Chilean Needle Grass offering low value habitat for the species. Wallaby Grass (*Rytidosperma spp*) were also noted in study areas, however these made up only 3% of the grass species, and were considered uncommon (MPC, 2020).

Habitats within and surrounding the delivery phase area are largely confined to small patches situated within roadside medians and verges. These patches are subject to considerable fragmentation due to the roads and structures such as bridge abutments and piers, retaining walls, buildings and dense landscape plantings. According to *Significant impact guidelines for the critically endangered golden sun moth* (Department of Environment, Heritage, Water and the Arts (DEWHA) (DEWHA, 2009) GSM habitats separated by more than 200 m or divided by solid barriers higher than 1 m, are effectively isolated and are to be considered separate populations. Subsequent to works undertaken before the commencement of this Project, the distance between habitat patches within and around the delivery phase area is generally greater than 200 m. Movement between habitat patches is not likely to occur. The habitats are therefore considered to be fragmented, including marginal habitats within Vernon Circle and the Parkes Way median west of Commonwealth Avenue.

Further details on measures to enhance GSM habitat value and connectivity are included in **Section 16.3.2.2**.

16.2.1.1 Habitat within the delivery phase area

Prior to the commencement of the Project, GSM would have been translocated, where required under the Translocation Plan (refer to Appendix C of the GSM Plan 2.0), out of several areas including:

- Commonwealth Avenue median
- Northwest cloverleaf
- Southwest cloverleaf.
- Parkes Way east and west medians
- Commonwealth Park verge.

The larvae would be relocated to the fenced GSM translocation area in the southeast cloverleaf if the habitat met the salvage criteria outlined in the GSM Plan 2.0 (MPC, 2022).

Following translocation activities, the remaining GSM habitat within the delivery phase area at the start of the Project is limited to the southeast cloverleaf, including the fenced GSM translocation area.

16.2.1.2 Habitat adjacent to the delivery phase area

The GSM population extends beyond the delivery phase area. These habitat areas may be affected by their proximity to the Project and are therefore included in subsequent discussions of potential impacts. Survey results indicate that the mapped habitat areas are likely to represent the full extent of the population, with any habitat further east on Parkes Way geographically disconnected from the population according to DEWHA (DEWHA, 2009). The habitat beyond the delivery phase area considered in this assessment includes:

- City Hill
- Commonwealth Park
- Parkes Way median east and west.

16.3 Assessment of potential impacts

The following sections summarise the potential impacts of the Project on biodiversity and ecology during construction and operation.

16.3.1 Construction

Construction activities are outlined in **Chapter 3.0 Project description**. The potential construction biodiversity and ecology impacts include vegetation removal and approved impacts to GSM.

Direct impacts to GSM (actions that result in a temporary or permanent loss of habitat), and indirect impacts to GSM (such as dust migration into adjacent habitat during construction) and their associated management and mitigation measures have been approved under the EPBC Act (2019/8582).

16.3.1.1 Vegetation removal

Removal of vegetation including approximately 100 mature trees is required to facilitate the Project and site access. The trees to be removed are predominantly Elm (*Ulmus* species), Oriental Plane (*Platanus orientalis*), and London Plane (*Platanus x acerifolia*). Following construction over 140 trees would be planted within the delivery phase area, ensuring a minimum 1:1 replacement ratio.

The majority of the Elm trees in the delivery phase area would be removed, with some to be retained. The close proximity of the retained trees to the construction works, and potential ground disturbance, may stress the remaining elms. Additional stress can make elm trees more susceptible to elm leaf beetles and management and mitigation measures to minimise stress to the remaining elm trees may be required.

As identified in **Section 16.2**, no trees within the delivery phase area are listed on the ACT Tree Register.

Where possible, trees would be retained in the placement of construction compound sites. As the design progresses, changes to vegetation impacts would be managed through the Light Rail Stage 2 Decision Making Framework (AECOM, 2021a) and SPR departures.

As outlined in **Section 16.2**, the grassed areas consist of primarily exotic grasses, including weeds such as Chilean Needle Grass. The removal of this grass is not considered ecologically significant, except where it provides habitat for GSM. The implications of construction on GSM are discussed in more detail in **Section 16.3.1.2**, and the operational impact of the removal of the medians is addressed in **Section 16.3.2.1**.

16.3.1.2 Golden Sun Moth

Construction impacts to threatened species would be limited to GSM. Direct and indirect impacts to GSM (impacts within and outside the delivery phase area), and their associated management and mitigation measures, have been approved under the EPBC Act (2019/8582), and subsequently through the approved GSM Plan 2.0 (MPC, 2022).

The potential impacts of the Project on GSM habitat would be limited to:

- Potential indirect impacts to GSM habitat in the Parkes Way median and City Hill (for example, through construction dust deposition)
- Direct impacts to adult GSM.

Details of the approved impacts to GSM and GSM habitat during construction of the Project is detailed in the GSM Plan 2.0 and summarised in **Table 16-1**. Impacts would be mitigated and offset in accordance with the management and mitigation measures outlined in **Section 16.5**.

The areas of GSM habitat adjacent to the delivery phase area (i.e., City Hill, Commonwealth Park, and the far east and west Parkes Way median areas) would be marked as exclusion zones, and would not be directly impacted by the Project. Any changes in slashing/mowing regimes for remaining grassland patches during construction would also impact grassland suitability for GSM. These impacts would be temporary and are unlikely to result in an ongoing disturbance to the habitat beyond construction. Where there are GSM habitat areas to be retained, fencing and exclusion markers would not interfere with access to continue the current slashing/mowing regime in the southeast cloverleaf and the translocation area, and in the exclusion zones adjacent to the delivery phase area.

The GSM habitat within the delivery phase area at the start of the Project is limited to the southeast cloverleaf, including within the fenced GSM translocation area. Utilities works would be required in the southeast cloverleaf outside of the fenced translocation area. However, following competition of the utilities works, the entire southeast cloverleaf would be fenced to undertake the rehabilitation works, which will include planting native GSM habitat species. Further details on the rehabilitation works can be found in the GSM Plan 2.1 (MPC, 2022). Once the utility relocation works are completed, the southeast cloverleaf would be marked as a no-go zone for the following three years (except for the purpose of managing the GSM habitat and completing restoration works) including the remainder of construction.

Table 16-1 Summary of unmitigated GSM risk assessment for Project construction activities

Impact	Nature	Impact type	Description
Species mortality	Direct	Permanent loss	It is likely that adult GSM would be impacted during construction through collision with vehicles and construction equipment and potential trampling underfoot during the flying season. These impacts would be minimised through the erection of signage or construction fencing which would be designed to preclude unauthorised vehicle or pedestrian access. As this fencing would be required to have hoarding to comply with safety standards, the fencing may act as a barrier for GSM movement. It is considered that this impediment to movement poses a lower risk to GSM mortality than the risk of collisions and trampling.
Habitat degradation	Indirect	Short-term disturbance associated with construction	Approximately 3.33 ha of remaining GSM habitat adjacent to the delivery phase area (as discussed above) would likely be subject to indirect disturbance during construction (such as through dust deposition or stormwater diversion). Any changes in slashing/mowing regimes for remaining grassland patches during construction would also impact grassland suitability for GSM. These impacts would be temporary and are unlikely to result in an ongoing disturbance to the habitat beyond construction. Where there are GSM habitat areas to be retained, fencing and exclusion markers would not interfere with access to continue the current slashing/mowing regime in the southeast cloverleaf and the translocation area, and in the exclusion zones adjacent to the delivery phase area. Such interference may make existing habitat unsuitable and reduce available habitat. It is possible that construction activities could facilitate the spread of exotic African Lovegrass (*Eragrostis curvula*). This has the potential to outcompete Chilean Needle Grass in dry, nutrient-poor environments. This could reduce the suitability of remaining habitats for GSM and could lead to displacement of the species if it is not appropriately managed (Sharp, 2011; MPC, 2020)

16.3.2 Operation

The potential operational biodiversity and ecology impacts include impacts to ecological value and connectivity, and approved impacts to GSM.

16.3.2.1 Ecological value and connectivity

The Project aims to have a net positive impact on biodiversity and ecology, including improving ecological value and connectivity within the delivery phase area and, more specifically, GSM habitat value and connectivity. This would be achieved through:

- Biodiversity offsets (outside the delivery phase area) to achieve no net loss of GSM habitat (refer to **Section 16.3.2.2**)
- Landscaping works including restoration of native grasslands (within the delivery phase area) to achieve a net enhancement of biodiversity and ecology values.

During operation the Project would maintain and enhance the ecological value of the delivery phase area (refer to **Section 16.3.3**). Through the proposed vegetation planting, following construction, the delivery phase area will be revegetated with a mix of exotic and native plant species, including trees, shrubs and grasses. The landscaping works would maintain and enhance the low general ecological connectivity that existed within the delivery phase area prior to the Project. This would be achieved through initiatives such as the green track – where the light rail track would be vegetated along Commonwealth Avenue (refer to **Figure 16-2**). Exotic trees would also be planted along Commonwealth Avenue and London Circuit, decreasing the distance between trees in these areas compared with the existing vegetation depicted in **Figure 16-1**. A greater diversity of habitat structures including, native groundcovers, native exotic plant mixes, and exotic trees would be incorporated on Northbourne Avenue Street, between the existing Alinga Street stop and London Circuit.

Rehabilitation activities in the southeast cloverleaf and the Parkes Way median would be undertaken during the Project, and would take at least three years to complete. This would include the restoration of native grasslands in these areas, providing improved habitat for GSM, compared with the exotic, low-quality grasslands which were present in these areas prior to the Project. Using the methods outlined in the GSM Plan 2.1, it is probable (at least a 50% chance) that the enhancement can be achieved.

Figure 16-2 Land types during Project operation based on the WA/DA submission design

16.3.2.2 Golden Sun Moth

Operational impacts to threatened species would be limited to GSM. Direct and indirect impacts to GSM, and their associated management and mitigation measures have been approved under the EPBC Act (2019/8582). **Table 16-2** provides a summary of the previously approved disturbance as it relates to the Project.

There would be a decrease in the overall area of GSM habitat and the GSM habitat connectivity within the delivery phase area, due to the removal of GSM habitat by the Project. To mitigate this, biodiversity offsets have been purchased which would result in the protection and maintenance of offsite GSM habitat for 'no net loss' of biodiversity value. These offsets have been secured for GSM impacts associated with all activities approved under EPBC2019/8582. The offsets package was delivered through the NSW Biodiversity Offsets Scheme (NSW BOS), which is the appropriate regional policy that sets out calculation criteria. The offsets are permanent and involve management regimes which ensure that the biodiversity objectives are achieved and maintained.

The purchase of the biodiversity offsets, combined with the rehabilitation activities to enhance the quality of GSM habitat within the delivery phase area (refer to **Section 16.3.2.1**) mean that the Project would result in an overall increase in ecological value and connectivity of GSM habitat.

Table 16-2 Summary of Project impacts on GSM habitat during operation

Impact	Nature	Extent
Habitat fragmentation isolation and edge effects	Indirect	Existing GSM habitats within the delivery phase area are already subject to considerable edge effects. Edge effects are changes to populations or communities along the boundary of a habitat. Habitat boundaries are often exposed to different levels of disturbance, invasive species, and other environmental conditions which can impact populations. Any increased risk of edge effects due to the Project would be negligible, as the shape and size of remaining habitats would not change significantly, and no significant intensification of road use would occur.
Higher quality habitat	Beneficial	The rehabilitation of the Parkes Way east median to provide a native grassland would create more favourable GSM habitat compared with the existing habitat. This would benefit GSM.
Species mortality	Direct	Some increased GSM mortality may occur within the light rail alignment as a part of proposed operations. The operation of the Project may involve vehicle collisions with GSM and potential trampling underfoot during the flying season, from pedestrian traffic. However, these impacts are considered negligible during operation.

16.3.3 Ecological value calculator

Land types were identified in consultation with ecologists when determining the ecological value of the delivery phase area. The existing vegetation areas featured in **Figure 16-1** were classified using existing vegetation survey data and, where the existing vegetation would be removed by RLC, the RLC Landscape Plan was used to indicate what vegetation would be present at the commencement of the Project. The Project operation land type areas (hard surfaces) were generated using landscaping and civil design at the time of the WA/DA submission. The areas for each land type are presented in **Table 16-3**.

An ecological value calculator (Umwelt, 2022) was developed to calculate the net change in ecological value due to the Project, and the calculator was tailored to the delivery phase area in consultation with ecologists. Based on the design submitted with the WA and DA, the calculator estimated that the Project would enhance ecological value by 3.5% based on the above area changes as a result of the Project. Through increasing land types that have a higher ecological value (such as retaining native vegetation, and planting native grass species, which can provide habitat for GSM), the ecological value within the delivery phase area would be improved.

Table 16-3 Land types within the delivery phase area used to calculate ecological connectivity and value

Land type classification	Existing areas (m^2)	Project operation areas(m^2)
Hard surface	192,040	174,020
Planted exotic grassland	44,165	19,908
Planted exotic trees and shrubs	33,706	68,856
Planted native grassland	6,994	10,150
Planted native trees and shrubs	7,680	6,377
Planted native/exotic vegetation mix	860	1,517
Retained native vegetation	1,912	6,528
Total area*	287,357	287,357
Total ecological value score % (total weighted area/total area)	6.7	10.3
Increase in ecological value (%)	3.5	

The existing land types (before the Project) and proposed land types (after Project construction) are presented in **Figure 16-1** and **Figure 16-2** respectively.

The delivery phase area would have poor habitat connectivity at the time of Project commencement given the urban location and highly disturbed nature of the Project site (refer to **Section 16.2**). The biodiversity offsets have been established with the aim to achieve no net loss of connectivity for GSM habitat (refer to **Section 16.3.2.2**). In addition, the rehabilitation of the Parkes Way median and the increase in vegetation areas as described in **Section 16.3.2.1** and quantified in **Table 16-3** would improve GSM habitat connectivity, and general habitat connectivity compared with the existing situation and broadly improve ecological connectivity within the delivery phase area.

As stated in **Section 16.3.2.1**using the methods outlined in the GSM Plan 2.1, as well as the planned landscaping in the delivery phase area, it is probable that the enhancement of ecological value can be achieved. With the provision of enhanced ecological value areas, and an increase in the total vegetation areas within the delivery phase area (refer to **Table 16-3**), it is also probable that ecological connectivity would be enhanced in the delivery phase area, within three years.

16.4 Preliminary risk assessment

A preliminary assessment of potential biodiversity impacts, without management and mitigation measures, is presented in **Table 16-4** below. The risk has been calculated using the methodology detailed in **Chapter 8.0 Environmental risk analysis approach**. There are no operational risks to biodiversity and ecology.

Given all direct and indirect impacts to GSM and their associated management and mitigation measures have been approved under the EPBC Act (2019/8582) and are managed in accordance with the Conditions of Approval, risks to GSM have not been assigned a risk level.

Table 16-4 Preliminary risk assessment for biodiversity and ecology during construction

Risk	Discussion	Likelihood	Consequence	Rating
A decrease in biodiversity value due to removal of vegetation	Removal of vegetation within the delivery phase area would be required to facilitate construction of the Project and site access. Following construction, trees would be planted within the delivery phase	Possible	Minor	Low

Risk	Discussion	Likelihood	Consequence	Rating
	area in accordance with an approved landscape management plan.			
Impacts to native fauna and flora encountered during construction	The CEMP which would be prepared by the construction contractor would include an unexpected flora and fauna finds protocol, prepared in accordance with the NC Act.	Possible	Minor	Low

16.5 Management and mitigation measures

Management and mitigation measures have been proposed to reduce the potential biodiversity impacts of the Project identified in the assessment.

Management and mitigation measures and safeguard protocols adopted for the Project are provided in **Table 16-5**, and have been prepared with the following objectives:

- Avoid any unplanned disturbance to habitat values.
- Minimise impacts on hollow dependent fauna species.
- Avoid weed infestation due to land disturbance.
- Ensure the Project is undertaken in a manner consistent with the existing EPBC Act Approval.

The GSM Plan 2.0 includes the management and mitigation measures in **Table 16-5** relevant to GSM.

Table 16-5 Management and mitigation measures – Biodiversity and ecology

Ref	Management and mitigation measure	Timing	Reference
B1	Establish 'no go zones' by marking-out the delivery phase area. Clearly identify limits though signage and fencing. The details of fencing and signing measures to be implemented would, as necessary, be the subject of an NCA Works Approval and Development Application.	Prior to clearing activities, during construction	
B2	Retain trees wherever possible. Trees to be retained should be marked and care taken to not disturb or compact the root zone of these trees. Pruning or lopping of branches should be minimised, and if required conducted by a suitably qualified arborist.	Prior to and during construction	
B3	Trees proposed to be removed should be checked for potential habitat (e.g., hollows) prior to felling. The CEMP would outline proposed management measures in the event fauna is present.	Prior to clearing activities during construction	
B4	The following control measures are to be implemented in line with standard biosecurity protocols including: • Inspect vehicle, equipment, and footwear prior to entering site	During Construction	Golden Sun Moth Construction Environmental Management and Rehabilitation Plan (GSM Plan (as amended)) (ACT Government, 2022b)

Ref	Management and mitigation measure	Timing	Reference
	• Preferably clean all vehicles, equipment, and footwear offsite prior to entering or leaving the site • If vehicles are not clean prior to entering site utilise dedicated cleaning bays at the compounds • Within wash bays clean footwear, equipment and vehicles with a hard brush or stick to remove as much mud, soil and organic matter as practicable before disinfecting with a solution of 70% methylated spirits and 30% water applied through a spray bottle.		
B5	Undertake weed management through weed removal and disposal without stockpiling; cleaning and wash down of equipment, and appropriate importation of material to site	During construction	Invasive Plants Control Plan 2020-25
B6	A GSM Plan (as amended) covering Project activities has been developed and approved by DCCEEW prior to the commencement of works. Measures within the GSM Plan (as amended) must be implemented throughout construction. Those include: • Competence, training and awareness, including environmental inductions and toolbox talks • Environmental monitoring and inspections • Compliance reporting and auditing.	Prior to Construction	EPBC Act Approval 2019/8582 GSM Plan (as amended) (ACT Government, 2022b)

16.6 Residual risk assessment

A residual risk impact assessment was undertaken to assess the remaining biodiversity issues after the proposed management and mitigation measures are applied, presented in **Table 16-6**. EPBC Approval 2019/8582 provides approval of residual impacts associated with GSM impacts, with conditions.

Table 16-6 Residual risk assessment for biodiversity and ecology during construction

Risk	Likelihood	Consequence	Rating
A decrease in biodiversity value due to removal of vegetation.	Possible	Minor	Low
Impacts to native fauna and flora encountered during construction.	Possible	Minor	Low

17.0 Hydrology and water quality

This Chapter provides an overview and assessment of the potential hydrology and water quality impacts associated with the construction and operation of the Project.

17.1 Approach

The Preliminary Environmental Risk Assessment (**Appendix C (PERA)**) identified risks relevant to hydrology and water quality, including two very low construction risks and two operational risks. In accordance with the methodology provided in **Chapter 8.0 Environmental risk analysis approach**, this Chapter has been prepared to further document and assess hydrology and water quality risks with consideration of subsequent design development.

The following approach was adopted to assess potential hydrology and water quality impacts associated with the Project:

- Desktop review of ACTmapi Flood Map and review of the Flood Study prepared for the Project
- Review of historical water quality data for LBG
- Construction and operational impact assessment
- Development of management and mitigation measures
- Determination of residual impacts.

17.1.1 Hydrology assessment considerations

The hydrology assessment considers the Canberra CBD catchment, which encompasses the entirety of the delivery phase area, and areas to which runoff from the delivery phase area would drain.

Scenarios assessed in this Chapter refer to Annual Exceedance Probability (AEP), specifically:

- 5% AEP: A flood with a one in a 20 chance of occurring in any year (minor storm event)
- 1% AEP: A flood with a one in a 100 chance of occurring in any year (major storm event).

Flood extent was assessed for both minor and major storm events, and flood hazard was assessed for the major storm event. Sensitivity analysis for climate change was undertaken to assess the potential impacts on flood behaviour. An increase in rainfall intensity of 20% was adopted in the modelling for the major storm event.

17.1.2 Water quality assessment considerations

Water quality objectives for the Project have been agreed for a ‘neutral or beneficial effect’ (NorBE) i.e., a minimum target of ‘no increase in pollutant loads as a result of the Project,’ relative to the existing water quality environment. As water quality in Lake Burley Griffin (LBG) is dominated by highly urbanised land uses in the CBD catchment, and the Project would affect a relatively small part of this catchment, the Project has been designed to meet the neutral effect target, rather than attempting to improve LBG’s water quality (refer to **Section 17.2.2** below). Management and mitigation measures would be implemented to meet the NorBE objective, as described in **Section 17.5**.

17.2 Existing environment

The existing environment in which the Project would be carried out assumes the completion of the RLC project (commenced October 2022). The Project would be located within the Canberra CBD catchment. The CBD catchment contains a mixture of residential, urban and commercial precincts. Stormwater runoff from the catchment predominantly flows in a southerly direction where it enters a system of underground stormwater pipes, discharging at various outlets into LBG.

17.2.1 Hydrology

Figure 17-1 and **Figure 17-2** show the flood extent for the 5% AEP (minor) and 1% AEP (major) storm events under existing conditions. There are several locations along London Circuit where the flood depth would be greater than 50 mm above the top of the kerb in both the minor and major storm events, indicating that the existing stormwater network cannot accommodate these events.

ARR2019 classifies flood hazard in accordance with the Australian Disaster Resilience Handbook (Geoscience Australia, 2019). This specifies six categories of hazard, as shown on **Figure 17-3**. Under existing catchment and drainage conditions within the delivery phase area and surrounds and with existing stormwater drainage infrastructure, the major storm event poses a low flood hazard in most areas (H1 risk classification) with very limited and isolated areas above risk class H3, meaning that a 1% AEP event would largely be safe for vehicles, people and buildings (see **Figure 17-4**).

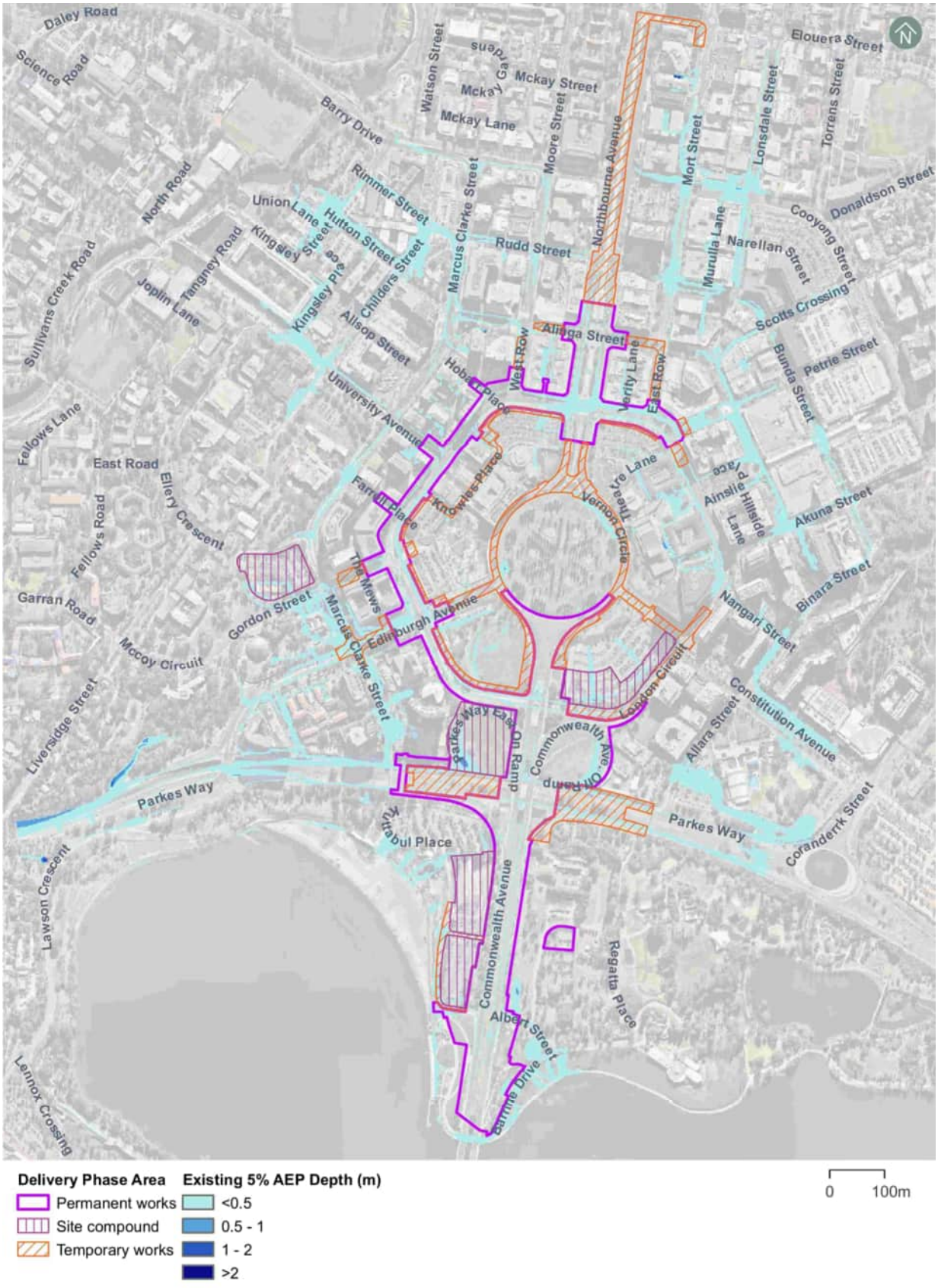


Figure 17-1 Existing conditions 5% AEP flood extent (m)

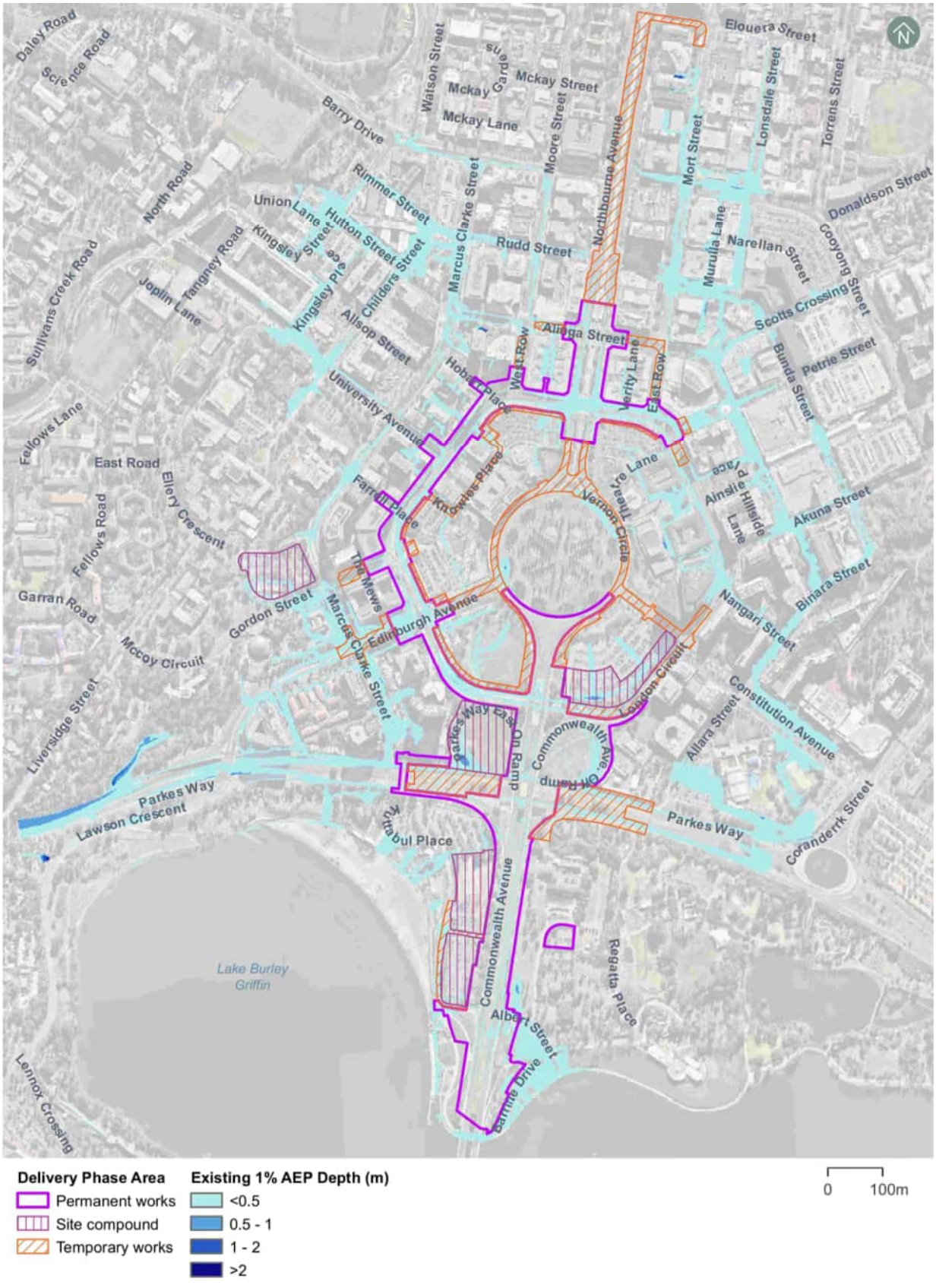


Figure 17-2 Existing conditions 1% AEP flood extent (m)

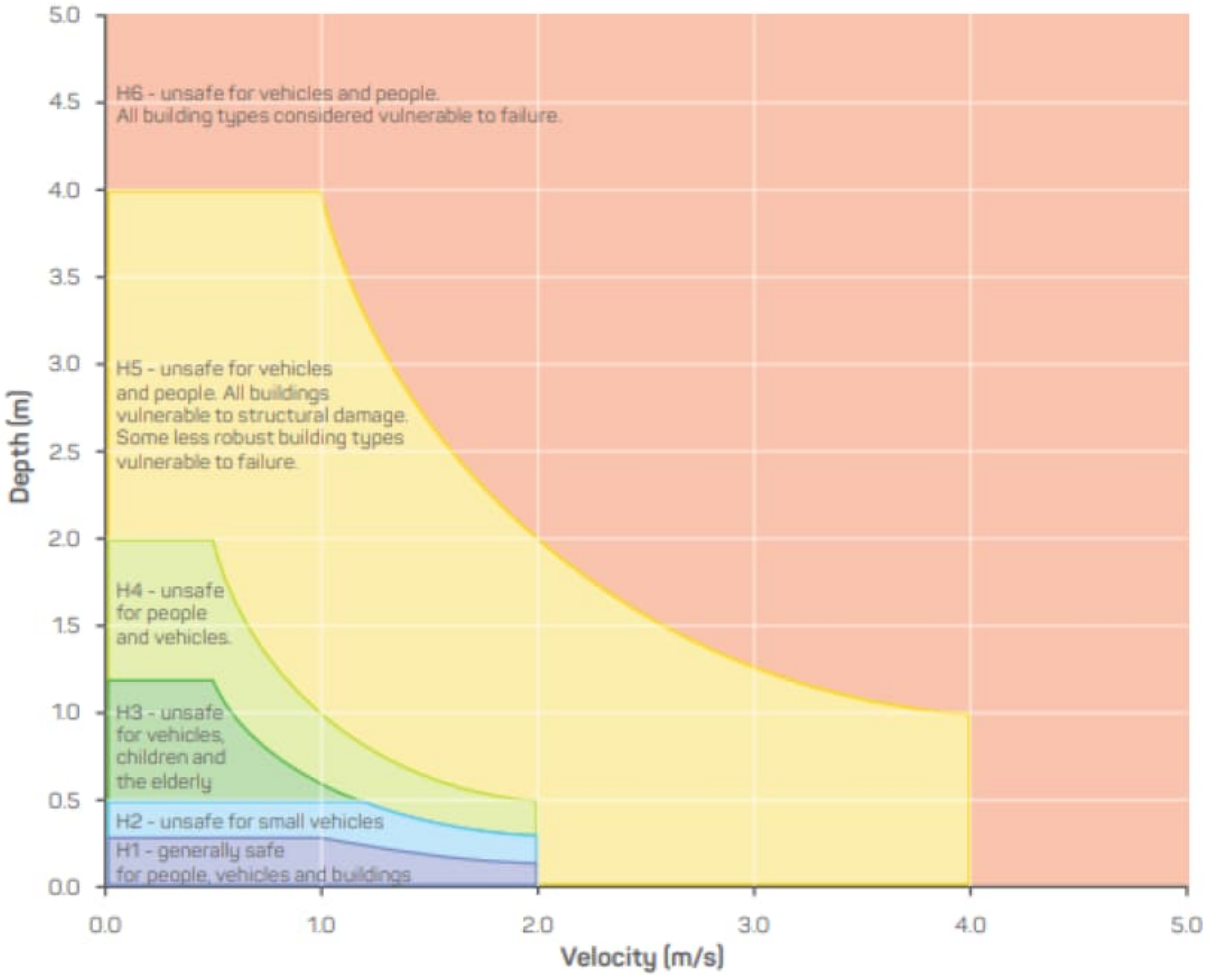


Figure 17-3 ARR2019 flood hazard classifications (Geoscience Australia, 2019)

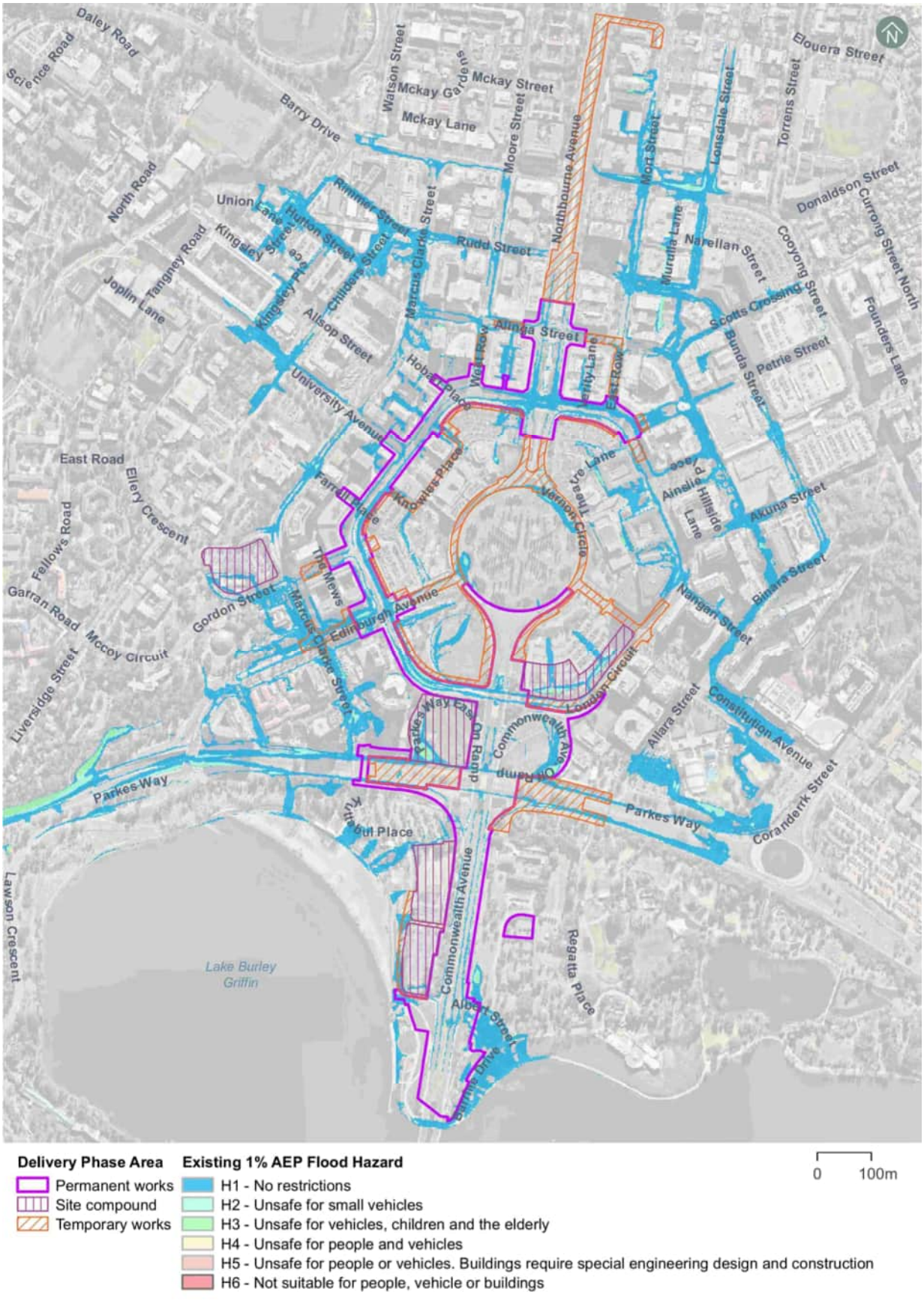


Figure 17-4 Existing conditions 1% AEP flood hazard (m)

17.2.2 Water quality

Water quality data was collected from LBG between 2017 and 2022 via the NCA LBG water quality monitoring program. To ensure baseline water quality data sampled was representative of long-term water quality trends, peak and average baseline data from the last five years was collected from the NCA, where available. Seasonal data over the last five years was used in the baseline assessment as opposed to time-of-day data over the same period as:

(a) Algal blooms are a primary water quality concern for LBG, and

(b) Cyanobacterial blooms respond strongly to seasonal effects.

Parameters collected were as follows:

- Rainfall (days/month)
- Turbidity (NTU)
- Phosphorus (µg/L)
- Nitrogen (µg/L)
- Algal volume (mm^3/L)
- Cyanobacteria count (cells/mL).

Data was available for the above biological parameters on a seasonal basis, typically from October to April but occasionally into May and June as well. The baseline data indicates that LBG has a total phosphorus concentration (60.1 µg/L) six times the ANZG recommended level of 10 µg/L. In addition, the observed total nitrogen concentration is almost three times (1,044.5 µg/L) the recommended level of 350 µg/L for slightly disturbed lakes and reservoirs.

This data indicates that LBG is prone to algal blooms, particularly in the warmer months and in low rainfall periods. In addition, these values far exceed the ANZG default trigger values for slightly disturbed ecosystems (lakes and reservoirs) (ANZECC, 2000).

A summary of water quality in LBG is provided in **Table 17-1**. The overall mean values for each parameter are provided, and minimum and maximum values are provided for each parameter except days of rainfall per month.

Table 17-1 Historical LBG water quality monitoring data

Season	Rainfall (days/ month)	Turbidity (NTU)	Phosphorus (µg/L)	Nitrogen (µg/L)	Algal volume (mm^3/L)	Cyanobacteria (cells/mL)
2016-17	10	10.1-28.0	33-65	640-740	0.0019-18.7	1,020-225,000
2017-18	8	2.3-13.9	7-52	460-720	0.0014-26.5	275-1,220,000
2018-19	8	1.6-14.6	15-44	560-960	0.0021-256.0	285-2,930,000
2019-20	7	1.2-21.8	12-92	450-1,530	0.0002-21.9	190-238,000
2020-21	10	11.8-451.0	45-1,380	800-19,500	0.0029-1,510.0	509-6,490,000
2021-22	11	7.0-32.9	40-81	800-1,160	0.0002-2.8	124-14,400
Overall mean	**9**	**14.9**	**60.1**	**1,044.5**	**14.836**	**117,470.6**

Several activities in the Molonglo River catchment are likely to affect the baseline data for water quality, including:

- Other proposed construction projects in the area
- Commercial and high-density residential urban land uses, which:
  - Facilitate higher levels of waste generation than other land use zones (e.g., Canberra CBD)
  - Often feature landscaped gardens where pesticides and fertilisers are used
  - Are more likely to have nearby construction projects.
- Discharges from Queanbeyan wastewater treatment plant.

Other than these activities, land uses are predominantly rural in the Molonglo River catchment upstream of the Project.

17.3 Assessment of potential impacts

17.3.1 Construction

17.3.1.1 Flooding impacts

The Project would include substantial and large-scale civil works, which would modify normal drainage direction and overland flow paths. There is potential for sediment to be directed into the drainage network during construction. Without appropriate management, this may result in blockage of the onsite stormwater management network, reducing its effectiveness and increasing the likelihood of onsite flooding or flooding downstream.

17.3.1.2 Water quality impacts

Construction activities associated with the Project have the potential to impact surface water quality and flow. These activities may include:

- Removal of trees
- Stripping, stockpiling and reuse of topsoil
- Utilities treatments requiring excavation and stockpiling spoil onsite
- Earthworks
- Installation of new stormwater drainage, utilities, road pavements, hard and soft landscaping
- Temporary works, including sheet piling to support existing earth and terrain, diversions of water, erosion and sediment controls
- The construction and operation of temporary compounds that would comprise the construction site office and worker amenities, equipment and material storage, temporary storage of waste, chemical and fuel storage and storage of construction plant and parking for light and heavy vehicles.

The Project may indirectly impact LBG water quality as the delivery phase area is drained by a stormwater pipe network which ultimately discharges to LBG. There is potential for the water quality of LBG to be impacted by the Project during construction, such as during flood events where potential contaminants from spills and leaks may be washed from the delivery phase area into the lake. There is also the potential for disturbed soil during construction to increase sediment load in stormwater runoff. Increased sediment load can disrupt downstream aquatic habitats and potentially support algal blooms.

Water discharge would produce no scour threat to sensitive aquatic receivers due to energy dissipation provided at stormwater discharges that facilitate quick dispersion of stormwater as it reaches LBG. Therefore, sensitive aquatic flora and fauna environments in or downstream from LBG are very unlikely to be impacted by stormwater runoff over the delivery phase area.

With standard management and mitigation measures in place, construction is not anticipated to have any significant impact on existing water quality in the receiving waters downstream of the site. Any exceedances would likely be localised, short term and within natural variances. In addition, water quality would stabilise once construction works are completed.

17.3.2 Operation

17.3.2.1 Flooding impacts

The Project involves upgrading the existing stormwater network to cater for flow characteristic changes and projected climate change. Once operational, the upgraded drainage infrastructure would be capable of conveying floodwaters up to and including the 1% AEP (major) storm event (refer **Figure 17-5**). LRV operations would not be impacted by a 5% (minor) storm event with the upgraded drainage network, with standing water depth limited to 40 mm (refer **Figure 17-6**). There are some areas outside the proposed alignment that would still experience flood depths of more than 50 mm in a major storm event, however these areas would still experience reductions in flood depth compared with existing conditions.

Most areas that are predicted to flood during the major storm event would be classified as low risk (H1), except for small areas of the southwest and southeast cloverleaves which would be low-medium risk (unsafe for vehicles, children and the elderly) (refer **Figure 17-7**). While publicly accessible, these locations are not frequently used by pedestrians. In a flooding emergency, light rail commuters would be able to safely exit the LRV at the nearest stop, with a maximum low risk (H1) flooding projected in a major storm event at Edinburgh Avenue. There are no areas within the delivery phase area that would be above risk class H3. These impacts would be a small improvement from existing conditions.

The above assessment of operational flooding impacts must be considered in the context of the Project extent. Flood impact mitigation in the existing environment is constrained by the size of surrounding drainage infrastructure. Although all drainage infrastructure associated with the Project has been sized such that full mitigation of flooding impacts, including for the climate change scenario, can be achieved, this requires upgrade of drainage infrastructure outside the Project extent by others in the future.

17.3.2.2 Water quality impacts

Stormwater treatment has been incorporated into the Project design, with a minimum water quality target of no increase in pollutant loads entering LBG as a result of the Project (NorBE).

Potential contaminants would include general litter and waste, sediment, minor discharges of hydrocarbons from vehicles (such as engine oil leaks), and wear products from vehicle parts (such as tyres and brakes). Potential contaminants would build up on impervious surfaces over time and during rainfall events may end up discharged into the environment. Water discharge would produce no scour threat to sensitive aquatic receivers due to energy dissipation provided at stormwater discharges that facilitate quick dispersion of stormwater as it reaches LBG. Therefore, sensitive aquatic flora and fauna environments in or downstream from LBG are very unlikely to be impacted by stormwater runoff over the delivery phase area.

To mitigate potential impacts associated with increased contaminant loads entering LBG via the stormwater network, permeable landscaping and passive irrigation (directing runoff from paved areas to areas where water can infiltrate into the landscape soils) have been incorporated into the design of the Project. With these management and mitigation measures in place, the potential pollutant loads discharged by the Project to the Lake would be reduced compared with existing conditions.

17.3.2.3 Irrigation of green tracks and landscaping

Landscaped areas and green tracks along sections of the Project alignment would be irrigated with stormwater runoff directed from adjacent pavement (i.e., passive irrigation).
This would be supplemented by groundwater pumped from a proposed new bore, subject to separate approvals, installed between the Capital Tower car park and Parkes Way. The irrigation required, and therefore the amount of groundwater extracted, would be based on soil water meters installed in landscaping and green tracks, which would restrict groundwater irrigation to occur only when soil moisture levels are low. For most of the year, around 100 kL of water would be required for drip irrigation per week, however this is dependent on seasonal variation and plant water requirements. This water would be non-potable.

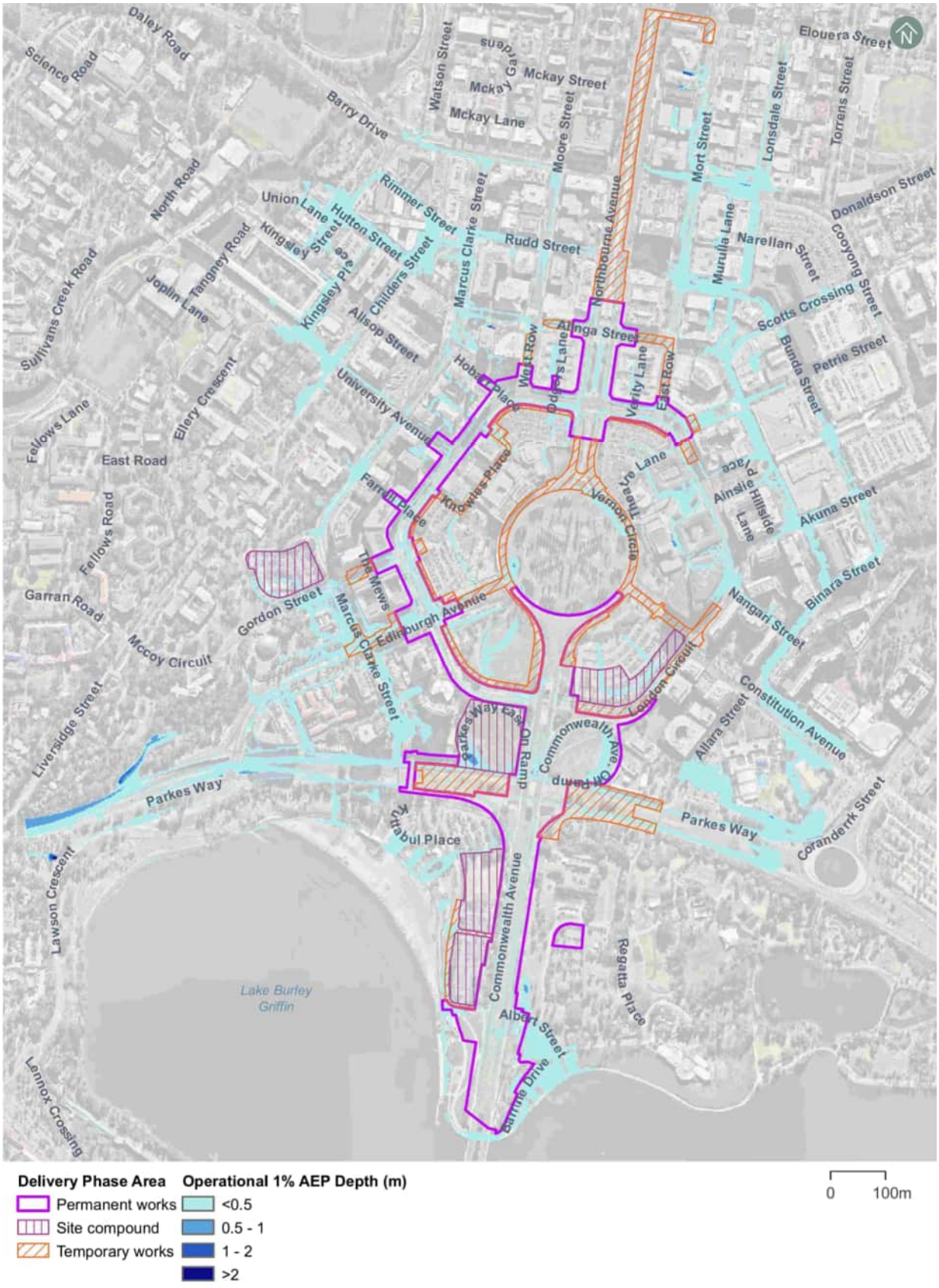


Figure 17-5 Operational flood extent (1% AEP event) (m)

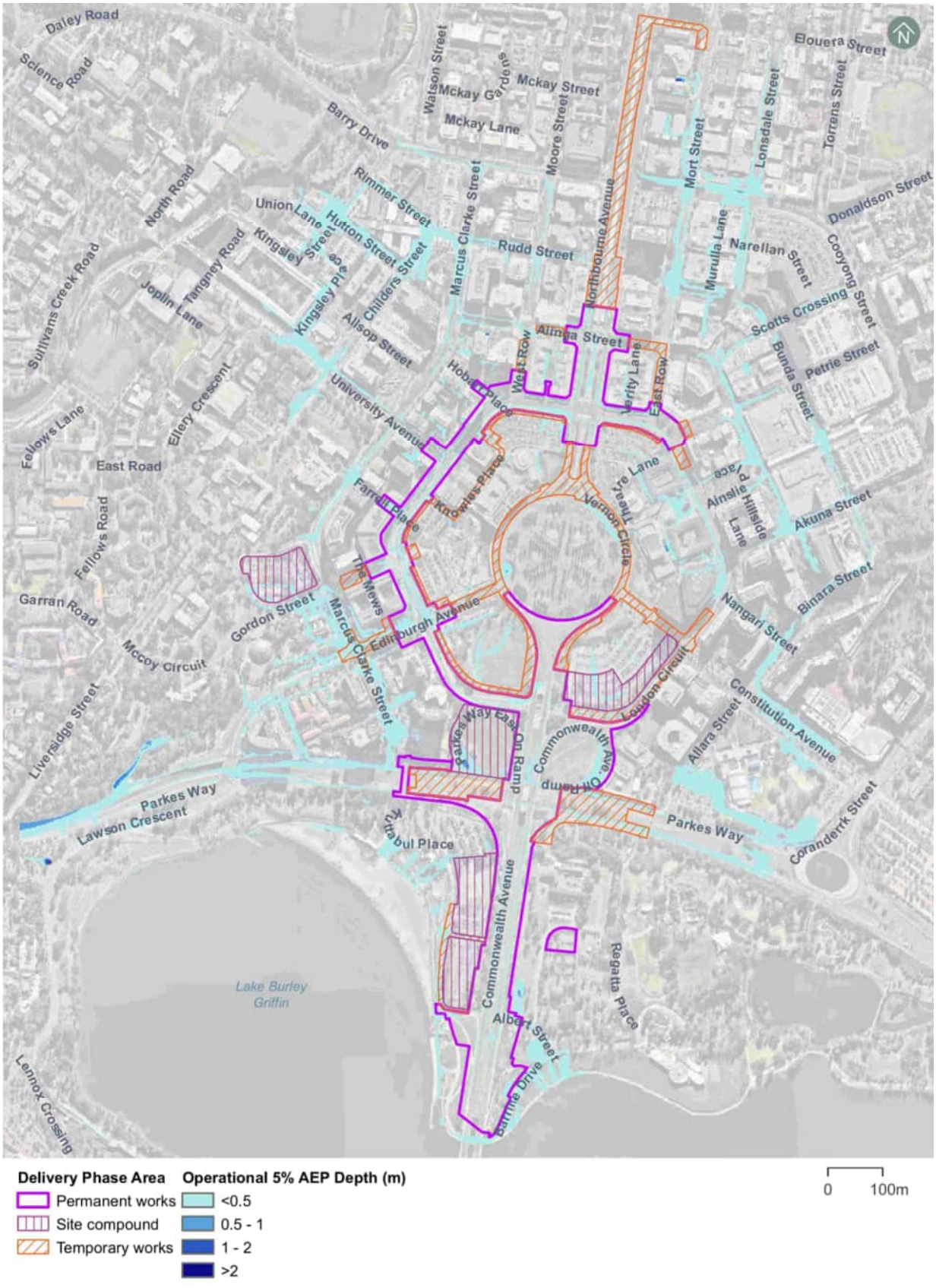


Figure 17-6 Operational flood extent (5% AEP event) (m)

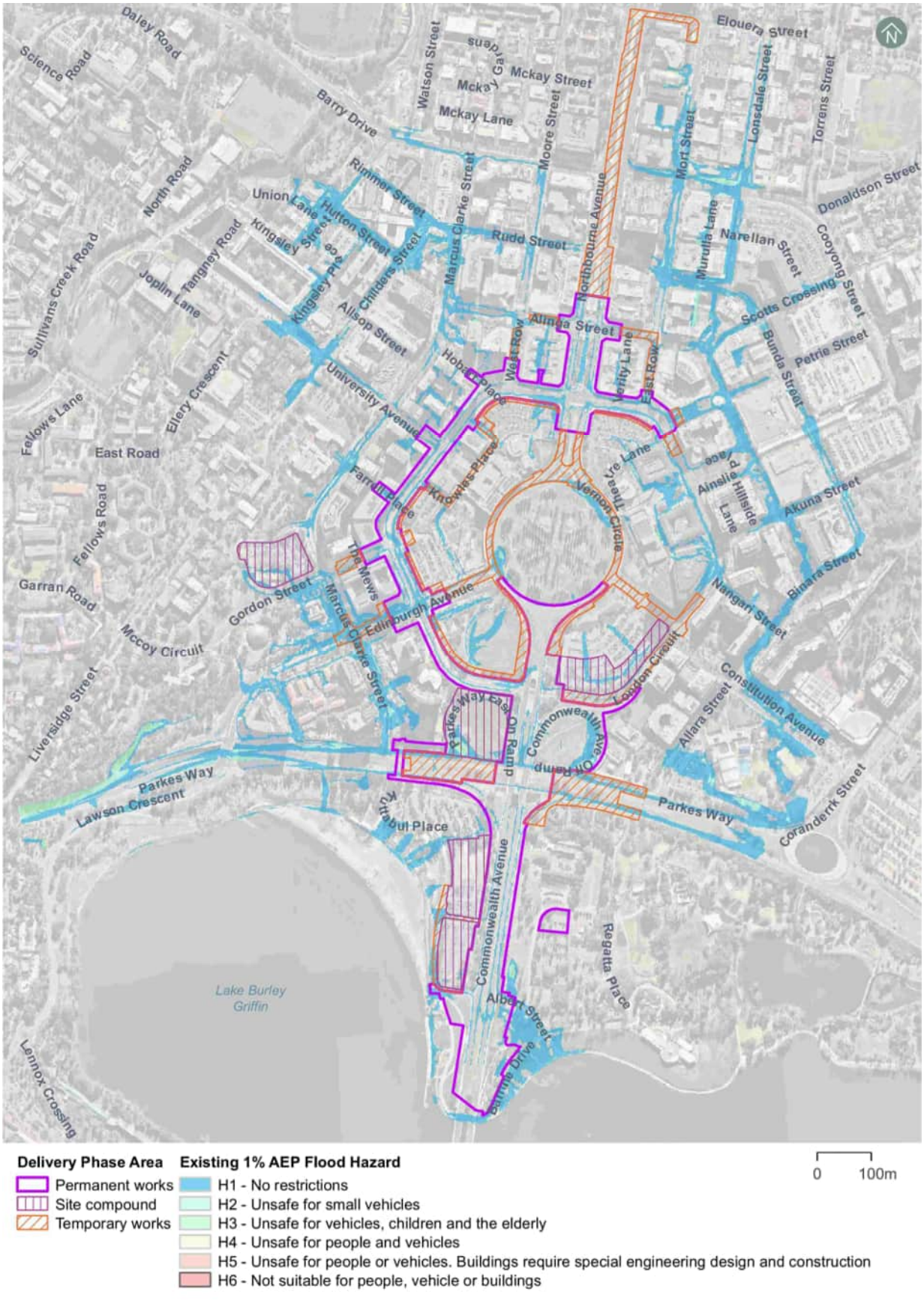


Figure 17-7 Flood hazard during operation of the Project (1% AEP event)

17.4 Preliminary risk assessment

A preliminary assessment of potential hydrology and water quality impacts, without Project-specific management and mitigation measures, is presented in **Table 17-2** and **Table 17-3** below. The risk has been calculated using the methodology detailed in **Chapter 8.0 Environmental risk analysis approach**.

Table 17-2 Preliminary risk assessment for hydrology and water quality during construction

Category	Description	Likelihood	Consequence	Rating
Frequency and extent of flooding events	The Project would include earthworks which would temporarily modify drainage direction and overland flow paths. There is potential for large quantities of sediment to enter LBG via the stormwater network during construction. If not appropriately managed, this could result in onsite flooding or flooding downstream.	Unlikely	Minor	Very Low
LBG water quality	There is a small risk of exposed soils and contaminants from plant and equipment to be discharged into LBG during flooding events. This potentially contaminated runoff could impact LBG water quality if not adequately managed.	Unlikely	Minor	Very Low
Uncontrolled runoff	Stormwater and surface water quality from uncontrolled runoff.	Possible	Minor	Low

Table 17-3 Preliminary risk assessment for hydrology and water quality during operation

Category	Description	Likelihood	Consequence	Rating
Frequency and extent of flooding events	The Project is not anticipated to impact on the frequency and extent of flooding events once construction is complete as landform and flow direction of runoff would not significantly change.	Rare	Minor	Negligible
LBG water quality	Stormwater treatment has been incorporated into the Project design, with a minimum target of no increase in pollutant loads as a result of the Project (refer **Section 17.1.2**). Potential contaminants include general litter and waste, sediment, minor leaks of hydrocarbons from vehicles (such as engine oil leaks), and wear products from vehicle parts (such as tyres and brakes). Potential contaminants would build up on impervious surfaces over time and during rainfall events may be discharged into LBG.	Unlikely	Minor	Very Low

17.5 Management and mitigation measures

Management and mitigation measures have been proposed to reduce the potential hydrology and water quality impacts of the Project identified in the assessment.

Management and mitigation measures and safeguard protocols adopted for the Project are provided in **Table 17-4**, and have been prepared with the following objectives:

- To ensure that the Project contributes to the long-term resilience of the stormwater network to projected climate changes impacts.

- Collect relevant information to establish Project performance in maintaining local water quality values.
- Ensure that Water Sensitive Urban Design measures continue to work effectively throughout operation.
- Minimise potable water use.

Table 17-4 Management and mitigation measures – Hydrology and water quality

Ref	Management and mitigation measure	Timing	Reference
WH1	Within the delivery phase area, stormwater infrastructure would be sized to account for projected climate change, consistent with TCCS standards, and enable future downstream network augmentation to be completed by others.	Detailed design	MIS08 Stormwater
WH2	Prior to discharge into the receiving stormwater system, water quality monitoring would be undertaken and recorded	Prior to and during construction	*Environment Protection Act 1997* (ACT) ACT EPA *Discharge from Sediment Control Ponds*
WH3	Detailed asset handover information would be developed to describe: • The function of porous paving and how it is to be maintained in accordance with manufacturer's instructions to maintain permeability • The passive irrigation/rain garden infrastructure and how it is to be maintained to keep it free of blockage	During construction and operation	
WH4	Consider use of water saving measures such as rainwater tanks at construction compounds.	Prior to and during construction	-
WH5	Non-potable water is to be used wherever feasible during construction and during operation for irrigation of green track and ongoing maintenance.	During construction and operation	-

17.6 Residual risk assessment

A residual risk assessment was undertaken to assess the potential hydrology and water quality impacts after the proposed management and mitigation measures are applied, presented in **Table 17-5** and **Table 17-6**. No significant residual impacts on hydrology and water quality are anticipated.

Table 17-5 Residual risk assessment for hydrology and water quality during construction

Category	Description	Likelihood	Consequence	Rating
Frequency and extent of flooding events	The Project would include earthworks which would temporarily modify drainage direction and overland flow paths. There is potential for large quantities of sediment to enter LBG via the stormwater network during construction. If not appropriately managed, this could result in onsite flooding or flooding downstream.	Unlikely	Minor	Very Low

Category	Description	Likelihood	Consequence	Rating
LBG water quality	There is a small risk of exposed soils and contaminants from plant and equipment to be discharged into LBG during flooding events. This potentially contaminated runoff could impact LBG water quality if not adequately managed.	Rare	Insignificant	Negligible
Uncontrolled runoff	Stormwater and surface water quality from uncontrolled runoff.	Unlikely	Minor	Very Low

Table 17-6 Residual risk assessment for hydrology and water quality during operation

Category	Description	Likelihood	Consequence	Rating
Frequency and extent of flooding events	The Project is not anticipated to impact on the frequency and extent of flooding events once construction is complete as landform and flow direction of runoff would not significantly change.	Rare	Minor	Negligible
LBG water quality	Stormwater treatment has been incorporated into the Project design, with a minimum target of no increase in pollutant loads as a result of the Project (refer **Section 17.1.2**). Potential contaminants include general litter and waste, sediment, minor leaks of hydrocarbons from vehicles (such as engine oil leaks), and wear products from vehicle parts (such as tyres and brakes). Potential contaminants would build up on impervious surfaces over time and during rainfall events may be discharged into LBG.	Rare	Insignificant	Negligible

18.0 Resource management and waste minimisation

This Chapter provides an overview and assessment of the potential waste impacts associated with the construction and operation of the Project.

18.1 Approach

The Preliminary Environmental Risk Assessment (**Appendix C (PERA)**) identified risks relevant to resource and waste management, including four low to very low construction risks and four negligible operational risks. In accordance with the methodology provided in **Chapter 8.0 Environmental risk analysis approach**, this Chapter has been prepared to further document and assess resource and waste management risks with consideration of subsequent design development.

Given that all preliminary environmental risks identified were low to negligible, a technical assessment was not required. Resource use and waste impacts associated with the Project have been assessed qualitatively in this Chapter by reviewing likely resource consumption and waste streams during construction and operation. This Chapter documents the Project's commitment to better waste management, in accordance with the *ACT Waste Management Strategy 2011-2025* (EPSDD, 2011), through the identification of opportunities to:

- Relieve pressure on raw materials through the re-use and recycling of material
- Ensure Canberra remains a clean, safe place to live and enjoy through reducing litter, managing hazardous waste in accordance with current regulatory requirements and disposal to a licenced land fill as a last resort only. This includes identification of options for avoiding, mitigating and managing major waste streams in accordance with the waste hierarchy outlined in the *ACT Waste Management Strategy* (**Figure 18-1**)
- Provide waste facilities, regular cleaning and maintenance services during operation of the Project to assist in the cleanliness of stops, Light Rail Vehicles (LRVs) and the alignment.

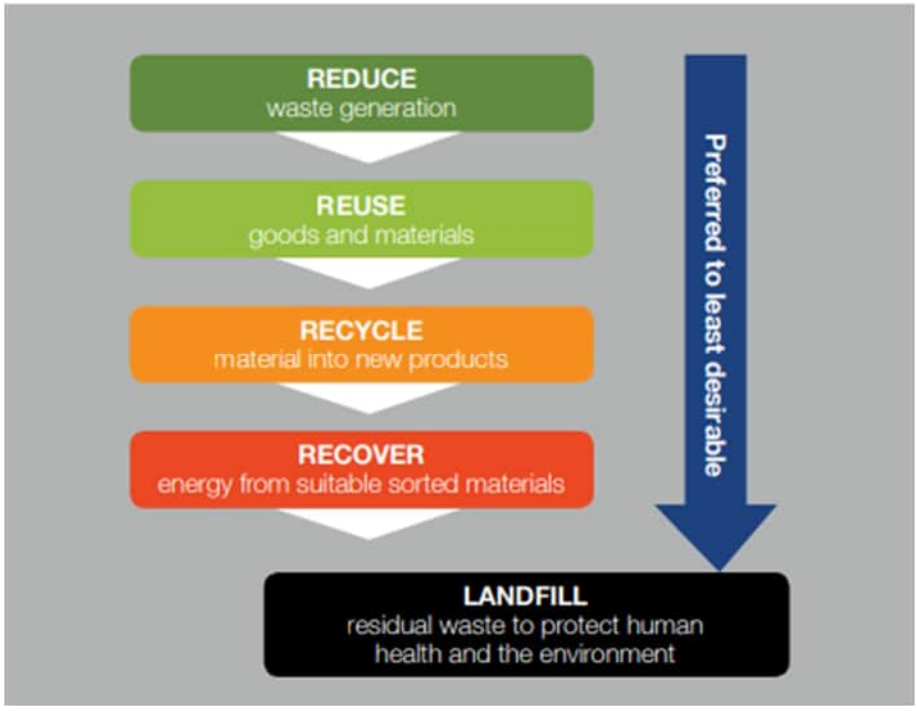


Figure 18-1 ACT waste hierarchy (EPSDD, 2011)

The three circular economy principles presented in the *Draft ACT Circular Economy Strategy 2022-2025* (TCCS, 2022) have also been considered by the Project, including designing out waste and pollution, keeping products and materials in use, and avoiding negative impacts to the environment and regenerating natural systems.

18.2 Assessment of potential impacts

The following provides an assessment of the potential impacts of the Project relating to resources and waste.

18.2.1 Construction

The construction methodology for the Project is provided in **Chapter 3.0 Project description**. **Table 18-1** summarises the anticipated resources and materials required for construction of the Project. The Project would seek to minimise the requirement for new materials as far as practical, designing out waste and pollution, including through the use of glass fibre reinforced polymer where possible as a replacement for traditional steel reinforcement, and through the use of geofabrics with recycled material content. Products and materials would be kept in use through re-use and recycling of materials (e.g., from demolition, clearing and grubbing, road resurfacing works and excavation). Examples of proposed waste reduction, re-use and recycling measures are provided in **Table 18-3**, and the Project would continue to explore opportunities to re-use materials onsite, where practicable.

Table 18-1 Resources and materials required for construction

Category	Resources and materials required (indicative)
Stops and precincts	• Imported engineering fill • Blinding concrete • Concrete pavers • Bench seats • Bins • Integrated service cabinets • Fabricated card reader poles • Ticketing machine • Drinking fountains • Driver facilities • Passenger information displays • Roof systems • Wall systems • Ceramic tile.
Roads and infrastructure	• Paving finishes (including cobble, granite and white limestone) • Kerb (including kerb, kerb ramps gutter and modified kerb) • Cyclist ramps.
Road furniture	• Bench seats • Decorative bollards • Standard single bike racks • Stainless steel hazard tactile studs • Sign posts • Closed circuit television (CCTV) and traffic camera hardware • Road barriers • Overhead wiring columns.
Landscaping	• Over 140 new trees • Soft-scaping, including ground cover plant species, shrubbery and planting mixes) • Irrigation materials including (mainline pipe, irrigation pipe and conduits).
Drainage	• Reinforced concrete pipe • Composite steel reinforced drainage pipe • Minor drainage pipe.
Street lighting	• Bronze street lamps • CCTV and traffic camera hardware.
Traffic signals	• Five new signalised 4-way intersection • Five new signalised T intersection.

Category	Resources and materials required (indicative)
Track works	• Concrete • Paved track • Green track (vegetation) • Track • Garden bed
Resources	• In addition to the requirement for construction materials, daily activities would require the consumption of potable water, electricity and fuel.

The construction of the Project would generate various waste streams, which are described in **Table 18-2**. **Table 18-3** summarises how the Project would seek to beneficially reduce, re-use and recycle material where practicable, keeping products and materials in use. Where storage and/or disposal of waste is required, this would be managed in accordance with a Project-specific Resource and Waste Management Plan (RWMP).

The receiving environment has the potential to be impacted if waste is not stored, managed or disposed of appropriately, through the release of waste material and inadvertent contamination of soils, groundwater and surface water for example. The consumption of materials and energy and the generation of waste have the potential to impact on the community and environment.

Table 18-2 Waste anticipated to be generated during construction

Waste	Description
Demolition waste	Concrete, steel, asphalt, copper, slurry from hydrovac excavations, bricks, pavers, timber and gravel.
General construction waste	Plastic and cardboard packaging, and excess construction material (such as concrete, timber, plastic and steel/metal).
Green waste	Organic waste from grubbing and vegetation removal.
Dangerous goods and hazardous substances	Waste oils and lubricants, excess corrosive substances (e.g., paints, chemicals and cement washout), asbestos containing material (from demolition), and contaminated soil material (e.g., in the event of an accidental spill).
Domestic waste	Food scraps, glass and plastic bottles, carboard/paper and plastic containers from site personnel.
Wastewater	Site run-off, water used to control dust, grey water and slurry from vacuum excavation trucks.
Sewage	Sewage from onsite toilets.
Spoil	Excavated material and excess fill material including topsoil, contaminated spoil and clean spoil.
Office waste	Paper, e-waste, plastics, food-waste, printing products and office equipment.

Table 18-3 Proposed material re-use and recycling

Activity	General re-use or recycling measures
Construction site establishment, trenching and general demolition	• Temporary gravel pavements installed during construction would be re-used onsite in service trench backfill, and select material would be re-used in new pavements where practicable. Recycled crushed concrete, recycled aggregate

Activity	General re-use or recycling measures
	(recycled ballast) and recycled glass sand may also be used as trench bedding and backfill material. • Excavated material from services would be re-used in backfilling or as fill onsite where possible to minimise the export of material and import of additional material • The following materials would be re-used/recycled either onsite, or otherwise separated and taken to a facility that is capable of recycling that material: - Concrete (e.g., concrete pipes) - Steel and copper (e.g., steel streetlights, guard rails, bridge rails) - Asphalt millings. • Any excess asphalt or concrete delivered to site would be recycled into rap or gravel products.
Clearing and grubbing	• Vegetation material would be mulched and stockpiled for re-use onsite or at other locations. In the instance that weeds or pathogens are identified in waste vegetation material, this would be contained and removed from site to undergo required treatment (if possible) prior to being directed to reuse, or otherwise disposed of, as appropriate. • Excess topsoil (subject to non-contamination) would be re-used where feasible, or taken to landscape yard and processed for use on landscape projects.
Domestic recyclable waste	• Domestic recyclable waste would be disposed of via mixed recycling bins.
Re-use of externally sourced waste	• Use of waste that is not generated by the Project. For example, the re-use of waste such as reconophalt or printer cartridges in asphalt layers. • Use of recycled steel in lieu of new steel reinforcement or basalt fibre rebar and use of macro synthetic fibres where feasible.

Management and mitigation measures to minimise potential resource and waste related impacts are provided in **Section 18.4**.

18.2.2 Operation

Resource consumption and waste generation during the operational phase of the Project are anticipated to be minimal. **Table 18-4** summarises the anticipated resources and materials required for the operation of the Project. The operation of the Project would generate various waste streams, which are described in **Table 18-5**.

Table 18-4 Resources and materials required for operation

Category	Resources and materials required
General operation	Daily operation would require the consumption of potable water, non-potable water (irrigation of green track) electricity (including solar- generated electricity) and fuel. It would also generate paper (ticketing), and plastic for MyWay passes.
Maintenance and repair	Repairs and maintenance would require resources and materials such as fuel, oils, lubricants, paints, electrical components, plastics, steel, etc.

Table 18-5 Waste anticipated to be generated during operation

Waste	Description
Domestic waste	Food scraps, glass and plastic bottles, carboard/paper and plastic containers from passengers and staff. Recyclable collection points at light rail stops would be provided.
Sewage	Sewage from onsite staff toilets.
General	Waste associated with the cleaning, repair and maintenance of light rail stops, LRVs, the alignment, ancillary infrastructure, and street furniture.
Green waste	Green waste from vegetation and green track maintenance.

18.3 Preliminary risk assessment

A preliminary risk assessment of potential construction and operational resource and waste related impacts without the implementation of management and mitigation measures are presented in **Table 18-6** and **Table 18-7**, respectively. The risk has been calculated using the methodology detailed in **Chapter 8.0 Environmental risk analysis approach**.

Table 18-6 Preliminary construction risk assessment – resource and waste impacts

Category	Description	Likelihood	Consequence	Rating
Generation of waste that contributes to landfill	Waste generated by the Project ends up in landfill as it is either not reusable or recyclable, or is incorrectly disposed of.	Unlikely	Minor	Very Low
Incorrect storage and disposal of waste	Industrial/construction/demolition waste, including dangerous goods and hazardous chemicals, are stored, or disposed of incorrectly, causing contamination, resulting in the generation of waste that must be removed offsite and disposed of at an appropriate facility.	Likely	Minor	Medium
Uncontrolled release of waste	Uncontrolled release of waste products to the environment and inadvertent contamination of onsite soil, groundwater and surface water resulting in the generation of waste that must be removed offsite and disposed of at an appropriate facility.	Unlikely	Moderate	Low

Table 18-7 Preliminary operational risk assessment – resource and waste impacts

Category	Description	Likelihood	Consequence	Rating
Substantial green waste generation that requires management and disposal	Green waste would be generated from vegetation maintenance on verges and medians. This is not considered to be significant and would not differ greatly from the current maintenance activities required in the delivery phase area.	Remote	Insignificant	Negligible
Substantial other resource	Resource consumption and waste generation during the	Remote	Insignificant	Negligible

Category	Description	Likelihood	Consequence	Rating
consumption and waste generation that requires management and disposal	operational phase of the Project are anticipated to be minimal and limited to maintenance activities, therefore not requiring substantial waste management activities.			
Uncontrolled release of waste	Uncontrolled release of waste products to the environment and inadvertent contamination of onsite soil, groundwater and surface water resulting in the generation of waste that must be removed offsite and disposed of at an appropriate facility.	Remote	Moderate	Very Low

18.4 Management and mitigation measures

Management and mitigation measures have been proposed to reduce the potential resource use and waste impacts of the Project identified in the assessment.

Management and mitigation measures and safeguard protocols adopted for the Project are provided in **Table 18-8**, and have been prepared with the following objectives:

- Minimise additional pressure on the ACT waste and resource management facilities.
- Maximise the reuse and recycling of waste.
- Ensure correct disposal of waste and hazardous materials.
- Ensure correct storage of hazardous materials.

Management and mitigation measures related to the management and disposal of potential contaminated material encountered during construction is found in **Chapter 11.0 Contamination and soil**.

Table 18-8 Management and mitigation measures – Resources and waste

Ref	Management and mitigation measure	Timing	Reference
RM1	A Resource and Waste Management Plan (RWMP) will be prepared prior to construction commencing that details strategies to apply the waste and circular economy hierarchies during construction. The RWMP would include performance targets for waste re-use and generation and monitoring performance against targets, and require justification where a higher-level option from the hierarchies was not selected if applicable.	Prior to and during construction	ACT Waste Management Strategy 2011–2025 ACT Circular Economy Strategy ISC IS Rating Tool Version 1.2
RM2	Where green waste from vegetation removal and topsoil cannot be reused onsite, reuse on other nearby sites would be investigated, and undertaken wherever practical.	During construction	ISC IS Rating Tool Version 1.2 (Lan-2)
RM3	Providing recycling and re-use facilities at construction compounds and worksites for use of staff and making arrangements for the recycling of materials from construction activities.	During construction	

Ref	Management and mitigation measure	Timing	Reference
RM4	Reuse and recycle materials where feasible during operation to minimise the amount of material sent to recycling and re-use facilities.	Operation	
RM5	Worksites would be maintained in a tidy state, and all general litter would be appropriately disposed of, and recycled where possible.	During construction	RLC EA (AECOM, 2021b)
RM6	Waste and hazardous materials generated from the construction of the Project would be transported to an appropriately licensed waste and hazardous materials disposal or transfer facility. Where required, this would include using a licensed contractor to remove regulated waste and hazardous materials, under current ACT EPA Guidelines.	During construction	Environment Protection Act 1997 (and Regulation) and accompanying Environment Protection Policies
RM7	All waste disposal would be monitored and recorded in accordance with the Resource and Waste Management Plan (RWMP) including volumes and categories of waste, transport and end point. This would be reviewed monthly by a qualified professional, with at least five years' waste management experience, or a NABERS Assessor, or equivalent.	During construction	
RM8	Hazardous chemicals and other volatile waste would be stored in accordance with the Dangerous Substances Act 2004.	During construction and operation	

Notes:
1 The site is subject to a contaminated site audit. All material removed would be subject to EPA requirements and records of materials removed would support the final audit. Refer to **Chapter 11.0 Contamination and soil** for discussion of contaminated material disposal.

18.5 Residual risk assessment

A residual risk assessment was undertaken to assess potential resource use and waste impacts after the proposed management and mitigation measures are applied. The residual construction and operation risk assessment is presented in **Table 18-9** and **Table 18-10**, respectively.

Table 18-9 Residual construction risk assessment for resource use and waste management

Category	Description	Likelihood	Consequence	Rating
Generation of waste that contributes to landfill	Waste generated by the Project ends up in landfill as it is either not reusable or recyclable, or is incorrectly disposed of.	Remote	Minor	Negligible
Incorrect storage and disposal of waste	Industrial/construction/demolition waste, including dangerous goods and hazardous chemicals, are stored, or disposed of incorrectly, causing contamination, resulting in the generation of waste that must be removed offsite and disposed of at an appropriate facility.	Unlikely	Minor	Very Low

Category	Description	Likelihood	Consequence	Rating
Uncontrolled release of waste	Uncontrolled release of waste products to the environment and inadvertent contamination of onsite soil, groundwater and surface water resulting in the generation of waste that must be removed offsite and disposed of at an appropriate facility.	Remote	Moderate	Very Low

Table 18-10 Residual operational risk assessment for resource use and waste management

Category	Description	Likelihood	Consequence	Rating
Substantial green waste generation that requires management and disposal	Green waste would be generated from vegetation maintenance on verges and medians. This is not considered to be significant and would not differ greatly from the current maintenance activities required in the delivery phase area.	Remote	Insignificant	Negligible
Substantial other resource consumption and waste generation that requires management and disposal	Resource consumption and waste generation during the operational phase of the Project are anticipated to be minimal and limited to maintenance activities, therefore not requiring substantial waste management activities.	Remote	Insignificant	Negligible
Uncontrolled release of waste	Uncontrolled release of waste products to the environment and inadvertent contamination of onsite soil, groundwater and surface water resulting in the generation of waste that must be removed offsite and disposed of at an appropriate facility.	Remote	Insignificant	Very Low

19.0 Cumulative impacts

Cumulative environmental impacts are the combined effect of individual impacts from multiple proposals occurring in proximity or concurrently at a given time. This Chapter provides an assessment of the potential cumulative impacts of the Project with other surrounding proposals in the area.

19.1 Approach

The following tasks were undertaken to assess the potential for cumulative impacts:

- Online searches to identify existing proposals (approved or under construction) and proposals in the planning phase within the vicinity of the Project, based on information in the public domain (**Section 19.2**). Searches included:
  - A review of the MPC website
  - Australian Government NCA– current projects
  - A search and review of media releases relating to major projects
- Review of information from stakeholder engagement to identify any proposals which have the potential to interact with the Project (refer to **Chapter 7.0 Consultation**)
- Identify and assess the significance of potential cumulative impacts by considering specific impacts from the Project with the potential for cumulative impacts with the other proposals identified, including:
  - consideration of the scale, location and timing of the other proposals, noting that information on the potential impacts (e.g., traffic, air quality and noise impacts) associated with each proposal is typically not publicly available and has been assumed based on understanding of the type and scale of each proposal.

19.2 Proposals and developments in proximity to the Project

The proposals in **Table 19-1** and on **Figure 19-1** were identified as occurring within close proximity or having the potential for a cumulative effect with the Project. Minor developments, such as alterations to residential properties for example, were not included due to the nature and limited extent of those developments to interact cumulatively with the Project.

The RLC project would be completed prior to the commencement of the Project, and therefore has not been assessed for cumulative impacts.

Table 19-1 Identified proposals in proximity to the Project

Proposal name	Description	Considered in cumulative impact assessment
Commonwealth Avenue Bridge Renewal	This proposal involves the renewal of the Commonwealth Avenue Bridge (including strengthening and widening) to future-proof the corridor against Canberra's long-term transport needs while maintaining the Bridge's considerable cultural and heritage value[11]. Construction of the proposal is anticipated to commence in late 2023 and be completed in the 2024/2025 financial year. The NCA has advised that the works will be undertaken in stages to minimise traffic disruptions and maintain operation as well as safe passage under the Bridge.	Yes

[11] NCA, 2022, Accessed at: https://www.nca.gov.au/environment/projects/current-projects/commonwealth-avenue-bridge-renewal

Proposal name	Description	Considered in cumulative impact assessment
Acton Waterfront Parkland	This proposal aims to provide a place along the Acton Waterfront with new open spaces, improved pedestrian and cycle connections with Canberra City and better access to water activities, and celebrate the location's historical and national significance[12]. Construction is anticipated to be completed from early 2023 to 2025.	Yes
HTI Group Hotel Development 13 London Cct	This proposal involves the demolition of an existing building and construction of a new sixteen-storey commercial accommodation building. A Development Application for the site has been approved. For the purposes of this assessment, construction of the proposal is assumed to be concurrent with the construction of the Project.	Yes
CRA Land Release Block 40, Section 100, City	Block 40, Section 100, City is currently used as a surface car park at the corner of Northbourne Avenue and London Circuit, next to the Magistrates Court and across from the Melbourne Building. A new 11-storey office block will be constructed at this site. Office leases are anticipated to commence in mid-2026, with construction completed prior. For the purposes of this assessment, construction of the proposal is assumed to be concurrent with the construction of the Project.	Yes
CRA land release Block 20, Section 63, City	The CRA is planning to release land for the construction of a mixed-use development where the northwest cloverleaf currently stands. The development would include residential, commercial and retail spaces. For the purposes of this assessment, construction of the proposal is assumed to be concurrent with the construction of the Project.	Yes
Morris Property Group Blocks 10 and 11, Section 100, City	The Section 100 mixed-use development is proposed to be constructed between London Circuit and Vernon Circle, to the north of Edinburgh Avenue. The development would include commercial properties, retail spaces and private basement parking spaces. Although timing of development is uncertain, for the purposes of this assessment, construction of the proposal is assumed to be concurrent with the construction of the Project.	Yes
CRA Land Release Block 38, Section 19, City	Block 38, Section 19, City is currently an empty lot, recently used as a site compound supporting the Constitution Place re-development and since rehabilitated and landscaped. The site is located between Vernon Circle, Theatre Lane, and Constitution Avenue. This site has been identified by the	Yes

[12] CRA, 2022, Accessed at: https://www.act.gov.au/cityrenewal/places/Acton-Waterfront-Project

Proposal name	Description	Considered in cumulative impact assessment
	CRA for sale or future sale. It is currently identified for release in the financial year of 2024-2025. For the purpose of this assessment, site investigation and construction activities at this site are assumed to be concurrent with the Project.	
Canberra Theatre redevelopment	The Canberra Civic and Cultural District is undergoing redevelopment. Plans for the Canberra Theatre will progress to detailed design in late 2024. The redevelopment of the Theatre would likely increase the capacity of the theatre and aim to improve the public's experience of the place. Construction is anticipated to commence in 2025-2026, although site investigation or early works may occur prior. The Canberra Theatre proposal is not anticipated to substantially occur concurrently with the Project.	Yes
Canberra Civic and Cultural Precinct	Canberra Civic and Cultural Precinct will be redeveloped to diversify the retail economy, enhance heritage features and liveliness. Upgrades would activate key pedestrian routes[13]. Other opportunities for residential accommodation would also be supported in neighbouring suburbs, and new community facilities would be developed. Construction is anticipated to commence in 2026, although site investigation or early works may occur prior. The Canberra Civic and Cultural Precinct proposal is anticipated to occur concurrently with the Project	Yes
Geocon Development 70 Allara St	The proposal includes the demolition of existing structures and the construction of three mixed use buildings. Construction is anticipated to be complete in 2024, prior to commencement of the Project.	No
UNSW City Campus	This proposal is for the development of a landmark university campus facility on Constitution Avenue near Parkes Way. Master planning for the site is ongoing, with timeframes for construction at the site unknown. For the purposes of this assessment, construction is not assumed to commence until after the Project is operational.	No

[13] CRA, 2022, Accessed at: https://www.act.gov.au/cityrenewal/places/city-centre

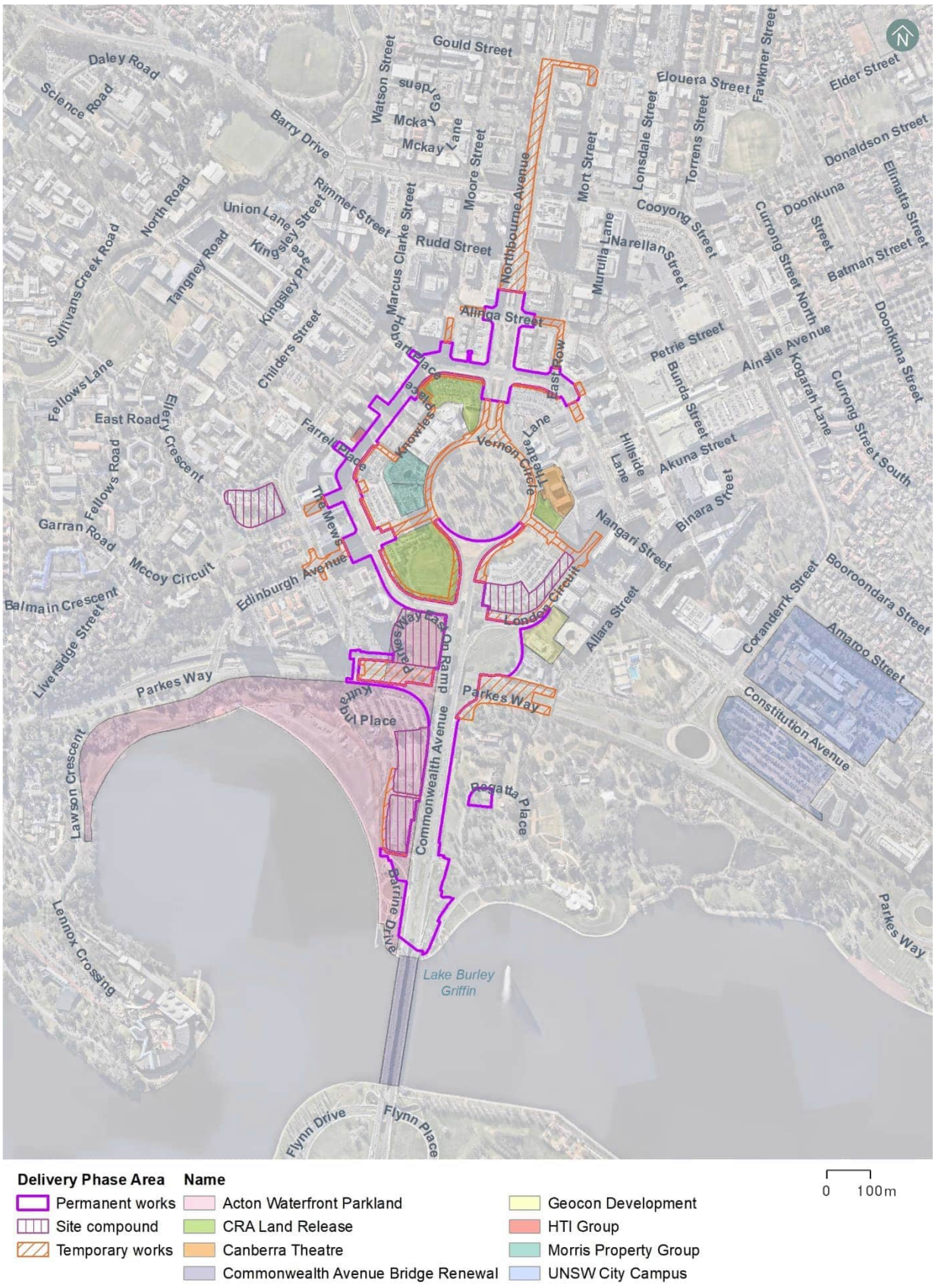


Figure 19-1 Identified proposals in proximity to the Project

19.3 Construction cumulative impacts

It is anticipated that construction of the Project would commence in 2024, with completion planned in 2026. Potential cumulative impacts associated with construction of the Project and the relevant proposals with potential for cumulative impacts are discussed in **Table 19-2** below.

Management and mitigation measures associated with the Project are provided in relevant Sections of this EA. These measures would contribute to the management of cumulative impacts.

Table 19-2 Potential cumulative impacts during construction

Environmental factor	Cumulative impact assessment
Traffic and transport	Potential traffic and transport impacts associated with the Project are discussed in **Chapter 9.0 Traffic and transport** including measures to minimise and manage impacts. Traffic modelling undertaken for the Project has also considered potential cumulative impacts associated with construction traffic generated by other proposals near the delivery phase area. Construction of the Project would require block closures to close off entire sections of the road network, typically between blocks to allow the Project contractor full access to the worksite and the best opportunity to complete the Project most efficiently. Construction works and block closures are likely to occur for multiple blocks concurrently. However, the proposed block closure sequencing aims to minimise cumulative impacts and maintain adjacent property access, as much as practical. Temporary traffic changes in the vicinity would also be required. For works on Commonwealth Avenue and Northbourne Avenue, a minimum of two traffic lanes in each direction would be maintained at all times while alignment and stop works occur. Long term road closures are not anticipated to be required for other proposals in the vicinity of the Project delivery phase area, however temporary traffic management may be required at times. Typically, these activities are likely to be undertaken during non-peak periods and would be coordinated to minimise conflict between proposals. Through the Disruption Taskforce, a whole of Government approach to citywide transport planning and management throughout construction would be adopted. The Project would require a range of construction vehicle movements, including trucks for the movement of materials, and light vehicles for personnel. Vehicle movements would also be generated by each proposal, however predicted traffic volumes are not publicly available. Given the location of the Project and proposals in the area, similar haulage routes may be required. As discussed in **Chapter 9.0 Traffic and transport**, up to ten heavy vehicle movements would be generated by the Project during the weekday AM and PM peak periods. Based on this estimate, the additional heavy vehicle volumes would be low, given the existing traffic volumes and road network conditions. Light vehicle movements associated with the Project and other proposals are likely to occur during non-peak periods. Construction workers would be the main generator of light vehicle trips for the Project, typically arriving to site earlier than the weekday AM peak hour at 8:00 am and leaving before the PM peak at 5:00 pm. Given that off-peak traffic volumes on the surrounding road network are significantly lower than during the weekday peak hours, the additional light vehicle activity generated by the Project and proximal proposals during the off-peak periods would be manageable within the existing road network. Nevertheless, **Chapter 9.0 Traffic and transport** provides mitigation measures to minimise the number of light vehicles generated by the works.

Environmental factor	Cumulative impact assessment
	Safe routes for pedestrians and cyclists would be maintained throughout the construction works with minimal diversion from desire lines (preferred routes). During block closures a pedestrian path would be allowed for to maintain connectivity. Volumes of truck and light vehicle movements, combined with other proposals, are not anticipated to contribute to significant cumulative impacts on traffic or active transport during construction.
Heritage	Potential heritage impacts associated with the Project are discussed in **Chapter 10.0 Heritage**, including measures to minimise and manage impacts associated with the Project. Potential impacts are limited to the temporary obstruction of significant views of Commonwealth Avenue (both north and south), the Reserve Bank of Australia, City Hill, and the Law Courts Precinct. Other proposals in the area are located outside views of these heritage items, and the Project is therefore unlikely to contribute to a significant cumulative impact on heritage.
Noise and vibration	Potential noise and vibration impacts associated with the Project are discussed in **Chapter 12.0 Noise and vibration**, including measures to minimise and manage impacts associated with the Project. Where possible, Project construction activities would be limited to daytime hours. However, from time to time works would need to be undertaken outside of these hours. Any such works outside of these hours would be the subject of a specific application to the ACT Government, detailing the need for such works and any additional or work specific noise mitigation measures. Activity specific communications and engagement activities would be undertaken in advance of the commencement of such works outside of normal work hours. Noise modelling for the Project identified that receivers near to construction activities would experience elevated noise levels, during a worst case period of construction activity while the construction equipment is at the nearest location to each sensitive receiver location. One receiver (Archbishop's Residence) may be highly noise affected during utilities works and construction of tracks, however this location is typically further from other proposals considered in this assessment. The proposals considered are likely to contribute to cumulative construction noise and vibration impacts at sensitive receivers including from the Section 100 development, Acton Waterfront Renewal, and HTI Hotel Development. The construction of these developments would not all occur concurrently, however it can be anticipated that some activities would overlap including with the Project. In addition, it can be expected that night works would sometimes be required by these proposals. However, noise levels from adjacent proposals would cause a maximum increase of 3 dB increase to noise levels (i.e., a doubling of sound energy) from the Project, and therefore, cumulative noise impacts are expected to be minimal. Stakeholder feedback has indicated that the significance of construction noise, in particular to residences and hotels, can be significant despite the central business district location where construction noise and vibration occurs regularly. There is the potential for cumulative noise and vibration to cause nuisance to nearby sensitive receivers.

Environmental factor	Cumulative impact assessment
Landscape and visual realm	Potential landscape character and visual impacts associated with the Project are discussed in **Chapter 13.0 Landscape and visual realm**, including measures to manage and mitigate impacts associated with the Project. During construction, the Project is likely to impact views close to the construction activity, including views seen on Northbourne Avenue, Commonwealth Avenue, London Circuit and within City Hill Park. The potential for cumulative visual impacts would depend on other proposals also being visible from any certain viewpoint, however the construction of the proposals outlined above is not anticipated to all occur concurrently, which would limit the scale and duration of potential cumulative impacts. Views of construction activities generally are also considered common given the central business district location of the Project and other proposals. Cumulative landscape character and visual impacts are not anticipated to be significant, due to their temporary nature in an existing urbanised environment.
Socioeconomic	Potential socioeconomic impacts associated with the Project are discussed in **Chapter 14.0 Socioeconomic impacts**, including measures to manage and mitigate impacts associated with the Project. Personal wellbeing of residents and the community is likely to be impacted by cumulative impacts. Impacts which impede on everyday life (such as construction traffic, reduced amenity, and reduced pedestrian accessibility, heritage, and local character) can generate frustration and stress. Cumulative impacts can have impacts on people's mental and physical health. Although cumulative impacts described above are not anticipated to be significant, there is still a risk that residents and community members may become frustrated with continuous and extended construction works regardless of the significance of cumulative impacts. Similarly, there is notable risk that community members and residents would experience consultation and construction fatigue associated with numerous construction activities.
Air quality	Potential air quality impacts associated with the Project are discussed in **Chapter 15.0 Air quality**, including measures to manage and mitigate impacts associated with the Project. With the application of mitigation measures, air quality impacts associated with construction of the Project would be very low. The air quality risks associated with construction of infrastructure are well known and generally well managed using standard mitigation measure and safeguards. Each proposal, including the Project, would be required to develop a construction environmental management plan (CEMP) which includes measures for the management and mitigation of dust. Therefore, cumulative air quality impacts are anticipated to be minimised through appropriate management at the source, and are not considered to be significant.
Biodiversity and ecology	Potential biodiversity impacts associated with the Project are discussed in **Chapter 16.0 Biodiversity and ecology**, including measures to minimise and manage impacts associated with the Project. Potential cumulative impacts on biodiversity have been assessed in the EPBC Act Approval Preliminary Documentation for the Project. This Preliminary Documentation discussed the Acton Waterfront Parkland development proposed for the southwest cloverleaf and at Parkes Way west of Commonwealth Avenue, which has been identified as GSM habitat. In addition, the proposals outlined in **Table 19-1** have been considered and are not expected to

Environmental factor	Cumulative impact assessment
	result in cumulative biodiversity impacts to potential GSM habitat. Therefore, potential cumulative biodiversity impacts to GSM habitat have been effectively assessed and received approval. The Preliminary Documentation identified potential GSM habitat in limited areas within and surrounding the delivery phase area. The remaining GSM habitat within the delivery phase area is limited to the southeast cloverleaf, including the fenced GSM translocation area. West Basin Precinct: Works associated with future stages of the Acton Waterfront development, including access options for connecting the City to Lake Burley Griffin over Parkes Way are likely to directly impact on GSM habitats to the west of Commonwealth Avenue at Parkes Way. There is the potential for cumulative impacts on GSM associated with this proposal. There is potential for indirect impacts to occur, particularly through noise, light (if night works are proposed for the other proposals), and generation and dispersion of dust to GSM habitat. Each proposal, including the Project, would be required to develop a construction environmental management plan which includes measures for the minimisation and management of dust at the source. Given the minimal biodiversity in the adjacent area and the requirement to implement appropriate management at the source, cumulative indirect impacts on biodiversity, including dust on GSM habitat, are not anticipated to be significant.

19.4 Operation

Cumulative impacts associated with operation of the Project are not anticipated, given that the study area retains its pre-construction land use as a travel corridor for vehicles, pedestrians and cyclists. However, the Project would contribute towards and enhance the land use function of the travel corridor and improved amenity along the alignment and adjacent areas.

19.5 Management and mitigation measures

Management and mitigation measures have been proposed to reduce the potential cumulative impacts of the Project identified in the assessment.

Management and mitigation measures and safeguard protocols adopted for the Project are provided in **Table 19-3**, and have been prepared with the following objectives:

- Reduce the potential for adverse impacts from the Project to operate cumulatively with adverse impacts of other projects.

Table 19-3 Management and mitigation measures – Cumulative impacts

Ref	Management and mitigation measure	Timing
CI1	Proactively engage with proponents of other projects in the area iteratively and throughout construction to: • Increase awareness of construction timeframes and potential impacts • Coordinate impact mitigation and management (e.g., respite periods) • Consider incorporating additional noise management and mitigation measures for cumulative construction noise impacts.	Prior to and during construction

20.0 Management and mitigation measures

This Chapter provides a consolidated summary of the measures identified to manage and mitigate potential environmental impacts associated with the construction and operation of the Project.

The Project would be undertaken in accordance with the Conditions of Approval of EPBC2019/8582. These conditions are not reproduced in this Chapter.

20.1 Environmental management approach

The assessment of key environmental issues associated with the Project is documented in **Chapters 9.0** to **19.0**. The environmental impact assessment has been approached using best-practice methodology, as detailed in **Chapter 8.0 Environmental risk analysis approach**; this includes a risk assessment process performed in accordance with the principles of AS/NZS/ISO31000:2018 Risk Management – Principles and Guidelines. Classifying the consequences of impacts and the likelihood of occurrence allows the ranking of potential impacts into one of seven risk levels.

Management and mitigation measures are proposed to lower the significance, frequency or risk of an impact occurring. Industry standard management measures have been identified for relevant impacts at all risk levels. Where the risk was noted to be medium or above, additional mitigation measures were identified to reduce impacts to below a medium risk level.

Measures for the management and mitigation of environmental impacts are detailed in this EA. As detailed design of the Project continues, this will be guided by both these measures and Scope and Performance Requirements (SPRs) (**Section 20.1.1**).

20.1.1 Scope and performance requirements

Scope and Performance Requirements (SPR) set out the minimum requirements for the Project and associated activities, and form a contractual obligation for the design, construction and operation of the Project. The Project design assessed in this EA was developed in accordance with relevant SPRs

The ongoing design, construction and operation of the Project must abide by SPRs, including in relation to:

- Road works
- Civil works
- Structural works
- Stops and termini
- Trackwork
- Public realm.

20.2 Management plans

Management and mitigation measures proposed for the construction and operational phase of the Project are anticipated to be consolidated in relevant management plans.

The primary environmental management plan to manage and mitigate environmental impacts during construction would be the Construction Environmental Management Plan (CEMP). The CEMP would be prepared by the Delivery Contractor and would incorporate the management and mitigation measures outlined in this EA. The CEMP would also outline in further detail how environmental management for the Project would be achieved and detail the roles and responsibilities of key personnel involved in the construction of the Project.

The CEMP would include specific subplans which would comprise (at minimum) the following:

- Biodiversity Management Plan
- Construction Noise and Vibration Management Plan
- Construction Transport Management Plan

- Contamination and Material Management Plan
- Emergency Management Plan
- Erosion and Sediment Control Plan
- Resource and Waste Management Plan
- Soil and Water Management Plan

The CEMP would be supported by the following documents:

- Communication Strategy
- Heritage interpretation plan
- Travel Demand Management Strategy

The Operational Environmental Management Plan would include:

- Carbon and Energy Management Plan
- Emergency Management Plan.

20.3 Management and mitigation measures

Environmental management and mitigation measures to be implemented during each phase of the Project, and detailed in previous Chapters, are summarised in **Table 20-1**. The measures in **Table 20-1** have in many cases been developed from the specialist technical reports that are appended to this EA. In the event of any inconsistency between environmental management recommendations canvassed in the appendices to the EA and the measures outlined in **Table 20-1** the measures in **Table 20-1** would prevail.

Each construction mitigation measure would be monitored during the relevant phase to ensure effective implementation. The Project's compliance with the mitigation measures outlined below would be assessed upon completion of the relevant stage.

Table 20-1 Proposed mitigation measures for the Project

Ref	Objective	Management and mitigation measure	Timing	Reference
G	**General**			
G1	Provide a centralised mechanism through which potential environmental impacts would be managed.	A **Construction Environmental Management Plan** (CEMP) would be prepared prior to construction to outline the construction conditions and temporary environmental protection measures to manage the impact of construction activities. The CEMP would be consistent with the environmental management measures documented in this EA and identified in the Works Approval, Development Application, planning approval conditions, and any other requirements or conditions within any licences or permits as issued or required by Government Authorities. The CEMP would be prepared by the Contractor and would be endorsed by MPC and the Principal's Authorised Person prior to commencement of construction.	Prior to and during construction	AS ISO 14001 Environmental Management Systems ACT EPA *Environmental guidelines for preparation of an Environment Management Plan* *Environment Protection Act 1997, Part 7 – Environmental Agreements*
G2	All Project workers are familiar with their obligations to protect the environment and comply with relevant Project requirements.	All Project workers would be provided with an induction prior to commencing work onsite and refreshed annually. This induction would include information on the following: • Environmental protection measures to be implemented to protect the quality of the surrounding environment, including flora and fauna management, weed control, erosion and sediment control, and water quality management • The location of, and protection measures for, any sensitive ecological areas • The location of site-specific emergency spill kits and trained in how to respond to a spill • Noise and vibration management, including location of sensitive receivers, good working practices and measures for reducing the source noise levels of construction equipment by construction planning and equipment selection where practicable	Prior to and during construction	

Ref	Objective	Management and mitigation measure	Timing	Reference
		• Traffic and transport management, including use of compounds or approved areas for vehicle parking, minimising impacts to property accesses and use of designated construction traffic vehicle routes • Basic training in the identification of potential Aboriginal archaeological issues, measures to minimise construction impacts to built and landscape heritage items and protocols for unexpected archaeological remains and any unexpected finds • A cultural awareness induction which would serve to outline the significance of areas of the route to Aboriginal and specifically Ngunnawal people and to alert construction personnel to the possibility of unexpected finds during the work • Bushfire protection measures and requirements would be included in the site induction for contractors working on the Project, including the restriction of hot works on Total Fire Ban Days • Heritage induction of all staff and contractors on potential archaeological issues and protocols • Sustainability induction on sustainability vision, goals, targets and Project commitments • Training on reuse and recycling of materials.		
G3	Ensure the adequacy and compliance of environmental management measures.	Dedicated, suitably qualified environmental personnel would be appointed to monitor the performance of the environmental management measures of the Project.	Prior to and during construction	
G4	Ensure the Project can obtain an ISC IS Rating	Dedicated, suitably qualified sustainability personnel would be appointed to monitor and report on all sustainability requirements of the Project.	Prior to and during construction	ACT Climate Change Strategy 2019; ISC IS Rating Tool Version 1.2
G5	Ensure that the mitigation and management measures remain	In consultation with key stakeholders and regulators, undertake a review of, and as necessary update, the management and mitigation measures.	Biannually during construction	

Ref	Objective	Management and mitigation measure	Timing	Reference
	appropriate for the life of the Project.			
G6	Develop a construction staging program to control the timing of works.	A construction staging program will be developed to control the timing of works in key intersections. This program is to be developed in consultation with key stakeholders	Prior to construction	
G7	To minimise the duration of impactful construction works.	The construction program would be reviewed quarterly and opportunities to consolidate and shorten the duration of impactful work would be explored in consultation with MPC.	During construction	
G8	Ensure that works are undertaken in a way to minimise impacts.	Grouping/bundling of services and installation within existing corridors where possible to minimise new excavations required.	Detailed design	
G9		Equipment would be chosen to have the least effect on the environment and so the construction methodology is least impactful.	During construction	
G10		Where necessary, light pollution, noise, vibration, and air quality monitoring and investigation would be undertaken in response to complaints.	During construction	
G11		Clearly identify the Project delivery phase area on all construction documentation and undertake inductions for all construction personnel to ensure thorough understanding of delivery phase area limits.	Prior to construction	
G12	Ensure appropriate consultation is undertaken to limit impacts to the community.	Undertake ongoing consultation with potential sensitive receivers to coordinate timing of construction works to limit impacts.	Detailed design	
G13		Continue to undertake community engagement with relevant stakeholders to communicate scope of works including expectations around construction hours and timeline. This engagement strategy should consider all phases of the Project, from detailed design to operation, be updated every six months, and include objectives such as: • Informing the community of the Project need and benefits – increasing Project awareness and understanding • Assisting the community to identify how to get to their destinations efficiently during construction	Prior to and during construction	IAP2 Public Participation Spectrum ('Collaborate')

Ref	Objective	Management and mitigation measure	Timing	Reference
		• Providing a summary of negotiable and non-negotiable issues and be compiled through active stakeholder involvement and participation. • Educating the community on how the Project will be accessed by pedestrian and cyclists once complete • Involving the community (particularly vulnerable groups) through focus groups and other opportunities in Project aspects that have a direct impact on people. The Community Engagement Strategy would include a list of all known stakeholders (including the community), with consideration given to any vulnerable or sensitive receivers.		
G14	Enable and support the involvement of local industry in the Project	To the greatest extent practicable, procurement activities associated with the Project would prioritise the use of trade and materials from within the local region.	Prior to and during construction	Canberra Regional Local Industry Participation Policy
G15	Promote the safe and efficient operation of light rail through the city	Prior to the commencement of testing and commissioning activities, a public education campaign would be developed and implemented to raise awareness around the different light rail operating characteristics of the system on London Circuit in particular, and how vehicles, cycles and pedestrians and other road users can safely interact with the system	Prior to Testing and Commissioning	
T	**Traffic**			
T1	Holistically consider traffic implications of proposed construction activities.	A Traffic and Transport Liaison Group (TTLG) would be established to oversee and review traffic and multi modal implications of proposed construction activities and network arrangements. TTLG would include representation from: • TCCS • MPC • ESA • NCA • AFP • CRA • Project delivery teams of adjacent developments.	Prior to and during construction	

Ref	Objective	Management and mitigation measure	Timing	Reference
T2	Minimise the potential strain on the road network during construction.	Prior to implementation, **Temporary Traffic Management** (TTM) Plans must be endorsed by the Traffic and Transport Liaison Group and have all other necessary approvals in place.	During construction	*Planning and Land Management Act 1988; AS1742 Part 3; Traffic Control at Worksites Manual* (RMS, 2012)*; Austroads Guide to Temporary Traffic Management*
T3	Through the Disruption Taskforce, adopt a whole of Government approach to citywide transport planning and management throughout construction that considers vulnerable users	A Disruption Management Strategy would be developed and widely socialised, to reduce the private vehicle trip generation and parking demand, particularly during weekday AM and PM peak hours, generated by local residents and employees of the broader CBD and surrounding area.	Prior to construction	ACT Transport Strategy 2020 ACT Transport Recovery Plan 2021 ACT Climate Change Strategy 2019
T4	Maintain appropriate vehicular access to directly impacted neighbours.	In consultation with relevant stakeholders, appropriate vehicular access would be maintained to the Sydney & Melbourne Buildings, Reserve Bank of Australia, Canberra City Police Station, ACT Courts, and 1 & 7 London Circuit at all times during construction.	During construction	
T5	Minimise general impacts from construction traffic movements.	A **Construction Transport Management Plan** (CTMP) would be developed to manage the impacts of the construction activities on the transport network and local parking.	Prior to construction	
T6		Construction vehicle movement arrangements (Temporary Traffic Management Plans) would be developed in consultation with the Traffic and Transport Liaison Group (TTLG) to minimise impacts on the city generally, with specific regard to: • Bus movements, and bus priority measures • Peak hour traffic in Canberra City • Coordination of material deliveries	Prior to and during construction	Hea-2 ISC IS Rating Tool 1.2

Ref	Objective	Management and mitigation measure	Timing	Reference
		• Key pedestrian movements and activity areas • Other construction projects in the locality • Local traffic movement requirements and peak traffic volumes, including long weekends and holiday periods • Crime prevention through environmental design principles • Special events.		
T7	Ensure that accessible parking provisions are not impacted from construction.	No net loss of accessible parking within the delivery phase area.	During construction and operation	
T8	Minimise the impacts to parking facilities from the construction workforce.	Consideration would be given to providing shuttle services to transport site workers. If shuttle services are not provided as part of the Project, parking restrictions around work zones would be considered to reduce the impact on public parking facilities by site workers. This must be included in the CTMP and approved by TCCS.	During construction	
T9	Optimise the performance of the transport network.	Continue to investigate measures to optimise the performance of key intersections (e.g., adjusted signal phasing). Refinement of intersection signals phasing to improve light rail, traffic and pedestrian movement efficiency	Prior to operation	
T10	Raise public awareness on changes to the transport network, and how people move around the city	Complete a public awareness campaign of possible disruption to the transport network, and alternatives for travel.	During construction	
T11		Clear and safe pedestrian and cyclist signage and wayfinding mechanisms would be in place prior to works commencing that would change access and movement arrangements through the Project delivery phase area.	Prior to and during construction	IAP2 Spectrum of Public Participation ('Inform'); Hea-2 ISC IS Rating Tool 1.2
T12		Public awareness campaigns will be undertaken to increase understanding of new arrangements and interactions between cars, bicycles and pedestrians with light rail.	Prior to operation	

Ref	Objective	Management and mitigation measure	Timing	Reference
T13	Plan special equipment deliveries to reduce impacts on community.	Detailed planning of special equipment deliveries (rail etc.) to reduce impacts on local communities.	Prior to construction	
H	**Heritage**			
H1	Celebrate the heritage values of Canberra, the Parliament House Vista, Commonwealth Avenue, Sydney and Melbourne Buildings, ANZ Building, Law Courts Precinct and Hotel Acton	Develop Project strategies to identify, interpret and communicate the history and heritage values of Canberra, the Parliament House Vista, Commonwealth, Sydney and Melbourne Buildings, ANZ Building, Law Courts Precinct and Hotel Acton, from early site establishment, throughout the construction phase and in the final completed landscape design.	Prior to and during construction	See also LV1; Her-1 ISC IS Rating Tool 1.2
H2	Document the heritage values of the delivery phase area for future generations	Complete a general photographic archival recording of heritage values within the delivery phase area, and make provision for these recordings to be made publicly available.	Prior to construction	Photographic Recording of Heritage Items Using Film or Digital Capture (NSW Heritage Office, 2006)
H3	Strengthen the landscape character of Commonwealth Avenue	In consultation with key stakeholders and technical specialists, develop detailed designs that are consistent with the Light Rail Commonwealth Avenue Masterplan.	Prior to construction	Commonwealth Avenue Landscape Heritage Advice (GML, 2021); EPBC Act Approval 2019/8582; Urb-2 ISC IS Rating Tool 1.2; Light Rail Commonwealth Avenue Masterplan (AECOM, 2022)

Ref	Objective	Management and mitigation measure	Timing	Reference
H4	Minimise potential for impacts (destruction/damage) to unexpected heritage items	Implement an unexpected heritage finds protocol which includes: • Measures to enable all personnel working onsite to receive awareness training relating to heritage matters • Cessation of all activity in the vicinity of the find and consultation with Representative Aboriginal Organisations and the ACT Heritage • Clear mechanisms to enable relevant clearance to be obtained and works to recommence.	During construction	**Appendix E (HIA)**
H5	Contribute to urban realm quality without impacting ability to appreciate heritage features	In consultation with ACT Heritage, the 'Canberra Tracks' sign in the median between the Sydney and Melbourne Buildings would be relocated to an appropriate location	Prior to construction	
H6		Trees within the median of Northbourne Avenue and adjacent to the Sydney and Melbourne building would be managed to enable the canopy to sit above the height of the colonnade	During operation	
CS	**Contamination and soil**			
CS1	Minimise disturbance to landform, geology and soils and prevent erosion and sedimentation.	**A Soil and Water Management Plan** (SWMP) would be prepared and implemented as part of the CEMP. The SWMP would at a minimum: • Assess erosion and sedimentation risks and impacts, include a process for developing detailed designs for major erosion and sedimentation control measures • Outline a process for the development, EPA approval and implementation of detailed erosion and sediment control plans • Document procedures for managing pollution associated with spillage or contamination on the site and adjoining area.	Prior to and during construction	
CS2		Detailed Erosion and Sediment Control Plans are to be developed prior to construction and implemented for the duration of construction activities and until disturbed areas are stabilised or revegetated. Erosion and sediment control measures will be inspected and maintained regularly and in particular prior to, during and following rain events.	Prior to construction	*Managing Urban Stormwater - Soils and Construction*, Volume 2D – Main Road Construction *Environment Protection*

Ref	Objective	Management and mitigation measure	Timing	Reference
				Guidelines for Construction and Land Development in the ACT (draft), 2019
CS3		Soil stockpiles would be managed in accordance with the EPBC Act Approval (2019/8582), employing effective erosion and sediment controls to minimises the risk of pollution, pests, and risk to human health, property and the environment.	During construction	ACT Guideline for Stockpile Management
CS4	Ensure that material handling and general construction activities manage the potential for contamination consistent with established polices and requirements.	A **Contamination and Material Management Plan** (CMMP) would be prepared and implemented as part of the CEMP. The CMMP would at a minimum: • Detail specific requirements for the importation of any material onto the site including environmental properties, tracking requirements, reporting/record keeping requirements • Detail specific requirements for the reuse of any material onsite, including where practical topsoil remediation and reuse • Document material tracking and reporting mechanisms for import and export of material • Provide for ongoing compliance inspections and record keeping • Include an Unexpected Finds Protocol that outlines the roles and responsibilities where unexpected finds of potential contamination are identified during any works within the delivery phase area • Identify the steps needed to be taken in the event that hazardous materials are identified (in particular, asbestos) • Describe procedures to enable the review and endorsement of the CMMP by the Project Independent Contaminated Sites Auditor • A Sampling Analysis and Quality Plan (SAQP) would be prepared to guide any additional investigative works to determine site condition, and the further assessment of residual fill soils within the delivery phase area that may require management during construction.	Prior to and during construction	Contaminated sites environment protection policy and relevant Information Sheets (various) Environment Protection Authority (Access Canberra)

Ref	Objective	Management and mitigation measure	Timing	Reference
		• Procedures for post-construction validation reporting detailing compliance with all approved plans and procedures implemented during works		
CS5	Minimise potential for contamination due to failure in storage mechanisms for hazardous materials onsite during construction.	A site-specific emergency spill procedure is to be developed. Emergency wet and dry spill kits would be kept in the delivery phase area. All construction personnel are to be made aware of spill kit locations and trained in how to respond to a spill.	Construction	
CS6		Refuelling and storage of fuels, chemicals and liquids are to be within an impervious bunded area within the construction compound.	Construction	
NV	**Noise and vibration**			
NV1	Minimise impacts on the amenity of adjacent land users due to noise and vibration during construction and operation	Implement controls on construction equipment and activities in accordance with Australian Standards and manufacturer specifications. Regularly inspect, test and maintain all stationary and mobile plant equipment to ensure that emission levels do not deteriorate over the life of the Project.	During construction	AS 2436-2010 Guide to Noise and Vibration Control
NV2		Orientate noisy/vibration generating equipment as far as possible from receivers, and implement a 'no-idling' policy by shutting down construction equipment and vehicles when not in use	During construction	
NV3		As part of monthly construction updates, receivers that could be highly noise affected by upcoming works would be notified, prior to the commencement of those works. The notification would include details of: • The construction activities likely to have noise or vibration impact • Construction period and construction hours • Any proposed mitigation measures for noise and vibration • Contact information for the Project, including out of hours contact • Complaint, corrective action, and incident procedures and how to obtain further information	During construction	

Ref	Objective	Management and mitigation measure	Timing	Reference
NV4		As necessary, undertake condition surveys on buildings and structures within the potential radius of effect, prior to commencement of demolition and heavy earthworks activities.	During construction	
NV5		Construction activities for the Project would be undertaken between the hours of 7.00 am and 6.00 pm Monday to Friday and 7am to 1pm Saturdays (normal hours), with no work on Sundays and Public Holidays unless otherwise approved through an Out of Hours Works Plan request.	During construction	MPC Out of Hours Works Request (refer **Appendix G (NVIA)**)
NV6		Construction works proposed to take place outside 'normal' construction hours would require individual assessment and approval on a case-by-case basis. In general, this process would include: • Identification of the duration, location, type of activities construction equipment involved • Assessment of the potential noise and vibration impact associated with the proposed construction activities and determination of the number and type of sensitive receivers potentially impacted • Identification of any reasonable and feasible mitigation measures to be implemented • Consultation with the potentially impacted receivers to inform them of the proposed out of hours works, and providing an opportunity for impacted receivers to provide feedback • Minimising out of hours works as much as practicable (e.g., deliveries of equipment and materials could be made, or disposal of construction waste may be delayed until on the following day) • Inclusion of scheduled respite for the community for extended periods of night work	During construction	MPC Out of Hours Works Request (refer **Appendix G (NVIA)**)
NV7		A **Construction Noise and Vibration Management Plan** (CNVMP) would be developed to identify: • Potentially major noise and vibration generating activities associated with the Project, including delivery activities • Noise and vibration sensitive receivers	Pre-construction and during construction	

Ref	Objective	Management and mitigation measure	Timing	Reference
		• Measures to be implemented during construction to minimise noise and vibration impacts. • A monitoring program that obtains noise data that is representative of construction activities, and in response to complaints will be developed to assess performance against relevant noise and vibration criteria and will be used to inform continuous improvement to the CNVMP. • Methods for assessment and review of impacts associated with Out of Hours Works as part of continuous improvement		
NV8		When establishing work areas, site compounds and laydowns consideration would be given to arranging the site to limit the need for reversing associated with regular/repeatable movements, where safe and space permits.	During construction	
NV9		Vibration generating activities would be managed, and construction equipment would be selected, to avoid working within the structural damage minimum working distances. The use of less vibration intensive methods of construction or equipment would be considered where feasible and reasonable.	During construction	
NV10		Minimise operational noise through ongoing maintenance of LRV wheels and tracks.	During operation	
LV	**Landscape visual and realm**			
LV1	Minimise the visual impacts of construction activities	Wherever possible, high quality construction hoarding would be used with consideration given to the potential for local public art or heritage interpretation, subject to all other necessary approvals. The design of the hoarding should consider visually recessive, natural colours and images, and where possible be developed with input from local schools or artists.	Prior to and during construction	
LV2		Storage of materials and equipment at worksites and compounds would be planned to reduce visual impacts	During construction	
LV3		Lighting associated with the Project would be designed to limit spill into non-target areas and up-lighting would be capped by structures. Light colour would be designed to complement the adjacent area and	Detailed design	NCA Outdoor Lighting Policy

Ref	Objective	Management and mitigation measure	Timing	Reference
	Enhance visual amenity within the delivery phase area	public safety cameras would be selected to function without unnecessary lighting.		
LV4		Wherever practicable, combine above-ground street elements (lighting, traffic signals, traffic signs) on common use poles to reduce visual clutter and to reduce potential conflict with landscape elements, in consultation with TCCS and NCA.	Detailed design, prior to construction	
LV5		Advanced trees would be procured for landscaping activities completed as part of the Project	Detailed design, prior to construction	
LV6		Trees removed for construction would be replaced in accordance with the Street Tree Masterplan.	Prior to construction	
LV7		Within the delivery phase area, green track areas would be monitored by an active irrigation system with an appropriate control system to monitor and provide optimum growing conditions for planted and turf grass areas, without unnecessarily overusing water	During operation	
LV8	Contribute to urban realm quality without impacting ability to appreciate existing local art and commemorative features	In consultation with relevant authorities, the 'Queen Elizabeth II' commemorative plaque and the public artwork 'Dream Lens to the Future' would be relocated to an appropriate location	Prior to Construction	

Ref	Objective	Management and mitigation measure	Timing	Reference
SE	**Socio economic impacts**			
SE1	Work with the community to optimise construction activities and leverage identified opportunities wherever possible.	Project materials will be displayed on a Project website, where appropriate, to support mitigations identified in this EA and enhance key benefits and opportunities for the Project.	Prior to and during construction	
SE2	Ensure effective management of complaints.	The following communications channels and support would be available to manage community enquiries and complaints: • A 24-hour toll-free telephone number for the registration of complaints and enquiries about the Project (when Project works are occurring) • A postal address to which written complaints and enquires may be sent • An email address to which electronic complaints and enquiries may be transmitted • A mechanism for community members to make enquiries in common community languages of the area.	During construction	
SE3		A grievance process for the community to raise comments, questions and complaints must be established prior to construction commencing. The grievance process must be made publicly available and must include a feedback process through which the complainant is provided with information relating to how their concern has been assessed, considered, and where feasible, addressed.	During construction	
SE4		A register of complaints received would be maintained. This information would provide the basis for assessing whether the mitigation and enhancement measures specified in the EA have been successful, and if not identify opportunities for continuous improvement to be implemented.		

Ref	Objective	Management and mitigation measure	Timing	Reference
SE5	Ensure employment opportunities for local and diverse people through provision of sustainable jobs.	The Project would develop a Labour Relations, Training and Workplace Equity Plan, which details how contractors will support employment participation and address barriers to employment or career development of Aboriginal and Torres Strait Islander people, women, people with disability and people from a culturally and linguistically diverse background.	Prior to construction	Secure Local Jobs Code 2020
SE6		Business engagement activities would seek to ensure that: • Construction activities undertaken in proximity to businesses would maintain visibility of business frontage, associated signage, and access points, where possible. Temporary signage could be provided in the vicinity of a business if construction works obstruct views to the business • During construction, wayfinding signage be implemented to assist customers in identifying parking opportunities to help them get to their destinations efficiently		
AQ	**Air quality**			
AQ1	Minimise generation of dust through effective construction planning and day to day management.	Plan site layout such that machinery and dust causing activities are located as far away from sensitive receivers as possible. Daily construction activities would be planned to consider the expected weather conditions for each workday, ensuring works zones are manageable.	Prior to and during construction	
AQ2		The CEMP would include a procedure for ongoing visual monitoring and recording of dust release by a nominated representative(s) regularly surveying the site for evidence of dust release from vehicle movements, stockpiling or demolition, or track out of material and remobilisation on access routes to the site. Where necessary the following actions would be implemented: • Restrict vehicles to stabilised areas, and where necessary remove mud and dirt tracked on to road surfaces • Establish and enforce appropriate onsite vehicle speed limits • Place gravel on surfaces where there would be significant vehicle movement (e.g., construction access and egress points)	During construction	UK Institute of Air Quality Management (IAQM), *Guidance on the assessment of dust from demolition and construction* (Holman et al, 2014)

Ref	Objective	Management and mitigation measure	Timing	Reference
		• Implemented suitable controls for exposed stockpiles and unsealed construction areas as appropriate, including the stabilising of long-term stockpiles and exposed areas • Cover vehicle loads involving loose materials • Use water assisted dust sweepers on access and local roads. Avoid dry sweeping of large areas • Ensure cement and fine materials are delivered in enclosed tankers and stored in silos to prevent material escape. For smaller supplies reseal bags after use.		ISC IS Rating Tool Version 1.2 (Dis-4)
AQ3	Minimise direct greenhouse gas emissions that also impact local air quality	Implement energy efficient guidelines for operational works such as a 'no-idling' policy for all construction vehicles and plant to switch of engines when not in use	During construction	
AQ4		The following measures to manage greenhouse gas emissions would be implemented: • Only use petrol or diesel generators where mains power is not feasible • Keep vehicles and construction equipment operating onsite well maintained and turned off when not operating (minimise idling on the site) • Energy efficiency measures for fixed construction components such as site offices, including solar panels and timer-controlled lighting • Consider other appropriate methods for reducing diesel use such as use of biodiesel or ethanol blends where feasible. • Use solar powered lights/message signs as appropriate.	During construction	
AQ5	Minimise impacts from exposure to potentially poor air quality	Where battery or solar power equipment is not feasible, locate fixed equipment (e.g., generators, or light towers) away from sensitive receivers	During construction	
B	**Biodiversity**			
B1		Establish 'no go zones' by marking-out the delivery phase area. Clearly identify limits though signage and fencing. The details of fencing and signing measures to be implemented would, as	Prior to clearing activities,	

Ref	Objective	Management and mitigation measure	Timing	Reference
	Avoid any unplanned disturbance to habitat values.	necessary, be the subject of an NCA Works Approval and Development Application.	during construction	
B2		Retain trees wherever possible. Trees to be retained should be marked and care taken to not disturb or compact the root zone of these trees. Pruning or lopping of branches should be minimised, and if required conducted by a suitably qualified arborist.	Prior to and during construction	
B3	Minimise impacts on hollow dependent fauna species.	Trees proposed to be removed should be checked for potential habitat (e.g., hollows) prior to felling. The CEMP would outline proposed management measures in the event fauna is present.	Prior to clearing activities during construction	
B4	Avoid weed infestation due to land disturbance.	The following control measures are to be implemented in line with standard biosecurity protocols including: • Inspect vehicle, equipment, and footwear prior to entering site • Preferably clean all vehicles, equipment, and footwear offsite prior to entering or leaving the site • If vehicles are not clean prior to entering site utilise dedicated cleaning bays at the compounds • Within wash bays clean footwear, equipment and vehicles with a hard brush or stick to remove as much mud, soil and organic matter as practicable before disinfecting with a solution of 70% methylated spirits and 30% water applied through a spray bottle.	During Construction	Golden Sun Moth Construction Environmental Management and Rehabilitation Plan (GSM Plan (as amended)) (ACT Government, 2022b)
B5		Undertake weed management through weed removal and disposal without stockpiling; cleaning and wash down of equipment, and appropriate importation of material to site	During construction	Invasive Plants Control Plan 2020-25
B6	Ensure the Project is undertaken in a manner consistent with the existing EPBC Act Approval.	A GSM Plan (as amended) covering Project activities has been developed and approved by DCCEEW prior to the commencement of works. Measures within the GSM Plan (as amended) must be implemented throughout construction. Those include: • Competence, training and awareness, including environmental inductions and toolbox talks	Prior to Construction	EPBC Act Approval 2019/8582 GSM Plan (as amended) (ACT Government, 2022b)

Ref	Objective	Management and mitigation measure	Timing	Reference
		• Environmental monitoring and inspections • Compliance reporting and auditing.		
WH	**Water and hydrology**			
WH1	To ensure that the Project contributes to the long-term resilience of the stormwater network to projected climate changes impacts.	Within the delivery phase area, stormwater infrastructure would be sized to account for projected climate change, consistent with TCCS standards, and enable future downstream network augmentation to be completed by others.	Detailed design	MIS08 Stormwater
WH2	Collect relevant information to establish Project performance in maintaining local water quality values.	Prior to discharge into the receiving stormwater system, water quality monitoring would be undertaken and recorded	Prior to and during construction	*Environment Protection Act 1997* (ACT) ACT EPA *Discharge from Sediment Control Ponds*
WH3	Ensure that Water Sensitive Urban Design measures continue to work effectively throughout operation.	Detailed asset handover information would be developed to describe: • The function of porous paving and how it is to be maintained in accordance with manufacturer's instructions to maintain permeability • The passive irrigation/rain garden infrastructure and how it is to be maintained to keep it free of blockage	During construction and operation	
WH4	Minimise potable water use	Consider use of water saving measures such as rainwater tanks at construction compounds.	Prior to and during construction	-
WH5		Non-potable water is to be used wherever feasible during construction and during operation for irrigation of green track and ongoing maintenance.	During construction and operation	-

Ref	Objective	Management and mitigation measure	Timing	Reference
RM	**Resource management and waste**			
RM1	Minimise additional pressure on the ACT waste and resource management facilities.	A **Resource and Waste Management Plan** (RWMP) will be prepared prior to construction commencing that details strategies to apply the waste and circular economy hierarchies during construction. The RWMP would include performance targets for waste re-use and generation and monitoring performance against targets, and require justification where a higher-level option from the hierarchies was not selected if applicable.	Prior to and during construction	ACT Waste Management Strategy 2011–2025 ACT Circular Economy Strategy ISC IS Rating Tool Version 1.2
RM2	Maximise the reuse and recycling of waste.	Where green waste from vegetation removal and topsoil cannot be reused onsite, reuse on other nearby sites would be investigated, and undertaken wherever practical.	During construction	ISC IS Rating Tool Version 1.2 (Lan-2)
RM3		Providing recycling and re-use facilities at construction compounds and worksites for use of staff and making arrangements for the recycling of materials from construction activities.	During construction	
RM4		Reuse and recycle materials where feasible during operation to minimise the amount of material sent to recycling and re-use facilities.	Operation	
RM5		Worksites would be maintained in a tidy state, and all general litter would be appropriately disposed of, and recycled where possible.	During construction	RLC EA (AECOM, 2021b)
RM6	Ensure correct disposal of waste and hazardous materials.	Waste and hazardous materials generated from the construction of the Project would be transported to an appropriately licensed waste and hazardous materials disposal or transfer facility. Where required, this would include using a licensed contractor to remove regulated waste and hazardous materials, under current ACT EPA Guidelines.	During construction	*Environment Protection Act 1997* (and Regulation) and accompanying Environment Protection Policies
RM7		All waste disposal would be monitored and recorded in accordance with the Resource and Waste Management Plan (RWMP) including volumes and categories of waste, transport and end point. This would be reviewed monthly by a qualified professional, with at least	During construction	

Ref	Objective	Management and mitigation measure	Timing	Reference
		five years' waste management experience, or a NABERS Assessor, or equivalent.		
RM8	Ensure correct storage of hazardous materials.	Hazardous chemicals and other volatile waste would be stored in accordance with the *Dangerous Substances Act 2004.*	During construction and operation	
CI	**Cumulative impacts**			
CI1	Reduce the potential for adverse impacts from the Project to operate cumulatively with adverse impacts of other projects.	Proactively engage with proponents of other projects in the area iteratively and throughout construction to: • Increase awareness of construction timeframes and potential impacts • Coordinate impact mitigation and management (e.g., respite periods) • Consider incorporating additional noise management and mitigation measures for cumulative construction noise impacts.	Prior to and during construction	
CC	**Climate change**			
CC1	To ensure that Project activities respond to observed and projected climate change.	Treatments and mitigation measures identified in the climate change technical report would be incorporated into the detailed design and delivery of the Project.	Prior to and during construction	**Appendix K (CNHA)**
CC2		Construction-related climate change risks (e.g., heatwaves or increased frequency and severity of extreme rainfall events) would be considered during the development of environmental management measures as part of the CEMP and other management plans, as relevant.	During construction	
CC3	Minimise indirect greenhouse gas emissions.	Development and implementation of a **Carbon and Energy Management Plan** to support the reduction of ongoing emissions associated with maintenance activities	During operation	
CC4		To reduce Scope 3 emissions where feasible: • Select materials with lower embodied energy values and for high embodied energy materials (such as concrete, steel and asphalt) reduce or substitute quantities • Select local materials or Australian materials over imported materials to minimise transport emissions.	Detailed design and during construction	

Ref	Objective	Management and mitigation measure	Timing	Reference
		• Minimise construction waste		
CC5	To offset residual greenhouse gas emissions associated with the Project.	Carbon offsets would be retired at the completion of construction to account for emissions associated with the construction of the Project to achieve a zero net carbon footprint for all Scope 1 and 2 emissions.	Post construction	ACT Climate Change Strategy 2019-2025
EM	**Emergency Management Procedures**			
EM1	Ensure the safety of workers and the public during construction and operation	Develop a **Work, Health and Safety Plan** (WHS Plan) for construction and operation of the Project. The WHS Plan must include an **Emergency Management Plan** which includes, at a minimum, response procedures in the event of fire, flood or other hazard source	Construction and operation	
EM2		Hot works would be prohibited on days when a catastrophic fire danger has been declared	Construction and operation	
EM3		Construction vehicles and mobile plant will be fitted with fire extinguishers	Construction and operation	

20.4 Offsets

20.4.1 Environmental Offsets

An environmental offset is intended to compensate for the negative environmental impacts of activity, such as a development. Offset activities are required to directly correlate with the impacts of any proposed activities such as construction work. In practical terms, offsets can include protecting at-risk environmental assets, restoring or extending habitat for threatened species, or improving the values of a heritage place.

In the case of the Project, MPC has already purchased environmental credits relating to Golden Sun Moth (*Synemon plana*) to offset expected impacts to Golden Sun Moth habitat within the city area. Impacts to Golden Sun Moth occurring as a result of the Project have been considered and approved under the EPBC Act Approval 2019/8582. Consistent with the requirements of the EPBC Act Approval, biodiversity credits were retired in mid-2021. The availability of suitable environmental offset land for Golden Sun Moth within the ACT is extremely limited. Investigations by MPC into potentially suitable environmental offset opportunities within the ACT proved unsuccessful. As such investigations were completed into using registered environmental offset lands within NSW that are within proximity to the ACT. Approval to use such this methodology has been provided by the Commonwealth Department of Climate Change, Energy, the Environment, and Water (DCCEEW) (formerly Department of Agriculture, Water and the Environment (DAWE)).

20.4.2 Carbon Offsets

A carbon offset or credit is a reduction or removal of one tonne carbon dioxide equivalent (CO_2-^{e}) of GHG emissions, in order to compensate for emissions made elsewhere. The Project will be carbon neutral for all Scope 1 and 2 emissions, and carbon credits may be purchased through the voluntary carbon market to meet this requirement. This commitment is consistent with the ACT Climate Change Strategy 2019-2025.

20.5 Residual risk assessment

A summary of residual risk ratings for each environmental issue, following the implementation of management and mitigation measures outlined in **Table 20-1**, is provided in **Table 20-2**.

There remains a high residual risk associated with noise from construction activities (during a worst-case scenario), and a potential decline in accessibility to services and business due to loss of parking during construction, with all remaining potential impacts for construction and operation reduced to a medium risk or below. Operation of the Project is anticipated to result in beneficial impacts to traffic and transport, landscape and visual realm, and socioeconomic conditions.

Table 20-2 Residual risks with a rating of high or greater

Environmental issue	Residual risk rating	
	Construction	Operation
Traffic and Transport	**Low to medium**	**Very low to low/ beneficial**
Heritage[1]	**Negligible to Medium**	**Negligible to Medium**
Contamination and soil	**Negligible to very low**	**Nil**
Noise and vibration	**Low to high**	**Very low**
Landscape and visual realm[2]	**N/A**[2]	**N/A**[2]
Socioeconomic	**Very low to high/ beneficial**	**Beneficial**
Air quality	**Very low**	**Very low**
Biodiversity	**Low**	**Nil**

Environmental issue	Residual risk rating	
	Construction	Operation
Hydrology and water quality	**Negligible to very low**	**Nil**
Resource management and waste minimisation	**Negligible to very low**	**Negligible to very low**

[2] As the landscape character and visual impact assessment has been undertaken using the TfNSW (2020) (TfNSW, 2020) matrix and framework, a further risk assessment using the methodology detailed in **Chapter 8.0 Environmental risk analysis approach** has not been undertaken. There are no adverse impacts anticipated on landscape character during operation, with beneficial impacts identified at LCZ 2: Major Avenues and Axes and LCZ 4: London Circuit. There are adverse impacts rated above moderate at ten viewpoints during construction, typically as ‘visual clutter’ of equipment, activity and changes to traffic that would result in adverse, temporary impacts on views. During operation, one viewpoint returned an adverse impact on the quality of the change in the view, where a shade structure for a light rail stop would be seen against a backdrop of City Hill. The remaining viewpoints returned a beneficial or neutral change in the quality of the view.

21.0 Justification and Conclusion

Canberra Light Rail currently operates from Gungahlin Place, Gunghalin to Alinga Street, Canberra City, transporting between 4,000 to 13,000 passengers per day and over 10 million passengers since 2019.

Major Projects Canberra (MPC) proposes to extend the light rail from its current southern terminus at Alinga Street, Canberra City, to Woden (Light Rail to Woden). Light Rail to Woden is being progressed in two, self-contained stages for faster Project delivery:

- Stage 2A City to Commonwealth Park (the Project, the subject of this EA)
- Stage 2B Commonwealth Park to Woden.

The Project is subject to its own EA, Works Approval application and Development Application. Stage 2B Commonwealth Park to Woden would be the subject to its own future planning and environmental approvals process.

The Project is needed as part of a coordinated and holistic delivery of a series of major projects in Canberra City and surrounds, to realise the strategic planning and development for Canberra City presented in the *Territory Plan 2008*, the *National Capital Plan* (NCP) and the ACT Transport Strategy. Transport for Canberra Plan. In accordance with these plans, the Project would:

- Provide additional sustainable transport options
- Enhance liveability by improving connectivity and access
- Future-proof the transport network to accommodate growth
- Support affordable transportation.

The Project also supports the ACT Governments vision for a compact and efficient city and reaching net zero greenhouse gas emissions by 2045 as outlined in the *ACT Climate Change Strategy 2019-2025* and the *Sustainability Strategy 2021-2025*. Furthermore, the Project is a specific directive identified as a key strategy for developing and delivering an efficient, compact and sustainable Canberra City within the *Moving Canberra Plan 2019-2045*, the *Light Rail Network Plan* and the *ACT Planning Strategy*.

This EA is not a statutory requirement for the Project but has been prepared to provide the community and other stakeholders with complete and consolidated details of the Project, its anticipated environmental impacts and the mitigation measures proposed to address those impacts. A number of assessments are supported by technical reports which are appended to this EA.

As the Project would generally be within the existing road easement which is a highly modified environment, it largely avoids impacts on environmental values and land use. Despite best efforts to avoid impacts, there would be some adverse environmental effects, mostly temporary in nature, which are likely to occur. Adverse environmental impacts would be minimised by implementing mitigation and management measures outlined in this EA and would include preparing and implementing a CEMP. This EA found that, with suitable mitigation and management measures in place, the environmental and social risks generated through the construction and operation of the Project can be managed to a general overall residual risk rating level of Low. There remains a high residual risk associated with noise from construction activities (in a worst-case scenario), and a temporary potential decline in accessibility to services and business due to loss of parking during construction, with all remaining potential impacts for construction and operation reduced to a medium risk or below. Operation of the Project is anticipated to result in beneficial impacts to traffic and transport, biodiversity, landscape and visual realm and socioeconomic conditions.

The Works Approval Planning Report concludes that the Project is consistent with the *Australian Capital Territory (Planning and Land Management) Act 1998* (Cth) and NCP, does not create adverse planning impacts, and is aligned with the strategic planning and development objectives for the various Designated Area precincts under the NCP affected by the Project.

The Development Application concludes that the Project is consistent with the *Planning and Development Act 2007* (ACT) and Territory Plan. The Project would not conflict with the objectives and development codes for land use zones established under the Territory Plan.

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

22.0 References

ACT Government. (2014). *City Plan.* Canberra City, ACT.

ACT Government. (2016). *Canberra: A Statement of Ambition.* Canberra City, ACT.

ACT Government. (2022a). *Caring for Dhawura Ngunnawal: A natural resource plan for the ACT 2022-2042.* Canberra City, ACT.

ACT Government. (2022b). *City to Commonwealth Park Light Rail: Golden Sun Moth Construction Environmental Management and Rehabilitation Plan.* Canberra City, ACT.

AECOM. (2021a). *Light Rail Stage 2 Decision Making Framework.* Canberra City, ACT: AECOM.

AECOM. (2021b). *Raising London Circuit Environmental Assessment.* Canberra City, ACT.

AECOM. (2022). *Light Rail Commonwealth Avenue Masterplan.* Canberra City, ACT.

ANZECC. (2000). *ANZECC & ARMCANZ (2000) water quality guidelines.* Retrieved from Australian and New Zealand Guidelines for Fresh and Marine Water Quality: https://www.waterquality.gov.au/anz-guidelines/resources/previous-guidelines/anzecc-armcanz-2000

Biosis. (2019). *City to Commonwealth Park Preliminary Environmental Assessment: Biodiversity.* Canberra City, ACT: Biosis.

CMTEDD. (2022). *Annual Report 2021-2022.* Canberra City, ACT: ACT Government.

CRA. (2021a). *The Sustainability Strategy 2021-2025.* Canberra City, ACT: ACT Government.

CRA. (2021b). *CRA 2025 Strategic Plan.* Canberra City, ACT: ACT Government.

CSIRO and BoM. (2020). *State of the Climate.*

DEC. (2006). *Assessing Vibration: A Technical Guideline (AVATG).*

DECC. (2009). *Interim Construction Noise Guideline (ICNG).*

Department of Sustainability, Environment, Water, Population and Communities. (2013). *Significant Impact Guidelines 1.2.* Canberra City, ACT: Australian Government.

DEWHA. (2009). *Significant impact guidelines for the critically endangered golden sun moth (Synemon plana): Nationally threatened species and ecological communities, EPBC Act policy statement 3.12.* Canberra: DEWHA.

DPE. (2021). *The NSW DPE Social Impact Assessment Guideline.*

EPA. (2021). *The ACT Air Quality Report 2020.* Canberra City, ACT: ACT Government.

EPSDD. (2008). *Territory Plan 2008.* Canberra City, ACT: ACT Government.

EPSDD. (2011). *ACT Waste Management Strategy.* Canberra City, ACT: ACT Government.

EPSDD. (2012). *Transport for a Sustainable City 2012-2031.* Canberra City, ACT: ACT Government.

EPSDD. (2018). *ACT Planning Strategy.* Canberra City, ACT: ACT Government.

EPSDD. (2019a). *ACT Climate Change Strategy 2019-2025.* Canberra City, ACT: ACT Government.

EPSDD. (2019b). *Canberra's Living Infrastructure Plan: Cooling the City.* Canberra City, ACT: ACT Government.

EPSDD. (2022a). *2021-22 Invasive Plants Annual Report.* Canberra City, ACT: ACT Government.

EPSDD. (2022b). *2022-23 Invasive Plant Control on ACT Public Land.* Canberra City, ACT: ACT Government. Retrieved from https://actgov.maps.arcgis.com/apps/dashboards/5449adb632884d68aeb585e3e73dde99

ERM. (2022). *Raising London Circuit – Environmental Assessment – Contamination.* Canberra City, ACT: ERM.

Geoscience Australia. (2019, May). *Australian Rainfall and Runoff: A Guide to Flood Estimation.* Retrieved from Australian Rainfall and Runoff: A Guide to Flood Estimation: http://www.arr-software.org/pdfs/ARR_190514.pdf

GML. (2021). *Commonwealth Avenue Landscape Heritage Advice.*

Holman et al. (2014). *IAQM Guidance on the assessment of dust from demolition and contstruction.* London: Institute of Air Quality Management. Retrieved from www.iaqm.co.uk/text/guidance/construction-dust-2014.pdf

IAIA. (2015). *International Association for Impact Assessment's Social Impact Assessment: Guidance for assessing and managing the social impacts of projects.*

International Organization for Standardization. (2018). *ISO 14064. 1:2018 Climate Active Standard.*

Invasive Plants and Animals Committee. (2017). *Australian Weeds Strategy.* Canberra City, ACT: The Australian Government, Department of Agriculture and Water.

IPCC. (2021). *Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report.*

ISCA. (2016). *IS Technical Manual Version 1.2.*

ISCA. (2018). *IS Rating Scheme.*

Landscape Institute and Institute of Environmental Management UK. (2013). *Guidelines for Landscape and Visual Impact Assessment* (Third edition ed.).

MPC. (2019). *City to Woden Light Rail: Stage 2A City to Commonwealth Park Business Case.* Canberra City, ACT: ACT Government.

MPC. (2020). *City to Commonwealth Park Light Rail, EPBC Act Preliminary Documentation Rev 6.0.* Canberra City, ACT: ACT Government.

MPC. (2022). *GSM Plan 2.1.* Canberra City, ACT: ACT Government.

National Environmental Protection Council. (2021). *National Environment Protection (Ambient Air Quality) Measure.* Canberra City, ACT: National Environmental Protection Council.

NCA. (1990). *National Capital Plan.* Australian Government.

NCA. (2007). *The Griffin Legacy.* Australian Government.

NCA. (2017). *Kings and Commonwealth Avenues Draft Design.* Australian Government.

NCA. (2018). *City and Gateway Urban Design Framework.* Australian Government.

NSW EPA. (2013). *NSW EPA Rail Infrastructure Noise Guideline (RING).*

NSW Government Architect. (2020). *NSW Government Architects, Connecting with Country Draft Framework.*

NSW Heritage Office. (2006). *Photographic Recording of Heritage Items Using Film or Digital Capture.*

Office of the Commissioner for Sustainability and the Environment. (2021). *Scope 3 Greenhouse Gas Emissions in the ACT.*

RMS. (2012). *Planning and Land Management Act 1988; AS1742 Part 3; Traffic Control at Worksites Manual.*

Sharp, S. (2011). *Distribution and abundance of African Lovegrass in the ACT and Capital Region and options for strategic control. Report to the Southern ACT Catchment Group.* Canberra City, ACT: Southern ACT Catchment Group.

TCCS. (2015). *Light Rail Network plan.* Canberra City, ACT: ACT Government.

TCCS. (2015). *Public Transport Improvement Plan.* Canberra City, ACT: ACT Government.

TCCS. (2018a). *Moving Canberra 2019-2045, Integrated Transport Strategy.* Canberra City, ACT: ACT Government.

TCCS. (2018b). *Roads ACT Noise Management Guideline.* Canberra City, ACT: ACT Government.

TCCS. (2020a). *ACT Transport Strategy.* Canberra City, ACT: ACT Government.

TCCS. (2020b). *Zero-Emission Transition Plan for Transport Canberra.* Canberra City, ACT: ACT Government.

TCCS. (2021). *Urban Forest Strategy 2021–2045.* Canberra City, ACT: ACT Government.

TCCS. (2022). *Draft ACT Circular Economy Strategy 2022-2025.* Canberra City, ACT: ACT Government.

TfNSW. (2020). *Environmental Impacts Assessment Practice Note – Guideline for Landscape Character and Visual Impact Assessment EIA-N04.* TfNSW.

TfNSW. (2022). *Construction Noise and Vibration Guideline.*

Treasury and Economic Development. (2020). *ACT Wellbeing Framework.* Canberra City, ACT: ACT Government.

Umwelt. (2022). Ecological value calculator. Canberra City, ACT: Umwelt (Australia) Pty Ltd.

World Business Council for Sustainable Development and World Resources Institute. (2001). *Greenhouse Gas Protocol (GHG Protocol) Corporate Accounting and Reporting Standard.*