EPBC Act referral

Australian Government

Department of the Environment and Energy

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Title of proposal	2019/8582 - City to Commonwealth Park Light Rail 2a

Section 1

Summary of your proposed action

1.1 Project industry type	Transport - Land

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

The Project would construct a new light rail route that connects the existing light terminus at Alinga Street to a new terminus at Commonwealth Park. From the Alinga Street stop the light rail would run south within the median of Northbourne Avenue turning into London Circuit (west). The light rail would then follow London Circuit (west) before joining Commonwealth Avenue. The southern portion of London Circuit will be raised to the same level as Commonwealth Avenue and the intersection at London Circuit and Commonwealth Avenue would be rebuilt and signalised to allow the light rail to turn right from London circuit onto Commonwealth Avenue. The light rail would continue south along the middle of Commonwealth Avenue and terminate north of Lake Burley Griffin.

The light rail vehicles will be fitted with an onboard energy storage system (OESS) to allow for wire-free running. The light rail vehicles will either receive a charge at each of the three proposed stops or have their batteries charged in the adjacent wired zones (existing LR Stg 1). This type of energy system eliminates the requirement for overhead wires and supporting infrastructure along the alignment.

Three light rail stops would be built as part of the Project:

- City West would be located on London Circuit between Gordon Street and Edinburgh Avenue and would comprise a side stop; a platform both sides of the rails.
- City South would be located on Commonwealth Avenue just south of the rebuilt intersection. This stop would comprise an island stop; a single central platform.
- Commonwealth Park would be located on Commonwealth Avenue north of the Albert Street intersection. This would also be an island stop, while forming a terminus similar to the Alinga Street stop.

The final design and configuration of the stops and terminus would use elements of the design adopted for the Gungahlin to City light rail such as canopies, platforms and material finishes.

Access and road configuration changes

The following access and road configuration changes will be needed to support the Project:

- Re-configuring London Circuit to create a signalised intersection at the same level as Commonwealth Avenue.
- Building a separate light rail bridge over Parkes Way between the two existing road bridges.
- Making minor changes to the intersections, kerb lines and footpaths along the route, while adjusting traffic signal timings.
- Installing new traffic signals and pedestrian crossings where required.
- A potential reduction in the road speed limit along Commonwealth Avenue.
- Installing 'green tracks' along Commonwealth Avenue, which involves planting grass or shrubs between and besides the light rail track.
- Potentially removing on-street parking and other kerbside uses on London Circuit.
- Potentially removing up to 30 off-street parking spaces at the Lot 5 Regatta Place and London Circuit East car parks to locate the traction power substation and create the battered embankments to raise London Circuit east of the intersection.
- Prioritising pedestrian movement on London Circuit between Gordon Street and Edinburgh Avenue to create a zone that would avoid potential conflicts between pedestrians and vehicles due to the expected very-high patronage of the City West stop.

London Circuit-Commonwealth Avenue intersection

The southern portion of London Circuit would be raised to the same level as Commonwealth Avenue to create a four-way signalised road intersection. This would reinstate the original intersection design and formation as included in the Griffin Plan and contemplated in the National Capital Plan. It would also allow the light rail to run down the middle of both roads.

This would be achieved by building ramps either side of the intersection to 'raise' London Circuit to the same level as Commonwealth Avenue. These ramps would require fill material (soil) to be imported to raise the road and light rail track. The ramps would have a batter-sloped in the adjacent areas ('clover leaf') for stability; meaning batter-slopes would be created either side of the ramp at a stable angle. The detail of the ramp and batter-slope lengths, angles and formation will follow in detailed design.

Construction of the London Circuit and Commonwealth Avenue intersection would occur in four stages. During each stage, temporary road routes and traffic management controls would be needed at various times along London Circuit and Commonwealth Avenue

Parkes Way

An 'insert' bridge would be built between the two existing road bridges on Commonwealth Avenue over Parkes Way to accommodate the light rail track running down the median. As there is limited height clearance under the existing bridges particularly during construction. Traffic management controls would be needed on Parkes Way to allow for construction.

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Substations

It is anticipated that one traction power substation might be needed to service the Project. The structures' perimeter fence is nominally 30 metres long, 10 metres wide and four metres high, a footprint of around 300 square metres. The requirement for this, its design detail and power specification of the substation (if required) would be confirmed during detailed design.

If required, the proposed location for installing the traction power substation is in the vicinity of Regatta Place car park (on the eastern side of Commonwealth Avenue) in a location to minimise its visual impact (refer to Figure 1.2 of Appendix C for its approximate location).

An under-bore would be used to connect the traction power substation with the light rail.

A high-voltage 'feeder' cable would connect the new traction power substation to the wider ACT power grid. It is anticipated the corridor for the feeder cable would follow existing utilities corridors and it would not require any separate routes to be created.

Drainage infrastructure

The following drainage provisions are likely needed to support the Project:

- Additional drainage for the light rail track zones to meet the required design standards.
- Additional drainage for the road and intersection upgrades plus modifications to existing infrastructure to meet current road design standards.
- Modifications to the existing drainage network to accommodate new track footings and changes to road heights and kerb lines.
- Modifications to existing surface drainage because of level changes, local catchment boundary changes and changes to runoff as a result of an increase in paved areas.
- Modifications to existing sub-surface drainage to enable the future proofing of third party developments that may otherwise need to install drainage infrastructure later. Carrying out these works as part of the Project would therefore avoid future community impacts and disruption to light rail operations.

Utilities

The Project would cross utilities and services that would either need protecting, adjusting or relocating. Section 5.3.5 of Appendix C describes the utilities within the route study area along with the utilities that maybe needed specifically to service the Project.

A full description of the project, actions and maps are provided in Appendix A and B

1.3 What is the extent and location of your proposed action?

See Appendix B

1.5 Provide a brief physical description of the property on which the proposed action will take place and the location of the proposed action (e.g. proximity to major towns, or for off-shore actions, shortest distance to mainland)

The Project footprint would occupy a relatively narrow corridor along the median of both London Circuit and Commonwealth Avenue (Figure 1.2, Appendix C). A wider Project footprint is required to accommodate temporary traffic management controls, plant, and equipment during construction. The study area considers a broader footprint that is appropriate for understanding potential direct and indirect impacts. Table 2 in Appendix A shows these footprints.

The Project footprint is mostly contained in existing Territory and National road reserve. Where the Project impacts on land outside of the road reserve it is predominantly due to the need for temporary works (e.g. the construction footprint) on unleased land that is returned to the appropriate custodian once construction work is complete.

Table 3 in Appendix A shows the Block and Section numbers relating to the above footprints.

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

The development footprint for the Project would be up to 29 hectares accounting for; the track formation, stops, and traction power substation, construction zones, compounds and areas subject to utilities connections and relocations.

1.7 Proposed action location

Lot - The median of Northbourne Avenue, London Circuit (west) and Commonwealth Avenue within the ACT

1.8 Primary jurisdiction Australian Capital Territory

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

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☐ Yes ☑ No

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

☑ Yes ☐ No

1.10.1 Is there a local government area and council contact for the proposal?

☑ Yes ☐ No

1.10.1.0 Council contact officer details

1.10.1.1 Name of relevant council contact officer	Mr Dominic Riches Assistant Director, Impact Assessment and Business Improvement ACT Planning and Land Authority
1.10.1.2 E-mail	dominic.riches@act.gov.au
1.10.1.3 Telephone Number	(02) 6205 1834

1.11 Provide an estimated start and estimated end date for the proposed action	Start Date	04/01/2021
	End Date	20/12/2024

1.12 Provide details of the context, planning framework and state and/or local Government requirements

Environmental Planning and Assessment Framework

The Project would be subject to both Territory and Commonwealth planning approvals under the ACT Planning and Development Act 2007 (P&D Act) and the Commonwealth Planning and Land Management Act 1988 (PALM Act) (respectively).

Territory planning approval

The parts of the Project located outside Designated Areas will need Development Approval from ACT Planning and Land Authority (ACTPLA) under the P&D Act. Development Approval is therefore needed primarily for sections of the Project Construction Footprint on London Circuit between Northbourne Avenue and University Avenue and University Avenue and Edinburgh Avenue.

The development approval process will involve an assessment of the Project against the provisions of the Territory Plan 2008 (Territory Plan), which is administered by ACTPLA under the P&D Act. The object of the Territory Plan is "to ensure, in a manner not inconsistent with the National Capital Plan, [that] the planning and development of the Territory, to provide … people … with an attractive, safe and efficient environment in which to live and work and have their recreation".

The Territory Plan is the statutory instrument used to implement the strategic land use, environmental, transport, built form and social policies established by ACT PLA. Development tables within the Territory Plan are used to determine whether development is 'exempt', 'prohibited' or 'assessable'. Assessable development is assessed via a specific process termed 'a track'. The 'assessment track' that is adopted for a particular project depends on that project's consistency with the Territory Plan development codes and land use zoning objectives, the suitability of the land for development, and the scale of the environmental and social impact.

Works approval

The parts of the Project located within Designated Areas will need a Works Approval from the NCA in accordance with the PALM Act. Works Approval would be needed for the Northbourne Ave sections, University Avenue as these are both Designated Areas. It would also be needed for London Circuit south of Edinburgh Avenue up to Commonwealth Avenue, and Commonwealth Avenue. The Works Approval process involves an assessment of the Project against the provisions of the National Capital Plan (NCP).

The NCP is administered by NCA under the PALM Act. The object of the NCP is "to ensure that Canberra and the Territory are planned and developed in accordance with their national significance".

The NCP identifies certain Designated Areas, which are those locations in the Australian Capital Territory that have the special characteristics of the National Capital, including that they are recognised for their cultural landscape, realm and amenity values in representing the Griffin Plan. This can include both Territory and National land. Works Approval is needed for all works in a Designated Area, and it focusses on managing impacts on the above values. The NCA will make its assessment against the NCP including relevant precinct codes, and other relevant policies.

The Project crosses four precincts: University Avenue (Precinct 4: City), London Circuit south of Edinburgh Avenue (Precinct 5: Commonwealth Park), Commonwealth Avenue north including Parkes Way (Precinct 6: Constitution Avenue & Anzac Parade), and Commonwealth Avenue south (Precinct 10: Lake Burley Griffin & Foreshores).

Where Territory land is in a Designated Area, as is the case for London Circuit south of Edinburgh Avenue up to Commonwealth Avenue, then the provisions of the NCP prevail over the Territory Plan to prevent inconsistency. Accordingly, while Works Approval is needed for this section, Development Approval is not.

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Major Projects Canberra and the NCA have been successful in establishing a solid working relationship throughout the design and delivery of the City to Gungahlin light rail project. This included, for example, effective coordination between ACT PLA and the NCA in agreeing consistent conditions of approval, as far as possible having regard to the different regulatory regimes that applied. This relationship would be beneficial in seeking Works Approval for this Project. The ACT Government has started engagement with the NCA on the proposal to extend the Canberra light rail network from the City to Woden in December 2016. This included discussing design concepts, route alignments and approvals processes, and it has fundamentally shaped the Project as described in this referral.

EPBC Act

The ACT Government is of the view that no further assessment activities are required under the EPBC Act. Should the Commonwealth Minister for the Environment determine that the Project is a controlled action, then the project should be assessed on the information included within this Referral.

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

Preliminary Consultation

Consultation has been integral to the development of the underpinning strategies for the extension of the light rail network. Reports such as the Transport for Canberra (2012), the ACT Planning Strategy (2018) and the Moving Canberra 2019-2045 (Integrated Transport Strategy) have informed consultation planning. Major Projects Canberra has undertaken a range of formal and informal consultation activities, which will continue throughout the life of the project.

In addition to regular information updates to the public, the following organisations and special interest groups have been identified as requiring stakeholder specific engagement as the light rail network expands including

- Community Councils,
- Residents, workers, businesses, organisations, and property owners along the route
- Business and industry groups
- Special interest groups
- Government bodies incl the City Renewal Authority, Climate Change Council, Heritage Council and the National Capital Authority.

Expert advice, community and stakeholder feedback, insights and the experience and lessons learnt from construction and operation of City to Gungahlin light rail are all informing the expansion of the light rail network.

Stakeholders have had the opportunity to comment on many aspects of the light rail project to date, either through formal consultations or informally by responding to publicly available project information updates, over the last 24 months.

In 2017, stakeholder and community views were sought on the potential routes for the light rail to travel from the City to Woden Town Centre, with four key themes explored:

1. Options for the route between the City and Woden
2. Alignment of the tracks
3. Proposed locations for the stops
4. Identification of items of community or environmental interest.

Several Commonwealth and Territory environmental approval and planning approval processes involve public consultation and provide interested stakeholders with a further opportunity to comment on the expansion of light rail.

The ACT Government, through Major Projects Canberra, is committed to an ongoing consultation process with the community, local businesses, educational institutions and other key stakeholders throughout the expansion of light rail. These stakeholder consultations are planned via various engagements including community pop-ups and workshops, website and social media channels, door knocks and surveying, formal meetings and working groups. Major Projects Canberra intends to continue engaging with:

- Employers
- Interest Groups: community or interest groups and Community Councils
- Residents and commuters
- Businesses and landlords
- Education institutions including schools, early learning, vocational and higher education
- Community and tourist destinations including major cultural institutions, event spaces, hotels, places of worship and embassies
- Local peak bodies with an interest in the expansion of light rail including those representing people living with a disability and specialist commuters (public transport and other e.g. cyclists)
- Aboriginal and Torres Strait Islander groups and individuals including the ACT Aboriginal and Torres Strait Islander Elected Body, registered Aboriginal Organisations and the United Ngunnawal Elders Council.

Consultation undertaken

Principles contained in the ACT Government's Engaging Canberrans: a guide to community engagement have been used to

guide the engagement and consultation process adopted by Major Projects Canberra. A full communications and engagement strategy has been developed for current light rail expansion plans. All engagement activity is guided by the approach set out in this overarching strategy. For each underpinning activity a communications plan has been or will be developed – for example, a Business communications and engagement plan.

Engagement activities are part of an ongoing conversation as the Canberra light rail network is delivered over the next 20 years. While the Canberra light rail network has been a public discussion for decades, Major Projects Canberra has been engaging directly on the network's expansion, with community and stakeholder conversations being undertaken since 2011 (as seen in the 'What we heard' report, June 2019).

Specifically, in August 2019, Major Projects Canberra initiated an engagement program with businesses along the alignment of Stage 2A. Over 370 businesses and offices were door knocked with an invitation to provide feedback to contribute to project planning.

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

Preliminary environmental assessment

Major Projects Canberra has carried out a preliminary environmental assessment (refer to Appendix C) to help develop the Project.

As described in Section 1.12, the project is subject to both Commonwealth and Territory approval requirements. At the present time, neither the Territory P&D Act nor Commonwealth PALM Act provide any specific guidance on completing a wholistic environmental impact assessment of a single linear project that traverses both jurisdictions.

In the absence of specific guidance, Major Projects Canberra is proposing to complete a comprehensive Environmental Assessment, that would be prepared to address requirements from both statues, and provide the community with a single point of information that would describe the Project in detail, provide assessments on the potential environmental impacts associated with the Project, and nominate environmental mitigation and management measures.

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

☐ Yes ☑ No

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

☑ Yes ☐ No

1.16.1 Identify the nature/scope and location of the related action (including under the relevant legislation)

Major Projects Canberra does not believe that the Project is part of a staged development or split referral, taking into account the policy document EPBC Act Policy Statement - Staged Developments - Split referrals: Section 74A of the EPBC Act.

The Project is a self-contained extension to Canberra's current light rail network from Gungahlin to the City. It is part of the ACT Government's long term intention to develop a light rail network in Canberra and facilitates the extension of the light rail network to Woden.

Australian Government

Department of the Environment and Energy

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Section 2

Matters of national environmental significance

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

☐ Yes ☑ No

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

☐ Yes ☑ No

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

☐ Yes ☑ No

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

☑ Yes ☐ No

Species or threatened ecological community

Golden Sun Moth (GSM)

Impact

The amount of golden sun moth habitat was far more extensive in 2017 than in 2019. This was due to the scope of the 2019 survey only focussing on a 100-metre-wide footprint centred of the Project route compared to the footprint investigated in 2016 and 2017; which was far wider and covering a larger area.

It is not possible to avoid an impact on the recorded golden sun moth population at the London Circuit and Commonwealth Avenue intersection. Given the ongoing work associated with the design of the project, a precautionary approach has been taken in assuming the loss of the whole population in the impacted area. The area of impacted habitat varies between 2.6 hectares and 6.9 hectares (Section 6.3, Appendix C). Despite the difference in the potential extent of habitat impact, the overall assessment is that the entire population would be lost to the construction footprint. More detailed assessment would be needed at the same time as the design is being developed to confirm the exact habitat impact across the construction footprint.

There are also inherent risks associated with any construction work relating to spills, accidents, edge effects and other key threatening processes indirectly impacting on ecological values in the area. These risks can be effectively managed through the adoption of standard measures that are proven effective in avoiding and/or minimising risks.

Further details of the potential impacts, further studies and mitigation are provided in Section 6.3 of Appendix C.

2.4.2 Do you consider this impact to be significant?

☑ Yes ☐ No

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

☐ Yes ☑ No

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

☐ Yes ☑ No

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

☑ Yes ☐ No

2.7.1 Is the proposed action likely to have any direct or indirect impact on the Commonwealth land?

☑ Yes ☐ No

2.7.2 Describe the nature and extent of the likely impact on the whole of the environment

Appendix C contains detailed descriptions of the potential project impacts. Specifically, Section 6.4 and Section 8 of Appendix C assesses the Project's impact on Commonwealth land (including the Reserve Bank of Australia's leased premises on the eastern side of London Circuit north of University Avenue and National Land along at the southern end of London Circuit and along Commonwealth Avenue). It confirms that while development would take place on National and Commonwealth land the impacts are not considered significant.

Potential impacts on Commonwealth land include the following:

- Construction and operation of the traction power substation (if required).
- Connection of a combined services route to the traction power substation from Commonwealth Avenue, noting that this would be under-bored and to the extent required, reinstated and would have no permanent surface impact.
- Construction and operation of the light rail on or near Commonwealth land.
- Raising of the intersection of Commonwealth Avenue and London Circuit.
- Installation of signaling infrastructure.
- Adjustments to other intersections along the alignment on Commonwealth land.
- Utility relocations and traffic management control.
- Impacts on the Reserve Bank of Australia leased premises (listed as a Commonwealth heritage place).
- Impact on the western edge of the Parliament House Vista along Commonwealth Avenue (listed as a Commonwealth heritage place)

The Project would involve locally excavating the modified landscape, however this would be restored through landscaping, tree-planting, and public realm enhancements as further developed through the Works Approval processes (and Development Application on Territory land). Where the Project footprint crosses turfed areas, a green track slab treatment is mainly proposed. Also, the traction power substation (if required) would be located to minimize tree removal, trimming and pruning where feasible.

Construction

Major Projects Canberra has used modelling to consider if the wider road network has the capacity to handle additional traffic for short periods during construction and what management controls and measures would be needed to ensure all transport modes, including pedestrians and cyclists, could still adequately function without any undue inconvenience, congestion or delay.

That said, there would be some inconvenience, minor delays and increased journey times for people moving across the city through needing to temporarily:

- Restrict access along the southern portion of London Circuit under Commonwealth Avenue.
- Temporarily realign and/or reduce the number of northbound and southbound lanes on Commonwealth Avenue around active work sites at various time during construction.
- Close off access to the northbound off-ramp from Commonwealth Avenue.
- Divert traffic from London Circuit and Commonwealth Avenue while the intersection is being upgraded.
- Introduce turning movement restrictions on London Circuit.
- Relocate bus stops and adjust the bus timetable and/or route.
- Use temporary footpaths and cycle lanes on London Circuit and Commonwealth Avenue for construction.
- Divert pedestrians and cyclists to allow for utility works and vegetation works in the road reserve.
- Removal of carparking between Constitution Avenue and Commonwealth Avenue (Section 112, Block 1, City) to allow a construction compound.

Operation

Extending the light rail infrastructure south from Alinga Street, raising London Circuit and reconfiguring the intersection is considered to bring improved transport benefit to Canberra. This will help connect people across the city while providing access to key areas in and around the Civic precinct, Acton Waterfront and Lake Burley Griffin.

A key change would be the permanent reduction in the number of lanes along sections of London Circuit to accommodate the light rail in the median. Despite this reduction in capacity, Major Projects Canberra has carried out preliminary traffic modelling that demonstrates that the city can accommodate a redistribution of traffic onto other roads without affecting network performance or travel times.

2.7.3 Do you consider this impact to be significant?

☐ Yes ☑ No

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2.8 Is the proposed action taking place in the Great Barrier Reef Marine Park? ☐ Yes ☑ No
2.9 Is the proposed action likely to have any direct or indirect impact on a water resource from coal seam gas or large coal mining development? ☐ Yes ☑ No
2.10 Is the proposed action a nuclear action? ☐ Yes ☑ No
2.11 Is the proposed action to be taken by a Commonwealth agency? ☐ Yes ☑ No
2.12 Is the proposed action to be undertaken in a Commonwealth Heritage place overseas? ☐ Yes ☑ No
2.13 Is the proposed action likely to have any direct or indirect impact on any part of the environment in the Commonwealth marine area? ☐ Yes ☑ No

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Section 3

Description of the project area

3.1 Describe the flora and fauna relevant to the project area

The city of Canberra is in the Southern Tablelands. The area host flora and fauna including remnant eucalyptus forest on the hills surrounding Canberra and lower lying areas and lake shores that contain remnant grasslands and riparian river frontages. The ecology of the Southern Tableland provides habitat for native trees and grasses, birds, insects, reptiles and mammals.

A desk review of Commonwealth and Territory records, and subsequent field assessments have identified the presence of the following ecological features in the study area:

- Two principal vegetation community types; modified grassland and urban vegetation of exotics.
- The critically endangered golden sun moth.

There were no threatened flora species and no threatened ecological communities recorded within the study area (refer to Section 5.2 of Appendix C).

Golden sun moth

A number of targeted surveys were undertaken in the project survey footprint in 2016, 2017 and 2019 to determine the presence, distribution and viability of golden sun moth. Golden sun moth population was recorded at the intersection of London Circuit, Commonwealth Avenue and along Parkes Way. In terms of observed individuals:

- Two golden sun moths were recorded in the south-west corner of the 'clover leaf' in 2019 compared to 16 in 2017 and 24 in 2016.
- 38 golden sun moths were recorded in the south-west corner of the 'clover leaf' in 2019 compared to 160 in 2017.
- 12 golden sun moths were recorded along a limited section of the Parkes Way median during 2019 compared to 88 in 2017.

The extent of golden sun moth habitat was far more extensive in 2017 than in 2019 and was due to the scope of the 2019 survey only focussing on a 100-metre-wide footprint centred of the Project route compared to the footprint investigated in 2016 and 2017; which was far wider and covered the City to Lake precinct.

There is not the survey record to confirm why the habitat and population changed across the common parts of the 2017 and 2019 footprints. As such, it can only be concluded that the construction footprint covers 2.6 hectares of confirmed golden sun moth habitat, based on the 2019 survey data, compared to 6.9 hectares of habitat based on the 2017 data.

The golden sun moth is critically endangered nationally and endangered in the Territory. Table 4 of Appendix A describes the core ecological values of the golden sun moth population and habitat as assessed within the study area in 2017 and 2019.

Under Commonwealth guidelines, any recorded sun moths within 200 metres of each other are considered part of a single population. Accordingly, even though there are major roads separating each of the intersection 'clover leaves' there is some mobility between the areas. This population is considered distinct and isolated from nearby populations at Campbell, Reid, Yarralumla, Ainslie and Barton (Mulvaney, 2012).

The golden sun moth is critically endangered under the EPBC Act. It is also endangered within the ACT under the Nature Conservation Act 2014 (ACT).

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

The Project is within the Lake Burley Griffin/Molonglo River catchment, with the light rail alignment will drain to Lake Burley Griffin. A review of existing flood mapping data on ACTMapi indicates that The Project catchment will not be impacted by 1-in-100-year flood level. London Circuit, near its intersection with Edinburgh Avenue, is however prone to short-duration nuisance flooding due to its lower lying nature.

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

The geology of the study area comprises the Canberra Formation; a conglomerate (mix) of mudstone, siltstone, minor sandstone, limestone, hornfels (a type of metamorphic rock), dacitic ignimbrite (a type of igneous rock made of hardened volcanic ash called tuff) and volcaniclastic sediments.

Soils

The overlaying soils are characteristic of the underlying geology of the study area and are mainly dominated by Williamsdale and Burra landscapes. The natural soils in the study area comprise a mix of alluvium, as deposited from the lake and river, and poorly draining sandy sodic (saline) and podzolic (formed from eucalypt) soils. Much of the area has been modified and infilled to support Canberra's development, and prior to that, to support the land's agricultural use.

Acid sulfate soils

There is an extremely low to low probability for acid sulfate soils (Class 4) across the Project area identified in the Australian Soil Resource Information System (CSIRO, 2011) .

Vegetation

The Project area is in central Canberra.

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The only vegetation in the Project area is planted, introduced and is modified and maintained. It therefore classified as two low-ecological value community-types: 'modified grasslands' and 'urban vegetation: exotics'. Chapter 5 of Appendix C provides more information regarding the soil and vegetation characteristics of the Project area.

The area to the south of the upgrade footprint is considered an area of urban vegetation consisting mainly of planted natives with a small patch of exotics present. Planted native urban vegetation communities are not considered 'native vegetation' as defined under the Nature Conservation Act 1980 (NC Act).

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

The light rail passes through the Central National Area, which is a combination of the NCP precincts crossed by the Project footprint. The Central National Area is a location of national significance as identified in the NCP. Most of the Project is also in a Designated Area, which are those locations in the Australian Capital Territory provisioned under the NCP that have the special characteristics of the National Capital, including that they are recognised for their cultural landscape, realm and amenity values in representing the Griffin Plan.

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

The study area is in central Canberra. The only vegetation in the Study area is planted, introduced and is modified and maintained. While it includes native species, these form part of an introduced landscape. Planted native vegetation communities are not considered 'native vegetation communities' as defined under the NC Act or the EPBC Act. Further details on vegetation relevant to the study area is described in detail in Chapter 5 of Appendix C.

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

Appendix D illustrates the Study area's gradient, which is generally level to gently undulating. The hydrological gradient is north to south, with the groundwater draining to Lake Burley Griffin. The topography would need to be modified locally as the light rail can only operate on a shallow gradient. This would be mainly at the intersection between London Circuit and Commonwealth Avenue. Other minor changes would be needed for the light rail to navigate existing bridges and traffic ramps within existing road reserves.

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

The Study area crosses two distinct urban precinct characters. The existing visual environment of the Study area is generally characterised by high-density commercial development (e.g. multistory buildings) within the City precinct and the more formal boulevard character of Commonwealth Avenue, flanked by parkland.

Each precinct represents a different character that would require differing treatments and strategies for integrating the Project within its context. There are also mature trees and other landscaping elements along the Project that have substantial value within the streetscape.

The environment is urban, highly modified and managed. It holds limited natural character other than the golden sun moth habitat at the London Circuit and Commonwealth Avenue intersection, where recorded species numbers have reduced over the past three years. The landscaped areas, even including the golden sun moth habitat, are managed and maintained as part of the urban environment.

There is considerable development and change taking place and planned on London Circuit with new commercial and residential development undertakings.

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

Places within or adjacent to the Project and construction footprints listed on the Commonwealth heritage list and other places recognised as having heritage values to the study area are identified in Section 5.1 of Appendix C. There are no ACT Heritage listed items within the Commonwealth Land areas as described in Section 5.1 of Appendix C.

There are two Commonwealth Heritage listed places within the study area that are relevant; Parliament House Vista and the Reserve Bank of Australia. The Commonwealth heritage values associated to these places is outlined below.

Parliament House Vista Anzac Parade, whole of Parliamentary Triangle

Values

A) Processes (historic value)

- The central national area of Canberra is strongly associated with the history of politics and government in Australia and the development of Canberra as the Australian National Capital. It is significant as the home of the Commonwealth Parliament, the focus of the Federal Government since 1927, initially in the Old Parliament House and from 1988 in the new Parliament House.

E) Aesthetic characteristics

- The place has high aesthetic significance due to the visual impact of the extensive open sweeping vista along the

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land axis that can be experienced in two directions, the designed axes set within natural features of forested hills, patterns and textures of architectural massing accentuated by planned open spaces, water planes and tree plantings that are arranged across the area.

- Symmetrical characteristics of the road networks.

F) Technical Achievement

- The Parliament House Vista is the central designed landscape of Canberra, which expresses the core of the Walter Burley Griffin design vision for Canberra.

G) Social Value

- The area has strong and special associations with the broad Australian community because of its social values as a symbol of Australia and the Federal Government.

H) Significant People

- The central national area has a special association with:
- Its designers, Walter Burley Griffin and Marion Mahony Griffin;
- John Smith Murdoch, chief architect of the Commonwealth Government;
- Thomas Charles Weston, Superintendent of Parks, Gardens and Afforestation; and Notable NCDC planners Sir John Overall, Peter Harrison and Paul Reid.

Reserve Bank of Australia

A) Processes (historic value)

- The Reserve Bank is important as the nation's central bank having evolved from the separation of the central banking (monetary policy) function from the commercial, customer focussed activities of the Commonwealth Bank.

D) Characteristic values

- It is one of three buildings in the precinct, demonstrating the Stripped Classical style of architecture with their typical features such as simple rectangular forms, echoes of colonnades, symmetry and horizontal skyline, all linked by a landscape plaza also expressing a geometric minimalist style. The sculptural work in the Reserve Bank, by Gerald and Margo Lewers demonstrates the sculptural styles of the times and the role of art to adorn public places.

E) Aesthetic characteristics

- The aesthetic importance of the Reserve Bank building which links harmoniously with the precinct, is created by the elegance of its minimalist design style, the low scale and simple building form, and the use of pale grey marble cladding which provides a light visual quality. The location of the bank in the precinct, being visual subservient to the former Law Courts building, enhances the latter's projection of authority and dignity. The Reserve Bank contributes to the visual axis of the Black Mountain vista.

F) Technical achievement

- The Reserve Bank of Australia building, constructed 1963-65, is a major component of the Law Courts Precinct. The precinct provides a noteworthy contribution to Canberra's townscape by its siting as a terminating point for University Avenue at City Hill, its arrangement of buildings giving prominence to the Supreme Court, and its design execution in the contemporary modern design idiom.
- The design of the Reserve Bank is additionally important for its overall impression of institutional security. The impressive space of its banking chamber makes full use of the building's height and proportions. Design features of the chamber are the sculpture, 'Four Pieces' by Gerald and Margo Lewers, and the timber counter and furniture contemporary with the design of the building.

Consideration will be given for those heritage items located outside of the Project study area that may have unobstructed views towards the Project. Views and vistas to and from parkways and hill tops such as Mount Ainslie, Mount Pleasant and Black Mountain will be taken into consideration during the detailed design and Development Application and Works Approval processes.

3.9 Describe any Indigenous heritage values relevant to the project area

There are no Aboriginal heritage values recorded in or local to the Study area. The nearest to the Study area are those recorded as being submerged on the bed of Lake Burley Griffin.

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

The majority of the Project would be contained within the existing road reserves. Table 3 in Appendix A identifies where the Project impacts on land outside of the road reserve and for each of these impacts, the tenure of that block of the land and a description of the impact is included.

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

Land use:

- London Circuit: four-lane public road with footpath provisions.
- City Hill: amenity public open space and key vantage point.

Note: PDF may contain fields not relevant to your application. These fields will appear blank or unticked. Please disregard these fields.

- East of London Circuit: principally public car parking, the city police station, and the Reserve Bank of Australia, ACT Magistrates Court and the Supreme Court of Australia.
- West of London Circuit: a mix of commercial and retail properties and low-rise residential units.

Key properties:

- Reserve Bank of Australia (a Commonwealth heritage place), Supreme Court of Australia, Canberra City police station, ACT Magistrates Court, Commonwealth Superannuation Corporation, QT Hotel, Capital Tower Hotel, and AON. The ANU and the National Film and Sound Archive of Australia are located to the west off University Avenue.

Commonwealth Avenue

Land use:

- Commonwealth Avenue: six-lane public road with marked cycle lane in both directions; intertown public transport route, as defined in the National Capital Plan. Footpath provisions south of the Parkes Way overbridge.
- West of Commonwealth Avenue: public open space and public car parking, Henry Rolland Park located near Lake Burley Griffin, and the foreshore area.
- East of Commonwealth Avenue: amenity planted verges, public car parking, the archbishop's house, and Lake Burley Griffin foreshore area.

Key properties:

- The archbishop's house, the ACT Parks Depot and the National Capital Exhibition. The Canberra Olympic Pool and National Convention Centre are respectively located about 400 metres and 500 metres to the east of Commonwealth Avenue.

Note: PDF may contain fields not relevant to your application. These fields will appear blank or unticked. Please disregard these fields.

Section 4

Measures to avoid or reduce impacts

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

This Project follows the general principles of 'avoid, minimise and mitigate' to manage impacts to the environment, and endeavors to, in order of consideration:

- Avoid impacts on environment, through the planning process.
- Minimise impacts on environment, through the planning process.
- Mitigate impacts on environment, though the use of a range of mitigation measures during the Project's planning, construction and operation.

As noted in Section 1.14, a comprehensive Environmental Assessment is proposed to be carried out to provide the community with a single point of information that would describe the Project in detail, provide assessments on the potential environmental impacts associated with the Project, and finalise environmental mitigation and management measures to be implemented throughout the ongoing design, construction and operation of the Project.

Noting the potential impacts to golden sun moth, the project is seeking to minimise the extend of direct impacts through the ongoing detailed design process. Notwithstanding, Major Projects Canberra has adopted the precautionary principle in describing potential impacts to golden sun moth and therefore the ongoing development of mitigation measures will be developed to address these "worst case" potential impacts.

Based on the information contained in this Referral, and through the development of the Preliminary Environmental Assessment a series of outline mitigations measures have been proposed (see Table 7.1 of Appendix C). These include site selection decisions, design measures, and standard and bespoke (e.g. Project-specific) environmental mitigation, management and monitoring measures. Any gaps or uncertainties are described. These measures are expected to be further developed through the future Environmental Assessment noted above, but include measures to respond to the following issues:

- General environmental management
- Biodiversity
- Heritage
- Landscape, urban character and visual amenity
- Contamination, soils and geology
- Surface water and flooding
- Groundwater
- Property and land use
- Utilities and energy resources
- Traffic and transport
- Noise and vibration
- Air quality and greenhouse gas
- Social and Economic

In preparing this referral, it has been necessary to assess a worst-case scenario based on the current design. This is consistent with the ecologically sustainable development principle of taking precaution where there is uncertainty. It therefore allows the opportunity for the design to be refined and its impacts minimised as the Project progresses.

Many of the measures would be introduced under a Construction Environmental Management Plan. This plan would define the measures to be outcome-focussed, specific, measurable, achievable, relevant and time-bound, consistent with the draft Outcomes-based Conditions Policy 2015 and Outcomes-based Conditions Guidance 2015 (DoE 2015).

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

As described in section 4.1, the Project would seek to minimise the extent of the significance of its impact on the known golden sun moth habitat. Where impacts are unavoidable, Major Projects Canberra would work with key stakeholders lo establish an appropriate treatment to enable to following ecological outcomes for the project:

- A comprehensive record of the remnant GSM population.
- Selection of an offset site, and development of an offset management plan ensuring the viability of the species within the offset site, in perpetuity.
- Offsets directly contribute to the ongoing viability of GSM impacted by the project and deliver an overall conservation outcome that improves or maintains the viability of GSM as compared to what is likely to have occurred under the status quo that is if neither the action not the offset had taken place.

Note: PDF may contain fields not relevant to your application. These fields will appear blank or unticked. Please disregard these fields.

While the Project is not predicted to have a significant impact on any other protected matter or Commonwealth land values it would be sensitively and carefully designed to ensure the landscape and amenity character of the surrounding area would be enhanced as part of the Project. This includes seeking to minimise impacts on the Commonwealth heritage values within the broader setting of the area. The Project also provides an opportunity to sensitively undertake renewal of some landscape areas identified as being in poor condition.

Note: PDF may contain fields not relevant to your application. These fields will appear blank or unticked. Please disregard these fields.

Section 5

Conclusion on the likelihood of significant impacts

5.1 You indicated the below ticked items to be of significant impact and therefore you consider the action to be a controlled action

- ☐ World Heritage properties
- ☐ National Heritage places
- ☐ Wetlands of international importance (declared Ramsar wetlands)
- ☑ Listed threatened species or any threatened ecological community
- ☐ Listed migratory species
- ☐ Marine environment outside Commonwealth marine areas
- ☐ Protection of the environment from actions involving Commonwealth land
- ☐ Great Barrier Reef Marine Park
- ☐ A water resource, in relation to coal seam gas development and large coal mining development
- ☐ Protection of the environment from nuclear actions
- ☐ Protection of the environment from Commonwealth actions
- ☐ Commonwealth Heritage places overseas
- ☐ Commonwealth marine areas

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

N/A

Note: PDF may contain fields not relevant to your application. These fields will appear blank or unticked. Please disregard these fields.

Section 6

Environmental record of the person proposing to take the action

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

Yes. Major Projects Canberra as an administrative unit of the ACT Government is the proponent of the proposed action. The ACT Government takes a proactive and responsible approach to environmental management.

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

N/A

6.3 If it is a corporation undertaking the action will the action be taken in accordance with the corporation's environmental policy and framework?

☑ Yes ☐ No

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

While Major Projects Canberra is undertaking the action, the Project would be undertaken in accordance with relevant ACT Government policies and guidelines, including the ACT Planning Strategy 2018, the Moving Canberra 2019 – 2045 Integrated Transport Strategy and the ACT Climate Change Strategy 2019.

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

☑ Yes ☐ No

6.4.1 EPBC Act No and/or Name of Proposal

The ACT Government has referred numerous proposed actions under the EPBC Act. Since 2014, these include the following:

- 2014/7327 ACT Economic Development Directorate/Residential development/Division of Symonston, ACT/ACT/Symonston Residential Estate Stage 2, Symonston, ACT
- 2015/7483 ACT Shared Services Procurement/Transport - Land/Pialligo/Australian Capital Territory/Construction of a link road on Marjura Parkway, Pialligo, ACT
- 2016/7742 ACT Procurement/Transport - Land/Mustang Avenue roundabout, Majura Road, Pialligo, ACT/Australian Capital Territory/Construction of the IKEA Canberra Northern Access Road, ACT
- 2016/7781 Land Development Agency/Residential Development/north of Isabella Pond Weir, between Drakeford Dr and Lake Tuggeranong, ACT/Australian Capital Territory/Urban Development of part Block 5 Section 10 Greenway, ACT
- 2017/8013 ENVIRONMENT, PLANNING AND SUSTAINABLE DEVELOPMENT DIRECTORATE - DEPARTMENTAL/Residential Development/Block 29, Section 36, Mawson/Australian Capital Territory/Construction of public housing units within Block 29, Section 36, Mawson, ACT.
- 2017/8061 Chief Minister, Treasury and Economic Development Directorate ACT Procurement/Transport - Water/Canberra, ACT/Australian Capital Territory/Molonglo 3 Water Supply Pipeline, ACT
- City Renewal Authority/Residential Development/ Section 63 City, Canberra /Australian Capital Territory/City Hill Section 63 Redevelopment Project, ACT

Note: PDF may contain fields not relevant to your application. These fields will appear blank or unticked. Please disregard these fields.

Section 7

Information sources

Reference source

Infrastructure Australia Population Estimated and Projections, April 2015

Reliability

Partially reliable – prepared by trusted Australian Government institution with experience in their specific areas of expertise. Data is not current, update from previous release of information from same source.

Uncertainties

Currency of date

Reference source

5220.0 - Australian National Accounts: State Accounts, 2016-17, Australian Bureau of Statistics

Reliability

Partially reliable – prepared by trusted Australian Government institution with experience in their specific areas of expertise. Data is not current, update from previous release of information from same source.

Uncertainties

Currency of data

Reference source

5220.0 - Australian National Accounts: State Accounts, 2017-18, Australian Bureau of Statistics

Reliability

Reliable - prepared by trusted Australian Government institution with experience in their specific areas of expertise. Data is most current, Specific to ACT, Update from previous release of information from same source.

Uncertainties

No known uncertainties. The information utilised is considered to be current as of the preparation of this referral and suitable for use to support the preparation of this referral.

Reference source

Australian Bureau of Statistics, Regional Population Growth, Australia 2016-2017, Released 24 April 2018.

Reliability

Reliable - prepared by trusted Australian Government institution with experience in their specific areas of expertise. Data is most current, Specific to ACT, Update from previous release of information from same source.

Uncertainties

No known uncertainties. The information utilised is considered to be current as of the preparation of this referral and suitable for use to support the preparation of this referral.

Reference source

Infrastructure Australia 2019, Urban Transport Crowding and Congestion The Australian Infrastructure Audit 2019 Supplementary report

Reliability

Reliable – prepared by trusted Australian Government institution with experience in their specific areas of expertise.

Uncertainties

none

Note: PDF may contain fields not relevant to your application. These fields will appear blank or unticked. Please disregard these fields.

Reference source

National Capital Plan Parliamentary Zone Precinct Code

Reliability

Reliable - quoted from relevant statutory document

Uncertainties

none

Reference source

Planning & Development Act 2007 (P&D Act).

Reliability

Reliable - quoted form relevant statutory document

Uncertainties

none

Reference source

National Capital Plan (NCP)

Reliability

Reliable - quoted form relevant statutory document

Uncertainties

none

Reference source

Atlas of Australian Acid Sulpahte Soils V2

Reliability

Reliable - quoted form relevant statutory document

Uncertainties

none

Reference source

Commonwealth Department of the Environment and Energy, EPBC Act Policy Statement

Reliability

Reliable - prepared by trusted Australian Government institution with experience in their specific areas of expertise. Data is most current, Specific to ACT, Update from previous release of information from same source.

Uncertainties

none

Note: PDF may contain fields not relevant to your application. These fields will appear blank or unticked. Please disregard these fields.

Section 8

Proposed alternatives

Do you have any feasible alternatives to taking the proposed action?

Yes ☑ No

Australian Government
Department of the Environment and Energy

Note: PDF may contain fields not relevant to your application. These fields will appear blank or unticked. Please disregard these fields.

Section 9

Person proposing the action

9.1.1 Is the person proposing the action a member of an organisation?

☑ Yes ☐ No

Organisation

Organisation name	Major Projects Canberra
Business name	
ABN	66676633401
ACN	
Business address	50 Easty Street, Phillip, 2606, ACT, Australia
Postal address	
Main Phone number	0262077396
Fax	
Primary email address	Ashley.Cahif@act.gov.au
Secondary email address	nick.bryant@act.gov.au

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

☐ Small business
☑ Not applicable

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

☐ Yes ☑ No

9.1.3 Contact

First name	Ashley
Last name	Cahif
Job title	Project Director
Phone	
Mobile	
Fax	
Email	ashley.cahif@act.gov.au
Primary address	Government Offices, Phillip, 2606, ACT, Australia
Address	

Declaration: Person proposing the action

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

Signature: Ashley Cahif Date: 6/12/19

I, Ashley Cahif, the person proposing the action, consent to the designation of Major Projects Canberra as the proponent for the purposes of the action described in this EPBC Act Referral.

Signature: Ashley Cahif Date: 6/12/19

Australian Government

Department of the Environment and Energy

Note: PDF may contain fields not relevant to your application. These fields will appear blank or unticked. Please disregard these fields.

Proposed designated proponent

9.2.1 Is the proposed designated proponent a member of an organisation?

☑ Yes ☐ No

Organisation	
Organisation name	Major Projects Canberra
Business name	
ABN	66676633401
ACN	
Business address	Government Offices, Phillip, 2606, ACT, Australia
Postal address	
Main Phone number	02 6207 1680
Fax	
Primary email address	ashley.cahif@act.gov.au
Secondary email address	

9.2.2 Contact	
First name	Ashley
Last name	Cahif
Job title	Project Director
Phone	02 6207 1680
Mobile	
Fax	
Email	ashley.cahif@act.gov.au
Primary address	Government Offices, Phillip, 2606, ACT, Australia
Address	

Declaration: Proposed Designated Proponent

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

Signature: Ashley Cahif Date: 6/12/19

Australian Government

Department of the Environment and Energy

Note: PDF may contain fields not relevant to your application. These fields will appear blank or unticked. Please disregard these fields.

Referring party (person preparing the information)

9.3.1 Is the referring party (person preparing the information) a member of an organisation?

☑ Yes ☐ No

Organisation	
Organisation name	Major Projects Canberra
Business name	
ABN	66676633401
ACN	
Business address	Government Offices, Phillip, 2606, ACT, Australia
Postal address	
Main Phone number	0262071487
Fax	
Primary email address	ashley.cahif@act.gov.au
Secondary email address	

9.3.2 Contact	
First name	Ashley
Last name	Cahif
Job title	Project Director
Phone	02 6207 1680
Mobile	
Fax	
Email	Ashley.cahif@act.gov.au
Primary address	Government Offices, Phillip, 2606, ACT, Australia
Address	

Declaration: Referring party (person preparing the information)

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

Signature: Ashley Cahif Date: 6/12/19

Australian Government

Department of the Environment and Energy

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Appendix A

Attachment

Document Type	File Name
action_area_images	C2WB_ConstructionArea_GDA94_MGA55.shp
action_area_images	Appendix B Insert Bridge Pks Wy.pdf
action_area_images	Appendix B Project route Nth.pdf
action_area_images	Appendix B Project Route Sth.pdf
action_area_images	EPBC Referral for Cty 2 Comwlth Pk light rail v2_0 Full Text.pdf
supporting_tech_reports	Appendix C - PEA C2CP ARUP NOV19 FINAL.pdf
supporting_tech_reports	Appendix A - Project Description and Tables v3-0.pdf
supporting_tech_reports	Appendix D - Project Gradient complete v3-0.pdf
supporting_tech_reports	Appendix B - Project Alignment Complete v3-0.pdf
supporting_tech_reports	Appendix C - Preliminary Environmental Assessment v3-0.pdf
hydro_investigation_files	Precinct 1 Project Profile_App D.pdf
hydro_investigation_files	Precinct 2 Project Profile_App D.pdf

Appendix B

Coordinates

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Title of Proposal - City to Commonwealth Park light rail

Contents

Section 1 - Summary of your proposed action

Provide a summary of your Project, including any consultations undertaken.

1.1 Project Industry Type

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

The Project would construct a new light rail route that connects the existing light terminus at Alinga Street to a new terminus at Commonwealth Park. From the Alinga Street stop the light rail would run south within the median of Northbourne Avenue turning into London Circuit (west).

The light rail would then follow London Circuit (west) before joining Commonwealth Avenue. The intersection at London Circuit and Commonwealth Avenue would be rebuilt and signalised to allow for this. It would consist of the southern portion of London Circuit being raised to the same level as Commonwealth Avenue. The light rail would continue south along the middle of Commonwealth Avenue and terminate north of Lake Burley Griffin.

The Act Government notes that the decision as to whether the project is a controlled action is a matter for the Commonwealth Minister for the Environment. The ACT Government is of the view that should the Minister for the Environment determine that the Project is a controlled action, then the project should be assessed on the information included within this Referral.

The light rail vehicle will be fitted with an onboard energy storage system (OESS) to allow for wire-free running. The light rail vehicles will either receive a charge at each of the three proposed stops or have their batteries charged in the adjacent wired zones (existing LR Stg 1). This type of energy system eliminates the requirement for overhead wires and supporting infrastructure along the alignment.

Three light rail stops would be built as part of the Project:

- City West would be located on London Circuit between Gordon Street and Edinburgh Avenue and would comprise a side stop; a platform both sides of the rails.
- City South would be located on Commonwealth Avenue just south of the rebuilt intersection. This stop would comprise an island stop; a single central platform.
- Commonwealth Park would be located on Commonwealth Avenue north of the Albert Street intersection. This would also be an island stop, while forming a terminus similar to the Alinga Street stop.

The final design and configuration of the stops and terminus would use elements of the design adopted for the Gungahlin to City light rail such as canopies, platforms and material finishes.

Access and road configuration changes

The following access and road configuration changes will be needed to support the Project:

- Reconfiguring London Circuit to create a signalised intersection at the same level as Commonwealth Avenue.
- Building a separate light rail bridge over Parkes Way between the two existing road bridges.
- Making minor changes to the intersections, kerb lines and footpaths along the route, while adjusting traffic signal timings.
- Installing new traffic signals and pedestrian crossings where required.
- A potential reduction in the road speed limit along Commonwealth Avenue.
- Installing ‘green tracks’ along Commonwealth Avenue, which involves planting grass or shrubs between and besides the light rail track.
- Potentially removing on-street parking and other kerbside uses on London Circuit.

- Potentially removing up to 30 off-street parking spaces at the Lot 5 Regatta Place and London Circuit East car parks to locate the traction power substation and create the battered embankments to raise London Circuit east of the intersection.
- Prioritising pedestrian movement on London Circuit between Gordon Street and Edinburgh Avenue to create a zone that would avoid potential conflicts between pedestrians and vehicles due to the expected very-high patronage of the City West stop.

London Circuit-Commonwealth Avenue intersection

The southern portion of London Circuit would be raised to the same level as Commonwealth Avenue to create a four-way signalised road intersection. This would reinstate the original intersection design and formation as included in the Griffin Plan, and contemplated in the National Capital Plan. It would also allow the light rail to run down the middle of both roads.

This would be achieved by building ramps either side of the intersection to 'raise' London Circuit to the same level as Commonwealth Avenue. These ramps would require fill material (soil) to be imported to raise the road and light rail track. The ramps would also be battered into the adjacent areas ('clover leaf') for stability; meaning slopes would be created either side of the ramp at a stable angle. The detail of the ramp and batter-slope lengths, angles and formation will follow in detailed design.

Construction of the London Circuit and Commonwealth Avenue intersection would occur in four stages. During each stage, temporary road routes and traffic management controls would be needed at various times along London Circuit and Commonwealth Avenue

Parkes Way

An 'insert' bridge would be built between the two existing road bridges on Commonwealth Avenue over Parkes Way to accommodate the light rail track running down the median. As there is limited height clearance under the existing bridges particularly during construction. Traffic management controls would be needed on Parkes Way to allow for construction.

Substations

It is anticipated that one traction power substation might be needed to service the Project. The structures' perimeter fence is nominally 30 metres long, 10 metres wide and eight metres high, a footprint of around 300 square metres. The requirement for this, its design detail and power specification of the substation would be confirmed during detailed design.

The proposed location for installing the traction power substation is adjacent to the Regatta Place car park in a location to minimise its visual impact (refer to Figure 1.2 of Appendix C).

An under-bore would be used to connect the transport power substation with the light rail.

A high-voltage 'feeder' cable would either connect the new traction power substation to the wider ACT power grid or this new connection would fee into the existing traction power station. It is anticipated the corridor for the feeder cable would follow existing utilities, or new relocated, corridors and it would not require any separate routes to be created.

Drainage infrastructure

The following drainage provisions are likely needed to support the Project:

- Additional drainage for the light rail track zones to meet the required design standards.
- Additional drainage for the road and intersection upgrades plus modifications to existing infrastructure to meet current road design standards.
- Modifications to the existing drainage network to accommodate new track footings and changes to road heights and kerb lines.
- Modifications to existing surface drainage because of level changes, local catchment boundary changes and changes to runoff as a result of an increase in paved areas.

- Modifications to existing sub-surface drainage to enable the future proofing of third party developments that may otherwise need to install drainage infrastructure later. Carrying out these works as part of the Project would therefore avoid future community impacts and disruption to light rail operations.

Utilities

The Project would cross utilities and services that would either need protecting, adjusting or relocating. Section 5.3.5 of Appendix C describes the utilities within the route study area along with the utilities that maybe needed specifically to service the Project.

Underground project-utilities would be extended about 20-metres beyond the terminus at Commonwealth Park to simplify existing tie-ins and support future connections to the Commonwealth Park to Woden light rail easier by avoiding the need to dig up infrastructure installed as part of this Project.

Additional works may be needed at each intersection to make connections into the existing utilities and stormwater drains, as allowed for in the temporary works boundary shown on Figure 1.2 of Appendix C. Final utility adjustments and provisions would be confirmed during the detailed design in consultation with the utility and service providers.

Construction

Construction activities would be limited to the footprints described in Table 3 and would indicatively involve:

- Enabling works, including site establishment, environmental and traffic management, and utilities identification, management and relocation.
- Earthworks and civil works.
- Track route and slab installation.
- Light rail stop construction, including mobility access, security provisions, closed-circuit television, amenity and security lighting, furniture, and other customer facilities such as passenger information display systems.
- Public domain paving.
- Overhead wiring pole installation.
- Power supply installation, including the traction power substation and overhead lines and wiring.
- Rail systems and signalling installation.
- Temporary and permanent road, traffic and intersection modifications including the raising of London Circuit and reconfiguration of the existing Commonwealth Avenue intersection.
- Modifications to the public domain along the route, including:
  - Interaction of rail/road transport including traffic signal prioritisation.
  - Temporary and permanent removal and/or relocation of existing facilities.
  - Creation of the prioritised pedestrian zone between Gordon Street and Edinburgh Avenue, including the prohibition of right hand turns from Gordon Street and Edinburgh Avenue across the light rail tracks.
  - Landscape and tree planting along the route, including the creation of the ‘green track’.
- Testing and commissioning.

Construction compounds

Figure 1.2 of Appendix C shows locations within the temporary works boundary that could be used to support construction. They may be used in full or part at various times to temporarily store materials and equipment, stockpile materials and waste for short periods, and to house site offices and worker amenities. Importantly, the long-term stockpiling of materials and waste would take place away from the site at an established facility in the ACT. The same site(s) would be used to carry out key maintenance activities. This is to avoid various impacts from occurring within the heart of the city.

The appointed Contractor will be responsible for determining suitable locations for construction compounds. The Contractor will coordinate their requirements with the landholder and the relevant authorities, including Major Projects Canberra, NCA (if located in a designated area) and the ACT and Australian Governments, having regard to the *RMS Specification D&C G4, RMS Site Facilities* (Roads and Maritime, 2019) as there is no similar guidance in the ACT. The Contractor will also be responsible for all community and stakeholder consultation relating to construction compounds.

Typical locations where construction compounds may be situated (subject to further consultation and impact assessment) include:

- Along the light rail alignment
- Existing surface car parks
- Areas of imminent (3-5 years) future development
- Existing sites used during Canberra Light Rail Stage 1 construction.

Traffic and pedestrian management

Various traffic and pedestrian management controls would be needed to build the Project.

General measures

Traffic and pedestrian management controls would be needed at various times along the route to allow for construction. Generally, these would involve:

- Speed restrictions through active working areas.
- Lane closures outside of peak periods.
- Possible traffic (road and cyclist) diversions for short periods during key activities (e.g. major equipment deliveries or lifting operations).
- Footpath closures and pedestrian diversions when installing kerbside utilities and the overhead wiring poles.

Key is that the lane closures, diversions, and other restrictions would be relaxed during peak periods and when key events are on in the city. Emergency vehicle access would also be maintained throughout.

The following specific controls would be introduced at the London Circuit-Commonwealth Avenue intersection and on Parkes Way to support construction.

London Circuit-Commonwealth Avenue intersection

Construction of the London Circuit and Commonwealth Avenue intersection would likely occur in four main stages. During each stage, temporary road routes and traffic management controls would be required along London Circuit and Commonwealth Avenue around the intersection.

The traffic management detail would be confirmed once the construction method is better-understood and further consultation is carried out with key stakeholders, including Transport Canberra and City Services, who is responsible for the operation of the city's bus network.

In broad terms, it is expected that the traffic management at the intersection would involve:

- Restricted access along the southern portion of London Circuit under Commonwealth Avenue.
- Temporary reroute of the northbound and southbound lanes of Commonwealth Avenue around the active work site. It is expected that at various time during construction, the number of lanes on Commonwealth Avenue between Parkes Way and Vernon Circle would be reduced from three to two in each direction.
- Access would be closed to the northbound off ramp to London Circuit from Commonwealth Avenue at the start of construction.

Parkes Way

This would possibly include temporary acceleration and deceleration lanes, and the possible switching (transfer) of traffic onto one carriageway to create a contraflow. To facilitate this, land would be temporarily

taken from the Parkes Way median. The exact location of traffic management controls and traffic switching would be confirmed during the detailed design.

Working hours

Construction would be staged along the route to minimise disruption to residents, businesses and existing transport operations and would typically occur during standard working hours. This would include civil construction, some utility diversions (where this would have minimal impacts), road works, rail systems and stop construction.

Various components of work may need to take place outside of normal construction hours. These activities would include:

- Work across major intersections along the route.
- Testing and commissioning.
- Utility diversions, where impacts to services cannot be otherwise reasonably managed within standard working hours.
- Oversize deliveries, unloading and lifting, moving large equipment and infrastructure, and collecting machinery that can only travel between specified hours.
- Work that can take place without having an amenity or noise impact on nearby residents and other sensitive receivers.
- Emergency works to avoid the loss-of-life, property and/or to prevent environmental harm.

Construction work needing to take place during special events would be coordinated between Major Projects Canberra, Transport Canberra and City Services, the appointed contractor, the event organisers and/or other relevant stakeholders prior to the event(s) occurring.

Operation

The Project, once complete, would operate as part of the overall Canberra light rail network with the common features summarised below. These details are indicative and are expected to be refined as the detailed design progresses.

Table 1: Operational features of the Project

Feature	Description	Additional detail
Services	• Every six minutes in peak periods. • At least every 10 minutes between 7am and 6pm on weekdays. • Every 15 minutes at other times on weekdays, and all day on Saturdays, Sundays and Public Holidays.	• Light rail vehicles would typically have priority.
Light rail vehicles	• Electric-powered. • Capacity for about 200 customers. • Maximum speed of 70 kilometres per hour. • Nominally 2.65 metres wide • About 33 metres long. • Heating, ventilation and air conditioning.	• On-board space provision to carry up to four bicycles. • Real-time passenger information displays. • Public announcement system. • Wi-fi service. • Closed-circuit television. • Features to reduce energy consumption.
Light rail stops	• Step-free access. • Passenger information displays, audio announcements and signage. • Additional platform capacity.	• Additional facilities at interchange and terminal stop(s) • Cycle racks would be provided where possible to encourage connectivity between the two modes.
Ticketing	• Adoption of the My Way ticketing system.	• Required at each stop including installation of card validators as well as ticketing and top-up machines where required.

Feature	Description	Additional detail
Accessibility	• Fully accessible vehicles in accordance with the Commonwealth *Disability Discrimination Act 1992.* • Offer low-floor level access at all passenger doors, with a height difference of less than 50mm between the light rail vehicles and stop platforms.	• Design consideration also taken for the elderly and those travelling in wheelchairs or with prams.

Table 2: Project Footprints

Area	Description and Reference
Study Area:	Includes all areas within the Project construction footprint and all areas adjacent to the Project construction footprint that might be impacted by Project activities. This footprint is approximately 100-metre wide for the length of the Project route. It includes areas that may not be directly impacted by the Project. Shown by the purple dotted line on Figure 1.2 in Appendix C.
Construction footprint	All areas that would be disturbed during construction, which extends beyond the Project footprint that would be used for batters, embankments, vegetation works, the areas of road reserve needed for overhead wiring pole installation etc. Shown by the orange shaded area on Figure 1.2 in Appendix C
Temporary works boundary	An extended area beyond the construction footprint, which includes additional land to install and connect utilities at each intersecting side road. It also includes the areas used as temporary construction compounds and laydown areas. Shown by the orange line on Figure 1.2 in Appendix C.
Project footprint	Operational area of the light rail including, tracks, stops, the traction power substation, landscaped areas and footpaths. This footprint is up to 15-metres wide for the length of the Project route. It includes areas that will be permanently impacted by the Project. Shown by the red line/area of Figure 1.2 in Appendix C.

Table 3: Description of Property on which the Action would take place

Description	Land Use Zone	Owner	Reason for occupation
Block 9, Section 63, CITY	DES: Designated (Land Use A)	TCCS-OTHER UNLEASED ASSETS - Carparks, Public Transport and Depots - Unleased	Intersection and verge works within the Project Construction Footprint and returned to custodian at the end of the Delivery Phase of the Project.
Block 21, Section 63, CITY	DES: Designated (Land Use A)	LEASED TERRITORY LAND - Private Lease - Not Public Land	Intersection and verge works within the Project Construction Footprint and returned to custodian at the end of the Delivery Phase of the Project.
Block 20, Section 63, CITY	DES: Designated (Land Use A)	LEASED TERRITORY LAND - Private Lease - Not Public Land	Intersection and verge works within the Project Construction Footprint and returned to custodian at the end of the Delivery Phase of the Project.
Block 3, Section 6, CITY	CZ5: MIXED USE	LEASED TERRITORY LAND - Private Lease - Not Public Land	Verge works within the Project Construction Footprint and returned to custodian at the end of the Delivery Phase of the

Description	Land Use Zone	Owner	Reason for occupation
			Project.
Block 1, Section 116, CITY	DES: Designated (Land Use A)	TCCS-OTHER UNLEASED ASSETS - Carparks, Public Transport and Depots - Unleased	Temporary construction compound within the Project Construction Footprint and returned to custodian at the end of the Delivery Phase of the Project.
Block 13 Section 63, CITY	DES: Designated (Land Use A)	TCCS-OTHER UNLEASED ASSETS - Carparks, Public Transport and Depots - Unleased	Temporary construction compound within the Project Construction Footprint and returned to custodian at the end of the Delivery Phase of the Project.
Block 1, Section 95, ACTON	DES: Designated (Land Use B)	EPSDD – City Renewal Authority	Temporary construction compound within the Project Construction Footprint and returned to custodian at the end of the Delivery Phase of the Project.
Block 24, Section 33, ACTON	DES: Designated (Land Use B)	EPSDD – City Renewal Authority	Temporary traffic management controls, accesses, diversions, to make utility adjustments, and accommodate plant, equipment and ancillary facilities within the Project Construction Footprint and returned to custodian at the end of the Delivery Phase of the Project.
PARKES: Block 4, Section 2	DES: Designated (Land Use B)	NATIONAL LAND - Unleased	Temporary traffic management controls, accesses, diversions, to make utility adjustments, and accommodate plant, equipment and ancillary facilities within the Project Construction Footprint and returned to custodian at the end of the Delivery Phase of the Project.
PARKES: Block 2, Section 2	DES: Designated (Open Space)	NATIONAL LAND - Unleased	Temporary traffic management controls, accesses, diversions, to make utility adjustments, and accommodate plant, equipment and ancillary facilities within the Project Construction Footprint and returned to custodian at the end of the Delivery Phase of the Project.
PARKES: Block 2, Section 3	DES: Designated (Open Space)	NATIONAL LAND - Unleased	Temporary traffic management controls, accesses, diversions, to make utility adjustments, and accommodate plant, equipment and ancillary facilities within the Project Construction Footprint and returned to custodian at the end of the Delivery Phase of the Project.
PARKES: Block 4, Section	DES: Designated	NATIONAL LAND -	Temporary traffic

Description	Land Use Zone	Owner	Reason for occupation
44	(Open Space)	Unleased	management controls, accesses, diversions, to make utility adjustments, and accommodate plant, equipment and ancillary facilities within the Project Construction Footprint and returned to custodian at the end of the Delivery Phase of the Project.
Block 1, Section 45, PARKES	DES: Designated (Open Space)	NATIONAL LAND - Unleased	Traction Power Substation within the Project Footprint and maintained during the Operations Phase of the Project.

Section 3

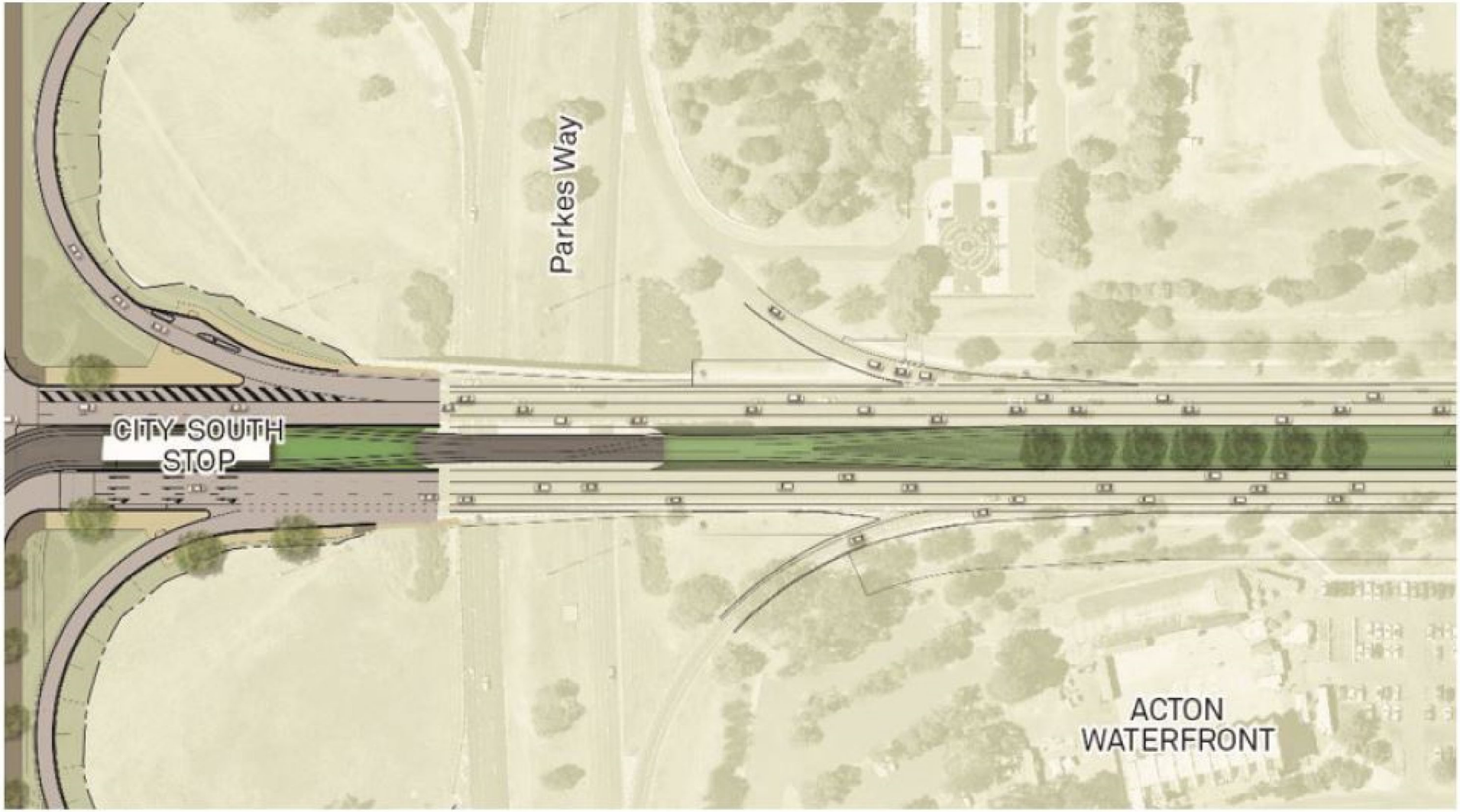
3.1 Golden Sun Moth Values

Table 4: Golden sun moth values and its habitat

Aspect	Ecological values
Species	The golden sun moth recorded in the study area is part of a population that is distributed on median strips, roadside verges and green space in the vicinity of the intersections of Commonwealth Avenue within London Circle (Section 5.2 of Appendix C). Between 2016 and 2019 there has been a recorded reduction in the species from 24 in 2016, to 16 in 2017 and two in 2019 in the south-west interscetion ‘clover-leaf’ and 160 in 2017 to 38 in 2019 in the south-east intersection ‘clover-leaf’. It is not known if the reduction is due to the diffiences in the survey times/periods or due to natural environmental factors or human activity and intervention.
Habitat	Golden sun moth habitat within the study area was classified as small and highly fragmented (Section 5.2 of Appendix C). Fieldwork carried out by SMEC in 2018 also classified the associated vegetation as ‘low quality’ golden sun moth habitat, mainly comprising highly invasive Chilean needle grass on which the larvae are known to feed. Chilean needle grass is a weed of national significance (Section 5.2 of Appendix C).

EXISTING CARPARK
SYDNEY BUILDING
Vernon Circle
EXISTING CARPARK
Northbourne Avenue
CITY HILL
Commonwealth Avenue
TO ALBERT
CITY SO
PRECINCT 2
PRECINCT 1
FUTU DEVELO (ACT WATERF
MELBOURNE BUILDING
SUPREME COURT
EXISTING CARPARK
West Row
ACT MAGISTRATES COURT
West Road
PROPOSED ROADS BY OTHERS SHOWN RED (INDICATIVE ONLY)
Knowles Place
RESERVE BANK OF AUSTRALIA
BREAKFREE CAPITAL TOWE
CANBERRA CITY POLICE STATION
WILSON CARPARK (SECTION 63)
QT HOTEL CANBERRA
Hobart Place
London Circuit
CITY WEST STOP
Edinburgh Avenue
University Avenue
METROPOLITAN
Marcus Clarke Street
Marcus Clarke Street
Farrell Place
Gordon Street
XCHANGE ON LONDON

Indicative Tree Locations
Indicative Road Network


Parkes Way
CITY-SOUTH STOP
ACTON WATERFRONT
Indicative Road Network
Indicative Tree Locations


arkes Way
Regatta Place
TPS
COMMONWEALTH
PARK
Commonwealth Ave
COMMONWEALTH
PARK STOP
ACTON
WATERFRONT
Corkhill Street
Albert Street
HENRY
ROLLAND
PARK

Major Projects Canberra

Canberra Light Rail – City to Commonwealth Park

Preliminary Environmental Assessment

CLR-ARU-C2W-00ENGN01-RPT-000002

Final | 15 November 2019

Job number

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Abbreviations

ACT	Australian Capital Territory
ANU	Australian National University
CEMP	Construction environmental management plan
DEWHA	Department of Environment, Water, Heritage and the Arts, now known as DoEE
DoE	Department of Environment, now known as DoEE
DoEE	Department of Environment and Energy
EPA	Environment Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
HGL	Hydrogeological landscape
MNES	Matters of National Environmental Significance
NCA	National Capital Authority
PALM Act	*Australian Capital Territory (Planning and Land Management) Act 1988*
P&D Act	*Planning and Development Act 2007*

Non-technical summary

Background

The ACT Government is investing in Canberra's public transport to cater for future population growth, a projected increase in visitor numbers, and to reduce the number of people who travel to work by car, which currently stands at around 85 percent. The aim is to build a modern, accessible and integrated public transport system across the city over the next 20 years to connect suburbs, precincts, services and amenities.

A key part of this investment was the Gungahlin to City light rail opening in April this year. This is now being followed through plans to develop a wider north-south, east-west light rail service across the city.

The next proposed light rail Project would run between the City and Commonwealth Park. It would extend from the existing Gungahlin to City light rail terminus at Alinga Street, via the western side of London Circuit before continuing south on Commonwealth Avenue to a terminus at Commonwealth Park.

Land administration in Canberra

Approval to carry-out development and undertake works in Canberra is mainly provided by the ACT Government (Environment, Planning and Sustainable Development Directorate – Planning) and the Australian Government (National Capital Authority).

If there are significant environmental impacts, additional approval may also be needed from another part of the Australian Government (Department of Environment and Energy).

For the Project, it crosses land where development is controlled by the Environment, Planning and Sustainable Development Directorate – Planning (Territory Land) and the National Capital Authority (Designated Areas and National Land). Approval would be needed from both planning authorities. Approval may also be needed from the Department of Environment and Energy if the Project significantly impacts on one of nine matters of national environmental significance or Commonwealth Land values.

Commonwealth Land in the ACT is all National Land, Designated Areas (that are not Territory Land) plus any areas of Territory Land that the Australian Government or wider Commonwealth has leased back.

Purpose

This preliminary assessment outlines the key environmental, social and economic impacts and benefits predicted to result from constructing and operating the Project. Its purpose is to help inform design outcomes that would either avoid or minimise impacts, while helping assess if the Project's actions are likely to have a significant impact under the *Environment Protection and Biodiversity Conservation Act 1999*. The assessment was carried out in accordance with the Australian Government's Significant Impact Guidelines relating to the above Act.

The assessment considered a study area 50-metres either side of the Project footprint to assess direct and indirect impacts. A construction footprint was also defined within the study area. In summary, the:

- Construction footprint covers all areas that would be temporarily used or disturbed in building the Project.
- Project footprint covers the operational area.

Figure 1.2 in the assessment shows the above footprints and features.

Project overview

The Project's key features would include:

- A 1.7-kilometre dual-track light rail running south from Alinga Street down the middle of Northbourne Avenue, London Circuit (west) and Commonwealth Avenue. The Project would terminate just north of Albert Street.
- Three light rail stops provided at City West, City South and Commonwealth Park (project terminus).

The final design and configuration of the stops and terminus would use elements of the design adopted for the Gungahlin to City light rail such as canopies, platforms and material finishes.

The following additional work may be needed along the route to support the light rail:

- Wire-free running along the entire alignment to prevent the need to install overhead line equipment.
- Installing a substation close to Commonwealth Park.
- Reconfiguring London Circuit to create a signalised intersection at the same level as Commonwealth Avenue.
- Protecting, relocating and installing utilities within the road reserve.
- Building a separate light rail bridge over Parkes Way between the two existing road bridges.
- Making small changes to the intersections, kerb lines and footpaths along the route, while adjusting traffic signal timings.
- Installing new traffic signals and pedestrian crossings where needed.
- Making turning movement adjustments and reducing the number of traffic lanes along sections of London Circuit to accommodate the light rail.
- Potentially removing on-street kerbside uses on London Circuit.
- Prioritising pedestrian movement on London Circuit between Gordon Street and Edinburgh Avenue to create a zone that would avoid potential conflicts between pedestrians and vehicles due to the expected very-high patronage of the City West stop.

In building the Project, up to 70 car parking spaces are expected to be permanently lost from the existing off-street facilities that are located alongside the Project route. Another 220 spaces would be unavailable east of Commonwealth Avenue north of London Circuit while the proposal is being built. Also, trees and vegetation may be removed from within the road reserve. This would be replaced under a strategy that would be developed in consultation and aligned to the Territory Plan and National Capital Plan. Any lost trees would be replaced on at least a one-for-one basis.

Temporary traffic management controls would be needed at various time along the route to allow for construction. Generally, these would involve speed restriction through active working areas, lane closures outside of peak periods, possible traffic diversions and footpath closures. Key is that the lane closures, diversions, and other restrictions would be relaxed during peak periods and when key events are on in the city. Emergency vehicle access would also be maintained throughout. The only permanent change would be the closure of the northbound off ramp from Commonwealth Avenue to London Circuit at the start of construction.

Construction is expected to start in late 2020 or 2021 and the Project is expected to be operational by 2024.

Environmental context

Heritage

There are no Aboriginal heritage records within or local to the study area. There are however the following 12 non-Aboriginal listed, nominated and registered heritage items:

- Four National-listed or nominated items.
- Three Commonwealth-listed or nominated places.
- Five Territory-listed places.

Key are the Reserve Bank of Australia and the Parliament House Vista, both of which are Commonwealth heritage places, within the study area.

Ecology

The key ecological values identified in the study area include:

- Three principal vegetation community types: modified grassland, urban vegetation of exotics, and planted natives.
- The golden sun moth, which is critically endangered under the EPBC Act.

Some records of endangered ecological communities and threatened plants and animals were identified within the wider locality but they are considered not to be present in the study area. There are also no migratory species, communities or wetlands of international importance recorded in the study area or locality.

Landscape and urban character

The study area comprises two key landscape character zones:

- The commercial and civic high-rise dense built-form and urban character around the edge of London Circuit that frames and encloses the natural amenity and open character of City Hill. This zone is undergoing transformation and development, including an increase in the built form and modernisation of the urban landscape.
- The wide boulevard open character of Commonwealth Avenue that provides a distinct north-south link across Lake Burley Griffin affording a sense of importance in its setting and context.

Both zones reflect the intention and design of the Griffins' Plans, thus their (partial) classification as 'Designated Areas'.

Contamination, soils and geology

The natural underlying geology comprises a mix of mudstone, siltstone, sandstone, limestone and other metamorphic and volcanic rocks. While the natural soils comprise a mix of alluvium and poor-draining saline soils, fill material is present across most of the study area, which was imported to build Canberra.

Asbestos has been found in the fill material along with other contaminants. Three specific potential contamination sources are present locally; two sites on London Circuit previously used to store petrol and the site of the former Randwick Barracks on the edge of Lake Burley Griffin.

Water

Lake Burley Griffin is the nearest surface water feature. The lake has been experiencing ongoing blue green algae outbreaks during the summer periods, which has resulted in a monitoring program to alert the public when outbreaks reach unsafe levels. Sullivans Creek is the next nearest surface water feature, located about 300 metres west of London Circuit.

The section of London Circuit near the Edinburgh Avenue intersection is prone to short duration nuisance flooding.

While there is no specific information on the groundwater depth, quality and flow along the route it is expected to be shallower close to the lake within a perched aquifer. Regionally, groundwater depth has been recorded at between two and eight metres below the surface. The regional groundwater has also been identified as partially saline.

Property and land use

Historically, the area was used for agricultural purposes; however, the existing use is very much an urban environment and includes a mix of residential and commercial properties, government and historical places, and educational and recreational facilities.

Utilities and energy resources

Multiple utilities cross the study area including: telecommunications, drainage, low and high-voltage electricity, gas mains, and potable water, sewage and stormwater infrastructure

Traffic and transport

The Project runs along Northbourne Avenue, London Circuit and Commonwealth Avenue; key roads linking the north and south of the city. Every day, there is typically around 10,000 vehicles that travel along London Circuit (west), around 35,000 that travel along the southern end of Northbourne Avenue and around 70,000 that travel along Commonwealth Avenue.

Noise and vibration

The main ambient noise sources are road traffic, localised construction activities, human activity, and occasional overhead aircraft. The key sensitive receivers to noise and vibration impacts are the residents and commercial properties fronting London Circuit, including the Reserve Bank of Australia and the Sydney and Melbourne buildings on Northbourne Avenue.

Air quality and greenhouse gas

In Canberra, the city's air quality is typically recorded as good-to-very-good, despite the vehicle emissions along local and major roads, supplemented by other commercial and industrial activities.

Greenhouse gas emissions and contributions are typically managed at a regional or national level under legislation and policy. The ACT Government is aiming to achieve a 40 percent reduction in greenhouse gas emissions on 1990 levels by next year extending to net zero emissions by 2045.

Socioeconomics

Two key (Civic and Acton) suburbs are within the study area. They include several community services and facilities that cater for residents, workers, visitors and tourists. These services and facilities include; schools/educational facilities, childcare centres, places of worship, medical/healthcare institutions, and recreational and public domain areas.

Key impacts

Heritage

There would be no direct built heritage impacts. The brick paving outside of the ***Reserve Bank of Australia*** forms part of its heritage value. However, the paving was impacted through utility work, in 2010 and 2011 to improve drainage and remove a trip hazard. As such, it is not original.

The introduction of light rail, possible reconfiguration of verge lighting poles and the removal and replacement of vegetation and tree planting would change the aesthetic and appearance of London Circuit. Despite this, the road would continue to operate as a transport corridor. The proposed wire-free running is an opportunity to minimise the Project's visual impact on key heritage values and views. Replacement tree species and their planting location and density can be selected to respond to Canberra's Living Infrastructure Plan and the National Capital Plan precinct codes.

Given that the introduction of light rail would still see Commonwealth Avenue function as a transport corridor there would be no principal change in its context, setting or relationship with the ***Parliament House Vista*** other than visually and indirectly through the introduction of the Commonwealth Park stop. While this infrastructure would be visible from within the vista, the existing trees bordering Commonwealth Park would continue to act as a suitable visual buffer. The apex of the Commonwealth Avenue bridge is likely higher than the maximum height of the Commonwealth Park stop, which would also be located at a natural low point along Commonwealth Avenue.

The only potential direct impact on the ***Parliament House Vista*** would result from installing the traction power substation next to Regatta Place. Its final location has been selected to reduce the impact on important viewscapes while respecting the area's heritage amenity. This decision has been taken to avoid any materially significant negative impact on the vista's values.

Ecology

There are expected to be some impacts to common native flora and fauna species because of the removal of the modified grassland, vegetation and trees within the road reserve along the Project route. These environments provide habitat value for common native flora and fauna species; and they do not support any threatened flora, fauna or associated communities.

The Project's key impact would be the loss of a small and fragmented golden sun moth population at the London Circuit and Commonwealth Avenue intersection through the removal of up to 6.9 hectares of associated habitat. According to the Australian Government's Significant Impact Guidelines for this species, any habitat loss is considered significant under the EPBC Act.

Despite the aim to reduce habitat loss it could not be avoided. Therefore, for the Project to go ahead, its actions would need controlling under the EPBC Act.

Landscape and urban character

There would be a temporary reduction in visual amenity across the study area during construction from the introduction of plant, equipment and machinery and the carrying out of various construction activities. While there would be some permanent removal of existing vegetation and trees in the road reserve, the impact would be mitigated through introducing an effective urban landscape and vegetation planting strategy that would improve the public realm and amenity of the route.

There is not expected to be any impact to natural landscape features because of the Project.

Contamination, soils and geology

There is the potential for encountering contaminants of concern and asbestos within the construction footprint. There is also the potential for spills and leaks to impact on soil and groundwater during construction and/or operation. Standard management measures and remediation actions would ensure adequate controls are in place to manage these potential impacts and therefore the risks are considered minor.

Water

It is possible that the ground excavation works would generate spoil during construction that may mobilise and discharge to the lake. Likewise, there is potential for onsite spills or leaks during construction and/or operation to result in a pollutant discharge to the lake. There is also potential for work sites to flood during construction around London Circuit and Edinburgh Avenue. The nuisance flood risk in this area may also increase from reconfiguring London Circuit.

Construction works may potentially interact with the perched groundwaters that occur locally, and dewatering may be needed to address this. There are not expected to be any material compaction impacts on the subsurface geology that could affect groundwater flows.

All the above potential surface and groundwater impacts can be effectively managed through standard mitigation measures such as water quality, erosion, dust suppression, and sediment control measures as managed through the implementation of a soil and water management plan. The stormwater drainage can also be designed to cope with the increased runoff. Where required, water sensitive urban design measures can also be included to prevent sediment or pollutant discharge offsite.

Property and land use

The Project is likely to result in a temporary impact on the amenity value and user enjoyment of the various properties and land uses in the study area. In addition, there may be some temporary loss of public infrastructure during construction, plus amenity impacts from the introduction of traffic management controls that may inconvenience road users and bus passengers. These impacts would be minor and temporary, and the traffic related impacts can be effectively managed through standard controls as described below.

The raising of London Circuit would improve connectivity to and from Commonwealth Avenue by increasing the number of turning movements currently permitted at this intersection. One of the main benefits of raising London Circuit would be improved pedestrian and cyclist connectivity, particularly between the city and the waterfront as well as facilitating future access for the planned release to market of City Section 63.

Utilities and energy resources

It is considered unlikely that there would be any utility impact because any adjustments, relocations or provisions can be managed in consultation with the service providers. In addition, the Project would be designed, built, managed and operated to minimise any demand on non-renewable resources.

While the work needed to protect, install and adjust utilities may have a temporary amenity and land use impact, the road reserve could be reinstated with no lasting effects.

Traffic and transport

Major Projects Canberra has used modelling to consider if the wider road network has the capacity to handle additional traffic for short periods and the management controls and measures needed to ensure adequate transport functionality during construction. Despite this, there would be some inconvenience, minor delays and increased journey times for people moving across the city during construction.

The permanent loss of around 70 car parking spaces and the additional temporary loss of up to 220 car parking spaces during construction would represent around a one percent reduction in the available off-street parking in the area. This is considered negligible. These car parking spaces are located east of Commonwealth Avenue in the London Circuit East car park (Section 116, Block 1, City). It may inconvenience the people who rely on this car park.

Extending the light rail infrastructure south from Alinga Street, raising London Circuit and reconfiguring the intersection is considered to bring improved transport benefit to Canberra. This will help connect people across the city while providing access to key areas in and around the Civic precinct, Acton Waterfront and Lake Burley Griffin.

A key change would be the permanent reduction in the number of lanes along sections of London Circuit to accommodate the light rail in the median. Despite this reduction in capacity, Major Projects Canberra has carried out preliminary traffic modelling that demonstrates that the city can accommodate a redistribution of traffic onto other roads without unduly affecting network performance or travel times.

Noise and vibration

Increased noise and vibration levels may be temporarily experienced during construction. Where possible, work would be carried out during standard working hours to avoid sleep disturbance impacts.

Noise and vibration impacts in urban environments are common to most construction works and can be effectively managed under controls implemented as part of a construction noise and vibration management plan. Key is the restriction of the types of equipment used near the Reserve Bank of Australia to prevent cosmetic building damage as specified under Construction Noise and Vibration Strategy (Transport for NSW, 2017) and German Standard DIN 4150-3.

The noise and vibration generated from the operational light rail can be effectively managed through design and maintenance measures as referenced under various guidelines and standards. This includes managing and maintaining the rail track and rolling stock using measures such as rail grinding, welding to smooth discontinuities, lubrication, using soft rail pads, wheel truing, and the use of specific types of brakes. The NSW Environment Protection Authority's Rail Infrastructure Noise Guideline describes these measures and confirms their effectiveness.

Air quality and greenhouse gas

Air emissions (i.e. dust) would be generated during any excavations and earthworks. This is a common issue that can be effectively managed and minimised through implementing standardised controls under an effective air quality and dust management plan.

As the operational light rail would be electrically powered there would be no direct or indirect emissions generated. This includes greenhouse gases. The only emissions would be negligible and associated with maintenance equipment and machinery.

Socioeconomics

A rage of temporary amenity related impacts would be experienced by those people local to the route, including frustration from road users, pedestrians and cyclists who may be inconvenienced through the introduction of temporary traffic management controls.

Building light rail in the median of Northbourne Avenue, London Circuit and Commonwealth Avenue would change their character, however this would be offset through the introduction of an urban design and landscape planting strategy that would improve the public realm and amenity of these corridors, and they can be developed to be consistent with Canberra's Living Infrastructure Plan and the National Capital Plan precinct codes.

The extension of the light rail, raising of London Circuit and improvements to the Commonwealth Avenue intersection also provide more people with the opportunity to access more of the city, while extending access to the public infrastructure around the Civic precinct, Acton Waterfront and lake foreshore area. It may also result in an improvement in health and wellbeing from reducing the number of trips made by private vehicle, with people walking to and from the light rail stops, while encouraging people to walk and cycle by improving provisions to the south of the city. Economically, light rail projects are proven to stimulate economic growth along and adjacent to the corridors through urban activation (Parsons Brinckerhoff, 2015). They can create more passing trade and support the establishment of new businesses around the stops.

Proposed avoidance and mitigation measures

At this stage of the Project it is considered that there are design, mitigation and management measures available to avoid likely significant impacts other than with regards to the loss of golden sun moth habitat at the London-Circuit and Commonwealth Avenue intersection.

These measures include key site selection decisions, effective design measures, and controls for managing the range of typical impacts common to most urban development projects. These measures would be further developed through the detailed design and future approvals.

Self-assessment

To determine if there is likely to be a significant impact on one of nine matters of national environmental significance or Commonwealth Land values, assessments were carried out in accordance with relevant Significant Impact Guidelines.

In conclusion:

Matters of national environmental significance:

- There would be a **likely significant impact** on the critically endangered golden sun moth: *a nationally threatened species* because:
  - There would be an unavoidable (partial) loss of a small and fractured population.
  - Removal of supporting habitat which is a significant action under the EPBC Act.
- There are no other matters of national environmental significance in the study area.

Commonwealth Land environmental values:

- There would **not be a likely significant impact** on the values of the two *Commonwealth heritage places* because:
  - There would be no notable direct impact on the key sensitive features or values of either the Reserve Bank of Australia or the Parliament House Vista. While the brick paving detail at the front of the Reserve Bank of Australia would be impacted it is not original. Also, the traction power substation could be placed, treated and screened to minimise its view on the Vista.
  - While the introduction of light rail, removal and replacement of vegetation and tree planting would change the aesthetic and appearance of the route it would continue to operate as a transport corridor. The proposed wire-free running is to minimise visual prominence of the light rail on key heritage values, vistas and views across the Central National Area. Replacement tree species and their planting location and density can be selected to respond to Canberra's Living Infrastructure Plan and the National Capital Plan precinct codes.
  - It is also possible to restrict the types and size of equipment used near the Reserve Bank of Australia to prevent any vibration impacts consistent with German Standard DIN 4150-3: 1999-02 on Structural Vibration – Part 3: Effects of vibration on structures.
- While it is evident that there would be impacts on Commonwealth Land values during construction and operation, the assessment concluded that mitigation would be available to avoid, minimise and manage actions to ensure there would be no significant residual effects on the receiving environment. It was also concluded that the severity of any residual risk after introducing the proposed mitigation would be minor.

Contents

1 Introduction

This Chapter overviews the City to Commonwealth Park light rail project (the Project), describing its purpose. It also summarises the report's content and structure.

1.1 Background

Existing transport pressures

Canberra is investing in its public transport to cater for future population growth and a projected increase in visitor numbers. Key was the Gungahlin to City light rail opening in April this year backed by an expansion of the (rapid route) bus services and network. The Government's aim is to reduce the number of people who currently travel to work by car, which currently stands at about 85 percent. This is despite the city having some of the shortest commutes across Australia (RMIT University, 2017).

The expectation is to also provide people with the means to easily travel across the city, by improving connectivity and making it accessible for residents, workers, visitors and tourists. This is capitalising on the recognition of Canberra as an emerging tourist destination. In 2018, Lonely Planet ranked Canberra as the third best city to visit in the world due to its "revitalised precincts, its boom in restaurants and cafés, and its large collection of national treasures". With the addition of new overseas flights and the attraction of key international exhibitions and events, the city needs the transport infrastructure to respond to this.

Reducing the city's car dependency

In 2015, Transport Canberra released the draft of its Light Rail Network: Delivering a Modern Transport System for a Growing City (ACT Government, 2015). This presented the idea, justification and options for bringing light rail to Canberra. The draft plan was updated in 2018 with the release of the ACT Planning Strategy (ACT Government, 2018a). The strategy states that building a light rail would:

- Promote the city as a world class and liveable destination.
- Encourage people to leave their cars at home.
- Assist the ACT Government deliver on its transport, climate change and health strategy goals.
- Increase public transport use and therefore help reduce congestion and greenhouse gas emissions.
- Increase economic growth and regeneration in the neighbourhoods and precincts along the light rail transport corridors.

In 2019, the ACT Government released the draft of Moving Canberra 2019 – 2045: The Integrated Transport Strategy (ACT Government, 2018b). The Strategy complements the 2015 draft plan and the ACT Planning Strategy by encouraging people to travel by sustainable transport modes, while focussing on building an effective integrated system across the city over the next 25 years. At its core is investing in "a modern and accessible public transport system focussed on light rail". Bringing light rail to Canberra is therefore a response to the above policies and strategies as it would service the city by helping provide an integrated public transport solution that would connect many suburbs, precincts, services and amenities.

Delivering light rail as separate projects

The basis of the light rail network is to create several key transport corridors into and out of the city. The priority under the 2018 update to the light rail network was to create a north-south and east-west spine. The north-south spine would run between Gungahlin and Woden via the city, while the east-west spine would run between Belconnen, Russell and the airport (refer to Figure 1.1).

The corridor to Gungahlin was the first scheme to be delivered, opening in April this year. It provides a 12-kilometre service from Gungahlin Place, via the racecourse and the Dickson interchange, to Alinga Street.

The next priority is a Project to build the light rail from the City to Commonwealth Park. The Commonwealth Park to Woden light rail is being progressed separately for the reasons described in the referral documentation.

The following objectives have been set to help develop and deliver light rail network.

Connectivity

Objective 1: provide a north-south public transport spine that represents the next stage of a future city-wide light rail network connecting communities across Canberra.

Shape and place

Objective 2: frame the shape of future development along the corridor while reinforcing the identity of existing communities.

Objective 3: provide early delivery of city-wide initiatives for urban renewal and diversity of place.

Transport choice

Objective 4: provide Canberrans with an attractive, convenient, efficient and reliable integrated public transport system that facilitates choice, increases public transport patronage and reduces car dependency.

Value and innovation

Objective 5: deliver an affordable project solution to the Territory that drives innovation and provides a value for money outcome.

Environment

Objective 6: reduce emissions and promote a sustainable urban form for the benefit of current and future generations.

Community benefits

Objective 7: provide a connected and accessible public transport network that strengthens opportunities for social and economic participation.

Liveable and productive

Objective 8: build a productive, diversified and smart economy by making Canberra a more attractive place to live, work and invest.

Providing connectivity to Canberra's waterfront

While the light rail aims to encourage people to leave their cars at home, the ACT and Australian Governments also realise the need to support multiple travel modes in Canberra, and for that reason, they are proposing to improve the connectivity of the southern end of the City Hill precinct by raising London Circuit to form a level intersection with Commonwealth Avenue. This would not only benefit the proposed light rail Project, but it would also support pedestrian and cyclist connectivity in this part of the city. This change to the city centre movement network would deliver long-term benefit to people living, working and visiting Canberra.

Creating a level intersection at Commonwealth Avenue effectively reintroduces the form that was built under the Griffin Plan (refer to Figure 4.5 and Figure 4.6) and this carries through into the ACT Government's vision for Canberra as outlined in its Statement of Ambitions and its City Plan, which describes London Circuit as the city's high street with generous verges, street trees, and active street frontages.

The decision to include the "raising of London Circuit" (e.g. effectively creating an intersection between London Circuit and Commonwealth Avenue) as part of the Project was in recognition that it forms a better place and transport outcome by allowing the tracks to run down the middle (median) of London Circuit, Commonwealth Avenue and the intersection, therefore creating an active street-level frontage along the route.

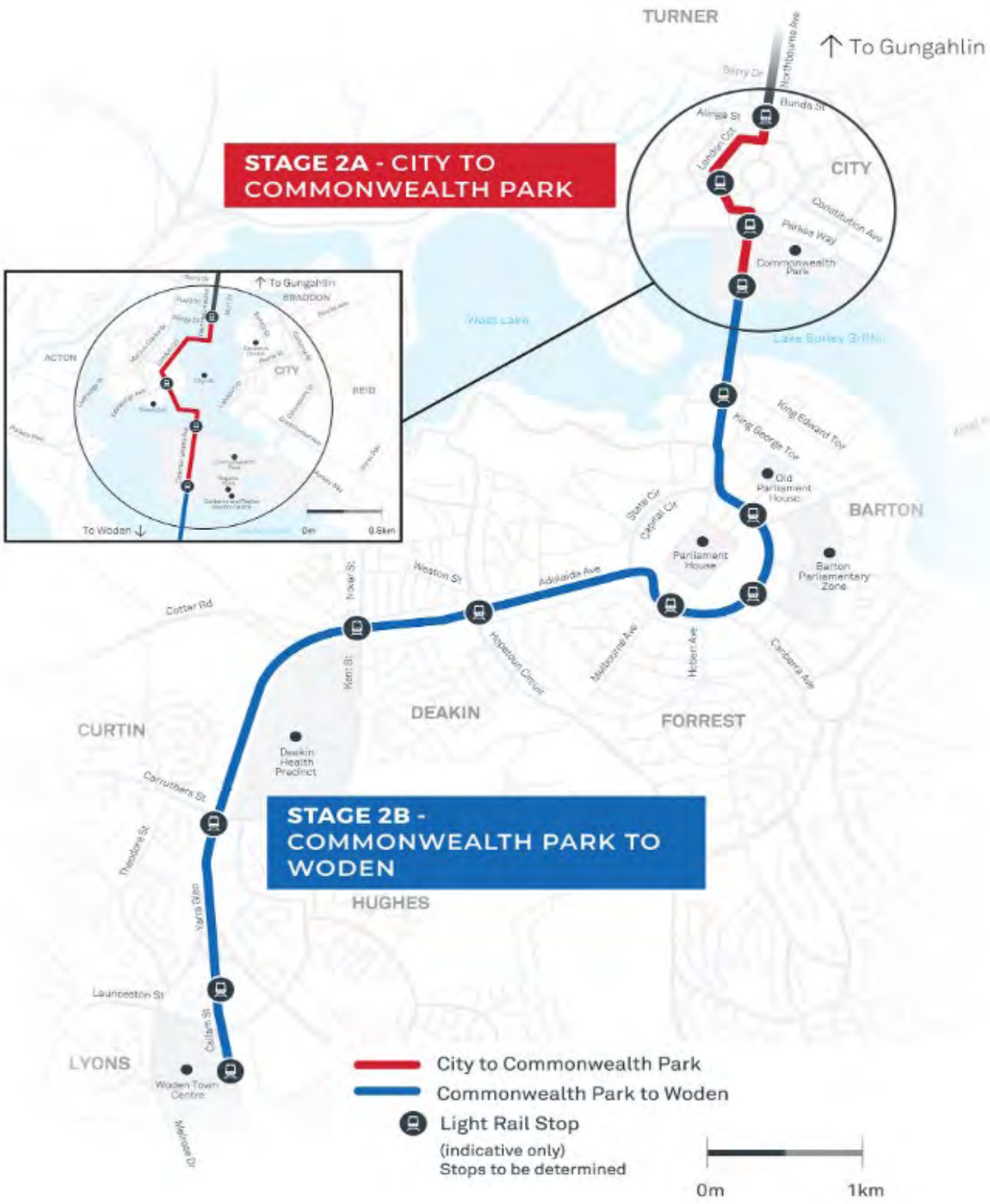


Figure 1.1 planned light rail network

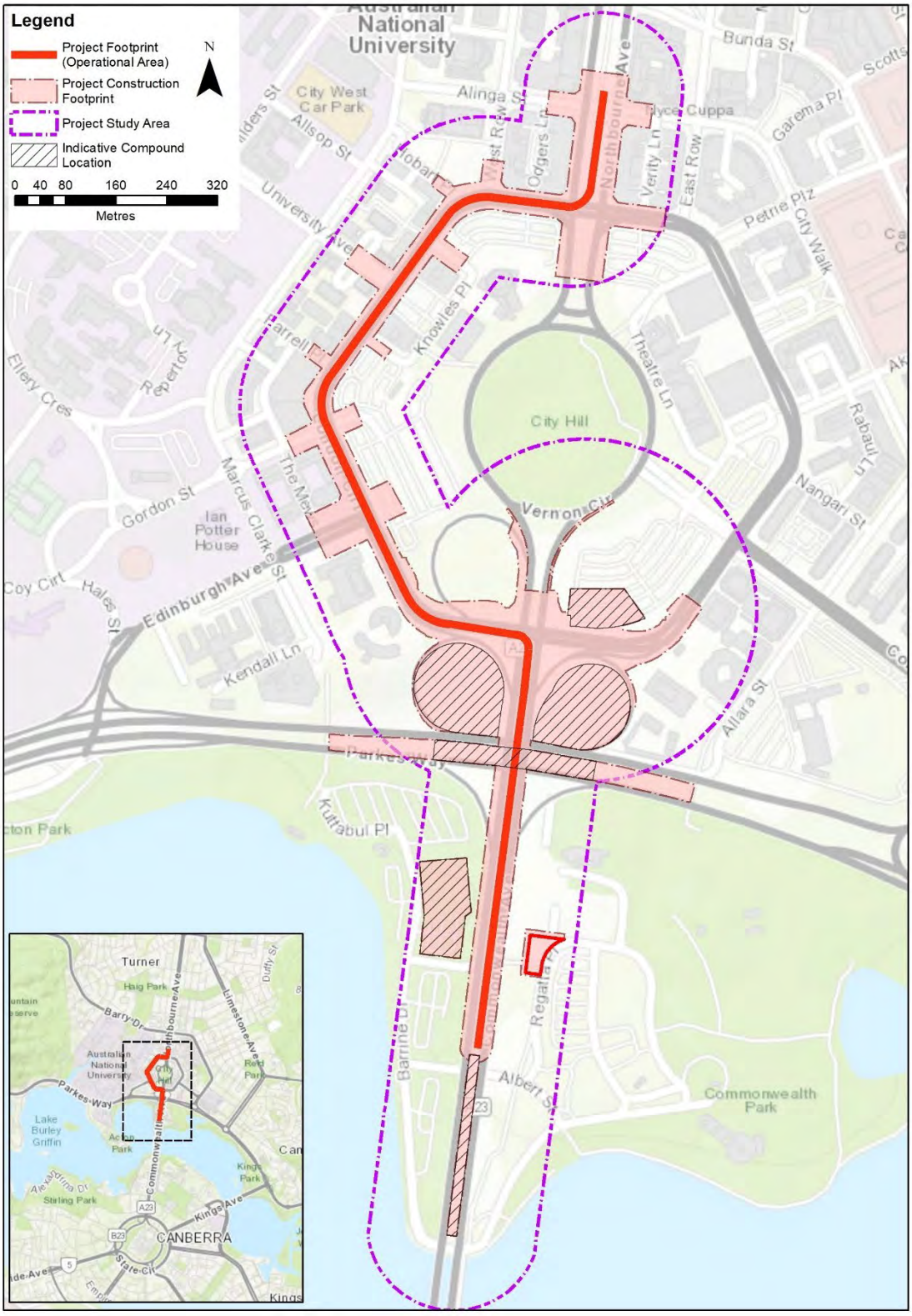


Figure 1.2: Overview of the Project route

1.2 Purpose of this report

This report considers City to Commonwealth Park light rail (the Project). Figure 1.2 shows an overview of the Project route. Chapter 4 describes the Project in further detail.

Any development in Australia is subject to the provisions of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). These provisions require Australian Government approval for actions that have, or are likely to have, a significant impact on one of nine matters of national environmental significance or Commonwealth Land values. To determine if this is the case, the Australian Government has prepared self-assessment guidelines. These help proponents decide whether they should submit a referral to the Australian Government Department of Environment and Energy (DoEE). The Department will then decide if their Project needs controlling under the above Act due to the likely significance of its impacts.

This report has been prepared in line with the above guidelines to help assess if the Project would, or is likely to have, a materially significant impact on:

- Ecological and heritage matters as defined under the criteria listed under the Significant Impact Guidelines 1.1 on 'matters of national environmental significance'.
- Commonwealth Land values as defined under the criteria listed under the Significant Impact Guidelines 1.2 on 'actions on, or impacting upon, Commonwealth Land, and actions by Commonwealth agencies'.
- Golden sun moth values defined under the criteria listed under the Significant Impact Guidelines for the critically endangered golden sun moth *Synemon plana* (DEWHA, 2009)

Figure 1.3 shows the self-assessment steps that have been followed in preparing this report.

The report also sets out the planning and approval framework to deliver the Project. It has used, and referred to, information provided by Biosis, Arup, SMEC, Philip Leeson Architects and Heritage Consultants, and Major Projects Canberra.

Figure 1.3 Self-assessment framework

Figure 1.4 shows the Project's location in relation to the protected matters and areas of Commonwealth Land[1].

[1] For the purposes of this referral, all National Land is considered Commonwealth Land.

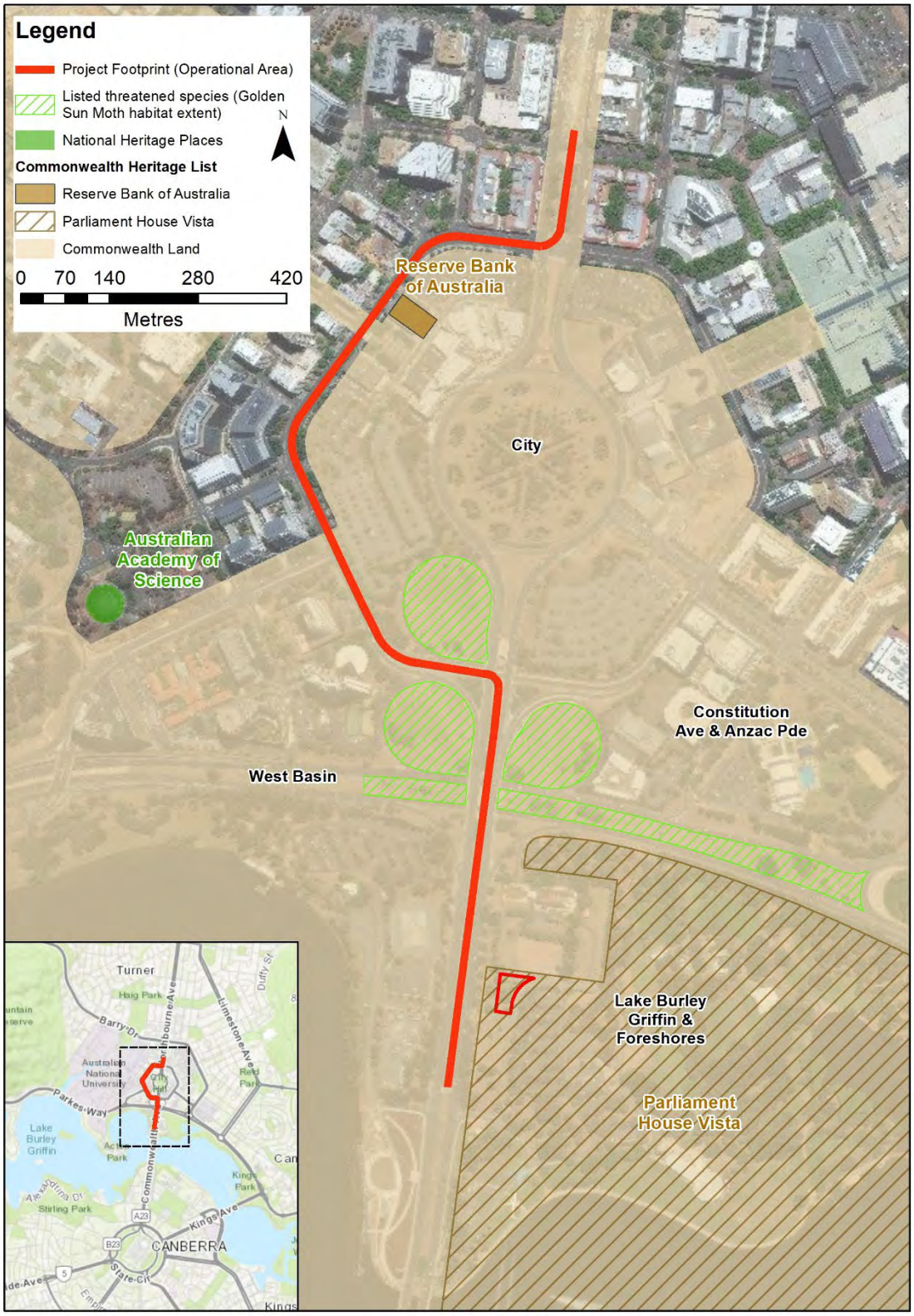


Figure 1.4: The Project, protected matters and Commonwealth Land

Relationship with Territory legislation

The Project would also be subject to assessment and approval under Territory legislation (refer to Section 3.1). As such, this report helps identify relevant Territory legislation and development controls.

1.2.1 Common terms used in the report

The Project footprint would occupy a corridor within the existing road reserve (defined as the area from the outside of one footpath to the outside of the opposite footpath, encompassing any footpaths, verges, roads or medians between) of Northbourne Avenue, London Circuit and Commonwealth Avenue. Wider temporary construction and works boundary footprints are also needed for traffic management controls, accesses, diversions, to make utility adjustments, and accommodate plant, equipment and ancillary facilities. The study area considers a broader footprint that is appropriate for understanding potential direct and indirect impacts. Table 1.1 defines these footprints.

Table 1.1: Project footprint descriptions

Footprints	Definition
Scoping phase	
Study area	Includes all areas within the Project construction footprint and all areas adjacent to the Project construction footprint that might be impacted by Project activities. This area is approximately 100-metre wide for the length of the Project route. It includes areas that may not be directly impacted by the Project. ***Shown by the purple dotted line on Figure 1.2.***
Project delivery phase	
Construction footprint	All areas that would be temporarily disturbed or used during construction, which extends beyond the Project footprint. ***Shown by the orange shaded area on Figure 1.2.***
Project footprint	Operational area of the light rail including, tracks, stops, the traction power substation, landscaped areas and footpaths. This footprint is up to 15-metres wide for the length of the Project route. It includes areas that will be permanently impacted by the Project. ***Shown by the red line/area of Figure 1.2.***

1.3 Report structure

The report is structured to be consistent with the above guidelines where:

- Chapter 1 introduces the Project and purpose of this report.
- Chapter 2 describes the Project's strategic context and benefits.
- Chapter 3 outlines the planning approval pathway for securing approval to extend the light rail to Commonwealth Park.
- Chapter 4 describes the Project.
- Chapter 5 provides the environmental context local to the Project.
- Chapter 6 describes the Project's potential impacts.
- Chapter 7 outlines how impacts would be inherently avoided or mitigated either through aspects of the design or the implementation of environmental controls.

- Chapter 8 assesses if the Project's has a residually significant impact on the receiving environment in the context of the criteria set out in the above guidelines.
- Chapter 9 summarises the self-assessment process.

2 Strategic context and benefits

This Chapter summarises key Territory and Commonwealth planning strategies and policies relevant to developing the Project. The Chapter also outlines the intended benefits from delivering light rail to Commonwealth Park.

2.1 Strategic planning context

The Project's preliminary design has been guided by the National Capital Plan and the development codes set for the following specific precincts: City Hill (4.6), West Basin (4.7), Constitution Avenue and Anzac Parade (4.8) and Lake Burley Griffin and Foreshores (4.12). It has also been guided by the Transport and Services Zone development code and supporting general codes made under the Territory Plan. Compliance with the Territory Plan and National Capital Plan codes, Australian Standards and relevant design guidelines would continue in developing the Project.

Below is a summary of the key strategic policies and plans that would apply to the Project.

Australian Government (National Capital Authority)

Table 2.1 summarises the key national policies and plans that will apply to the Project's development as set by the National Capital Authority (NCA).

Table 2.1: Key Australian Government plans relevant to the Project

Policy/Strategy	Overview	Relationship to the Project
The National Capital Plan 2016	Provides a strategic framework for land use and development throughout the Territory including ensuring the legacy of the Griffin Plan are incorporated. Objective is "to ensure that Canberra and the Territory are planned and developed in accordance with their national significance". Defines development control within Designated Areas across the Territory. Sets out the general location of inter-town public transport corridors within the Territory.	• The Project is in Canberra and would consider the Griffin Plan as well as impacts on Commonwealth Land. • Most of the Project route is within a Designated Area (refer to Figure 3.2) so would need to consider specific development controls and approval pathways. • The Project would meet all the core objectives of the Plan related to Productivity, Sustainability, Liveability and Accessibility. • The Project is consistent with the National Capital Plan's policies for the inter-town public transport system.
The Griffin Legacy 2004	Provides a blueprint for Canberra and the Territory. It represents a renewed vision to unlock the Central National Area, its landscape setting and approaches. The strategy establishes eight core design propositions.	• The Project would meet the following strategic initiatives of the Griffin Plan: - Build on the Griffin Legacy. - Extend the city to the Lake. - Reinforce main Avenues. - Link national attractions.
Kings and Commonwealth Avenues Design Strategy (Draft) 2017	Outlines the long-term vision and key principles to redefine the avenues and re-establish them as memorable and functional public spaces.	• The Project route is on Commonwealth Avenue and incorporates the objectives of this draft strategy. • The Project would meet the following principles of the Strategy: - Unified expression of the National Triangle.

Policy/Strategy	Overview	Relationship to the Project
		- Effective movement and connections for all. - High quality urban streetscapes benefitting their status and use. - Providing a robust landscape character that is consistent and sustainable.

Territory Government (ACT Government)

The following territory plans are relevant to the Project's design and development.

Table 2.2: Key ACT Government plans relevant to the Project

Policy/Strategy	Overview	Relationship to the Project
Spatial plans		
The Canberra Plan 2008	Developed to reflect the views and values of Canberrans through providing key directions for the municipality's continued prosperity. Seven strategic themes including: a vibrant city and great neighbourhoods; a sustainable future and high-quality services.	The Project would assist Canberra in meeting the following strategic themes: • Strong, dynamic economy • A vibrant city and great neighbourhoods • A sustainable future • High-quality services.
Territory Plan 2017	The key statutory planning document in the ACT, providing the policy framework for the administration of planning in the ACT. The purpose of the Territory Plan is to manage land use change and development in a manner consistent with the directions set by the ACT Government, Legislative Assembly and the community. Its polices are to be consistent with the National Capital Plan. Identifies the Intertown Public Transport Route.	The Project would align with the objectives of the Territory Plan (Transport Zone TSZ1) by ensuring that light rail infrastructure is developed in a comprehensive manner including the provision of appropriate landscaping, street furniture and lighting, traffic control devices, and noise attenuation (where required).
Canberra City Plan 2014	Focusses on the city centre and provides a single over-arching strategic framework and vision for future development focussing on civic, cultural and recreational life. Determines development and growth and ensures projects and infrastructure are delivered efficiently and effectively. 'Transport and movement' is one of the six components of the Plan's framework and aims to develop the city through providing a range of transport and movement options around it.	Investment in the Light Rail transit system has clear economic benefits for Canberra and would be transformational in changing the way people move in and around the city centre. The raising of London Circuit also supports the Transport and Movement theme and its need is recognised in the Plan. The Project would assist the city centre in achieving its six themes of: • Growth • Land use and development • Transport and movement • Community infrastructure • Public realm and design • Strengthening character.

Policy/Strategy	Overview	Relationship to the Project
ACT Planning Strategy 2018	Directs the development of Canberra to help the city achieve its economic, cultural and environmental aspirations. The main vision is to be a "sustainable, competitive and equitable city that respects Canberra's unique legacy" including providing a compact and efficient city, diverse Canberra, sustainable and resilient Territory, liveable Canberra and accessible Canberra.	Key directions from the Strategy related to the light rail are: • Direction 1.1, support sustainable urban growth by working towards delivering up to 70 percent of new housing within our existing urban footprint, and by concentrating development in areas located close to the city centre, town and group centres and along key transit corridors. • Direction 3.1, transition to a net zero emissions city through the uptake of renewable energy, improved building design and transport initiatives. Links to ACT Climate Change Adaptation Strategy 2016. • Direction 5.1, enhance accessibility by better integrating transport and land use. The raising of London Circuit is also consistent with Direction 5.1 in enhancing accessibility to the southern end of the City Hill precinct.
Canberra: Statement of Ambitions	Addresses four themes relating to an integrated city strategy: a summary of future ambition; a recognition of current momentum; clarification of the challenges; and drivers shaping Canberra and the future direction of travel.	The Statement recognises that building a light rail is a key urban renewal task which is critical to developing compact urban centres. The Statement also recognises a delivery focus in improving connectivity across the city, which includes the provision of the light rail backed by intersection and connectivity improvements as is proposed at London Circuit/Commonwealth Avenue.
Infrastructure plans		
Infrastructure Plan Update 2017-18	Outlines the key infrastructure projects being funded through the 2017-18 budget.	The Project would assist in achieving the following objectives: • Economic growth and diversification. • Enhancing liveability and social inclusion. • Suburban renewal and better transport.
Transport plans		
Transport for Canberra 2012-2031	Anticipates investment into transport infrastructure and services, including the introduction of light rail into the public transport network. Prepared in conjunction with the *ACT Planning Strategy to* support land use and transport planning for sustainable transport in Canberra. Defines the basis against which the light rail network was planned and developed.	Transport for Canberra's strategic goals include: • Integrated transport system • Active travel • Efficient and cost effective • Accessible and socially inclusive • Sustainable • Safe. The Project is being designed to provide an integrated solution that supports active transport movement. It is also a socially inclusive form of public transport that is being designed to be sustainable and safe.
Draft Moving Canberra 2019 – 2045: Integrated Transport Strategy, 2018	Provides the vision for Canberra's transport future and the city's ambitions of: Economic growth, diversification and competitiveness; net zero emissions by 2045; urban renewal, increased vibrancy and	The following are relevant excerpts from the Strategy that specifically mention the Project: • "The City to Woden project is preparing to commence planning and environmental approval processes to confirm the route and commence construction by 2021." *Note: this*

Policy/Strategy	Overview	Relationship to the Project
	liveability; a smart and connected digital city; and social inclusion. Enforces the importance of an integrated public transport network focussing on prioritising light rail and a bus network. It reinforces updates *Transport for Canberra* (ACT Government, 2012) to include north-south and east-west public transport spines. Draws on the inter-relationships between planning, transport and climate change adaptation strategies.	*has now been divided into two separate projects as described in Section 1.1.* • "Investment in light rail will support national objectives for continued economic growth and improved productivity, while helping the city to remain a liveable destination of choice." • "The ACT Government is committed to delivering a city-wide light rail network as part of our integrated public transport network. A north-south and east-west light rail public transport spines are fundamental to the functionality of the network." • "The north-south spine was commenced first to maximise patronage, urban uplift and connectivity of employment, residential and cultural centres."

2.2 Project benefits

The following benefits were identified in 2015 when the ACT Government developed its ideas, justification and options for delivering light rail to Canberra. In 2019, this was supplemented through a coordinated proposal to bring the City Renewal Authority's proposed raising of London Circuit under the Project as it deliver several combined benefits. Table 2.3 summarises the Project's combined identified benefits.

Table 2.3: Project Benefits

Benefits	Key aspects
Economic growth and diversification	Underpins the next phase of growth and diversification in Canberra's economy by enticing businesses and skilled people to live and work in Canberra. Helps drive investment and urban renewal along the Project corridor development including residential and commercial development. Positions Canberra with the right urban environment and transport network to continue to benefit from, but also foster new economic growth. Supports the timing for the release and development of City Section 63, a proposed land release comprising of a portion of land around London Circuit including a car park and the north-west leaf exit from Commonwealth Avenue (refer to Table 5.6 for more detail on this development).
Connected and compact city	Ensures future development is well planned and supports more sustainable travel behaviours. Provides more opportunities for people to live close to jobs and services rather than on the outskirts of the city, reducing travel time and costs, providing greater housing choice across the region. Provides positive health outcomes from more compact mixed-use urban development and the provision of high-quality public transport that supports more walking and cycling.
Improved access to employment and services	Improves public transport service frequencies and hours of operation compared to the existing bus network. Provides a range of destinations that include major hubs, educational institutions and key cultural and recreational attractions. Provides choice for a great proportion of the population and increases equity in the provision of and access to high-quality public transport services across the City.
Reducing car dependency	Provides capacity in the transport network to accommodate growth and densification by providing a viable, sustainable and attractive alternative to car travel.

Benefits	Key aspects
Improving connectivity	Supports pedestrian and cyclist connectivity in this part of the city by raising London Circuit. Provides a better place and transport outcome by allowing the light rail to track down the middle of London Circuit and Commonwealth Avenue.

3 Planning approval pathway

This Chapter overviews relevant Territory and Australian Government legislation and the Project's overall planning approval process.

3.1 Land management, administration and approvals

Land use ownership, management, and development control in the ACT is complex.

The Australian Capital Territory was established in 1911 when the Federation was formed. At this point, New South Wales transferred the land to the Commonwealth. It remained as Commonwealth Land until 1989 when a locally-elected government was formed.

At the point of creating the ACT Government, parts of Canberra were effectively designated as Territory Land, and new planning laws were created. However, land that was still considered of national value remained under the administrative management of the Australian Government (referred to as National Land). This land is currently managed by the NCA. The NCA was initially established in 1921 to oversee building Canberra.

The Australian Government also identified areas in Canberra that needed designating due to their importance in representing the nation's capital. These Designated Areas are also managed by the NCA.

Today, approval to carry-out development and undertake works in Canberra is mainly provided by the ACT Government (Environment, Planning and Sustainable Development Directorate – Planning) and the Australian Government (NCA).

If there are significant environmental impacts, additional approval may also be needed from another part of the Australian Government (Department of Environment and Energy).

The Project crosses land where development is controlled by the Environment, Planning and Sustainable Development Directorate – Planning (Territory Land) and the NCA (Designated Areas and National Land). Approval for this Project would be needed from both planning authorities. Approval may also be needed from the Department of Environment and Energy if the Project significantly impacts on one of nine matters of national environmental significance or Commonwealth Land values.

In summary, due to the Canberra's history all National Land and Designated Areas (that are not Territory Land) remain Commonwealth Land under the constitution. Conversely, Territory Land is not Commonwealth Land unless it is leased back by the Australian Government or wider Commonwealth.

Figure 3.1 and Figure 3.2 respectively show the land management and administration boundaries along the Project footprint as defined under the Territory Plan and the National Capital Plan. It confirms that the Project crosses:

- Territory Land where the ACT Government would approve development under the *Planning and Development Act 2007* (P&D Act).
- Designated Areas and National Land where the NCA would approve works and ensure development consistency under the National Capital Plan. This is provisioned under the *Australian Capital Territory (Planning and Land Management) Act 1988* (PALM Act).
- Commonwealth Land (e.g. Designated Areas that are not Territory Land and all National Land) where the Department of Environment and Energy would need to 'control'

(approve) any development whose actions have a significant impact under the *Environment Protection and Biodiversity Conservation Act 1999.*

The Department of Environment and Energy would also need to control any development actions that would significantly impact on any one of nine protected matters of national environmental significance. This applies to all areas of Canberra.

Table 3.1 describes the land use zones and precincts associated with the Project footprint. All four precincts also form part of the Central National Area.

Table 3.1 Land use zones and precincts

Areas	Territory Plan		National Capital Plan				Commonwealth Land
	Land	Road	National Land	Designated Area	Special Requirements Area	Precinct	
Northbourne Avenue	-	✓	-	✓	✓	-	-
London Circuit north of Edinburgh Avenue	TSZ1[1]	✓	-		✓	City Hill	-
London Circuit south of Edinburgh Avenue	-	✓	-	✓	-	West Basin	-
London Circuit east of Commonwealth Avenue	-	✓	-	✓	-	Constitution Avenue & Anzac Parade	-
Commonwealth Avenue north & including Parkes Way	-	-	✓	✓	-		✓
Commonwealth Avenue south of Parkes Way	-	-	✓	✓	-	Lake Burley Griffin & Foreshores	✓

Note 1: TSZ1: Transport and Services Zone.

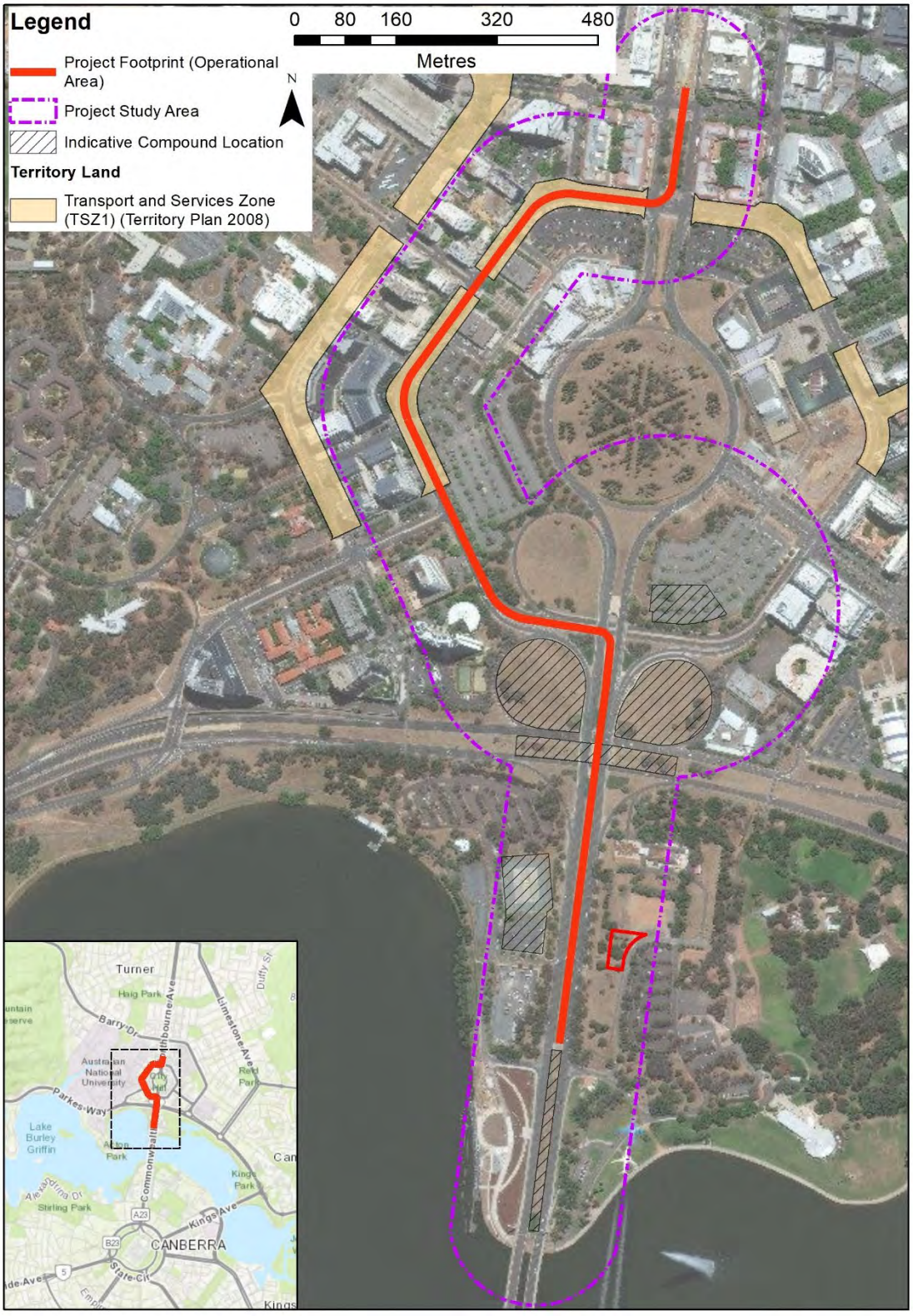


Figure 3.1: Territory Plan land administration

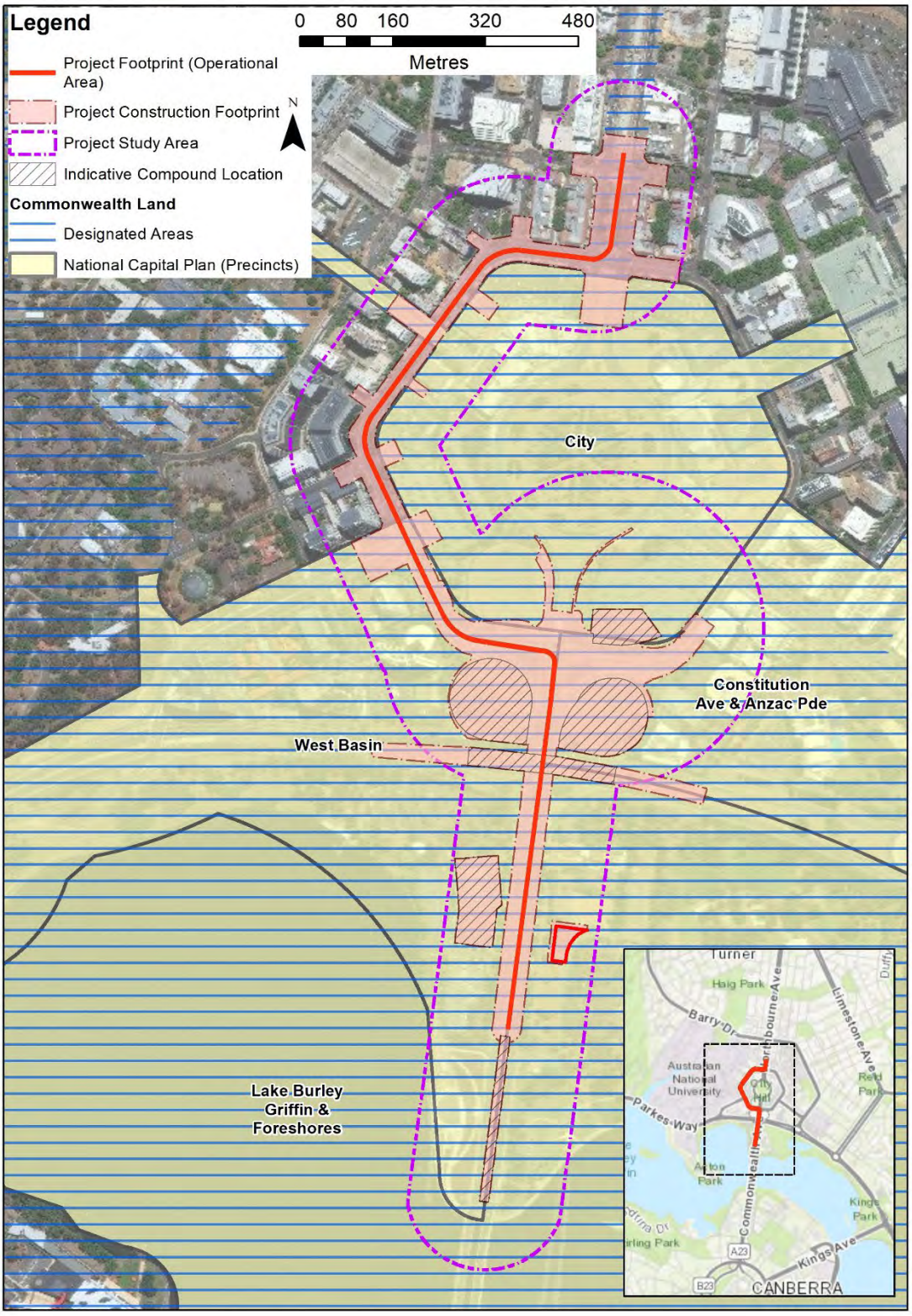


Figure 3.2: National Capital Plan land administration

4 Project description

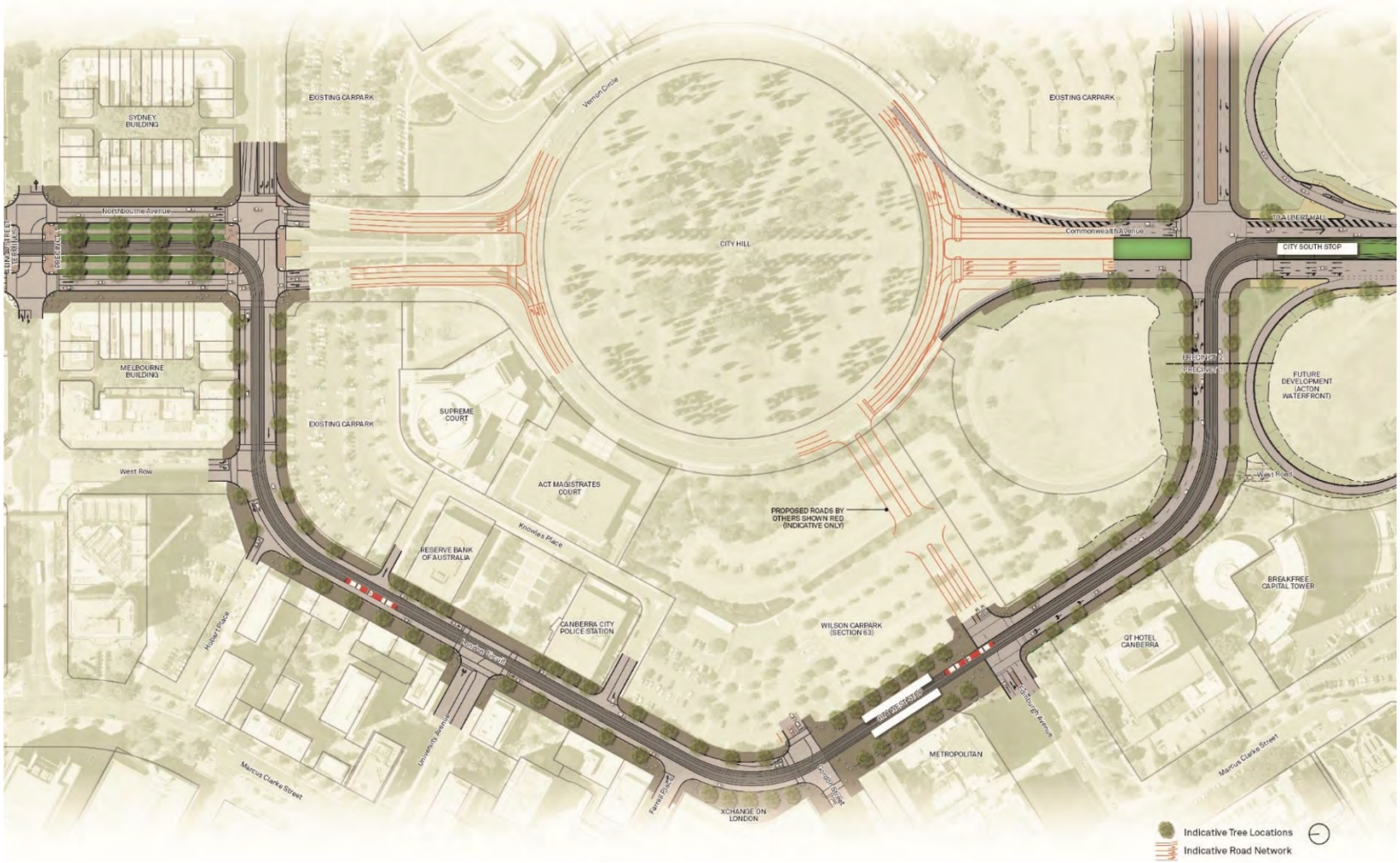
This Chapter describes the Project and outlines the construction method and operational requirements.

4.1 Overview

The Project would create 1.7-kilometres of light rail that extends from the existing Gungahlin to City light rail terminus to a terminus at Commonwealth Park (refer to Figure 4.1). The Project would create three new stops and provide access to educational institutions and key areas in the city.

Areas and precincts serviced by the Project would include:

- Australian National University
- City Hill
- National Film and Sound Archive of Australia
- Henry Rolland Park
- Lake Burley Griffin and foreshore area
- City West, City East and City South East territory precincts
- City Hill, West Basin, Constitution Avenue & Anzac Parade, and Lake Burley Griffin & Foreshores national precincts
- Acton Waterfront



Source: Hassell

Figure 4.1a: Key features of the Project route

Source: Hassell

Figure 4.1b: Key features of the Project route

4.2 The Project

Overview of the route and stops

A new light rail route would be construction that connects the existing light terminus at Alinga Street to a new terminus at Commonwealth Park. From the Alinga Street stop the light rail would run south within the median of Northbourne Avenue turning into London Circuit (west).

The light rail would then follow London Circuit (west) before joining Commonwealth Avenue. The intersection at London Circuit and Commonwealth Avenue would be rebuilt and signalised to allow for this. It would consist of the southern portion of London Circuit being raised to the same level as Commonwealth Avenue. The light rail would continue south along the middle of Commonwealth Avenue and terminate north of Lake Burley Griffin.

Power to the light rail would be provided via wire-free charging to an on-board battery energy storage system on the light rail vehicle. The general arrangement and location of wire-free charging points is still being confirmed.

Three light rail stops would be built as part of the Project:

- City West would be located on London Circuit between Gordon Street and Edinburgh Avenue and would comprise a side stop; a platform both sides of the rails.
- City South would be located on Commonwealth Avenue just south of the rebuilt intersection. This stop would comprise an island stop; a single central platform.
- Commonwealth Park would be located on Commonwealth Avenue north of the Albert Street intersection. This would also be an island stop, while forming a terminus similar to the Alinga Street stop.

Figure 4.2 and Figure 4.3 show photos of a stop and terminus from the existing Gungahlin to City alignment. The light rail stops for the Project would be consistent with the design of these existing stops.

The final design and configuration of the stops and terminus would use elements of the design adopted for the Gungahlin to City light rail such as canopies, platforms and material finishes. Table 4.1 describes the Project's operational characteristics.

Source: Major Projects Canberra

Figure 4.2: existing Gungahlin to City light rail stop

Source: Major Projects Canberra

Figure 4.3: existing Gungahlin to City light rail terminus

4.3 Supporting work

The following additional work would be needed along the route to support the light rail.

4.3.1 Access and road configuration changes

The following access and road configuration changes may be needed to support the Project:

- Reconfiguring London Circuit to create a signalised intersection at the same level as Commonwealth Avenue.
- Building a separate light rail bridge over Parkes Way between the two existing road bridges.
- Making minor changes to the intersections, kerb lines and footpaths along the route, while adjusting traffic signal timings.
- Installing new traffic signals and pedestrian crossings where needed.
- Potentially reducing the speed limit along Commonwealth Avenue.
- Installing 'green tracks' along Commonwealth Avenue, which involves planting grass or shrubs between and besides the light rail track (refer to Figure 4.4).
- Potentially removing on-street parking and other kerbside uses on London Circuit.
- Permanent loss of around 70 off-street car parking spaces London Circuit East car park to install the intersection and an additional temporary loss of around 220 at the same location during construction.
- Prioritising pedestrian movement on London Circuit between Gordon Street and Edinburgh Avenue to create a zone that would avoid potential conflicts between pedestrians and vehicles due to the expected very-high patronage of the City West stop.

Source: Transport for NSW

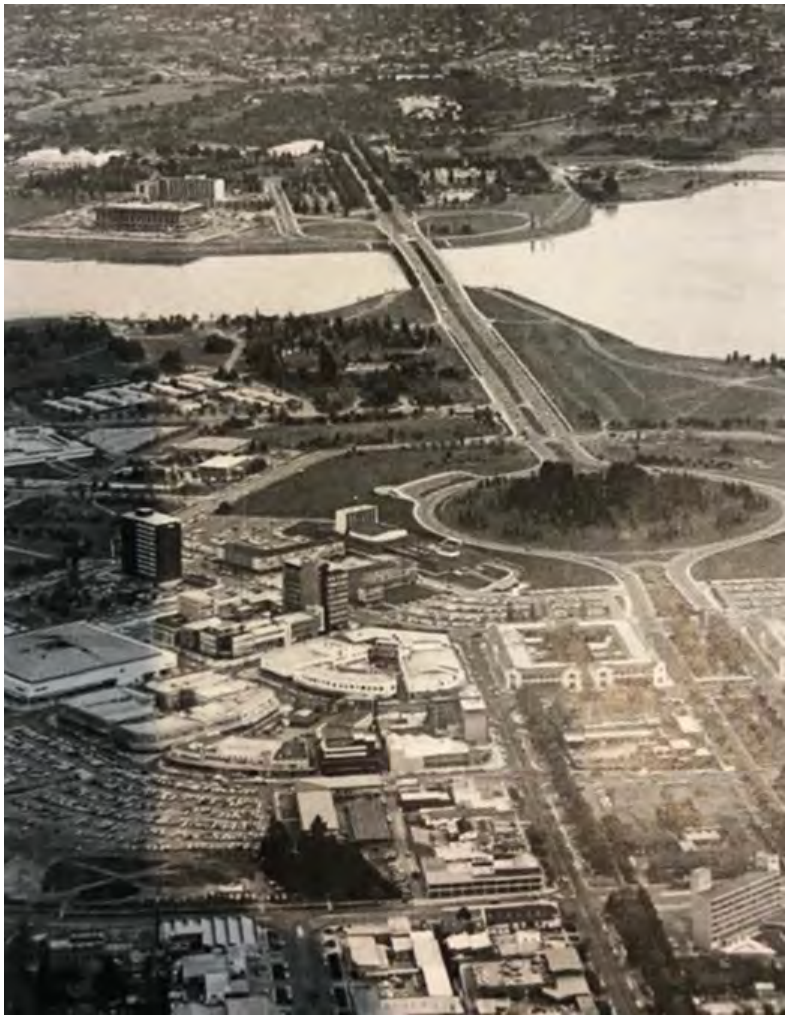
Figure 4.4: a representation of a 'green track'

London Circuit-Commonwealth Avenue intersection

The southern portion of London Circuit would be raised to the same level as Commonwealth Avenue to create a four-way signalised road intersection. This would reinstate the original intersection design and formation as included in the Griffin Plan as shown below in Figure 4.5 and Figure 4.6. It would also allow the light rail to run down the middle of both roads.

Source: National Library of Australia

Figure 4.5: London Circuit at the Commonwealth Avenue intersection looking south 1965.

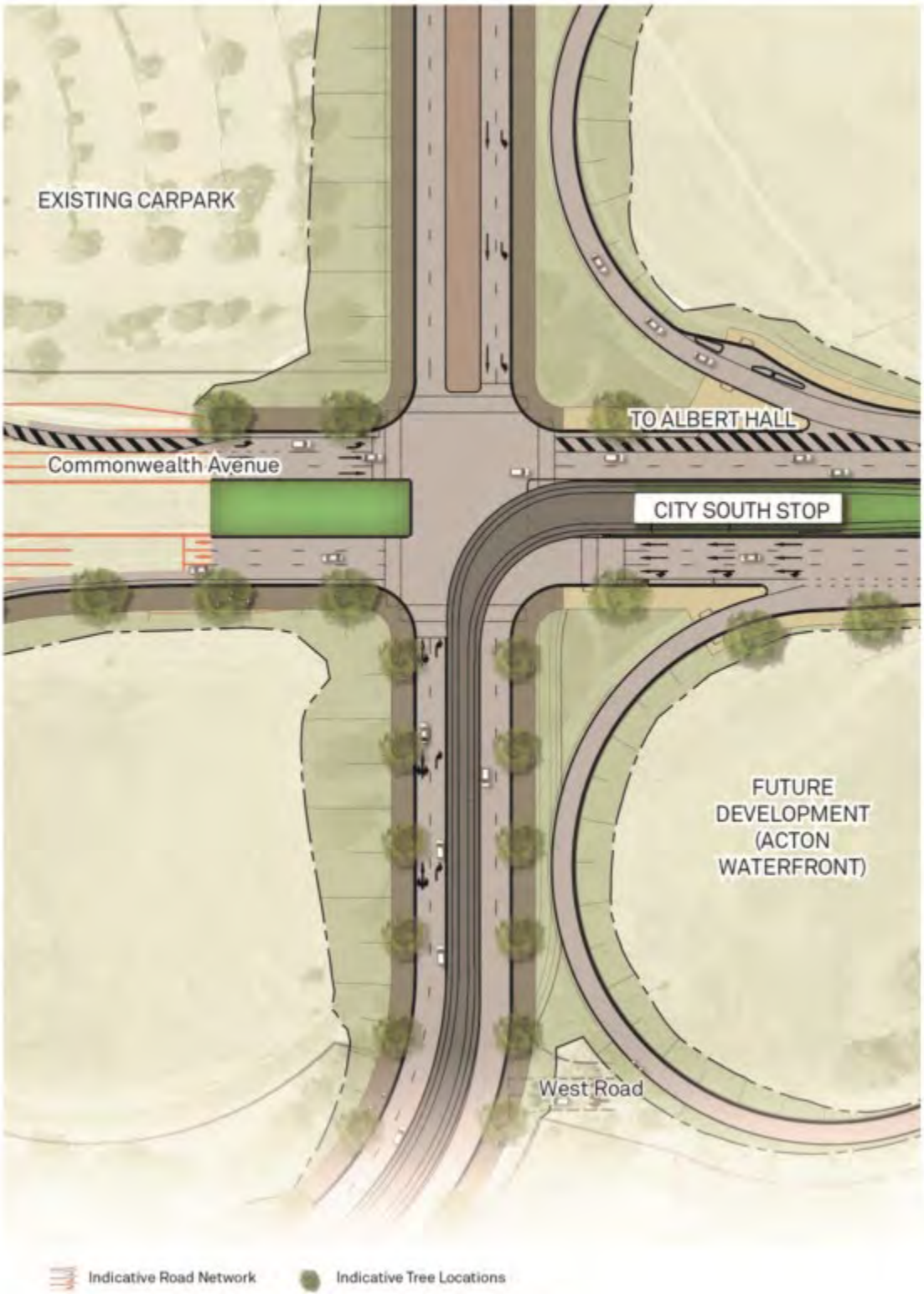


Source: National Library of Australia

Figure 4.6: Aerial photo looking over London Circuit looking south, undated.

This would be achieved by building ramps either side of the intersection to 'raise' London Circuit to the same level as Commonwealth Avenue. These ramps would require fill material (soil) to be imported to raise the road and light rail track. The ramps would also be battered into the adjacent areas ('clover leaf') for stability; meaning slopes would be created either side of the ramp at a stable angle. The detail of the ramp and batter-slope lengths, angles and formation will follow in detailed design. Figure 4.7 shows the intersection detail.

Construction of the London Circuit and Commonwealth Avenue intersection would occur in four stages. During each stage, temporary road routes and traffic management controls would be needed at various times along London Circuit and Commonwealth Avenue (refer to Section 4.4.2).



Source: Hassell

Figure 4.7: illustration of the 'raising' of London Circuit and intersection reconfiguration at Commonwealth Avenue

Parkes Way

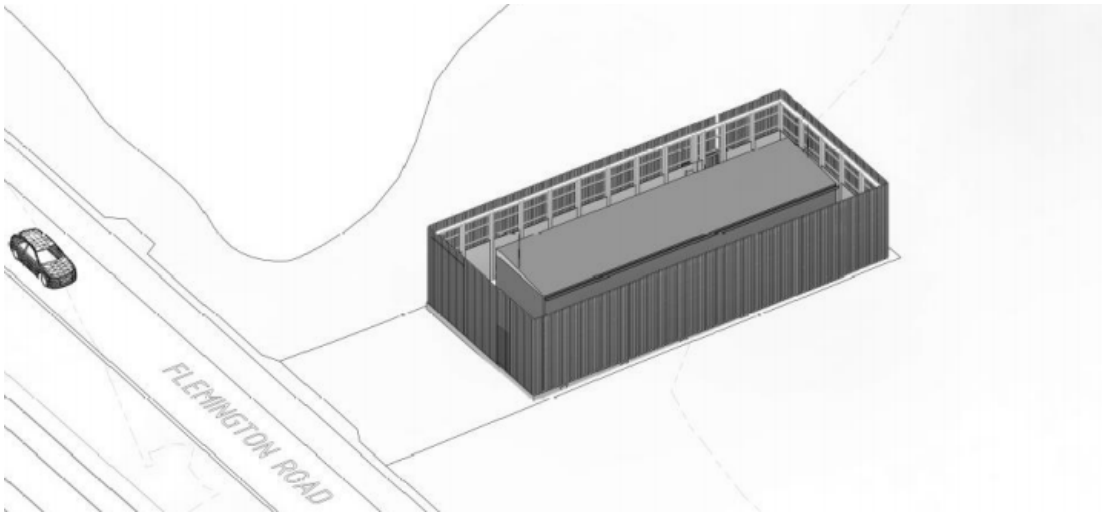
An 'insert' bridge would be built between the two existing road bridges on Commonwealth Avenue over Parkes Way to accommodate the light rail track running down the median. As there is limited height clearance under the existing bridges traffic management controls would be needed on Parkes Way to allow for construction (refer to Section 4.4.2). Figure 4.8 shows the bridge detail.

Source: Hassell

Figure 4.8: illustration of the 'insert' bridge on Commonwealth Avenue

4.3.2 Substations

It is anticipated that one traction power substation would be needed to service the Project. The structure is nominally 30 metres long, 10 metres wide and eight metres high, and it covers a footprint of around 300 square metres. The detail and power specification of the substation would be confirmed during detailed design. Figure 4.9 shows the substation design used on the Gungahlin to City light rail for reference. Something of a similar design would be built for the Project.



Source: ActewAGL

Figure 4.9: Gungahlin to City light rail traction power substation design

The proposal is to install the traction power substation close to Regatta Place as shown in Figure 4.1b). An electricity cable would be installed underground (not shown on Figure 4.1b) to connect the transport power substation with the light rail.

A high-voltage 'feeder' cable would connect the traction power substation to the wider ACT power grid. It is anticipated the corridor for the feeder cable would follow existing utilities corridors and it would not require any new routes to be created.

4.3.3 Drainage infrastructure

The following drainage provisions are likely needed to support the Project:

- Additional drainage for the light rail track zones to meet the required design standards.
- Additional drainage for the road and intersection upgrades plus modifications to existing infrastructure to meet current road design standards.
- Modifications to the existing drainage network to accommodate new track footings and changes to road heights and kerb lines.
- Modifications to existing surface drainage because of level changes, local catchment boundary changes and changes to runoff because of an increase in paved areas.
- Modifications to existing sub-surface drainage to enable the future proofing of third party developments that may otherwise need to install drainage infrastructure later. Carrying out these works as part of the Project would therefore avoid future community impacts and disruption to light rail operations.

4.3.4 Utilities

The Project would cross utilities and services that would either need protecting, adjusting or relocating. Section 5.3.5 describes the utilities within the route study area along with the utilities that maybe needed specifically to service the Project.

Underground project-utilities would be extended about 20-metres beyond the terminus at Commonwealth Park to make existing tie-ins while also supporting future connections in to

the Commonwealth Park to Woden light rail easier by avoiding the need to dig up infrastructure installed as part of this Project.

Additional works may be needed at each intersection to make connections into the existing utilities and stormwater drains, as allowed for in the construction footprint shown on Figure 1.2. Final utility adjustments and provisions would be confirmed during the detailed design in consultation with the utility and service providers.

4.4 Construction

Construction activities would be limited to the footprints described in Chapter 1 and would indicatively involve:

- Enabling works, including site establishment, environmental and traffic management, and utilities identification, management and relocation.
- Earthworks and civil works.
- Track route and slab installation.
- Light rail stop construction, including mobility access, security provisions, closed-circuit television, amenity and security lighting, furniture, and other customer facilities such as passenger information display systems.
- Public domain paving.
- Power supply installation, including the traction power substation, electricity cables and wire-free charging locations (which are still to be confirmed).
- Rail systems and signalling installation.
- Temporary and permanent road, traffic and intersection modifications including the raising of London Circuit and reconfiguration of the existing Commonwealth Avenue intersection.
- Modifications to the public domain along the route, including:
  - Interaction of rail/road transport including traffic signal prioritisation.
  - Temporary and permanent removal and/or relocation of existing facilities.
  - Creation of the prioritised pedestrian zone between Gordon Street and Edinburgh Avenue, including the prohibition of right hand turns from Gordon Street and Edinburgh Avenue across the light rail tracks.
  - Landscape and tree planting along the route, including the creation of the ‘green track’.
- Testing and commissioning.

4.4.1 Construction compounds

Figure 1.2 shows the proposed construction compounds. They may be used in full or part at various times to temporarily store materials and equipment, stockpile materials and waste for short periods, and to house site offices and worker amenities. Importantly, the long-term stockpiling of materials and waste would take place away from the site at an established facility in the ACT. The same site(s) would be used to carry out key maintenance activities. This is to avoid various impacts from occurring within the heart of the city.

The appointed Contractor would be responsible for determining suitable construction compound locations. The Contractor would coordinate their requirements with the landholder and the relevant authorities, including Major Projects Canberra, NCA (if located in a Designated Area) and the ACT and Australian Governments having regard to the *RMS Specification D&C G4, RMS Site Facilities* (Roads and Maritime, 2019) as there is no similar guidance in the ACT. The Contractor would also be responsible for all community and stakeholder consultation relating to construction compounds.

Typical locations where construction compounds may be situated (subject to further consultation and impact assessment) include:

- Along the light rail alignment.
- Existing surface car parks.
- Areas likely to be developed in the next three to five years.
- Existing sites used for the Gungahlin to City light rail.

4.4.2 Traffic and pedestrian management

Various traffic and pedestrian management controls would be needed to build the Project.

General measures

Traffic and pedestrian management controls would be needed at various times along the route to allow for construction. Generally, these would involve:

- Speed restrictions through active working areas.
- Lane closures outside of peak periods.
- Possible traffic (road and cyclist) diversions for short periods during key activities (e.g. major equipment deliveries or lifting operations).
- Footpath closures and pedestrian diversions when installing kerbside utilities.

Key is that the lane closures, diversions, and other restrictions would be relaxed during peak periods and when key events are on in the city. Emergency vehicle access would also be maintained throughout.

The following specific controls would be introduced at the London Circuit-Commonwealth Avenue intersection and on Parkes Way to support construction.

London Circuit-Commonwealth Avenue intersection

Construction of the London Circuit and Commonwealth Avenue intersection would likely occur in four main stages. During each stage, temporary road routes and traffic management controls would be required along London Circuit and Commonwealth Avenue around the intersection.

The traffic management detail would be confirmed once the construction method is better-understood and further consultation is carried out with key stakeholders, including Transport Canberra and City Services, who is responsible for the operation of the city's bus network.

In broad terms, it is expected that the traffic management at the intersection would involve:

- Restricted access along the southern portion of London Circuit under Commonwealth Avenue.

- Temporary reroute of the northbound and southbound lanes of Commonwealth Avenue around the active work site. It is expected that at various time during construction, the number of lanes on Commonwealth Avenue between Parkes Way and Vernon Circle would be reduced from three to two in each direction.
- Access would be closed to the northbound off ramp to London Circuit from Commonwealth Avenue at the start of construction.

Parkes Way

This would possibly include temporary acceleration and deceleration lanes, and the possible switching (transfer) of traffic onto one carriageway to create a contraflow. To facilitate this, land would be temporarily taken from the Parkes Way median. The exact location of traffic management controls and traffic switching would be confirmed during the detailed design.

4.4.3 Working hours

Construction would be staged along the route to minimise disruption to residents, businesses and existing transport operations and would typically occur during standard working hours. This would include civil construction, some utility diversions (where this would have minimal impacts), road works, rail systems and stop construction.

Standard working hours would be:

- 7am to 6pm Monday to Saturday.
- No work on Sundays or during public holidays.

Various components of work may need to take place outside of normal construction hours. These activities would include:

- Work across major intersections along the route.
- Testing and commissioning.
- Utility diversions, where impacts to services cannot be otherwise reasonably managed within standard working hours.
- Oversize deliveries, unloading and lifting, moving large equipment and infrastructure, and collecting machinery that can only travel between specified hours.
- Work that can take place without having an amenity or noise impact on nearby residents and other sensitive receivers.
- Emergency works to avoid the loss-of-life, property and/or to prevent environmental harm.

Construction work needed to take place during special events would be coordinated between Major Projects Canberra, Transport Canberra and City Services, the appointed contractor, the event organisers and/or other relevant stakeholders prior to the event(s) occurring.

4.5 Operation

The Project would operate as part of the overall Canberra light rail network with the common features summarised in Table 4.1. These details are indicative and are expected to be refined as the detailed design progresses.

Table 4.1: Operational features of the Project

Feature	Description	Additional detail
Services	• Every six minutes in peak periods. • At least every 10 minutes between 7am and 6pm on weekdays. • Every 15 minutes at other times on weekdays, and all day on Saturdays, Sundays and Public Holidays.	• Light rail vehicles would typically have priority.
Light rail vehicles	• Electric-powered. • Capacity for about 200 customers. • Maximum speed of 70 kilometres per hour. • Nominally 2.65 metres wide • About 33 metres long. • Heating, ventilation and air conditioning.	• On-board space provision to carry up to four bicycles. • Real-time passenger information displays. • Public announcement system. • Wi-fi service. • Closed-circuit television. • Features to reduce energy consumption.
Light rail stops	• Step-free access. • Passenger information displays, audio announcements and signage. • Additional platform capacity.	• Additional facilities at interchange and terminal stop(s) • Cycle racks would be provided where possible to encourage connectivity between the two modes.
Ticketing	• Adoption of the My Way ticketing system.	• Required at each stop including installation of card validators as well as ticketing and top-up machines where required.
Accessibility	• Fully accessible vehicles in accordance with the Commonwealth *Disability Discrimination Act 1992*. • Offer low-floor level access at all passenger doors, with a height difference of less than 50mm between the light rail vehicles and stop platforms.	• Design consideration also taken for the elderly and those travelling in wheelchairs or with prams.

4.6 Project timeframe

Subject to approval and funding, construction is expected to start in late 2020 or 2021 with the Project operating from 2024. The Project's operational life would depend on various factors, however key elements have a 100-year design life.

5 Environmental context

This Chapter describes the environmental baseline local to the Project. It also provides an overview of the area's history, current use and condition.

Published records, previous studies, targeted walkovers and investigations were used to define the environmental baseline across a 100-metre-wide study area centred along Northbourne Avenue, London Circuit and Commonwealth Avenue. Each section includes boxed green text. This provides a summary in relation to the issues considered in the Australian Government's Significant Impact Guidelines 1.1[2] and 1.2[3]. Table 5.1 identifies which section in this report considers relevant matters or aspects under these Significant Impact Guidelines.

Table 5.1: Cross-referencing

Matter or aspect	Where considered in this report	
	Section	Heading
Environmental aspect – Significant Impact Guidelines 1.1		
Listed threatened species & ecological communities	5.1	Ecology
Listed migratory species	5.1	Ecology
Wetlands of international importance	5.1	Ecology
National heritage places	5.2	Heritage
Environmental aspect – Significant Impact Guidelines 1.2		
Landscape and landform	5.3.1	Landscape, urban character and visual amenity
Soils and other substrate	5.3.2	Contamination, soils and geology
Water	5.3.3	Water
Vegetation	5.2	Ecology
Animal species	5.2	Ecology
Conservation and special use areas	5.1 5.3.1	Heritage Landscape, urban character and visual amenity
Heritage places and items	5.1	Heritage
Renewable and non-renewable resources	5.3.5	Utilities and energy resources
Utilities, energy, transport, resources and infrastructure	5.3.5 5.3.6	Utilities and energy resources Traffic and transport

[2] *Significant impact guidelines 1.1 – Matters of National Environmental Significance (MNES):* https://www.environment.gov.au/system/files/resources/42f84df4-720b-4dcf-b262-48679a3aba58/files/nes-guidelines_1.pdf
[3] *Significant impact guidelines 1.2 – actions on, or impacting upon, Commonwealth land, and actions by Commonwealth agencies:* https://www.environment.gov.au/system/files/resources/a0af2153-29dc-453c-8f04-3de35bca5264/files/commonwealth-guidelines_1.pdf

Matter or aspect	Where considered in this report	
	Section	Heading
People and communities	5.3.4	Property and land use
	5.3.6	Traffic and transport
	5.3.7	Noise and vibration
	5.3.8	Air quality and greenhouse gases
	5.3.9	Socioeconomics

5.1 Heritage

A desk review of the Commonwealth and Territory heritage record within and local to the study area confirmed there to be:

- No Aboriginal heritage records.
- The following 12 non-Aboriginal listed, nominated and registered heritage items:
  - Four National-listed or nominated items.
  - Three Commonwealth-listed or nominated places.
  - Five Territory-listed places.

Most of study area is in a Designated Area as described in Section 3.1. Designated Areas are recognised for their cultural landscape, public realm and amenity values in representing the Griffin Plan. Table 5.2 details each listing, noting that only the listed National and Commonwealth sites (shaded grey) are 'protected matters' under the EPBC Act. This is because the other (unshaded) items are either nominated or registered and therefore not currently protected under a listed status.

Figure 5.1 specifically shows the location of all the Commonwealth heritage items listed in Table 5.2 while Figure 5.2 shows the location of all of the heritage items (i.e. National, Commonwealth and Territory) listed in Table 5.2. *Note that Canberra-Central National Area and Inner Hills and Canberra and Surrounding Areas cover the entire study area for the Project and are therefore not shown on the figure.*

Table 5.2: Listed and nominated heritage items

ID	Name and identification	Listing and location
National heritage list: ***Matter of National Environmental Significance***		
1	Canberra-Central National Area and Inner Hills	Nominated place: within the study area
2	Canberra and Surrounding Areas	
3	Lake Burley Griffin and Lakeshore Landscapes	
4	Australian Academy of Science Building	Listed place: 300 metres west of the study area
Commonwealth heritage place: ***Commonwealth Land heritage value***		
5	Lake Burley Griffin and Adjacent Lands	Nominated place: within the study area
6	National Land Roads	
7	Reserve Bank of Australia including the brick paving in front of the buildings.	Listed place: within the study area
8	Parliament House Vista	Listed place: within the study area
Territory list: ***ACT heritage-registered***		
9	ANZ Bank Building	Final registration: within the study area

ID	Name and identification	Listing and location
10	Sydney & Melbourne Buildings	
11	City Hill	Final registration: about 180 metres east of the study area
12	Civic Square	Nominated for provisional registration: about 45 metres south east of the study area
13	Law Courts Precinct	Nominated for provisional registration: about 25 metres south east of the study area

The heritage assessment being prepared to support the planning approvals and inform the design appraised the value of the Commonwealth Heritage listed items within the study area, including the Reserve Bank of Australia (former) and the Parliament House Vista.

5.1.1 Undiscovered sites and archaeology

Despite there being a comprehensive heritage record across the study area supplemented by a long European development history, the potential for discovering intact unexpected and unregistered heritage and archaeological finds cannot be fully discounted. This is consistent with any area of Canberra.

National heritage places

There are no national heritage places located directly within the study area. The closest is the Australian Academy of Science Building, located about 300 metres to the west of the study area.

Commonwealth heritage places

There are two Commonwealth heritage places within the study area; namely the Reserve Bank of Australia, located on Knowles Place between London Circuit and City Hill, and Parliament House Vista, located to the south of the lake along the eastern side of Commonwealth Avenue. While Commonwealth heritage places are not matters of national environmental significance, they are protected where they are located on Commonwealth Land (refer to Section 6.5).

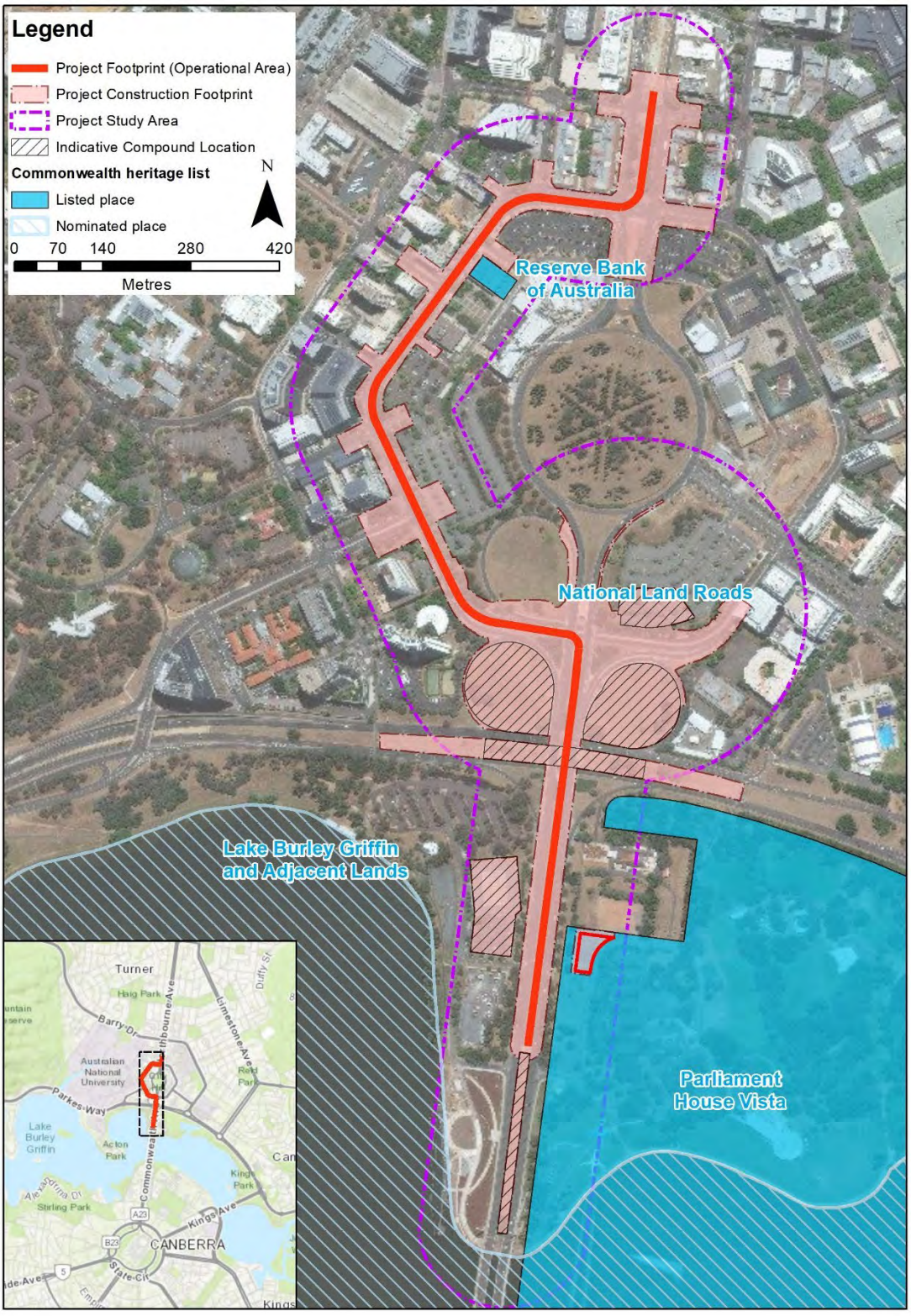


Figure 5.1: Commonwealth heritage nominated, listed and registered places

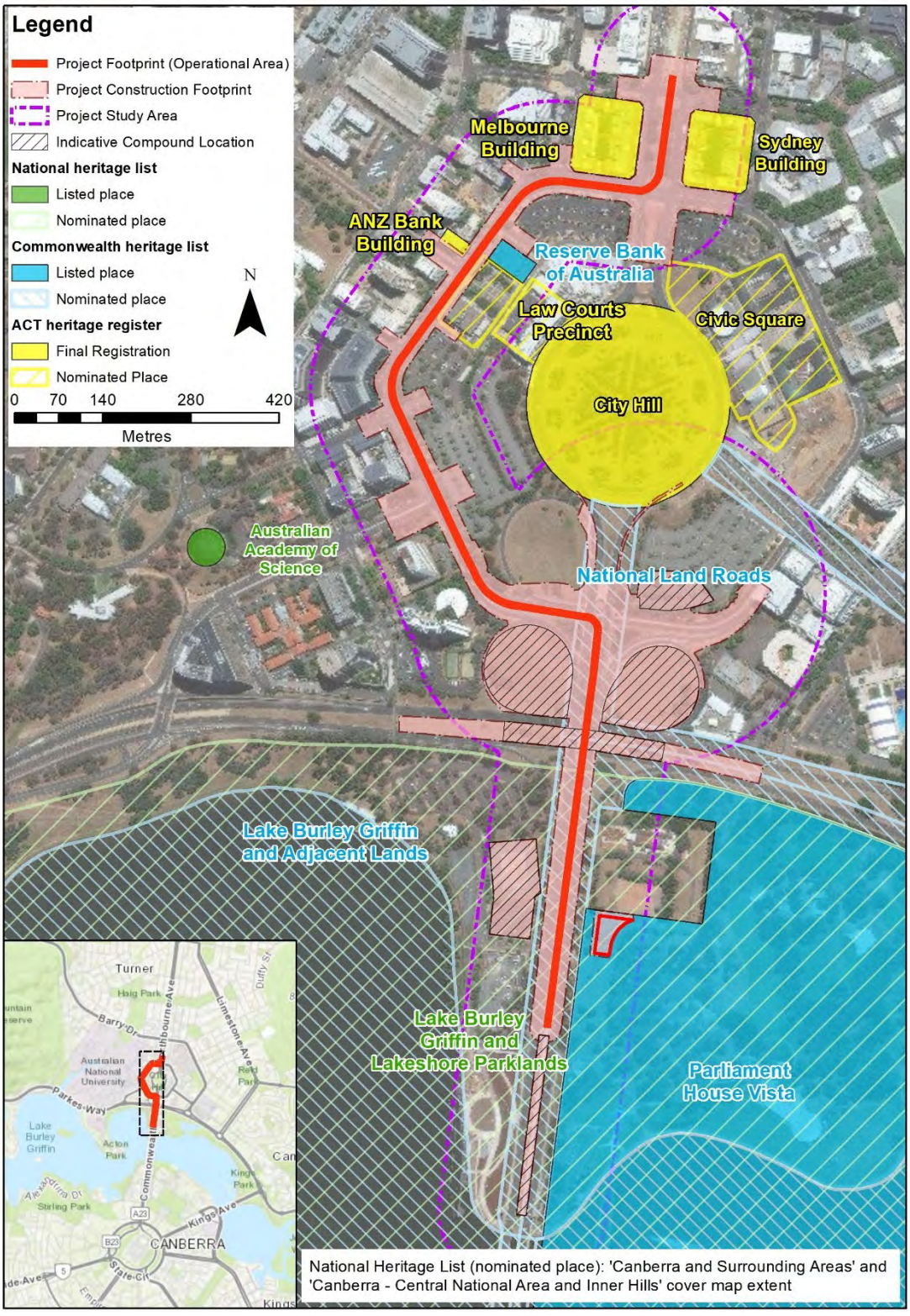


Figure 5.2: Heritage nominated, listed and registered places

5.2 Ecology

In 2019, the City Renewal Authority submitted a referral relating to the proposed development of City Section 63. This referral was supported by golden sun moth surveys carried out by SMEC in 2017 and 2018 across the City and Lake Precinct; the extent of which is shown in Figure 5.3. A broader preliminary ecological assessment was carried by Biosis in early 2019 to cover a corridor between the City and Woden to help define the future light rail corridor. This study also included targeted golden sun moth surveys, however it covered a smaller area as shown in Figure 5.4. These surveys have been referenced in this report.

A review of Australian Government and Territory records identified the following ecological values within the study area:

- Three principal vegetation community types: modified grassland, urban vegetation of exotics, and planted natives.
- The critically endangered golden sun moth.

The following species were also recorded locally:

- Two endangered ecological communities.
- Six threatened plant species.
- 15 threatened animal species.

There are no records of migratory species, communities or wetlands of international importance in the study area or locality. The habitat of the study area also has limited potential to support other threatened species or communities (Biosis, 2019).

Chilean needle grass is also present in the study area. This is a weed of national significance meaning it must be managed according to published strategies. However, Chilean needle grass also provides habitat for the golden sun moth.

Critically endangered species

A single golden sun moth population[4] was recorded and observed during targeted surveys in 2016, 2017 and 2019. The population was recorded at the intersection of London Circuit, Commonwealth Avenue and along Parkes Way. In terms of observed individuals:

- Two golden sun moths were recorded in the south-west corner of the ‘clover leaf’ in 2019 compared to 16 in 2017 and 24 in 2016.
- 38 golden sun moths were recorded in the south-west corner of the ‘clover leaf’ in 2019 compared to 160 in 2017.
- 12 golden sun moths were recorded along a limited section of the Parkes Way median during 2019 compared to 88 in 2017.

The extent of golden sun moth habitat was far more extensive in 2017 than in 2019, as can be seen on Figure 5.4 compared to Figure 5.3. This was due to the scope of the 2019 survey only focussing on a 100-metre-wide footprint centred of the Project route compared to the

[4] Under Australian Government guidelines, any recorded sun moths within 200 metres of each other are considered part of a single population. Accordingly, even though there are major roads separating each of the ‘clover leaves’ and Parkes Way it was still assessed as a single population. This population was considered distinct and isolated from nearby populations at Campbell, Reid, Yarralumla, Ainslie and Barton (Mulvaney, 2012).

footprint investigated in 2016 and 2017; which was far wider and covered the City to Lake precinct.

There is not the survey record to confirm why the habitat and population changed across the common parts of the 2017 and 2019 footprints. As such, it can only be concluded that the construction footprint covers 2.6 hectares of confirmed golden sun moth habitat, based on the 2019 survey data, compared to 6.9 hectares of habitat based on the 2017 data.

The golden sun moth is critically endangered nationally and in the territory. Table 5.3 describes the core ecological values of the golden sun moth population and habitat as assessed within the study area in 2017 and 2019.

Table 5.3: Values of the golden sun moth and its habitat

Species	Ecological values
Golden sun moth	The golden sun moth population that falls within the 2017 and 2019 study areas form part of a single population that is distributed on median strips, roadside verges and green space near the London Circuit/Commonwealth Avenue intersection. According to the 2017 data, the Project could impact on habitat where 327 golden sun moths were recorded. This compares the 2019 survey where the Project would only impact on habitat were 52 golden sun moths were recorded.
Golden sun moth habitat	By the same virtue, the Project would impact on 6.9 hectares of golden sun moth habitat based on the 2017 data and 2.6 hectares based on the 2019 data. In both cases the vegetation is being classified as ‘low quality’ golden sun moth habitat, mainly comprising highly invasive Chilean needle grass, on which the larvae are known to feed (SMEC, 2017).

Figure 5.3: Golden Sun Moth records and habitat from the 2019 Biosis surveys

Figure 5.4: Golden Sun Moth records and habitat from the 2016-2017 SMEC surveys

5.3 Commonwealth Land

The extent of Commonwealth Land in the study area includes all National Land and extends from the intersection of Commonwealth Avenue and London Circuit to the terminus at Commonwealth Park. It also covers Lake Burley Griffin and its foreshore area and the Designated Areas outside of the Territory Land around City Hill.

As set out in Table 5.1, Significant Impact Guidelines 1.2 include 10 environmental aspects (topics) associated with features of Commonwealth Land that maybe significantly impacted by development.

Seven of the 10 aspects have been considered below, with the heritage aspect and two ecological aspects (vegetation and animal species) discussed above in Section 5.1 and Section 5.2. Reference has been made to the entire study area and locality (e.g. including Territory land) through needing to consider both direct and indirect impacts on Commonwealth Land along with transboundary effects.

5.3.1 Landscape and urban character and visual amenity

There is a mix of landscape character zones across the study area defined and bounded by the National Capital Plan precincts. The two principal zones are:

- The commercial and civic high-rise dense built-form and urban character around the edge of London Circuit that frames and encloses the natural amenity and open character of City Hill. This zone is undergoing transformation and development, including an increase in the built form and modernisation of the urban landscape.
- The wide boulevard open character of Commonwealth Avenue that provides a distinct north-south link across Lake Burley Griffin affording a sense of importance in its setting and context.

Both zones reflect the intention and design of the Griffins' Plans, thus their (partial) classification as 'Designated Areas'.

Another key feature of the urban environment of the study area is the spatial relationship and the use of wide medians and planted corridors throughout. These inform and define Canberra's unique character and give distinction to each of the above zones. This is especially true of the Commonwealth Avenue corridor within the study area that exhibits a clear design theme of verges and medians, albeit with an incomplete and disjointed landscape character.

The Griffin Plan

The Griffin Plan is an important design legacy for Canberra. The Project interacts with one nationally important vista created in the Griffins' design of the city; namely the National Triangle. The National Triangle provides Canberra's ceremonial precinct, containing some of Australia's most significant buildings. The triangle is bound by Constitution Avenue, Kings Avenue and Commonwealth Avenue; all roads of national significance. At its centre is the convergence of the land and water axes that Griffin's planned around. Development within this area is controlled by the NCA.

Vistas and viewscapes

The Griffins' ensured Canberra was designed geometrically to create important corridor views and vistas throughout the city; and the importance of this is recognised in the National Capital Plan. Key to the study area are the views of London Circuit and Commonwealth Avenue from City Hill, and in the wider viewscape, views over Lake Burley Griffin to the Parliamentary Zone. This includes the view from Commonwealth Avenue north of the lake towards the Parliament House Vista; which is a Commonwealth heritage place (refer to Section 5.1). Originally, London Circuit was built at the same level as Commonwealth Avenue to form a single level pentagon (refer to Figure 4.6). There are also other visually sensitive receivers that overlook the Project route, including residents and workers in the buildings fronting London Circuit.

Mount Ainslie and Black Mountain overlook this part of the city. The Project route forms part of the viewscape from these areas. Importantly, none of the features of London Circuit and Commonwealth Avenue are landmarks that provide distinction from these vantage points. Nonetheless, both roads 'inform' the general character of the urban landscape of this part of the city.

Natural landscape features

There are no natural landscape features in the study area within the meaning and definition of the Significant Impact Guidelines. Both the hard and soft features of the cityscape are manufactured including Lake Burley Griffin, the amenity planting and parklands. The nearest natural landscape features surround the city, and as described above, they have views over the study area. They include Mount Ainslie and Black Mountain, and to a lesser extent, Red Hill Nature Reserve.

Sullivans Creek is the nearest natural landscape feature to the Project. It is located about 700 metres west of London Circuit at its nearest point. Despite the creek's amenity and value, it is removed and visually isolated from the Project.

5.3.2 Contamination, soils and geology

The geology of the study area comprises the Canberra Formation; a conglomerate (mix) of mudstone, siltstone, minor sandstone, limestone, hornfels (a type of metamorphic rock), dacitic ignimbrite (a type of igneous rock made of hardened volcanic ash called tuff) and volcaniclastic sediments.

The overlaying soils are characteristic of the underlying geology and are mainly dominated by Williamsdale and Burra landscapes. The natural soils in the study area comprise a mix of alluvium, as deposited from the lake and river, and poorly draining sandy sodic (saline) and podzolic (formed from eucalypt) soils. Much of the area has been modified and infilled to support Canberra's development, and prior to that, to support the land's agricultural use.

Contaminated land and acid-sulfate soils

The study area's soils do not contain iron sulphides meaning there is an extremely-low potential for acid sulfate soils (Australian Soil Resource Information System, 2019).

The limited detailed site investigation (RPS, 2017) identified two sites within the study area with a potential contamination risk due to their previous storage of hydrocarbons (petrol) onsite:

- 20 to 22 London Circuit
- 25 London Circuit

Both sites are recorded on the contaminated sites database as they "are known, have been, or have the potential to be contaminated". RPS reported that both sites should be further investigated, however the report provided no further information on the site or contamination history or the potential impact this may have had on the local area.

There is also a potential risk for contaminants associated with the use of uncontrolled imported fill and associated road-building materials including tar, bitumen and road base. Asbestos containing materials have also been recorded across the city and study area; again, associated with the use of uncontrolled imported fill.

A final contamination risk is associated with the former barracks located on the edge of the lake to the east of Commonwealth Avenue.

5.3.3 Water

Surface water and flooding

Lake Burley Griffin is the nearest, albeit artificial, surface water feature. It was created by flooding the Mongolo River. The lake and river flow in a westerly direction and are fed by a series of creeks to the north and south.

London Circuit, near its intersection with Edinburgh Avenue, is prone to short duration nuisance flooding due to its lower lying nature.

Surface water quality

The Lake Burley Griffin Water Quality Management Plan (The Plan, NCA, 2011) reported on the historical trends in water quality of the lake from 1989 to 2009.

The Plan indicated that the lake's overall environmental health was generally good. Turbidity, phosphorus and nitrogen levels had gradually decreased over the review period, with turbidity remaining consistently in the lower range. High metal concentrations were recorded in the lake sediments; however, pH values have remained in the same general range and within acceptable limits for this type of water feature over the 20-year period.

The intensity of late summer algal blooms had increased over the review period. This has led to an ongoing program during the recreational season (mid-October to mid-April) to monitor enterococci and blue green algae (cyanobacteria) every week at various locations within the lake. The nearest monitoring locations to the Project are the Acton Beach (Ferry Terminal) and the Central Basin.

The most recent monitoring results taken in 2019 at Acton Beach and the Central Basin passed water quality tests between 60 and 95 percent of the time (SWIM GUIDE, 2019). Warnings are issued when blue-green algae concentrations are high (≥50,000 cells/ml) or extreme (≥125,000 cells/ml, SWIM GUIDE, 2019). A warning was last issued in February 2019. Water monitoring is not undertaken outside of the recreational season.

Data collected for Sullivans Creek during 2013 and 2014, downstream of the Australian National University (ANU) to Lake Burley Griffin (Parsons Brinckerhoff, 2015), found that the water quality in relation to turbidity, pH and electrical conductivity was acceptable. However, total phosphorus and limited dissolved oxygen data indicated a degraded system.

Water quantity and availability

The city and its residents rely on water supplied by a series of dams managed and operated by Icon Water.

The ACT has a four-stage scheme of water restrictions and permanent water conservation measures[5]. In 2010, Stage two water restrictions were downgraded to stage one, the lowest restrictions. This is where they are currently.

Groundwater

Regionally, the underlying Lachlan Fold geological belt comprises a mix of shallow perched (unconfined) aquifers associated with the alluvium and fill across the area, and deeper fractured rock (semi-confined) aquifers. Little is currently known about the depth to, and quality of, the groundwater beneath the Project footprint, suffice that it is likely to be closer to the surface towards the lake. Planned geotechnical investigations will confirm this.

Groundwater quality, quantity and availability

Locally, the study area sits within the Sullivans Creek hydrogeological landscape (HGL). This is a large area running north of the lake to Mitchell, Mount Majura and Mount Ainslie. Spread over 72 km^2, the area receives up to 750 mm of rainfall every year on average. Groundwater depth across the area is influenced by the soils, geology and rainfall. Typically, it varies between two and eight metres below the surface [6].

Perched waters occur close to surface, and groundwater is expected to be shallower close to the lake. The groundwaters are moderately yielding (five to 15 percent) with a flow length of less than 10 kilometres. Importantly, the deeper base (rock) aquifer does not quickly recharge with the waters remaining in the ground for several years. The other key feature of the groundwater is its saline nature, which if encountered, may affect foundation materials used in the Project.

The ACT Government has developed a series of management actions to protect the Sullivans Creek hydrogeological landscape. These have been considered in Chapter 7.

5.3.4 Property and land use

The study area is primarily an urban environment that includes residential properties, commercial premises, government and historical areas, and educational and recreational facilities. Table 5.4 lists the key properties and land uses throughout the study area. Figure 5.5 shows the key properties listed below.

[5] https://www.iconwater.com.au/my-home/saving-water/when-can-i-water/permanent-water-conservation-measures.aspx

[6] http://app.actmapi.act.gov.au/Hydrogeological_Landscape_Reports/Reports/Salinity/23_SullivansCreek_Salinity_160131.pdf

Table 5.4: Land uses and key properties

Location	Land use and key properties
Northbourne Avenue	Land Use • Northbourne Avenue: six-lane public road with shared footpath and cycleway on each kerb. • Central median: wide tree-lined boulevard with central paved pedestrianised area. Key properties: Melbourne Building (Territory heritage listed), and Sydney Building (Territory heritage listed).
London Circuit (west)	Land use: • London Circuit: four-lane public road with footpath provisions designated an intertown public transport route as defined in the National Capital Plan. • City Hill: amenity public open space and key vantage point. • East of London Circuit (west): principally public car parking, the city police station, and the Reserve Bank of Australia, ACT Magistrates Court and the Supreme Court of Australia. Note: commercial and residential developments are currently under construction in sections of these car parks. • West of London Circuit (west): a mix of commercial and retail properties and low-rise residential units. Key properties: Reserve Bank of Australia (Commonwealth heritage place), Supreme Court of Australia, Canberra City police station, ACT Magistrates Court, Commonwealth Superannuation Corporation, QT Hotel, Capital Tower Hotel, AON, Department of Foreign Affairs and Trade and ACT Corrective Services. The ANU and the National Film and Sound Archive of Australia are located to the west off University Avenue.
Commonwealth Avenue	Land use: • Commonwealth Avenue: six-lane public road with marked cycle lane in both directions, designated an intertown public transport route as defined in the National Capital Plan. There are footpath provisions south of the Parkes Way overbridge. • West of Commonwealth Avenue: public open space and public car parking, Henry Rolland Park located near Lake Burley Griffin, and the foreshore area. • East of Commonwealth Avenue (including the eastern portion of London Circuit within the Project footprint): amenity planted verges, public car parking, the archbishop's house, and Lake Burley Griffin foreshore area. Key properties: The archbishop's house, the ACT Parks Depot and the National Capital Exhibition. The Canberra Olympic Pool and National Convention Centre are respectively located about 400 metres and 500 metres to the east of Commonwealth Avenue.

Social and public infrastructure

The key social and public infrastructure in the study area comprises:

- Public roads including Northbourne Avenue, London Circuit and Commonwealth Avenue along with key intersecting roads such as Edinburgh Avenue, University Avenue and Parkes Way.
- The educational buildings of ANU located about 200 metres west of London Circuit.
- Public and government buildings including; Reserve Bank of Australia, Melbourne Building, Sydney Building, Supreme Court of Australia, Canberra City police station, ACT Magistrates Court, Department of Foreign Affairs and Trade, ACT Corrective Services, ACT Parks Depot, Capital Exhibition and Canberra Olympic Pool.

- The car parking provisions along the route, which are either accessed from London Circuit or Commonwealth Avenue.
- The footpaths, cycleway and pedestrianised area along Northbourne Avenue, cycle lane along Commonwealth Avenue, and the footpaths along London Circuit and Commonwealth Avenue.
- The public open space of City Hill, Henry Rolland Park, Lake Burley Griffin foreshore, National Library, and National Capital Exhibition.

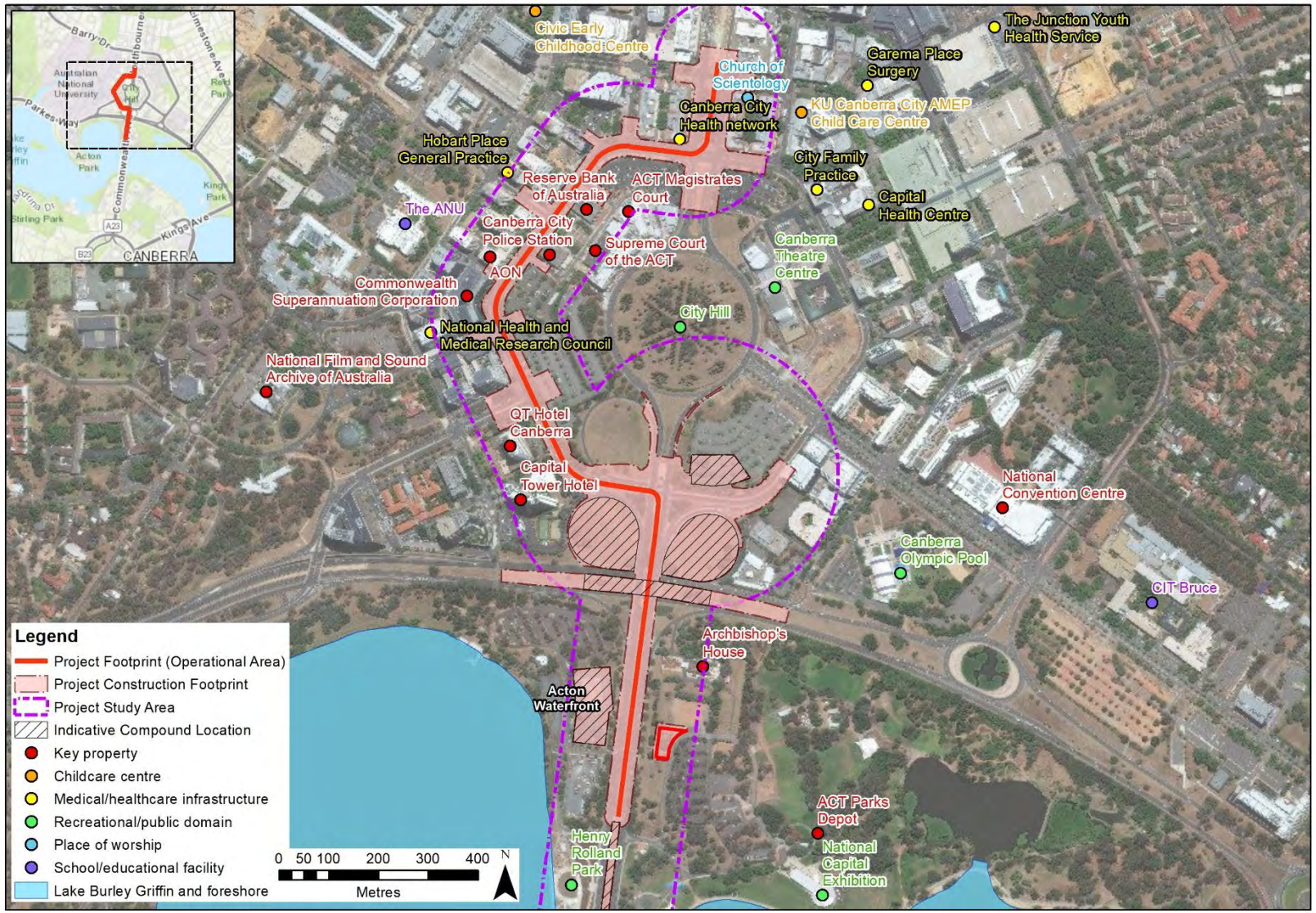


Figure 5.5: Key properties, community services and facilities

5.3.5 Utilities and energy resources

As is typical of any urban environment, there are multiple utilities that service the city's infrastructure. The key utilities within the study area include: telecommunications, drainage, low and high-voltage electricity, gas mains, and potable water, sewage and stormwater infrastructure. There is a complex arrangement of utilities and services that cross and run parallel to the study area.

Natural and non-renewable energy resources

Given the urban character and nature of the study area, it does not form or contain any energy resources (e.g. worked coal seams, wind farm infrastructure).

5.3.6 Traffic and transport

The Project route runs along Northbourne Avenue, London Circuit and Commonwealth Avenue, part of the intertown public transport route defined under the National Capital Plan. As described above:

- Northbourne Avenue is a six-lane divided triple-carriageway with a wide pedestrianised and tree-planted median. There are no restrictions in place and it can be used by all forms of traffic. This section of Northbourne Avenue has a 60 km/h speed limit. Bus zones flank either side of Northbourne Avenue in the Project footprint (note: these zones are for local services. There are no bus stops within this section of Northbourne Avenue).
- London Circuit is a four-lane divided dual-carriageway with a paved median. There are no restrictions in place and it can be used by all forms of traffic. Most of London Circuit has a 40 km/h speed limit, with road signage noting it is an area of "high pedestrian activity". There is one northbound bus stop on London Circuit that is located between Elizabeth Drive and Gordon Street servicing this area. Limited kerbside parking and loading is available.
- Commonwealth Avenue is a six-lane divided triple-carriageway with a wide grassed median. It generally has a 70 km/h speed limit (although the speed limit is reduced during key events, e.g. Floriade). There are no restrictions in place and it can be used by all forms of traffic. Despite this, it is mainly used by cars due to weight restrictions over the Commonwealth Avenue bridge. Pedestrians and cyclists are not well catered for along the road with no footpath provisions north of Parkes Way and only a marked on-road cycleway. There are two bus stops on opposite sides of the road within the study area. No kerbside parking or loading is permitted.

Every day, there is typically around 10,000 vehicles that travel along London Circuit (west) around 35,000 that travel along the southern end of Northbourne Avenue and around 70,000 that travel along Commonwealth Avenue. These numbers are low meaning, there is limited delay, congestion or network performance issues along either road; however, there is some limited traffic queuing in peak periods and during events such as Floriade. Without any investment to increase road capacity or provide alternative forms of public transport, the prediction is that there will be an overall increase in traffic on Canberra's roads; particularly in the most congested corridors around the city centre (Infrastructure Australia, 2015).

Commonwealth Avenue also passes over London Circuit and Parkes Way with access given via a series of circular on-ramps and off-ramps that form the characteristic 'clover leaf' shape.

Transport Canberra and City Services is currently developing and delivering a work program to improve access throughout the city. This includes proposed, planned and committed works, such as the Edinburgh Avenue extension, to upgrade and reconfigure certain roads to allow the city's network to continue to function over the coming years to maintain performance while supporting development of light rail.

Public and community transport provisions

The key public transport provisions in the study area are:

- Rapid bus routes that run along London Circuit and Commonwealth Avenue.
- The bus stops along London Circuit and Commonwealth Avenue.
- The bus zones along Northbourne Avenue.
- The various public car parking areas that flank, and are accessed from, London Circuit and Commonwealth Avenue.
- The footpath and marked cycle lane provisions on Northbourne Avenue, London Circuit and Commonwealth Avenue.

5.3.7 Noise and vibration

Ambient noise within, and local to, the study area is characteristic of its urban setting. Noise levels are therefore typically higher during the day and quieter in the evening and at night. The main ambient noise sources are road traffic, localised construction activities, human activity, and occasional overhead aircraft.

Noise-sensitive land uses and receivers

There are various noise-sensitive receives within, and local to, the study area. The sensitivity of these receivers depends on their location, nature and use. Specifically:

- The most sensitive receivers are the residents located on the western side of London Circuit and in the archbishop's house. Within the study area, proposals exist for future residential accommodation on the east side of London Circuit and the City Section 63 development.
- The other key sensitive receivers include:
  - Employees working along London Circuit.
  - Users of the public open space, namely City Hill, Henry Rolland Park, Lake Burley Griffin foreshore area and the National Capital Exhibition.
  - Guests at the QT and Capital Tower Hotels.
  - (Potentially) students at ANU.

5.3.8 Air quality and greenhouse gas

In general, air quality in Canberra is influenced by natural events such as bushfires, plus industrial, commercial and transport-related sources. The city's air quality is typically recorded as good (ACT Government, 2018c) and is affected by natural events such as bushfires and the use of wood/fuel stoves in winter.

Ambient air quality

The closest air quality monitoring station to the Project is in the carpark of Canberra Olympic Pool and Health Club on Allara Street. The air quality index (AQI) for this site is 'very good'. That said, the station appears not to monitor key traffic-related pollutants such as oxides of nitrogen (NOx) but it does monitor particulate matter (PM_{10} and $PM_{2.5}$). The

particulate matter monitoring results show no human health risks or exceedances of air quality standards. Overall, despite road traffic being the primary air pollution source in Canberra, the lack of monitoring of other pollutants by the ACT Government infers that the concentrations present no human-health risks.

The noise sensitive receivers described above would also be sensitive to air pollutants.

Greenhouse gas emissions

Greenhouse gas emissions and contributions are typically managed at a regional or national level under legislation and policy. The ACT Government is aiming to achieve a 40 percent reduction in greenhouse gas emissions on 1990 levels by next year extending to net zero emissions by 2045[7].

5.3.9 Socioeconomics

The study area is located within an urban environment with a mixture of land uses including residential, commercial and educational institutions as described in Section 5.3.4. The study area crosses two suburbs, Civic (the city-centre) and Acton. Table 5.5 describes the demographic characteristics of these suburbs relative to the wider ACT.

Table 5.5: Demographic characteristics (ABS, 2017)

Region	Number of residents	Number of employee jobs (total)	Population density (person/km²)	Median commuting distance to place of work (km)
ACT	**411,667**	**313,361**	**174.6**	**11.4**
Civic	4,790	3,413	3,347.5	12.4
Acton	2,198	793	803	10.3

Community services, social organisations and community resources

There are several community services and facilities located in, and local to, the study area that cater for residents, workers, visitors and tourists. These include:

- Schools/educational facilities, the principal of which is ANU.
- Childcare centres, the closest of which is KU Canberra City AMEP Child Care Centre on E-Row Street.
- Places of worship, the closest of which is the Church of Scientology on Alinga Street.
- Medical/healthcare infrastructure, the principal of which is the City Community Health Centre, the Junction Youth Health Service and the National Aboriginal Community Controlled Health Organisation.
- Recreational and public domain areas including: City Hill, Henry Rolland Park, Lake Burley Griffin foreshore, National Library, Canberra Theatre Centre, Canberra Olympic Pool and Health Club and National Capital Exhibition.

Lake Burley Griffin and its foreshore area is a major recreational asset valued locally, regionally and nationally. It provides amenity in the form of several parklands, the most notable of which in relation to this Project is Henry Rolland Park at Acton Waterfront. These foreshore parkland and amenity areas provide and integrated greenspace in the

[7] https://www.environment.act.gov.au/cc/act-climate-change-strategy/emission-reduction-targets

centre of the city attracting locals, visitors, and tourists. Figure 5.5 shows the community services and facilities described above.

Community health and welfare demographics

The ACT general health survey is carried out each year. It targets 1,200 adults and 500 children. The 2018 survey was reported in the Health Canberra: Australian Capital Territory Chief Health Officer's Report. Key for this Project were data collected on walking and cycling.

This confirmed that between 2007 and 2016 the portion of children who walked or cycled to school increased by about 1.6 percent. It stood at about 40 percent at the end of 2016. This compared to about 15 percent of adults who walked or cycled to work. The report also acknowledged the importance of integrating active living into the Territory Plan and the ACT Government's Towards Growth Goal: Healthy Weight Action Plan (2013). As of 2017, the Territory Plan included six active living principles meaning that this will affect all aspects of future planning and development. The principles are; connected places, open spaces, mixed land use and density, safe and attractive places, supportive infrastructure, and environments for all.

Key individual or communities and cultural identity

London Circuit forms part of the heart of the city providing a looped circuit of some of Canberra's key cultural institutions. The circuit also provides an indirect link to many of Canberra's open greenspaces including City Hill, Henry Rolland Park and Lake Burley Griffin. The New Acton Waterfront precinct has recently been redeveloped into what is now considered a culturally diverse area. It includes three large upmarket hotels and a range of restaurants and cafés. A small section of the precinct remains residential and caters to affluent Canberrans.

5.4 Other committed and approved development

Table 5.6 lists the two main committed and approved developments in the local area.

Table 5.6: Committed and approved development

Project	Description
City Section 63	This project is part of the ACT Governments Indicative Land Release Program (ILRP) and involves part of City Section 63 for land release as mixed-use development and an offsite works area for road improvements to the intersection of Commonwealth Avenue and Vernon Circle (e.g. the north-western segment of the 'clover leaf'). An EPBC referral has been submitted for this project and is currently under assessment.
Commonwealth Park to Woden light rail	Commonwealth Park to Woden light rail is a separate project that is part of the broader ACT Government commitment to extend light rail to Woden. There are several important design issues for the Commonwealth Park to Woden project currently under consideration. Commonwealth Park to Woden is also expected to be undertaken over a longer timeframe given that any impacts on the Parliamentary Zone will trigger a requirement for Parliamentary Approval and a Joint Standing Committee Inquiry. It is also subject to further detailed environmental assessment.

6 Potential impacts

This Chapter describes the direct and indirect impacts that may occur from building, operating and maintaining the Project. It considers the likelihood, scale, intensity, duration and timing/frequency of these impacts consistent with the Significant Impact Guidelines.

6.1 Project impacts

Table 6.1 provides a matrix of how the Project's construction and operation may impact on key aspects (elements) of the environment. This is presented by considering if the Project-related activities and actions described in Chapter 4 may impact on the values described in Chapter 5 that may potentially impact on the receiving environment. The table scopes out if any activity is considered to potentially interact with the identified environmental aspects discussed in Chapter 5. A 'low-level' of interaction is marked with a green dot (●) while a 'high level' of interaction is marked with a red cross (+). The key difference is that any 'low level' of interaction is indicative of impacts that are either transient, temporary or short-term. They are unlikely to result in a residual effect on the environment's values. Such impacts can be typically managed using standard safeguards and design measures, meaning they are unlikely to have a significant impact.

Conversely, a 'high level' of interaction is indicative of an impact that is long-term, permeant or it would likely affect key values. Such impacts typically lead to an irreversible effect on the receiving environment that can be reduced through bespoke mitigation. These are impacts that have a potential to be significant if they cannot be effectively mitigated. Potential beneficial interactions are marked as such (**B**).

Table 6.1: Level of interaction

	Heritage	Ecology	Landscape & visual	Contamination & soils	Surface water & flooding	Groundwater	Property and land use	Utilities	Traffic and transport	Noise and vibration	Air quality and GHG	Socioeconomic
Construction	●	+	+	+	●	●	●	●	+	+	●	+
Operation	●	●	+	●	●	●	+	●	B	+	●	B

6.2 Heritage

Construction

Building the light rail down the middle (median) of Northbourne Avenue, London Circuit and Commonwealth Avenue and improving the London Circuit/Commonwealth Avenue intersection would avoid direct impacts on the built heritage identified in the study area with one exception as described below.

The main potential impacts are indirect and temporary and relate to the listed and nominated (e.g. put forward for listing) buildings that either front or overlook London Circuit and Commonwealth Avenue (refer to Table 5.2). Their amenity, setting and vistas, maybe temporarily impacted from carrying out various disruptive construction activities in

the road reserve such as utility relocations, track laying, earthworks, light rail stop installation, tree removal/planting, and traction power substation construction. The most sensitive heritage values that maybe impacted would be the ANZ Bank Building, Reserve Bank of Australia and the Law Courts of Australia on London Circuit, and the Melbourne Building and Sydney Building at the bottom of Northbourne Avenue at its intersection with London Circuit. These properties may also be subject to construction-activity vibration, which can be effectively managed to avoid any materially significant impacts as described below in Section 6.4.8.

The only expected direct impact would be to the brick paving detail of the Reserve Bank of Australia, which may be impacted through utility work and any infrastructure work along the footpath. While this is the case, the paving in this area was replaced in 2010 and 2011 to improve drainage and remove a trip hazard. As such, it is not original; something recognised in the current plan of management (Eric Martin and Associates, 2012). This means any impact can be effectively managed through a similar replacement process.

The Designated Areas across central Canberra are recognised for their cultural landscape, realm and amenity values in representing the Griffin Plan. During construction, these values maybe temporarily adversely impacted through the introduction of equipment and machinery and the carrying out of various construction activities. Other construction impacts may result from erecting hoardings and establishing and operating construction compounds and temporary material laydown areas.

While there is the potential for encountering unrecorded or undiscovered heritage items or archaeology, this is typical of many urban developments and major projects and can be effectively managed through an unexpected finds procedure.

Operation

Given that the impacted medians are either currently paved or grassed and hold no discrete heritage value, the extent of any permanent impacts would be limited in nature and scale. Further, the introduction of light rail infrastructure would, to some extent, reinforce the functional use of both roads as transport corridors. There would however be some sense of an increase in the dominance and prominence of the transport infrastructure within the road reserve.

Raising London Circuit

The raising of London Circuit and changes to the intersection would affect the local character at the intersection. The aim however is to reinstate the intersection configuration and arrangement as shown in Figure 4.5 and Figure 4.6. The intersection would therefore retain its original form, having a small visual impact over a small zone. This would be helped by not increasing the overall intersection height above the existing level of Commonwealth Avenue.

Visual impacts

The visual change from introducing the light rail (including the stops and other infrastructure) maybe perceived negatively in relation to the core values of the Designated Areas and Parliament House Vista; and in the context and setting of the various heritage-listed items that front and overlook the Project footprint. The key potential impacts would be the introduction various infrastructure and potential tree removal/planting within the road reserve.

The proposed wire-free running is an opportunity to minimise the visual prominence of the light rail on key heritage values and views. Replacement tree species and their planting location and density can also be selected to respond to Canberra's Living Infrastructure Plan and the National Capital Plan precinct codes. There is also opportunity in the design to carefully place and design any structure to respect the area's heritage values to minimise impacts.

A heritage assessment is currently being prepared to support the environmental assessment and help guide the design to minimise any impacts.

Properties within 20 metres of the rail route may also be subject to vibration from passing light rail vehicles which can be effectively managed to avoid any material impacts as in Section 6.4.8.

Impacts on national heritage places

There are no predicted direct impacts on this matter of national environmental significance due to there being no national heritage places in the study area. At 300 metres from the study area, the Australian Academy of Science Building is located outside of the Project's likely zone of visual influence and beyond the 20-metre distance where cosmetic building damage can occur (refer to Section 6.4.8). As such, there are no predicted indirect impacts.

Impacts on Commonwealth heritage places

Reserve Bank of Australia

The introduction of vertical elements associated with the light rail (such as signs, lighting columns), utilities works and tree loss and replacement planting on London Circuit would be perceived as changing the relationship between the bank and road corridor. Vertical elements and planted trees, which if poorly located and designed, may have a material impact on the bank's heritage value, amenity and setting. Any impact on the brick paving detail from these works or utility relocation and/or installation is not considered material or significant due to its replacement in 2010 and 2011 (Eric Martin and Associates, 2012).

Wire-free running is proposed to reduce the light rail's overall visual impacts on the streetscape, amenity and associated heritage values. City West is the nearest stop to the bank however given the geometry of London Circuit, there is no line of sight between the bank and this light rail stop meaning it would have no visual or heritage impact.

The Reserve Bank of Australia is located 15 metres from the middle of London Circuit. At this distance, the bank is sufficiently close to be impacted by cosmetic building damage either from construction or operational vibration. As described in Section 6.4.8, any vibration impacts can be avoided by the careful selection and use of construction equipment near the bank, use of vibration monitors, and various controls and maintenance measures to manage operational vibration. The referenced guidelines in Section 6.4.8, which were written for rail development, are also clear that unless there is specific concern about structural condition, then there is nothing to suggest that heritage listed buildings are more sensitive to vibration. This would be true of the bank. Given that it was built between 1963 and 1965, its form and age mean that it is likely to be structurally sound. Chapter 7 describes the proposal to manage construction and operational vibration risks.

Appendix A of Significant Impact Guidelines 1.2 describes the management of Commonwealth heritage places. It states that consideration must be given to the significance of impacts on the "*environment of the place including its heritage values*" and that "*a Commonwealth agency must not contravene a plan made under the EPBC Act for managing a…place or authorise a person to do so, or omit to do, anything that would be*

inconsistent with the plan". Section 4.1 of the Reserve Bank of Australia's management plan (Eric Martin and Associates, 2012) describes the Commonwealth heritage values. Potential impacts associated with the Project's construction and operation are not expected to significantly affect the bank's values and attributes. Notwithstanding, a range of high-level mitigation and management measures have been identified to guide the ongoing planning, design, construction and operation of the Project. These will be further developed through a heritage impact assessment.

Parliament House Vista

Commonwealth Avenue borders the Parliament House Vista heritage place (refer to Figure 5.1). While this is the case, the road would continue to function as a transport corridor. This means there would be no principal change in its context, setting or relationship with the vista other than visually and indirectly through the introduction of the wire-free light rail infrastructure, including the Commonwealth Park stop. While this infrastructure would be visible from within the vista, the existing tree planting bordering Commonwealth Park would continue to act as a suitable visual buffer. Also, these design elements would not be visible from within the vista to the south of the lake due to the separation distances, flat-to-undulating topography, and intervening planting.

The apex of the Commonwealth Avenue bridge is likely higher than the maximum height of the Commonwealth Park Stop infrastructure. The stop would also be located at a natural low-point along Commonwealth Avenue.

The traction power substation would be installed in the Parliament House Vista heritage place. There is the opportunity to for the traction power substation to be placed and screened from view to minimise its impact on views and the area's heritage amenity. Its proposed location has been selected to reduce the impact on important viewscapes while respecting the area's heritage amenity. This decision has been taken to avoid any materially significant negative impact on the vista's values. The final location and screening and facade treatment would be made during the detailed design. The aim would be to minimise tree removal, trimming and pruning. In addition, the combined services route to the traction power substation at this location would be installed via a trenchless (under bore) method to avoid disturbing the surface. Urban design treatments would be developed in consultation with the NCA through the Works Approval process under the PALM Act to ensure the overall impacts to the vista and associated precincts are aligned and consistent with the supporting values and codes.

The Project is not expected to result in any significant impacts on Parliament House Vista's Commonwealth heritage values and attributes. Notwithstanding, a range of high-level mitigation and management measures have been identified to guide the ongoing planning, design, construction and operation of the Project with respect to this item. These will be further developed through a heritage impact assessment.

6.3 Ecology

Construction

The Project's ecological impacts would be mainly limited to the removal of the modified exotic grassland within the Commonwealth Avenue median, the Parkes Way median, and the 'clover leaves'. This vegetation also provides habitat for the golden sun moth.

The other vegetation impact would be the loss of planted exotic mature trees and shrubs along London Circuit, at the 'clover leaf', Commonwealth Avenue, and potentially at the southern end of Northbourne Avenue. These environments provide habitat value for

common native flora and fauna species. They do not support any threatened flora, fauna or associated communities (Biosis, 2019).

It is not possible to avoid an impact on the recorded golden sun moth population at the London Circuit and Commonwealth Avenue intersection. Given the uncertainty in the design, a precautionary approach has been taken in assuming the loss of the whole population. As discussed in Section 5.2, the area of impacted habitat varies between 2.6 hectares (refer to Figure 5.3) and 6.9 hectares (refer to Figure 5.4). Despite the difference in the potential extent of habitat impact, the overall assessment is that the entire population would be lost to the construction footprint. More detailed assessment would be needed at the same time as the design is being developed to confirm the exact habitat impact across the construction footprint.

There are also inherent risks associated with any construction work relating to spills, accidents, edge effects and other key threatening processes indirectly impacting on ecological values in the area. These risks can be effectively managed through the adoption of standard measures that are proven effective in avoiding and/or minimising risks as discussed in the following chapter.

Operation

There are not expected to be any ecological operational impacts on threatened species or habitat.

Critically endangered species

The Australian Government's Significant Impact Guidelines for the golden sun moth (DEWHA, 2009) consider *any* loss, disturbance or fragmentation of small or fragmented areas of habitat as being potentially significant. In 2017 and 2019 both SMEC and Biosis confirmed the surveyed golden sun moth population to be 'small and fragmented' and as such any habitat loss would be significant. Table 8.1 describes the self-assessment of the significance of the impact against the above guidelines.

6.4 Commonwealth Land

6.4.1 Landscape and urban character and visual amenity

Construction

Consistent with the heritage-related impacts described in Section 6.2, the amenity setting and value of the landscape and streetscape amenity, mainly of London Circuit, would be temporarily impacted while the Project is being built. This extends to the visual impacts created through the introduction of equipment and machinery and the carrying out of various construction activities.

Other temporary impacts may result from, erecting hoardings, and establishing and operating construction compounds and material laydown areas.

Any vegetation and tree removal also needed to support development would affect the character of the local landscape. This would be most notable in relation to the boulevard character of Commonwealth Avenue, the urban character of Northbourne Avenue and London Circuit, and a loss of grassland within the 'clover-leaf'. However, any vegetation and tree replacement can be selected to respect the heritage and amenity values of the streetscape and vistas aligned with Canberra's Living Infrastructure Plan and the National

Capital Plan precinct codes. Also, any lost trees would be replaced at least on a one-for-one basis.

Operation

The key impact to landscape character and visual amenity would be associated with the introduction of the light rail infrastructure and the creation of the London Circuit/ Commonwealth Avenue intersection.

The final location and design of light rail infrastructure is still to be confirmed and the design will minimise its visual prominence where reasonable and feasible.

The raising of London Circuit would essentially restore the intersection to its original arrangement as proposed under the Griffin Plan (refer to Figure 4.5 and Figure 4.6). To achieve this would involve constructing battered embankments next to the existing road reserve on London Circuit on the approaches to Commonwealth Avenue and modifying the circular entry and exit lanes from Parkes Way to and from Commonwealth Avenue that form the characteristic 'clover leaf'. The impact of reconfiguring the intersection back to its original configuration and height would affect its current character locally; however, it would replicate the historical layout of Canberra. Overall, the work would be contained within the current intersection footprint and the intersection height would not increase above the existing level of Commonwealth Avenue.

Landscape planting and urban design would be used supplement and reinforce the existing amenity character of the study area despite changes introduced under the Project. The tracks would be laid on a concrete base along Northbourne Avenue and London Circuit to maintain the urban setting while a 'green track' would be laid on Commonwealth Avenue where possible to soften the impacts and maintain its visual amenity and boulevard character. These landscape and urban treatments would be further developed during the detailed design.

Natural landscape features

There are no natural landscape features within the study area or locality. This includes the lake, foreshore area and amenity areas, which were all created in developing Canberra.

The nearest natural landscape feature is Sullivans Creek. As it is removed and isolated from the study area there is not expected to be any associated direct or indirect impacts on its values.

6.4.2 Contamination, soils and geology

Construction

Most urban environments include areas where there is a potential risk of encountering contaminants of concern. In the case of the Project, the planned earthworks, civil works, and track and light rail stop construction may therefore encounter and mobilise any residual contaminants most likely associated with the recorded legacy of hydrocarbon storage, use of uncontrolled imported fill, and/or associated with the road's formation (e.g. road base materials, bitumen and/or tar). Another key risk is identifying and managing asbestos containing materials.

There is also the potential for spills and leaks to impact on soil and groundwater quality. Such risks are common to any development and they can be effectively managed through standardised controls as discussed in Chapter 7.

Operation

Potential impacts are limited to accidental spills and leaks during routine and non-routine operations and maintenance activities. Operational management processes would ensure adequate controls are in place to minimise any risks and effectively mitigate against any impacts.

Contaminated land and acid-sulfate soils

As described in Section 5.3.2, there is an extremely-low potential for acid sulfate soils locally. Equally, the nature and scale of the construction work and forward operation of the light rail are not considered polluting or contaminating activities or processes of a scale that would contaminate the land under the definitions of either the EPBC Act or ACT *Environment Protection Act 1997*. Further, all construction and operational activities are routinely carried out and they can be adequately managed using standardised practices that are proven as being effective in avoiding, minimising and containing spill/leak incidents.

Further investigation across the construction and Project footprints (refer to Chapter 7) will define the nature of any potential contamination risk and determine what safeguards may be needed.

There is a lower-risk of substantially disturbing known or unknown areas of contamination due to the shallow nature of construction for light rail projects and proposed measures to manage risk during construction. There is however some risk of disturbing the asbestos containing materials recorded across the study area. Again, it is anticipated that this risk would be effectively managed via the implementation of best practice management measures during construction.

6.4.3 Surface water and flooding

Construction

All construction work will be controlled, managed and monitored given that the entire study area is within the Lake Burley Griffin catchment.

Any works close to, or over, surface waters increases the risk and potential for impacting on their water quality.

During construction, the associated ground excavations, earthworks, civil works, and light rail stop construction would likely generate spoil, which may mobilise and discharge to the lake (e.g. sediment loading of the lake). Equally, any contaminant mobilisation (refer Section 6.4.2), spills or leaks may result in pollutant discharge to the lake.

There are effective water quality, erosion, dust suppression, and sediment control measures to deal with construction and earthworks contained in the various volumes of Managing Urban Stormwater: Soils and Construction (the Blue Book, NSW Government, 2004). These are typically implemented under an effective soil and water management plan (refer to Chapter 7). The controls are proven and effective in managing and avoiding impacts when working near and over surface waters. However, as there is a limited amount of proposed work taking place near the lake this means that any impacts can be effectively avoided or minimised. There would be a restriction on the activities that could take place in the median south of the Commonwealth Park stop to minimise any risk of impact on the lake's water quality.

The extent, nature and scale of construction would be insufficient to affect any regional flood risk and patterns. There is however the potential for work sites to flood when

constructing around London Circuit and Edinburgh Avenue. While any nuisance flooding during construction has the potential to result in issues such as sedimentation or pollutant discharge, there are effective controls in place for monitoring the weather and closing-down sites in the event of heavy rainfall. These measures are proven effective in preventing flood-related environmental impacts from construction sites.

The construction work may affect the local stormwater and drainage regime by temporarily interrupting overland flow paths and drainage lines. That said, the scale of such impacts would be negligible in the context of the size of the overall catchment (Arup, 2018). Temporary measures can also be introduced to effectively divert overland flow paths around construction works and excavations. This would avoid any impact on the local stormwater system.

Operation

A key change may be a reduction in surface permeability and an increase in runoff from replacing median vegetation with concrete track slabs in locations where 'green track' running is not feasible. In addition, there is potential for an increase in the extent and duration of existing nuisance flooding, particularly at the low point of London Circuit near Edinburgh Avenue, due to an increase in runoff from the proposed raising of London Circuit and reconfiguration of the intersection.

The increase in stormwater runoff volumes and rates would be minimal in the context of the total volumes discharged from within the urban environment and catchment.
The stormwater infrastructure would also be designed to consider the need to resize or supplement any drains to accommodate the increase in runoff and deal with any potential pollutants if needed. The route and rail infrastructure would also be designed not to cause any change in flood risk onsite or offsite.

Surface water quality, quantity and availability

The key risk is any discharges to either Lake Burley Griffin and/or the foreshore areas. These can be controlled and managed during construction through proven and effective measures described in the Blue Book to prevent sediment or pollutant discharge. This, combined with the limited extent of proposed works close to the lake means than any impacts could be effectively avoided or minimised. Temporary impacts on the local stormwater and drainage regime would be negligible in the context of the size of the overall catchment. Further, stormwaters can be effectively diverted around any construction sites.

Operationally, the works would see a minor increase in runoff volumes and rates through median and verge vegetation removal, the raising of London Circuit and reconfiguration of the intersection. The stormwater infrastructure would be designed to accommodate the increase in runoff and handle any pollutant discharge if needed.

Based on the ability to effectively manage the construction works under the provisions of the Blue Book, and the design including provisions to manage the increase in stormwater discharge while preventing any increased flood risk, it is concluded that there would be no material impact on the availability or quality of surface waters in the area, including Lake Burley Griffin.

While water would be needed to carry out certain civil works (e.g. batching and mixing) the largest quantities would be used for dust suppression and control. Operationally, small volumes of water would be needed for cleaning, maintenance and landscape management.

6.4.4 Groundwater

Construction

The earthworks, civil, utility and track works, along with the construction of the light rail stops and other infrastructure would involve piling and foundation works. This may potentially intersect with the perched groundwaters that occur locally. The unconfined nature of these waters means that they are not under pressure. As such, any ground excavations may fill with water to a static level. Dewatering may therefore be needed to support construction. This may cause a temporary drawdown of the groundwater locally.

Spills and leaks during construction have the potential to see a pollutant discharge into the groundwater. This risk would be greatest when there are open excavations. However, any impacts can be avoided by adopting standard controls set out in the Blue Book, which require any materials handling or refuelling to take place in controlled and contained areas (e.g. away from open ground or excavations). There would also be restrictions on the works that could take place in the median beyond the Commonwealth Park stop.

Operation

The need to compact the ground to create a level surface may locally affect its permeability and lateral flows. The compaction would only affect the surficial layers, and therefore most likely the existing road sub-base. As such, there are not expected to be any material impacts on the subsurface geology that could affect groundwater flows.

Changes at the London Circuit/Commonwealth Avenue intersection could reduce the amount of rainfall that could recharge the aquifer due to a small increase in hardstand and reduction in permeability. However, these areas would represent a negligible increase compared to the entire recharge area, which extends across much of northern Canberra.

Groundwater quality, quantity and availability

As described in the previous section, the ability to effectively manage construction works under the provisions of the Blue Book, while including design provisions to manage the increase in stormwater runoff, would prevent any material impact on the underlying groundwaters.

While there maybe localised drawdown of the water table during construction from dewatering this would have no wider, regional or long-term impact given the scale of the works in relation to the extent of the entire recharge area. Also, any ground compaction and increase in hardstand would not be sufficient to have any impact on regional groundwater flows. This is consistent with the conclusions of the Gungahlin to City light rail environmental impact statement (Parsons Brinkerhoff, 2015). Chapter 7 describes the mitigation measures that the ACT Government has introduced to manage groundwater impacts that would be applied on the Project.

6.4.6 Property and land use

Construction

Construction work activities are likely to temporarily impact on the amenity value and user enjoyment of the various land uses along the route. This would include the recreational value and user enjoyment of City Hill, Henry Rolland Park, the lake foreshore area, and potentially the National Library, National Capital Exhibition, Department of Foreign Affairs and Trade, and ACT Corrective Services. It may also temporarily impact on the amenity of the residents, employees, and hotel guests who live, work and/or are staying in/on London Circuit. Such impacts would include the temporary introduction of noise and dust along with traffic disruption and the introduction of equipment and machinery into the neighbourhood (e.g. visual impacts). These are discussed under the corresponding headings in this Chapter.

Other amenity impacts may result from a temporary loss in public infrastructure including kerbside provisions (e.g. taxi ranks), footpaths, pedestrian crossings and the marked cycle provisions on Northbourne Avenue and Commonwealth Avenue. The assumption is that the bus stops on London Circuit and Commonwealth Avenue could be moved/diverted, meaning that people would be inconvenienced however they are unlikely to be impacted.

There may also be times where one or two lanes on either London Circuit and/or Commonwealth Avenue may need closing to traffic to allow for development (refer to Section 4.4). This may result in a temporary increase in congestion, which could affect travel times. The most notable issue may be the need to close the off-ramp from Commonwealth Avenue to London Circuit. This would inconvenience road users through traffic needing to divert onto other roads. This may result in secondary impacts for people that live and work along diversion routes. These issues can be effectively managed under a traffic management plan that is developed and implemented in consultation with key stakeholders. Depending on the final route, any temporary traffic management controls may restrict traffic to left-in, left-out movements. This would inconvenience road users extending their journeys. Section 6.4.7 describes this in more detail.

There would be a temporary change in land use during construction along and adjacent to the route, including for the establishment of construction compounds. As described in Section 4.4, these compounds would primarily be used to store materials and equipment, and house site offices and worker amenities. The long-term stockpiling of materials would be undertaken away from the site; however, materials may be stored onsite for a short period nonetheless. Most of the land required for construction compounds would be reinstated, except for areas that form part of the permanent Project footprint.

Operation

The raising of London Circuit would improve connectivity between London Circuit and Commonwealth Avenue by increasing the number of turning movements currently permitted at this intersection. One of the main benefits of raising London Circuit would be improved pedestrian and cyclist connectivity, particularly between the city and the waterfront as well as facilitating future access for the planned release to market of City Section 63.

The design runs the light rail down the middle (median) of Northbourne Avenue, London Circuit and Commonwealth Avenue. In the case of Northbourne Avenue this would result in the loss of the pedestrianised median, while on Commonwealth Avenue, this would result in the loss of the wide vegetated median. Additional land-take would be needed at the London Circuit/Commonwealth Avenue intersection to accommodate the proposed raising and associated embankments and retaining walls, which would result in some loss

from the 'clover leaf'. This would extend onto Commonwealth Avenue, which could result in the removal of mature trees and shrubs along the verges. Proposed landscape planting and urban design treatments would be used to minimise and offset vegetation loss. These treatments would be consistent with the Griffin Plan, National Capital Plan precinct codes, and requirements of the ACT Government and NCA.

The Project is likely to require closure of certain right-turn accesses from London Circuit either to the car parking areas near City Hill (northbound) or the various intersecting roads (southbound).

It is expected all turning movements would be preserved at the main intersections at Northbourne Avenue and University Avenue. with right-turn restrictions in place at Gordon Street and Edinburgh Avenue to allow for the prioritised pedestrian zone. The only private access that maybe affected would be to the QT Canberra Hotel; as southbound traffic is currently permitted to turn right into the hotel. The impact of any of the above changes would be to inconvenience road users as their travel and journey times would increase slightly.

Rapid (bus) route 6 may also need adjusting to accommodate turning movement restrictions. This may also inconvenience customers.

Social and public infrastructure

The Project extends the public infrastructure of the light rail service south through the city. In delivering this, the key loss of public space would be the median along London Circuit and Commonwealth Avenue and the removal of vegetation at the 'clover leaf'. While these areas provide no direct social or economic function to the public or community they do hold an amenity value. This would be mitigated through an effective urban and landscape design strategy. It would also result in the loss of a traffic lane in each direction on parts of London Circuit, the impacts of which is discussed in Section 6.4.7.

The Project has the potential to strengthen the amenity character and value of the area due to the introduction of key transport corridors and associated public realm improvements (i.e. landscaping).

The other potential impact would be the inconvenience to people from changing the traffic arrangements along London Circuit and Commonwealth Avenue, which may see certain right-turn movement restrictions and pedestrian and cycle path modifications. These impacts would first occur during construction.

The proposed raising of London Circuit would improve its connectivity with Commonwealth Avenue.

There is no planned removal, or loss of access to, any public or private infrastructure to deliver the Project, other than the right-turn into the QT Hotel along London Circuit. Pedestrians along Northbourne Avenue and London Circuit may be temporarily inconvenienced during construction through possible temporary footpath closures and diversions.

People may be inconvenienced during construction through needing to introduce temporary traffic management controls. The various construction works may also affect the amenity of those that live and work on Northbourne Avenue and London Circuit, or commute along Commonwealth Avenue. However, as with any construction works taking place in urban areas, the impacts can be managed so as not to have any material or long-term impact on people's welfare or health. As Northbourne Avenue, London Circuit and Commonwealth Avenue can remain open to traffic throughout (albeit with some occasional lane closures, restrictions and diversions, refer to Section 4.4), there is not any expected economic

impacts on the businesses that either front or rely on road access through this part of the city. Emergency vehicle access would also be maintained throughout.

There will be lane and speed restrictions on sections of Northbourne Avenue, London Circuit, Commonwealth Avenue and Parkes Avenue at certain times during construction. This may temporarily affect access to social infrastructure along the route.

6.4.7 Utilities and energy resources

Construction

Any construction work would involve the need to protect, relocate and adjust utilities to accommodate the Project. This would be managed in consultation with the utility and service providers to ensure emergency and maintenance access would be preserved throughout. The works would also be timed to prevent or minimise any supply disruption.

The final utility adjustments are unknown; however, they would be contained within the footprint of the road reserve shown in Figure 1.2. This footprint includes for utility tie-ins at each intersection along the route (refer to the construction footprint on Figure 1.2), and an indicative connection to the proposed traction power substation; noting that this would be installed using trenchless methods from the light rail corridor to avoid surface impacts. Also, the high-voltage connection from the grid to the traction power substation would be installed within existing utility corridors and not require any new routes to be created.

The utility work along Northbourne Avenue and London Circuit may require some additional short-term footpath and road closures with supporting diversions; however, these could be effectively managed not to materially inconvenience or impact on pedestrians and traffic.

Any utility trenching in the road reserve and verges of Northbourne Avenue, London Circuit and Commonwealth Avenue may temporarily affect the amenity and setting of the area. However, as controlled installation and defined reinstatement methods can be used to protect vegetation and minimise ground disturbance (as defined under an NCA Works Approval and ACT Government landscape management plan) impacts can be minimised. Also, there would be the need to reinstate and ‘make-good’ any areas consistent with the above approval and plans.

As noted in Section 6.1, while the brick paving detail of the Reserve Bank of Australia is part of its Commonwealth heritage values it was replaced in 2010 and 2011. While this paving would be potentially impacted to install utilities, it could be replaced in a manner consistent with the previous work to avoid any material impacts.

Operation

There are no predicted operational impacts. By installing the utility infrastructure to connect into the future Commonwealth Park to Woden light rail this would avoid further disruption in the future.

Key utilities and energy sources

A standard part of any urban development is ensuring and managing utility relocations, adjustments and disruptions to prevent any user and customer impacts. The proposal would not place any undue demand on utilities and resources used by the community. The ACT Government plans its works to avoid any impact on key utilities throughout the territory when carrying it key infrastructure work. This process was effectively implemented on the Gungahlin to City light rail and would be adopted for this Project.

While the Project would require the use of energy, resources and equipment, the ACT Government is committed to meeting all its needs from renewable sources where reasonable and feasible. This means the Project would be designed, built, managed and operated to minimise any demand on non-renewable resources. This would be supplemented by the initiatives to use renewable energy and locally-sourced recycled and recovered construction materials.

6.4.8 Traffic and transport

Construction

Major Projects Canberra has used modelling to consider if the wider road network has the capacity to handle additional traffic for short periods during construction and what management controls and measures would be needed to ensure all transport modes, including pedestrians and cyclists, could still adequately function without any undue inconvenience, congestion or delay.

That said, there would be some inconvenience, minor delays and increased journey times for people moving across the city through needing to temporarily:

- Restrict access along the southern portion of London Circuit under Commonwealth Avenue.
- Temporarily realign and/or reduce the number of northbound and southbound lanes on Commonwealth Avenue around active work sites at various time during construction.
- Close access to the northbound off ramp to London Circuit from Commonwealth Avenue at the start of construction.
- Divert traffic from London Circuit and Commonwealth Avenue while the intersection is being upgraded.
- Introduce turning movement restrictions on London Circuit.
- Relocate bus stops and adjust the bus timetable and/or route.
- Use temporary footpaths and cycle lanes on London Circuit and Commonwealth Avenue for construction.
- Divert pedestrians and cyclists to allow for utility works and vegetation works in the road reserve.

The temporary loss of 220 spaces in the London Circuit East car park would inconvenience the people that rely on its use. The local-service bus zones along Northbourne Avenue would be likely lost to the Project, however they could be easily relocated.

Operation

Extending the light rail infrastructure south from Alinga Street, raising London Circuit and reconfiguring the intersection is considered to bring improved transport benefit to Canberra. This will help connect people across the city while providing access to key areas in and around the Civic precinct, Acton Waterfront and Lake Burley Griffin.

A key change would be the permanent reduction in the number of lanes along sections of London Circuit to accommodate the light rail in the median. Despite this reduction in capacity, Major Projects Canberra has carried out preliminary traffic modelling that demonstrates that the city can accommodate a redistribution of traffic onto other roads without affecting network performance or travel times.

The proposed program of road upgrades is also planned to help facilitate the operation of light rail down London Circuit (refer to Section 5.3.6). Refined modelling and assessment will be carried out to confirm that the design has no impact on travel times and network performance.

The Project would introduce permanent right-turn restrictions on London Circuit. That said, all turning movements are likely to be preserved at Northbourne Avenue and University Avenue with right-way restrictions in place at Gordon Street and Edinburgh Avenue to allow for the introduction of the prioritised pedestrian zone. These restrictions are unlikely to have any measurable impact on network performance. The only impact may be an inconvenience to road users; including cyclists and bus passengers.

The raising of London Circuit and reconfiguration of the Commonwealth Avenue intersection are being introduced to improve connectivity. They are not being proposed to improve network performance or capacity. Therefore, they are not expected to bring any benefit to road users or support an increase in traffic. They would however improve access and connectivity for pedestrians and cyclists; especially to and from the lake and waterfront.

The footprint of the London Circuit/Commonwealth Avenue intersection would likely result in the permanent loss of around 70 car parking spaces from the London Circuit East car park. This represents about 220 percent of the car park, and less than one percent of the available current parking around London Circuit. Nonetheless, it would inconvenience the people that rely on using the car-park. The local-service bus zones along Northbourne Avenue would be likely lost to the Project, however they could be easily relocated.

Public and community transport provisions

The permeant loss of around 70 spaces in the London Circuit East car park and an additional 220 spaces during construction. This represents around a one percent loss of the total available parking in the area, which is considered negligible.

While the Project may result in the need to marginally alter the route and timetable of rapid (bus) route 6 to cater for specific temporary and/or permanent turning movement restrictions this is unlikely to have any material impact on people's use of the bus service other than inconvenience during construction and people making minor adjustments to their travel habits once the light rail is operational.

Against this is the benefit of extending the light rail south of its current terminus at Alinga Street and reconfiguration of the Commonwealth Avenue intersection, which will improve accessibility across the city by public transport, foot and bike.

6.4.10 Noise and vibration

Construction

The construction works would generate noise and vibration at levels that would temporarily affect people's amenity. The scale of impact would depend on: the size, nature and combination of equipment being used; the location and intensity of construction activities; and the timing of the work, as people are more sensitive to noise in the evening, at night, over the weekend and during public holidays.

If not managed, the need to use vibration-generating equipment to carry out foundation and piling work along the route could potentially result in both amenity (human comfort) impacts and possible cosmetic building damage. In the absence of local standards, Transport for NSW has developed a series of safe working distances where vibration-generating equipment can be safely used to avoid any vibration-related impacts. These are based on international best practice taken from the German Standard DIN 4150-3: 1999-02 on Structural Vibration – Part 3: Effects of vibration on structures, which sets limits to ensure buildings are not damaged during construction.

Appendix D of the Construction Noise and Vibration Strategy (Transport for NSW, 2017) and German Standard DIN 4150-3 demonstrate that smaller and specific types of piling and hammering equipment can be safely used within two metres of a building to prevent cosmetic building damage. This can be supplemented by carrying out pre-condition surveys and using vibration monitors to avoid any impacts. These controls are often used to avoid any material impacts on (heritage-listed) buildings. While this equipment can be safely used next to buildings to prevent cosmetic building damage, the vibration may still be felt up to 50 metres away. This may result in temporary amenity impacts for people living and working in the area for the short periods when piling and hammering work takes place. The above guidelines also note that "*heritage buildings and structures should not be assumed to be more sensitive to vibration unless they are found to be structurally unsound*". The guidelines also note that cosmetic damage relates to impacts such as hairline cracks and it is not the same as structural damage, which occurs a far higher vibration levels. Chapter 7 describes how these mitigation measures would be applied to the Project to avoid cosmetic building damage and minimise amenity impacts.

Noise and vibration impacts in urban environment are typical and common to most construction works. They are effectively managed under controls defined and implemented under a construction noise and vibration management plan. While people may be inconvenienced, any effects are temporary, and the impacts are not of a nature or scale to have any human health outcomes.

Operation

The key issue is the noise and vibration created from light rail vehicles passing by properties and people along the route. Various tonal and impulsive noise caused by wheel squeal, brake squeal, and from light rail vehicles travelling over track joints and curved rails can be annoying, typically leading to a strong community reaction. Modern light rail infrastructure is designed to minimise the amount of track-generated noise and vibration to meet corresponding international guidelines. This includes managing and maintaining the rail track and rolling stock using measures such as rail grinding, welding to smooth discontinuities, lubrication, using soft rail pads, wheel truing, and the use of specific types of brakes. The NSW Environment Protection Authority's Rail Infrastructure Noise Guideline describes these measures and confirms their effectiveness.

Given the proximity of some of the buildings to London Circuit there is a risk of people feeling the vibration from passing light rail vehicles. Dampening (including the use of

wheel vibration absorbers) can be used to minimise such impacts to avoid any cosmetic building impacts. Again, the effectiveness of these measures is reported in the Rail Infrastructure Noise Guideline.

The light rail vehicles operate using warning bells. These are used occasionally and for public safety. The generated noise is insufficient to have any material impact on the health or amenity of noise-sensitive receivers. Also, while the traction power substation needed to power the light rail can generate low-frequency noise, it can be selectively placed and enclosed to prevent any impact.

Any traffic condition changes along the road network needed to support the light rail are unlikely to result an increase or change in traffic on adjacent roads to the extent of having a material increase in noise; namely between two and 3dBA. This is roughly equivalent to a 60 percent change in traffic volumes as described by NSW Roads and Maritime in its Noise Criteria Guidelines. No operational impacts are predicted as there is nowhere on the network where such changes are expected as confirmed through preliminary traffic modelling (refer to Section 6.4.7). This includes at the Commonwealth Avenue intersection.

Noise-sensitive land uses and receivers

People's amenity and comfort would be temporarily impacted by construction noise and vibration. This is a common issue for urban developments; however, it can be effectively managed using standardised best practices. Importantly, any impacts would be temporary and short-term (e.g. only experienced when the noise is being generated). While vibration would be generated from piling and hammering, the effective selection of equipment coupled with the possible use of monitors can allow works to safely take place within two metres of buildings to avoid cosmetic damage. Chapter 7 describes this in more detail.

Operational noise and vibration impacts would be transient (e.g. only experienced from light rail vehicles passing by). Key would be using effective design and maintenance measures to minimise tonal and impulsive track and light rail vehicle noise. Dampening, including the use of wheel vibration absorbers, is an effective and proven way to avoid cosmetic building damage as described in the NSW Environment Protection Authority's Rail Infrastructure Noise Guideline.

6.4.11 Air quality and greenhouse gas

Construction

Any excavations and earthworks would generate dust. This is a common issue that can be effectively managed and minimised through implementing standardised controls, such as those described in the UK's Institute of Air Quality Management Guidance on the assessment of dust from demolition and construction activities.

Equipment, traffic and machinery emissions can be managed under an effective air quality management plan. The associated greenhouse gas emissions generated from constructing the Project, including those associated up and down the supply chain, would make an insignificant contribution to the Territory's overall emissions. Nonetheless, the ACT Government is committed to a 40 percent reduction in greenhouse gas emissions, which would be carried forward into the construction planning for this Project under the process described in Section 4.7.

Operation

As the light rail is electrically-powered then there would be no operational vehicle air or greenhouse gas emissions associated with the Project footprint. Further, as there is the commitment to power the light rail using renewable energy sources, the Project would not indirectly and remotely generate emissions, including greenhouse gases, from conventional power and electricity generation (e.g. coal or gas). The only emissions would be negligible and associated with maintenance equipment and machinery.

Any shift from people travelling by car and using the light rail would have a regional benefit in terms of a reduction in air and greenhouse gas emissions.

As described in Section 1.1 and Section 6.4.7, the improvements at the Commonwealth Avenue intersection with London Circuit are not intended to support an increase in vehicle use. As such, this element of the Project is considered unlikely to indirectly create an increase in emissions.

Ambient air quality

The scale and nature of the construction works would not generate air and greenhouse gas emissions at levels and concentrations that would have any long-term local or regional air quality impact or effect on people's health. While dust would be generated during construction, this would be limited to a nuisance issue (e.g. deposition on cars) over creating any health-impacts.

The Project's operation would neither directly nor indirectly generate air or greenhouse gas emissions due to the commitment to power the light rail using renewable energy sources. The emissions from maintenance equipment and machinery would also be negligible.

The planned road works, including reconfiguration of the London Circuit and Commonwealth Avenue intersection, are neither proposed to support an increase in traffic nor would they bring traffic closer to sensitive receivers. Therefore, there are not expected to be any air quality impacts.

6.4.12 Socioeconomics

Construction

As described in the sections above, constructing the Project would result in a range of temporary amenity-related impacts for those people local to the route. Road users, including pedestrians and cyclists, would also be inconvenienced through the introduction of temporary traffic management controls; the most notable of which would be speed restrictions and the need for temporary lane closers along sections of Northbourne Avenue, London Circuit, Commonwealth Avenue, and Parkes Way.

Importantly, the Project can be built without any loss in provision or access to public and community infrastructure and services in the area other than around 70 car parking spaces (refer to section 6.4.8), which collectively represents around one percent of the total available parking in the area.

While traffic management controls and temporary lane closures maybe in place, there are options available to divert traffic around Canberra without having any material impact on network performance other than minor road-user inconvenience (refer to Section 6.4.7). This is unlikely to have any economic impact on the city as there are no businesses or community groups that solely depend on access to these sections of London Circuit and Commonwealth Avenue. The closures and diversions would also avoid any key business

frontages or accesses to community facilities along Northbourne Avenue, London Circuit and Commonwealth Avenue.

Removing the median and potentially some of the street trees on Northbourne Avenue, London Circuit and Commonwealth Avenue would change the amenity and character of these roads. This would be offset through the planned introduction of an urban design and landscape planting strategy that would improve the public realm of these corridors, and they can be developed to be consistent with Canberra's Living Infrastructure Plan and the National Capital Plan precinct codes. This includes a commitment to at least replace any lost trees on a one-for-one basis.

Overall, there is expected to be a social amenity benefit by reinforcing and improving the functional use of Northbourne Avenue, London Circuit and Commonwealth Avenue as major transport corridors.

The extension of the light rail, raising of London Circuit and improvements to the Commonwealth Avenue intersection also provide more people with the opportunity to access more of the city, while extending access to the public infrastructure around the Civic precinct, Acton Waterfront and lake foreshore area. It may also result in an improvement in health and wellbeing from reducing the number of trips made by private vehicle, with people walking to and from the light rail stops, while encouraging people to walk and cycle by improving provisions to the south of the city. Economically, light rail projects are proven to stimulate economic growth along and adjacent to the corridors through urban activation (Parsons Brinckerhoff, 2015). They can create more passing trade and support the establishment of new businesses around the stops.

Community, social, cultural, health and welfare

As described above, people's amenity maybe temporarily affected along and near the route when it is being built because of noise, dust, visual and traffic related impacts; as described above under various sections. These impacts would be temporary, reversible and non-significant. They can be effectively managed, and they would not lead to any long-term or permanent adverse impacts on the health, welfare, or the economic or social status of the surrounding communities, including any disadvantaged or vulnerable people.

Once operational, the Project would provide an affordable means for all members of the community to access a wider range of services and amenity across Canberra. In promoting a reduction in private car use, this would also help with community health and welfare by encouraging people to walk to and from the stops, while promoting people to walk and cycle. It also offers an opportunity to extend the cultural identity for Canberra created by the Gungahlin to City light rail through connecting multiple suburbs to the social and cultural amenity of the city.

As described above, the Project is likely to create economic stimulus and uplift along, and adjacent to, the route. The proposal also improves access to the Civic precinct and Acton Waterfront for rail passengers, pedestrians and cyclists.

The light rail component of the Project extends a needed community service, while helping support and provide access to a range of social and community infrastructure such as parks and educational facilities located in and around Civic and Acton.

6.6 Uncertainty

At this early design stage certain Project elements are still being confirmed including the final intersection arrangements, wire-free charging locations and configurations, tree and vegetation planting schedules, and utility and drainage works. However, given the knowledge and experience of designing and building the Gungahlin to City light rail, along with other light rails such as those in Newcastle, Sydney, Melbourne and the Gold Coast, the level of uncertainty is greatly reduced.

Where there has been uncertainty precaution has been adopted, as is the case of the expected footprint, tree loss, verge impacts, and the impact on the golden sun moth population. This is consistent with the principles of Ecologically Sustainable Development. Further, as Major Projects Canberra is submitting a referral in advance of finalising the concept design and carrying out any associated environmental assessment, there are gaps that need further confirmation and clarification.

7 Impact avoidance and mitigation

This Chapter describes the measures that would be further developed and implemented to avoid or mitigate against any adverse impacts described in Chapter 6. Where relevant, the effectiveness of these measures is described. A summary risk assessment register is presented at the end of this Chapter that has been used to carry-out the self-assessment presented in Chapter 8.

7.1 Avoidance and mitigation measures

Table 7.1 describes the measures to avoid, minimise and manage the potential environmental impacts described in Chapter 6. These include: site selection decisions, design measures, and standard and bespoke (e.g. Project-specific) environmental mitigation, management and monitoring measures. Any gaps or uncertainties are described. These measures are expected to be further developed through the future approvals.

Table 7.1: design, avoidance, mitigation and/or management measures

Impact	Design, avoidance, mitigation, and/or management measure	Timing
General		
General	**G1:** a construction environmental management plan (CEMP) would be prepared 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. The CEMP must comply the documentation requirements of AS ISO 14001 Environmental Management Systems and would be prepared in accordance with local guidelines.	Pre-construction/ construction
General	**G2:** all workers would be provided with an environmental induction prior to commencing work onsite.	Pre-construction/ construction
Heritage *Note: specific vibration management and mitigation are described under the corresponding heading*		
Aboriginal heritage: general	**H1**: further Aboriginal heritage assessment would be carried out with input from local Aboriginal stakeholders and Indigenous interest groups. This would confirm the need for any additional controls.	Detailed design
Aboriginal heritage: general	**H2:** an unexpected finds procedure would be implemented and followed if any suspected Aboriginal objects and/or remains are found during construction.	Pre-construction/ construction
Non-Aboriginal heritage: general	**H3**: landscape planting, urban design measures and the infrastructure siting, form and structure would be used to minimise any visual amenity and setting impacts on the heritage values of the Reserve Bank of Australia and the Parliament House Vista to ensure consistency with their respective heritage management plans. These measures would also be used to ensure consistency with Canberra's Living Infrastructure Plan and the National Capital Plan precinct codes. These measures would be developed through detailed consultation and engagement with the ACT Government, DoEE and NCA.	Environmental assessment/ detailed design
Non-Aboriginal heritage: general	**H4:** an unexpected finds procedure would be implemented and followed if any suspected heritage items and/or archaeological remains are encountered.	Pre-construction/ construction

Impact	Design, avoidance, mitigation, and/or management measure	Timing
Ecology		
Vegetation and fauna habitat	**E1:** further ecological assessment is proposed to characterise the current condition, value and extent of the golden sun moth population and its habitat. This information will be collected to allow for a robust impact assessment and to establish offset requirements.	Environmental assessment/ detailed design
Vegetation and fauna habitat	**E2:** where feasible, opportunities would be sought to minimise vegetation clearing focussing on the golden sun moth habitat. This would be carried out in consultation with the appointed contractor. If there are no opportunities to reduce the impact, then appropriate offset sites will be identified before construction and used to offset the impact.	Environmental assessment/ detailed design
Vegetation and fauna habitat	**E3**: standard pre-clearing protocols would be implemented before any work takes place, including inspection of trees, demarking of no-go areas, use of toolbox talks and unexpected finds processes.	Pre-construction/ construction
Golden sun moth habitat	**E4**: enhancement measures would be considered to improve the quality, connectivity and productivity of the remnant golden sun moth habitat where feasible and reasonable.	Environmental assessment
Golden sun moth habitat	**E5:** work would be undertaken outside of the golden sun moth flying season where feasible and reasonable.	Pre-construction/ construction
Golden sun moth habitat	**E6:** a washdown protocol would be introduced onsite before any equipment and machinery entered the golden sun moth habitat area.	Pre-construction/ construction
Local fauna (low-mobility smaller species)	**E7:** an ecological management plan would be implemented comprising pre-clearance inspections and translocation activities.	Pre-construction/ construction
Ecology: general	**E8:** a biodiversity management plan would be prepared and implemented as part of the CEMP. The plan would detail measures to protect and manage biodiversity within and next to the Project and minimise impacts to native vegetation and threatened species during construction.	Pre-construction/ construction
Ecology: general	**E9:** pre-clearance inspections would be developed and implemented to check for the presence of unexpected flora and fauna; establish exclusion zones; and identify suitable habitat for the release of captured fauna.	Pre-construction/ construction
Ecology: general	**E10:** clearing protocol would be developed and implemented as part of the CEMP. This would be supported by tool-box talks and the use of no-go zones.	Pre-construction/ construction
Ecology: general	**E11:** biosecurity management measures would be developed and implemented as part of the CEMP. The plan would be prepared in accordance with the ACT Weed Strategy. It would also include measures to ensure pest and weed species were not brought to site in imported fill and spoil.	Pre-construction/ construction
Landscape, urban character and visual amenity		
Landscape, urban character and visual amenity: general	**L1**: consultation with the ACT Government, DoEE and NCA would continue to understand how the urban design needs to respond to and satisfy the requirements of the Territory Plan, Canberra's Living Infrastructure Plan and the National Capital Plan. This includes support and collaboration in having a design that respects the Griffin Plan and respects the landscape and heritage values of Commonwealth Avenue, the Reserve Bank of Australia, the Parliament House Vista, and the Designated Areas.	Environmental assessment/ detailed design
Landscape, urban character and visual amenity: general	**L2:** the CEMP would define specific measures covering aspects such as working arrangements and use of illustrative hoardings during construction to minimise any visual impacts. Methods to keep the construction footprint clean and tidy would also be included in the above plan to minimise any amenity impacts locally.	Pre-construction/ construction

Impact	Design, avoidance, mitigation, and/or management measure	Timing
Landscape, urban character and visual amenity: general	**L3:** a landscape planting and urban design strategy would be used to inform the design and minimise its visual impact. This would include the use of native species and designs that reinforce the amenity of the urban landscape and respect the values of the National Capital Plan, Designated Areas, and Commonwealth Heritage Management Plans impacted by the Project. The objective would be to reinforce and supplement the existing amenity character of the area.	Detailed design
Design configuration and layout, and tree planting	• **L3A:** part of the above strategy would specifically focus on the design and placement of any prominent infrastructure along with the landscape species composition, planting density and location of replacement trees and vegetation. This would be to ensure there would be no materially significant adverse visual impact, obstruction or loss in cultural or heritage value along the corridor.	Detailed design
Tree loss and replacement	• **L3B:** as a minimum, trees would be replaced on a one-for-one basis, while the species, locations and densities would be consistent with Canberra's Living Infrastructure Plan and the National Capital Plan precinct codes.	Detailed design
Landscape, urban character and visual amenity: general	**L4:** an urban design plan would be prepared that defines how the Project would be delivered to minimise its impact on the landscape character, designation character and visual amenity of the area. This would define specific measures covering aspects such as finishes, treatments and materials selection to respond to specific precinct characteristics defined under the National Capital Plan (e.g. City Hill (4.6), West Basin (4.7), and Lake Burley Griffin and Foreshores (4.12)). The objective would be to reinforce and supplement the existing amenity character of the area. Much of this information would be reported in the Works Approval application.	Detailed design/ pre-construction
Change in urban character	**L5:** an archival and photographic record of London Circuit and Commonwealth Avenue would be prepared before construction.	Pre-construction
Parliament House Vista	**L6:** all infrastructure would be designed to have no substantial impact on the Parliament House Vista. This would include the use of natural landscape features, including the undulating topography and existing mature vegetation to avoid any notable visual intrusion into or impact on the vista. Where required, this would be supplemented through defined and specific measures, build height restrictions and in the landscape planting and urban design strategy (**L1**).	Detailed design
Landscape, urban character and visual amenity: general	**L7:** temporary facilities, such as the laydown areas and construction compounds, would be located to minimise their visual impact. Hoardings and equipment would be screened from view during construction.	Detailed design
Contamination, soils and geology		
Soils and geology: general	**SG1:** a soil and water management plan would be prepared and implemented as part of the CEMP. The plan would detail all risks related to soil erosion and water pollution. It would also describe how these risks would be addressed during construction, including the short-term (onsite) and long-term (offsite) stockpiling of material and management of stormwater and overland flows both onsite and offsite. The plan would be consistent with Managing Urban Stormwater: Soils and Construction (the Blue Book) and Environment Protection Guidelines for Construction and Land Development in the ACT.	Pre-construction/ construction
Soils and geology: general	**SG2:** a site-specific erosion and sediment control plan would be developed before construction and implemented throughout the construction period as part of the above plan.	Pre-construction/ construction
Contamination: general	**SG3**: detailed and targeted site investigations would be carried out to inform the environmental assessment and characterise the contamination risk along the route.	Environmental assessment/ detailed design

Impact	Design, avoidance, mitigation, and/or management measure	Timing
Contamination: general	**SG4**: supplementary remediation actions or management controls would be identified and implemented before construction starts. Where needed, this would include soil and groundwater sampling to fully characterise the risk.	Environmental assessment/ detailed design
Contamination: general	**SG5:** a contaminated land and asbestos management plan would be prepared and implemented as part of the CEMP. The plan would include details on, but not limited to; measures to ensure the safety of site personnel and local communities during construction and the process for dealing with unexpected contamination and asbestos finds.	Detailed design/ pre-construction
Contamination: general	**SG6 (provisional)**: if needed, a remediation action plan would be prepared and implemented before construction. The plan would outline the remediation and validation strategy in relation to human health and environmental risk to ensure that the site is suitable for development.	Detailed design/ pre-construction
Contamination: general	**SG7:** a spill management plan would be prepared and implemented as part of the CEMP to minimise the risk of pollution arising from spillage or contamination onsite or from adjacent areas.	Pre-construction/ construction
Contamination: general	**SG8:** any contaminated materials and asbestos encountered during construction would be managed and disposed of in accordance with relevant guidelines including: ACT's Environmental Standards: Assessment & Classification of Liquid and Non-liquid Wastes; Information Sheet 4 – Requirements for the reuse and disposal of contaminated soil in the ACT; Work Health and Safety (Asbestos) Amendment Regulation 2014; Safe Work Australia 2011, How to manage and Control Asbestos in the Workplace; and Code of Practise for the Safe Removal of Asbestos 2nd Edition (NOHSC, 2005).	Pre-construction/ construction
Surface water and flooding		
Surface water and flooding: general	**SW1:** modelling would be carried out to ensure a design outcome that provides appropriate flood protection and immunity along the route. Flood immunity measures would be included in the design that would also ensure no there would be no increased flood risk to adjacent areas.	Environmental assessment/ detailed design
Surface water and flooding: general	*As per **SG1**, a soil and water management plan would be prepared and implemented as part of the CEMP.*	*Pre-construction/ construction*
Surface water and flooding: general	*As per **SG2** a site-specific erosion and sediment control plan would be prepared and implemented as part of the CEMP.*	*Pre-construction/ construction*
Surface water and flooding: general	*The soil and water management plan (**SG1**) and erosion and sediment control plan (**SG2**) would include the installation of physical barriers, such as catch drains and diversion bunds, at the entry or exit to the work areas to contain sediment laden runoff within the work area (i.e. construction compounds). This would ensure overland flow paths would be diverted around sites.*	*Pre-construction/ construction*
Surface water and flooding: general	**SW2**: a flood emergency management plan for both the construction and operational phases of the Project would be prepared for a potential flood event. The plan would include details on, but not limited to; monitoring of weather to determine potential periods of heavy rainfall and corresponding evacuation procedures.	Pre-construction/ construction and operation
Surface water and flooding: general	**SW3:** the drainage would be designed to accommodate the increased runoff. Where required, attenuation would be included in the design including water sensitive urban design measures.	Detailed design

Impact	Design, avoidance, mitigation, and/or management measure	Timing
Water use: general	**SW4:** commitments would be made to use grey water or site recovered/recycled water in the first instances during construction where feasible and reasonable.	Construction
Groundwater		
Groundwater: general	*As per **SG7,** a spill management plan would be prepared and implemented as part of the CEMP.*	*Pre-construction/ construction*
Groundwater: general	**GW1**: a dewatering strategy would be developed to deal with any temporary drawdown of the groundwater table during construction. This would be prepared prior to any excavation works taking place.	Pre-construction/ construction
Groundwater: general	**GW2:** the final foundations and any other in-ground structures would be designed to be corrosion resistant.	Detailed design
Groundwater: general	**GW3**: the following management measures would be used, as taken from the ACT Government's Hydrogeological Landscape Report for the Sullivans Creek HGL. These include minimising deep drainage (UC1), ensuring the paving and slab construction is suitable for the underlying conditions (UC5), minimising the depth of cut and exposure of susceptible soils (UC6), and introducing a landscape design formed of native and deep-rooted vegetation (UV2). These can be complemented by the following urban planning controls: measures to identify saline soils before starting earthworks (UP1), the implementation of water-sensitive urban design (UP2), the identification of discharge sites (UP3), and the maximisation of impervious areas to prevent perched water recharge (UP4).	Detailed design
Property and land use		
Property and land use: general	**P1**: design solutions would be developed to ideally avoid, otherwise minimise and manage, any temporary/permanent loss in property, social, cultural and community value.	Environmental assessment/ detailed design
Property and access: general	*The traffic and transport management plan (**TT2**) would include provisions to preserve road user, property and emergency vehicle access during construction, where feasible and reasonable.*	*Pre-construction/ construction*
Social and public infrastructure: general	*The landscape planting strategy (**L3**) and urban design plan (**L4**) would include measures to protect the public realm and amenity of the area and respect the Griffin Plan, Territory Plan and National Capital Plan.*	*Detailed design*
Utilities and energy resources		
Utilities: general	**U1:** the location of existing utilities and relocation details would be confirmed following consultation with the affected asset owners and service providers and exploratory surveys before starting work.	Detailed design/ pre-construction
Utilities: general	**U2:** any utilities that need installing for the Project would be designed in consultation with the relevant service providers.	Detailed design/ pre-construction
Heritage impacts	**U3:** the detailed utilities assessment carried out as part of the detailed design would ensure there being no material heritage or amenity impacts. This includes defining clear construction, installation and reinstatement methods. This may include specific controls and methods when working next to the Reserve Bank of Australia, within and near to Commonwealth Park, and the Designated Areas. It would also be carried out in consultation with the ACT Government, DoEE and the NCA.	Detailed design
Utilities: general	**U4:** a utility management plan would be prepared and implemented under the CEMP. The plan would set specific construction requirements to minimise any utility disruption, while allowing maintenance and emergency access. It would also include any specifics identified under **U3**.	Pre-construction/ construction

Traffic and transport		
Traffic and transport: general	**TT1**: further traffic modelling and assessment would be carried out to inform the design to ensure network performance during construction and operation. The modelling would identify the need for any additional improvement works on adjacent roads in the city to maintain performance across the network.	Environmental assessment/ detailed design
Traffic and transport: general	**TT2:** a construction traffic management plan would be prepared and implemented as part of the CEMP. The plan will include details on, but not limited to; confirmed haulage routes, temporary diversion routes, road closures, including those for public services (i.e. buses), and measures to maintain pedestrian and cyclist access.	Detailed design / pre-construction
Traffic and transport: general	**TT3:** potentially affected businesses, residents, transport companies and user groups would be consulted during the detailed design to ensure their requirements are accommodated.	Detailed design
Traffic and transport: general	**TT4:** potentially affected businesses, residents, transport companies and user groups would be consulted before starting works or before starting any key activities.	Pre-construction/ construction
Noise and vibration		
Noise and vibration: general	**NV1**: a detailed assessment will be carried out to consider construction and operational based activity noise and vibration, and associated traffic noise impacts. The assessment will be prepared to be consistent with the ACT *Environment Protection Act 1997* (noting that light rail vehicles are exempt noise sources), the NSW EPA Rail Infrastructure Noise Guideline, German Standard DIN 4150-3: 1999-02 Structural Vibration – Part 3: Effects of vibration on structures, Assessing Vibration: A Technical Guideline, NSW EPA Noise Environment Protection Policy, and the Transport for NSW Construction Noise and Vibration Strategy.	Environmental assessment
Noise and vibration: general	**NV2**: a construction noise and vibration management plan would be prepared and implemented as part of the CEMP. The plan would include details on notable noise and vibration generating activities and measures to reduce the impacts of these, such as installation of hoardings, temporary noise barriers, equipment selection, and/or restricting the timing of certain activities.	Pre-construction/ construction
Noise and vibration: general	**NV3:** track noise and vibration dampening measures would be included consistent with international best practice to avoid cosmetic building damage and amenity impacts. This will consider design, management and maintenance measures such as rail grinding, welding to smooth discontinuities, lubrication, using soft rail pads, wheel truing, and the use of specific types of brakes and wheel vibration absorbers.	Detailed design/ operation
Noise and vibration: general	**NV4:** the substation would be located away from noise-sensitive receivers.	Detailed design
Noise and vibration: general	**NV5:** the design would look at solutions to prevent out of hours construction. If this is not possible an individual assessment would be carried out to demonstrate the out of hours impact on adjacent receivers. Addition controls would be implemented to minimise the impact of out of hours work consistent with the guidelines set by Transport for NSW in the absence of similar ACT guidelines.	Detailed design/ construction
Noise and vibration: general	**NV6:** precondition building surveys would be carried out along the route before construction and operation**.**	Detailed design/ construction
Noise and vibration: general	**NV7:** vibration monitors would be set up along the route at key sensitive locations with triggers set below impact thresholds to prevent/minimise cosmetic and human comfort impacts. These would be introduced during construction and during the initial operational phase. They would be removed once there has been an agreed period without incident.	Detailed design/ construction

Noise and vibration: general	**NV8:** equipment specifications and equipment limitation exclusion zones would be set around key buildings including the Reserve Bank of Australia. Specific types and sizes of vibration-generation equipment would be used in these zones consistent with Appendix D of the Construction Noise and Vibration Strategy (Transport for NSW, 2017). Where required (and as allowed for in the above strategy) this would be supplemented by reference to the short-term vibration guidelines provided in German Standard DIN 4150-3: 1999-02 Structural Vibration – Part 3: Effects of vibration on structures.	Pre-construction/ construction

Air quality and greenhouse gas		
Air quality: general	**AQ1:** an air quality management plan would be prepared and implemented as part of the CEMP. The plan would include details on potential air pollution sources and air quality management objectives consistent with those of the ACT Government. It would also include the controls to be implemented to reduce potential impacts on receivers.	Pre-construction/ construction
Air quality: general	**AQ2**: a dust management plan would be prepared and implemented as part of the CEMP. The plan would include measures consistent with international best practice.	Pre-construction/ construction
Socioeconomics		
Social and economic: general	**SE1**: a communication plan would be prepared an implemented as part of the CEMP to help provide timely and accurate communication to the public during construction. The plan would include details on the timing of proposed activities to affected businesses and residents (where relevant), including changed traffic and access conditions.	Detailed design / pre-construction
Social and economic: general	**SE2:** consultation would be carried out with commercial and residential properties alongside the route to identify appropriate management strategies to avoid or minimise impacts on access and operations.	Detailed design / pre-construction

7.2 Preliminary risk assessment

7.3 Overview

Significant Impact Guidelines 1.2 describe impact severity (● minor, ♦ moderate or + major) as a combination of intensity, scale, duration and frequency. The guidelines also ask that in the event of uncertainty you apply precaution and make a conservative assessment. Finally, the guidelines describe that you should consider if the identified impact severity can be reduced through avoidance, mitigation and management measures. Table 7.2 summarises the above. In certain instances, while the Project would largely deliver a long-term benefit (e.g. the creation of public and community infrastructure) its construction would still cause a short-term impact on public amenity. For that reason, the table reports impact over benefit, which is consistent with the guidelines.

As concluded in the table, the only impact that cannot be effectively mitigated is the loss of golden sun moth habitat at the London Circuit and Commonwealth Avenue intersection.

Intensity:	(1) low, (2) moderate, (3) high
Scale:	(1) local, (2) regional, (3) territorial, (4) national
Duration	(1) short-term, (2) long-term, (3) permanent
Frequency:	(1) periodic, (2) continuous
Overall severity:	● minor, ♦ moderate, + major, **B** beneficial
Uncertainty:	yes, no
Residual severity:	● minor, ♦ moderate, + major, **B** beneficial

Table 7.2: risk and impact assessment summary

Protected matter or Commonwealth Land value	Feature	Pre-mitigation					Uncertainty	Impact summary overview and outline mitigation measures	Post mitigation
		Intensity	Scale	Duration	Frequency	Severity			Severity
National heritage places: *Matter of national environmental significance*	The nearest national heritage place is the Australian Academy of Science building located about 300 metres west of London Circuit	N/A	N/A	N/A	N/A	N/A	No	The Academy is located outside of the Project's likely zone of visual influence and beyond the distance where cosmetic building damage can occur from construction and operational vibration.	N/A
Commonwealth heritage place: *Commonwealth Land value*	The nearest Commonwealth heritage place is the Reserve Bank of Australia located about 15 metres from the median of London Circuit.	2	1	3	2	♦	No	The Bank is sufficiently close to the Project that it may experience cosmetic building damage either through construction or operational vibration. The magnitude of such impacts can be managed through including track dampening along the route. This is proven as being an effective on the many examples of operational light rail services around the world.	●
	Commonwealth Avenue borders the Parliament House Vista heritage place.	1	1	3	2	●	Yes	The indicative location for the traction power substation is within Commonwealth Park, and therefore within the Parliament House Vista heritage place. However, the traction power substation would be installed next to Regatta Place. There is the opportunity to for the traction power substation to be placed and screened from view to minimise its impact on views and the area's heritage amenity. Its proposed location has been selected to reduce the impact on important viewscapes while respecting the area's heritage amenity.	●
Critically endangered species *Matter of national environmental significance*	Presence of a small, isolated and fragmented population of golden sun moth at the intersection of London Circuit and Commonwealth Avenue.	3	4	3	2	+	Yes	The Commonwealth guidelines identify that impacts on a fragmented golden sun moth population is a significant impact on a matter of national environmental significance. In the case of the Project it is not possible to avoid an impact on the recorded golden sun moth population. Given the uncertainty in the design, a precautionary approach has been taken in assuming the loss of the whole population. Therefore, impacts on the golden sun moth habitat cannot be avoided. It can be refined during the detailed design, while possible enhancement and offset measures would be used to compensate for the impact.	+
Natural landscape features *Commonwealth Land value*	The nearest natural landscape feature is Sullivans Creek located about 700 metres west of London Circuit.	N/A	N/A	N/A	N/A	N/A	No	Sullivans Creek is removed and isolated from the study area, and therefore it is not expected that there would be any associated direct or indirect impacts on its values. By implementing the measures and controls set out in Managing Urban Stormwater Soils and Construction (the Blue Book) and the Environment	N/A

Protected matter or Commonwealth Land value	Feature	Pre-mitigation					Uncertainty	Impact summary overview and outline mitigation measures	Post mitigation
		Intensity	Scale	Duration	Frequency	Severity			Severity
								Protection Guidelines for Construction and Land Development in the ACT this provides an effective means to prevent sediment or pollutant discharge. These measures would be implemented under the controls of a soil and water management plan. Further, adequate drainage and water quality provisions would be included in the design to deal with the increased runoff because of installing the light rail along the vegetated median/verges of London Circuit and Commonwealth Avenue.	
Contaminated land *Commonwealth Land value*	There are no sites on the EPA's register of contaminated land within and local to the study area. There are two sites on London Circuit "known to be, have been or have the potential to be contaminated" but are not recorded on the above register. Former barracks located on the edge of the lake to the east of Commonwealth Avenue also may pose a contamination risk. There is the potential risk of contaminants and asbestos containing materials associated with the use of uncontrolled fill within the study area.	2	1	2	2	♦	Yes	Without additional information, it is currently unknown if the two noted sites (places where hydrocarbons are stored) have resulted in the contamination of the local area, of if they continue to present a risk to the development of the Project. RPS recommended that both sites be characterised further. While this is the case, hydrocarbon contamination can be effectively remediated and treated so as not to present a risk to developing the Project. These investigations and any remediation would take place before construction starts. By following this process, and working to an unexpected finds procedure, impacts can be effectively mitigated and avoided.	●
Acid sulfate soils *Commonwealth Land value*	There is an extremely low potential for acid sulfate soils to occur locally.	N/A	N/A	N/A	N/A	N/A	No	No applicable	N/A
Surface water quality, quantity and availability *Commonwealth Land value*	The nearest surface water body is Lake Burley Griffin to the south of the terminus.	1	1	3	2	●	Yes	Consistent with the discussion above on natural landscape features, by implementing measures and controls set out in Managing Urban Stormwater: Soils and Construction (the Blue Book), Environment Protection Guidelines for Construction and Land Development in the ACT, and including adequate stormwater and water quality design measures, then any impacts on the quality of the waters of Lake Burley Griffin can be adequately managed.	●

Protected matter or Commonwealth Land value	Feature	Pre-mitigation					Uncertainty	Impact summary overview and outline mitigation measures	Post mitigation
		Intensity	Scale	Duration	Frequency	Severity			Severity
								Water would be needed mainly for dust suppression and certain civil works during construction. These waters could potentially, supplied through dewatering. However, the volumes of water would be small and could be likely sourced from a grey-water (recycled) source. Operationally, small volumes of water would be needed for cleaning, maintenance and landscape maintenance. Overall, the water demand for the Project is not of a scale or nature that would affect existing supply and resources in the area.	
Groundwater quality, quantity and availability *Commonwealth Land value*	Groundwater occurs between two and eight metres below ground across the entire 72 km^2 Sullivans Creek HGL. There are also occurrences of perched groundwaters across the area that respond to the underlying geology.	1	1	3	2	+	Yes	As above, groundwater impacts can be managed during construction by through implementing measures and controls set out in Managing Urban Stormwater: Soils and Construction (the Blue Book) and Environment Protection Guidelines for Construction and Land Development in the ACT. Impacts on groundwater can also be managed by implementing the specific urban management actions for areas within the Sullivans Creek HGL presented in the ACT Government's Hydrogeological Landscape Reports. These include minimising deep drainage (UC1), ensuring the paving and slab construction is suitable for the underlying conditions (UC5), minimising the depth of cut and exposure of susceptible soils (UC1), and introducing a landscape design formed of native vegetation and deep-rooted vegetation (UV2). These can be complemented by the following urban planning controls: measures to identify saline soils before starting earthworks (UP1), the implementation of water-sensitive urban design (UP2), the identification of discharge sites (UP3), and the maximisation of impervious areas to prevent perched water recharge (UP4). As all the above controls can be reasonably and feasibly introduced on the Project then it is concluded that impacts can be avoided and minimised.	●
Social and public infrastructure *Commonwealth Land value*	The Project would be built within the public realm (London Circuit and Commonwealth Avenue). The area contains a range of public infrastructure including: public roads, footpaths, marked cycleways, bus stops, recreational areas (City Hill, Henry Rolland Park, Lake Burley Griffin, and the National Capital	1	1	1	1	●	No	The Project would result in the loss of the median along London Circuit and Commonwealth Avenue and removal of vegetation at the 'clover-leaf'. While these areas provide no direct social or economic function, they do hold an amenity value, which would be mitigated through an effective urban and landscape design. Roads users, including pedestrians, cyclists and bus passengers would be inconvenienced during construction and operation from the temporary and permanent introduction of turning movement restrictions and the loss of a traffic lane in each direction on parts of London Circuit. This may include the	●

Protected matter or Commonwealth Land value	Feature	Pre-mitigation					Uncertainty	Impact summary overview and outline mitigation measures	Post mitigation
		Intensity	Scale	Duration	Frequency	Severity			Severity
	Exhibition), educational facilities (ANU) and car parks.							need to either temporarily or permanently re-route and relocate the bus stops and bus routes. Any changes would take place under consultation and the modifications would be limited, meaning people would only be inconvenienced temporarily. Importantly, there would be no temporary or permanent loss of social/public infrastructure. The Project would have beneficial impacts associated with the potential strengthening of the amenity character and value of the area due to the introduction of key transport corridors and associated public realm improvements. The proposed raising of London Circuit would also improve connectivity.	
Key utilities *Commonwealth Land value*	As is typical of any urban area, there are numerous utilities in the study area, including those that cross under/over the road. They include telecommunications, drainage, communications, low and high-voltage electricity, gas mains, clean and waste water infrastructure.	1	1	1	1	●	No	A standard part of any urban development is ensuring and managing utility relocations, adjustments and disruptions to prevent any user and customer impacts. This can be affected under a utility management strategy developed in consultation with, and under the agreement and approval of, the utility asset owners.	●
Reduction in energy sources *Commonwealth Land value*	The ACT Government has set a target to achieve a 40 percent reduction in greenhouse gas emissions on 1990 levels by next year, extending to net zero emissions by 2045.	1	1	1	1	●	No	Given the Government's commitment, then the Project would not directly require the use of non-renewable energy. While the Project's construction would involve the direct and indirect use of non-renewable energy and materials, quantities would be small to the point of having no material large-scale regional impact. There is also opportunity to use recovered and recycled materials to further reduce the Project's construction energy footprint and impact.	●
Natural and renewable energy resources *Commonwealth Land value*	Given the urban character and nature of the study area it does not form or contain any energy resources (e.g. worked coal seams, wind farm infrastructure). While there appears to be no smart-technology powering the light or signage along the road the ACT Government is committed to having	1	1	1	1	●	No		●

Protected matter or Commonwealth Land value	Feature	Pre-mitigation					Uncertainty	Impact summary overview and outline mitigation measures	Post mitigation
		Intensity	Scale	Duration	Frequency	Severity			Severity
	100 percent of the public asset powered by renewable energy by 2050.								
Public and community transport *Commonwealth Land value*	The key public transport provisions in the study area include three bus stops (two on Commonwealth Avenue and one on London Circuit). There are also footpaths along London Circuit and Commonwealth Avenue and a marked cycle lane along Commonwealth Avenue in both directions. Several public car parks can be directly accessed from within the study area.	3	2	3	2	**B**	No	The Project extends the public transport provisions across the city, which will improve access and connectivity. To achieve this may require some adjustment to the rapid (bus) route services and timetabling along London Circuit and Commonwealth Avenue. This may also include temporarily/permanently relocating the three bus stops in the study area to nearby locations. This would be done in consultation with the public, bus passengers and the operators. The only impact of this would be to inconvenience people. The Project would result in the loss of up to 70 off-street parking spaces, which represents around one per cent of the total available parking in the area. However, overall the Project would improve accessibility across the city by public transport, foot and bicycle. The raising of London Circuit would support pedestrian and cyclist connectivity between the city and the waterfront. On balance, the Project would have an overall beneficial impact on public and community transport.	**B**
Noise-sensitive land uses and receivers *Commonwealth Land value*	Given the urban location, there is a range of sensitive receiver-types within and local to the study area. The most-sensitive receivers are the residents on the western side of London Circuit. Other receivers include employees, users of the public open space, hotel guests, and potentially students.	2	1	1	1	●	No	People's amenity would be temporarily impacted from construction noise and vibration; however, any impacts would be temporary and short term. Construction noise and vibration management can be effectively planned for and managed using effective and standardised best-practices such as those included in the EPA's guidelines for preparing noise management plans. Operational impacts would be transient as they would only be experience due to light rail vehicles passing by. Effective design and maintenance measures would be used to minimise tonal and impulsive noise. Dampening (e.g. use of wheel-vibration absorbers) can be used to avoid cosmetic building damage.	●
Ambient air quality *Commonwealth Land value*	The above noise-sensitive receivers are also considered sensitive to air pollution. Ambient air quality in the city is recorded as 'very good' and monitoring results show no human	1	1	1	1	●	No	The scale and nature of the construction works would not generate air and greenhouse gas emissions at levels and concentrations that would have any long-term local or regional air quality impact or effect on people's health. Dust would be generated during construction; however, this can be effectively controlled by implementing measures such as those included in UK's Institute of Air Quality Management Guidance on the assessment of dust from	●

Protected matter or Commonwealth Land value	Feature	Pre-mitigation					Uncertainty	Impact summary overview and outline mitigation measures	Post mitigation
		Intensity	Scale	Duration	Frequency	Severity			Severity
	health risks or exceedances of air quality standards. Road traffic emissions are the primary air pollution source in the ACT (about 30 percent).							demolition and construction. These are proven to be effective at avoiding and minimising associated impacts. Vehicle and equipment emissions generated during construction can be managed through regular servicing and maintenance, responsible use (e.g. switching off idling equipment) and placement onsite (e.g. away from sensitive receivers).	
Greenhouse gases *Commonwealth Land value*	The ACT Government has set a target to achieve a 40 percent reduction in greenhouse gas emissions on 1990 levels by next year, extending to zero emissions by 2045.	1	1	1	1	●	No	The scale and nature of the construction works would not generate emissions and levels and concentrations that would have any local or regional air quality impact. Equally, the Project's operation would neither directly or indirectly generate greenhouse gas emissions due to the commitment to power the rail using renewable energy sources. The planned road works, including the raising of London Circuit, are not proposed to support an increase in traffic nor would they bring traffic closer to sensitive receivers and therefore there are not expected to be any air quality impacts.	●
Community services, social organisations and community resources. *Commonwealth Land value*	The study area and locality include a range of social and community infrastructure including: schools and educational facilities (ANU), childcare facilities, places of worship, medical/healthcare facilities, and recreational and public domain areas.	1	1	1	1	●	No	The Project provides a community service that connects people to areas of the city and its supporting amenity and infrastructure. This includes public open space and key facilities such as hospitals and educational institutions. While there would temporary loss of amenity across the public realm during construction, there are effective controls to avoid and minimise noise, dust, visual and traffic impacts. These impacts can be effectively managed and would not lead to any long-term or permanent adverse impacts on the health, welfare, or the economic or social status of the surrounding communities.	●
Community health and welfare *Commonwealth Land value*	The ACT general health survey is carried out each year. This confirmed that between 2007 and 2016 the portion of children who walked or cycled to school increased by about 1.6 percent every year. It stood at about 40 percent at the end of 2016. This compared to about 15 percent of adults who walked or cycled to work.	2	2	3	2	**B**	No	An objective of the Project is to reduce private vehicle travel and car dependency. This promotes community health and welfare by encouraging people to walk to and from the light rail. It also offers an opportunity to extend the cultural identity for Canberra created by the Gungahlin to City light rail, by connecting multiple suburbs to the social and cultural amenity of the city. The proposed raising of London Circuit would support pedestrian and cyclist connectivity, and also improve accessibility between the city and the waterfront. This would deliver long-term benefits to people living, working and visiting Canberra.	**B**

Protected matter or Commonwealth Land value	Feature	Pre-mitigation					Uncertainty	Impact summary overview and outline mitigation measures	Post mitigation
		Intensity	Scale	Duration	Frequency	Severity			Severity
	The report also acknowledged the importance of integrating active living into the Territory Plan and the ACT Government's Towards Growth Goal: Healthy Weight Action Plan (2013).								
Individual and community identity *Commonwealth Land value*	London Circuit provides a link to many of Canberra's open greenspaces including City Hill, Henry Rolland Park and Lake Burley Griffin. The Acton Waterfront precinct has recently been redeveloped into what is now considered a culturally diverse area. It includes three large upmarket hotels and a range of restaurants and cafés. A small section of the precinct remains residential and caters to affluent Canberrans.	3	3	3	2	**B**	No	The Project would extend the public transport network leading to access improvement across Canberra to landmarks such as City Hill and Lake Burley Griffin. This would help connect people with the identifiable and cultural features of city.	**B**

8 Impact significance

This Chapter considers if the Project is expected to have a significant environmental impact on the receiving environment accounting for all matters set out in Chapter 6 to Chapter 8.

8.1 Self-assessment

Table 8.1 considers the "total adverse impact [of the Project] in the context of the environment which will be impacted" with reference to the assessment criteria set out in the guidelines described in Section 1.2. Additional criteria have been considered where relevant. This is consistent with the guidelines stating that the provided criteria are not exhaustive or definitive.

Table 8.1: Assessment criteria

Feature	Yes/no	Description
Significant Impact Guidelines 1.1: matters of national environmental significance		
National heritage places		
Result in one or more of the National Heritage values to be lost.	No	There are no national heritage places located directly within the study area. The closest national heritage place to the project is the Australian Academy of Science Building located approximately 300 metres west. This building is located outside of the Project's likely zone of influence and it is beyond the 20-metre distance where cosmetic building damage could occur. As such, no indirect impacts are expected to occur from building and operating the Project.
Result in one or more of the National Heritage values to be degraded or damaged.	No	There are no national heritage places located directly within the study area. The closest national heritage place to the Project is the Australian Academy of Science Building located approximately 300 metres west. This building is located outside of the Project's likely zone of influence and it is beyond the 20-metre distance where cosmetic building damage could occur. As such, no indirect impacts are expected to occur from building and operating the Project.
One or more of the National Heritage values to be notably altered, modified, obscured or diminished.	No	
Critically endangered and endangered species		
Lead to a long-term decrease in the size of a population	Yes	A precautionary approach has been taken in assuming loss of the entire recorded golden sun moth habitat (2.6 hectares based on 2019 survey data compared to 6.9 hectares of habitat based on 2017 data). Removal of this habitat is highly likely to lead to a long-term decrease in the size of the population.
Reduce the area of occupancy of the species	Yes	Construction of the Project will impact on areas of occupied golden sun moth habitat and will therefore reduce the area of occupancy of the species.
Fragment an existing population into two or more populations	Yes	Proposed works will disrupt continuity of habitat in the medium to long-term to the extent that each of the existing populations are fragmented into two or more populations. However, the current level of fragmentation in the surrounding landscape is already high, given the extent of urbanisation. Golden sun moths can persist in highly fragmented landscapes.
Adversely affect habitat critical to the survival of a species	Yes	Habitat critical to the survival of a species is defined by DoE (2013) as areas that are necessary for essential activities (e.g. foraging, breeding, roosting, or dispersal), for the long-term maintenance of the species, maintaining genetic diversity and long term evolutionary development, and/or the recovery of the species. All populations of golden sun moth are important for the long-term survival and recovery of the species (Commonwealth of Australia 2009).

Feature	Yes/no	Description
		By extension, it is therefore assumed that the Project will adversely affect habitat critical to the survival of the species by permanently removing occupied habitat.
Disrupt the breeding cycle of a population	Yes	The Project may affect an unknown number of breeding individuals within and near the construction footprint through direct mortality and disturbance during construction works. This is likely to result in a disruption to the breeding cycle within the four habitat patches which make up the population identified within the study area.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Yes	The Project will result in the destruction and removal of habitat for the species. While vegetation outside of the direct construction footprint can be re-established following works through sod-salvage and planting, vegetation is unlikely to represent original structure and quality and will therefore be modified.
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat	No	The population of golden sun moth within and adjacent to the project area occurs in exotic grassland dominated by the invasive Chilean Needle-grass. The Project is highly unlikely to result in new weeds or pests becoming established within the study area. It is recommended that a suitable weed management protocol is implemented to ensure that no transfer of weeds or pests occur because of the Project.
Introduce disease that may cause the species to decline,	No	There are no known diseases that have been transmitted to this species because of human activity.
Interfere with the recovery of the species	Yes	There is no approved recovery plan for golden sun moth, however the Commonwealth of Australia (2009) consider all populations to be important for the long-term survival and recovery of the species. It is likely that the Project will substantially interfere with the recovery of the species, however measures will be undertaken to preserve the remaining golden sun moth habitat where considered to be feasible.
Significant Impact Guidelines 1.2: actions on Commonwealth Land		
Landscape and landforms		
Substantially alter natural landscape features	No	The nearest natural landscape features are Sullivans Creek located about 700 metres west of London Circuit. The Project is not expected to directly or indirectly impact on Sullivans Creek. Implementing the measures and controls set out in Managing Urban Stormwater: Soils and Construction (the Blue Book) provides an effective means to prevent sediment or pollutant discharge to the creek. Further, implementation of a soil and water management plan would provide effective means such as installation of drainage controls, to deal with the increased runoff from installation of the light rail along the vegetated median/verges of London Circuit and Commonwealth Avenue that may flow in Lake Burley Griffin. Impacts are unlikely to be significant.
Cause subsidence, instability or substantial erosion	No	The geology of the study area comprises the Canberra Formation; a conglomerate (mix) of mudstone, siltstone, minor sandstone, limestone, hornfels (a type of metamorphic rock), dacitic ignimbrite (a type of igneous rock made of hardened volcanic ash called tuff) and volcaniclastic sediments. Construction activities such as earthworks and vegetation clearing have the potential to create land instability and erosion at the site due to sediment run-off, particularly if there are high rainfall events. However, the implementation of a soil and water management plan would provide effective means such as installation of drainage controls, to prevent subsidence or erosion during construction of the light rail and the potential for increased runoff. Impacts are unlikely to be significant.
Involve medium or large-scale excavation of soil or minerals	No	Soil will be excavated for the Project however this would be minor in scale compared to other large infrastructure projects. Implementation of a soil and water management plan would include arrangements for managing spoil and excavation material in accordance with the relevant guidelines and impacts are unlikely to be significant.
Coastal landscapes and processes		
Alter coastal processes, including wave action, sediment movement or accretion, or water circulation patterns.	No	Not relevant as the Project is not within a coastal environment.

Feature	Yes/no	Description
Permanently alter tidal patterns, water flows or water quality in estuaries.	No	Not relevant as the Project is not within a coastal environment.
Reduce biological diversity or change species composition in estuaries.	No	Not relevant as the Project is not within a coastal environment.
Extract large volumes of sand or substantially destabilise sand dunes.	No	Not relevant as the Project is not within a coastal environment.
Ocean forms, ocean processes and ocean life		
Reduce biological diversity or change species composition on reefs, seamounts or in other sensitive marine environments.	No	Not relevant as the Project is not within a coastal environment.
Alter water circulation patterns by modification of existing landforms or the addition of artificial reefs or other large structures.	No	Not relevant as the Project is not within a coastal environment.
Substantially damage or modify large areas of the seafloor or ocean habitat, such as seagrass.	No	Not relevant as the Project is not within a coastal environment.
Release oil, fuel or other toxic substances into the marine environment in sufficient quantity to kill larger marine animals or alter ecosystem processes.	No	Not relevant as the Project is not within a coastal environment.
Release large quantities of sewage or other waste into the marine environment.	No	Not relevant as the Project is not within a coastal environment.
Water resources		
Measurably reduce the quantity, quality or availability of surface or ground water.	No	Lake Burley Griffin is the nearest, albeit artificial, surface water feature. Sullivans Creek, the nearest natural surface water feature, is located about 700 metres west of London Circuit and is not anticipated to be impacted by the Project. The water quality of both Lake Burley Griffin and Sullivans Creek have been identified as acceptable. There is potential for impacts from the Project to these surface water features, such as sediment loading of the lake. These impacts can be controlled and managed during construction through proven and effective controls described in the Blue Book to prevent sediment or pollutant discharge and through water sensitive urban design. These would be implemented under the controls of a soil and water management plan and a landscaping management plan. Based on the ability to effectively manage construction works under the provisions of the Blue Book and the design including provisions to manage the increase in stormwater discharge, and prevent any increased flood risk, it is concluded that there would be no measurable impact on the availability or quality of surface waters in the area, including Lake Burley Griffin.

Feature	Yes/no	Description
		Groundwaters are moderately yielding (five to 15 percent) with a flow length of less than 10 kilometres and the deeper base (rock) aquifer does not quickly recharge with the waters remaining in the ground for several years. The other key feature of the groundwaters are their saline nature. As with surface water above, the ability to effectively manage construction works under the provisions of the Blue Book, while including design provisions to manage the increase in stormwater runoff, would also prevent any material impact on the underlying groundwaters. It is therefore concluded that there would be no measurable impact on groundwaters from the Project.
Channelise, divert or impound rivers or creeks or substantially alter drainage patterns.	No	Sullivans Creek is unlikely to be directly impacted by the Project such as channelising, diverting or impounding the creek due to its distance from the study area (about 700m). The Project would see a minor increase in runoff volumes and rates through the median and verge vegetation removal. The stormwater infrastructure would be designed under the principles of water sensitive urban design and to accommodate the increase in runoff and handle any pollutant discharge if needed. The works are unlikely to have any impact on the flow of watercourses (i.e. Sullivans Creek) and existing drainage patterns.
Measurably alter water table levels.	No	Groundwater depth is influenced by the soils, geology and rainfall. Typically, is varies between two and eight metres below the surface. Perched waters may also occur close to surface, and groundwater is expected to be shallower close to the lake. Construction works may temporarily affect groundwater levels however, impacts are likely to be localised and could be managed through design of the Project in relation to areas of known shallow groundwater depth. Impacts to the proposal on groundwater levels are unlikely to be significant.
Pollutants, chemicals and toxic substances		
Generate smoke, fumes, chemicals, nutrients, or other pollutants which will substantially reduce local air quality or water quality.	No	There is unlikely to be any burning for the Project. Earthworks and vegetation removal could potentially result in increased nutrients entering Lake Burley Griffin. However, implementation of the standard controls measures contained in the various volumes of Managing Urban Stormwater: Soils and Construction (the Blue Book) are proven and effective in managing and avoid impacts when working near and over surface waters. In combination with the proposed limited amount of works taking place near the lake means that any impacts can be effectively avoided or minimised. It is unlikely that the water quality of the lake would be substantially reduced. Any excavations and earthworks would generate dust during construction. This is a common issue that can be effective managed and minimised through implementing standardised controls, through an air quality management plan. It is unlikely that local air quality would be substantially reduced during construction. As the light rail is electrically powered then there would be no operational vehicle air or greenhouse gas emissions. Further, as there is the commitment to power the light rail using renewable energy sources, the Project would not indirectly and remotely generate emissions from conventional power and electricity generation (e.g. coal or gas).
Result in the release, leakage, spillage, or explosion of flammable, explosive, toxic, radioactive, carcinogenic, or mutagenic substances, through use, storage, transport, or disposal.	No	The storage and handling of dangerous goods and hazardous materials have the potential to impact construction workers and the surrounding environment if leaks and spills occur, resulting in the potential contamination of air, soils, surface water, and/or groundwater. Such impacts are common to any development and can be effectively managed through standardised controls such as implementation of a CEMP and the storage and handling of dangerous goods in accordance with the relevant standards and guidelines.
Increase atmospheric concentrations of gases which will contribute to the greenhouse effect or ozone damage.	No	Any excavations and earthworks would generate temporary localised dust impacts during construction. This is a common issue that can be effective managed and minimised through implementing standardised controls, through an Air Quality Management Plan for demolition and construction. It is therefore unlikely that local air quality would be substantially reduced during construction. As the light rail is electrically powered then there would be no operational vehicle air or greenhouse gas emissions. Further, as there is the commitment to power the light rail using renewable energy sources, the Project would not indirectly and remotely generate emissions from conventional power and electricity generation (e.g. coal or gas).
Substantially disturb contaminated or acid-sulphate soils.	No	There is an extremely low potential for acid sulfate soils locally and equally, the nature and scale of the construction work and forward operation of the light rail are not considered polluting or contaminating activities or processes of a scale that would contaminate the land under the definitions of either the EPBC Act or *Environment Protection Act 1997*. Further, all construction and operational activities are routinely

Feature	Yes/no	Description
		carried out and they can be adequately managed using standardised practices that are proven as being effective in avoiding, minimising and containing spill/leak incidents. Substantial disturbance of contaminated or acid-sulphate soils is considered unlikely.
Plants		
Involve medium or large-scale native vegetation clearance.	No	There were no native vegetation communities recorded in the Project study area during the 2017 surveys carried out by Biosis (Biosis, 2019). Two vegetation communities were identified in the study namely, modified grassland and urban vegetation (exotics). Although the modified grassland community includes areas of mixed native and exotic grasses, the native areas are likely to have been planted and therefore do not meet the criteria for native vegetation classification.
Involve any clearance of any vegetation containing a listed threatened species which is likely to result in a long-term decline in a population or which threatens the viability of the species.	No	There were no listed threatened flora species identified within the study area. Therefore, the proposed works would not involve the clearance of any listed threatened flora species which is likely to result in a long-term decline in a population or which threatens the viability of the species.
Introduce potentially invasive species.	No	The Project is highly unlikely to result in additional invasive species becoming established within the study area. It is recommended that a suitable weed management protocol is implemented to ensure that no transfer of weeds or pests occur because of the Project.
Involve the use of chemicals which substantially stunt the growth of native vegetation.	No	The Project would not involve the use of chemicals which would substantially stunt the growth of native vegetation.
Involve large-scale controlled burning or any controlled burning in sensitive areas, including areas which contain listed threatened species.	No	The Project will not involve large-scale controlled burning or any controlled burning in sensitive areas.
Animals		
Cause a long-term decrease in, or threaten the viability of, a native animal population or populations, through death, injury or other harm to individuals.	No	The study area provides limited fauna habitat for native animal populations other than the golden sun moth which was observed in the modified grassland and urban vegetation (planted exotic) vegetation communities. The Project has the potential to cause a long-term decrease or threaten the viability of the small golden sun moth population in the study area. As a precautionary approach has been taken, assuming a loss of the entire recorded golden sun moth habitat (2.6 hectares based on 2019 survey data compared to 6.9 hectares of habitat based on 2017 data). Through landscaping there is the potential to create additional habitat with native species preferred by the golden sun moth.
Displace or substantially limit the movement or dispersal of native animal populations.	No	The study area provides limited fauna habitat for native animal populations other than the golden sun moth which was observed in the modified grassland and urban vegetation (planted exotic) vegetation communities. Although these vegetation communities provide habitat for the golden sun moth, this species has a very limited dispersal ability and the proposed works are unlikely to substantially limit the movement of dispersal of this species outside of their current limitations.
Substantially reduce or fragment available habitat for native species.	No	The study area provides limited fauna habitat for native animal populations other than the golden sun moth. The golden sun moth habitat within the study area is not located on Commonwealth Land and as this species is a matter of national environmental significance, impacts will be considered under the Significant Impact Guidelines 1.1 and covered by the controlling provisions for a matter of national environmental significance.
Reduce or fragment available habitat for listed threatened species which is likely to displace a population, result in a long-term decline in a	No	The study area provides limited fauna habitat for native animal populations other than the golden sun moth. The golden sun moth habitat within the study area is not located on Commonwealth Land and as this species is a matter of national environmental significance, impacts will be considered under the Significant Impact Guidelines 1.1 and covered by the controlling provisions for a matter of national environmental significance.

Feature	Yes/no	Description
population, or threaten the viability of the species.		
Introduce exotic species which will substantially reduce habitat or resources for native species.	No	The Project would not involve the use of chemicals which would substantially reduce habitat or resources for native species.
Undertake large-scale controlled burning or any controlled burning in areas containing listed threatened species.	No	The Project would not involve large-scale controlled burning or any controlled burning in sensitive areas.
People and communities		
Substantially increase demand for, or reduce the availability of, community services or infrastructure which have direct or indirect impacts on the environment, including water supply, power supply, roads, waste disposal, and housing.	No	The approach would be to construct the Project without any loss in provision or access to public and community infrastructure and services including the car parking on London Circuit, the Rapid (bus) routes, and the public open spaces of City Hill, Henry Rolland Park and Lake Burley Griffin foreshore area. Temporary traffic management controls and restrictions during construction may inconvenience road users, pedestrians and cyclists temporarily, however, these works would be planned and executed under a traffic management plan and potential impacts are only expected to be minor. Other temporary amenity-related impacts may be experienced by people local to the route such as noise and dust impacts. Again, these are common construction impacts that can be effectively managed and minimised through implementing standard controls through a CEMP. These impacts are therefore considered unlikely to significantly and substantially impacts on the local community. Extending the light rail is considered to bring notable public transport benefits to Canberra by connecting people across the city and improving access to key areas.
Affect the health, safety, welfare or quality of life of the members of a community, through factors such as noise, odours, fumes, smoke, or other pollutants.	No	During construction, there is a potential risk of encountering contaminants of concern through mobilising residual contaminants most likely associated with any imported storage of hydrocarbons, uncontrolled fill, and/or the road's formation (e.g. road base materials, bitumen and/or tar). There is also the potential for leaks and spills during operational maintenance activities. All construction and operational activities are routinely carried out and they can be adequately managed using standardised practices that are proven as being effective in avoiding, minimising and containing spill/leak incidents. There is also likely to be some temporary amenity-related impacts experienced by people local to the route such as traffic, noise and dust impacts. Again, these are common construction impacts that can be effectively managed and minimised through implementing standard controls through a CEMP. These impacts are therefore considered unlikely to affect the health, safety, welfare or quality of life of members of the community.
Cause physical dislocation of individuals or communities.	No	Extending the light rail will improve accessibility and connectivity for individuals and communities, particularly between the city and a range of public amenity and infrastructure around the Civic precinct and lake foreshore area. There will be no physical dislocation of individuals or communities caused by the Project.
Substantially change or diminish cultural identity, social organisation or community resources.	No	The Project will not substantially change or diminish cultural identity, social organisation or community resources. London Circuit forms part of the heart of the city providing a looped circuit of some of Canberra's most cultural institutions, open greenspaces including City Hill and Henry Rolland Park and the redeveloped culturally diverse Acton Waterfront precinct. Construction of the light rail will improve access to these areas, providing an opportunity to extend the cultural diversity of Canberra by connecting multiple suburbs to the social and cultural amenity of the areas surrounding London Circuit.
Heritage		
Permanently destroy, remove or substantially alter the fabric (physical material including structural elements and other components, fixtures,	No	There are no Aboriginal heritage places or objects within or local to the study area. There is the potential for encountering unrecorded or undiscovered heritage items or archaeology, however this is typical of many urban developments and major projects and it can be effectively managed through an unexpected finds procedure. There are several non-Aboriginal heritage items within and local to the study area. There are four registered heritage places located within the study area, two Commonwealth heritage places (Reserve Bank of Australia and Parliament House Vista) and two territory listed heritage places (ANZ Bank Building and Sydney and Melbourne Buildings). The

Feature	Yes/no	Description
contents, and objects) of a heritage place.		default design is to build light rail down the middle (median) of London Circuit and Commonwealth Avenue. The Project would have no direct impact on the built heritage identified in the study area, however, there is potential for tree removal/planting within the road reserve. Trees can be aligned to minimise visual prominence and avoid them blocking key heritage values and views. There is the potential for indirect impacts to heritage items within and adjacent to the study area, including cosmetic impacts due to construction and operational vibration. However, it is expected that any vibration impacts can be avoided by careful selection and use of construction equipment and various controls and maintenance measures to manage operational vibration. A detailed heritage impact assessment, including a heritage visual impact assessment would be prepared in close consultation with community stakeholders exploring opportunities to reduce impacts to cultural heritage, including potential impacts to the visual relationship of Parliament House Vista with other heritage items within the wider area. The Project is considered unlikely to have a significant impact on heritage values, with any impacts considered to be manageable through design refinement and standard mitigation.
Involve extension, renovation, or substantial alteration of a heritage place in a manner which is inconsistent with the heritage values of the place.	No	There are four heritage places located within the study area, two Commonwealth heritage places (Reserve Bank of Australia and Parliament House Vista) and two territory listed heritage places (ANZ Bank Building and Sydney and Melbourne Buildings). The default design is to build light rail down the middle (median) of London Circuit and Commonwealth Avenue. As such, the Project would involve no direct impact on these heritage items and would not involve any extension, renovation of substantial alteration to these.
Involve the erection of buildings or other structures adjacent to, or within important sight lines of, a heritage place which are inconsistent with the heritage values of the place.	No	There are several listed and nominated (e.g. put forward for listing) places that either front or overlook London Circuit and Commonwealth Avenue whose amenity, setting and vistas may be temporarily impacted from carrying out various disruptive construction activities such as track laying, earthworks and stop construction. Principal are the ANZ Bank Building, Reserve Bank of Australia, Parliament House Vista, the Law Courts of Australia on London Circuit and the Melbourne Building and Sydney Building on Northbourne Avenue. However, as the area is already highly urbanised and a transport hub for Canberra, operation of the Project is unlikely to impact on the core values of the surrounding heritage places as the light rail will operate within the current extents of a key transport locality for Canberra along the existing road route. The extent of permanent impacts would also be limited in nature and scale with the light rail built down the middle (median) of London Circuit and Commonwealth Avenue.
Substantially diminish the heritage value of a heritage place for a community or group for which it is significant.	No	There are no Aboriginal heritage places or objects within or local to the study area. There is the potential for encountering unrecorded or undiscovered heritage items or archaeology, however this is typical of many urban developments and major projects and it can be effectively managed through an unexpected finds procedure. There are several non-Aboriginal heritage items within and local to the study area. There are four registered heritage places located within the study area, two Commonwealth heritage places (Reserve Bank of Australia and Parliament House Vista) and two territory listed heritage places (ANZ Bank Building and Sydney and Melbourne Buildings). The default design is to build light rail down the middle (median) of London Circuit and Commonwealth Avenue. The Project would have no direct impact on the built heritage identified in the study area, however there is potential for tree removal/planting within the road reserve. Trees can be aligned to minimise visual prominence and avoid them blocking key heritage values and views. There is the potential for indirect impacts to heritage items within and adjacent to the study area, including cosmetic impacts due to construction and operational vibration. However, it is expected that any vibration impacts can be avoided by careful selection and use of construction equipment and various controls and maintenance measures to manage operational vibration. A detailed heritage impact assessment, including a heritage visual impact assessment would be prepared in close consultation with community stakeholders exploring opportunities to reduce impacts to cultural heritage, including potential impacts to the visual relationship of Parliament House Vista with other heritage items within the wider area. The Project is considered unlikely to substantially diminish the heritage value of a heritage place, with any impacts considered to be manageable through design refinement and standard mitigation.
Substantially alter the setting of a heritage place in a manner which is inconsistent	No	There are no Aboriginal heritage places or objects within or local to the study area. There is the potential for encountering unrecorded or undiscovered heritage items or

Feature	Yes/no	Description
with the heritage values of the place.		archaeology, however this is typical of many urban developments and major projects and it can be effectively managed through an unexpected finds procedure. There are several non-Aboriginal heritage items within and local to the study area. There are four registered heritage places located within the study area, two Commonwealth heritage places (Reserve Bank of Australia and Parliament House Vista) and two territory listed heritage places (ANZ Bank Building and Sydney and Melbourne Buildings). The default design is to build light rail down the middle (median) of London Circuit and Commonwealth Avenue. The Project would have no direct impact on the built heritage identified in the study area, however there is potential for tree removal/planting within the road reserve. Trees can be aligned to minimise visual prominence and avoid them blocking key heritage values and views. There is the potential for indirect impacts to heritage items within and adjacent to the study area, including cosmetic impacts due to construction and operational vibration. However, it is expected that any vibration impacts can be avoided by careful selection and use of construction equipment and various controls and maintenance measures to manage operational vibration. However, as the area is already highly urbanised transport hub for Canberra and the proposed design for the light rail will operate within the current extents of London Circuit and Commonwealth Avenue, operation of the Project is unlikely to substantially alter the setting of a heritage place in a manner which is inconsistent with the heritage values of the place as the function of this area will be maintained as a key transport locality for Canberra supporting access and connectivity to, from and across the city.
Substantially restrict or inhibit the existing use of a heritage place as a cultural or ceremonial site.	No	The default design is to build light rail down the middle (median) of London Circuit and Commonwealth Avenue. As such, the Project would have no direct impact on the built heritage identified in the study area and is unlikely to substantially restrict or inhibit the existing use of a heritage place. Likewise, as the Project is located within a highly urbanised transport hub for Canberra and the proposed design for the light rail will operate within the current extents of London Circuit and Commonwealth Avenue, the Project is unlikely to substantially restrict or inhibit views of important vistas such as Parliament House Vista.
Significant Impact Guidelines for the critically endangered Golden Sun Moth (*Synemon plana*; Commonwealth of Australia 2009)		
Habitat loss, degradation or fragmentation >0.5 ha of a large or contiguous habitat area (>10 ha)	Not applicable	The area of golden sun moth habitat within the study area does not form part of a large or contiguous habitat area consisting of greater than 10 hectares.
Any habitat loss, degradation or fragmentation of a small or fragmented habitat area (<10 ha).	Yes	As a precautionary approach, the project is expected to impact between 2.6 hectares (2019 survey) to 6.9 hectares (2017 survey) of golden sun moth habitat consisting of one population, resulting in further fragmentation to the existing population. Despite the difference in the potential extent of habitat impact, the overall assessment is that the entire population would be lost to the construction footprint.
Fragmentation of a population through the introduction of a barrier to dispersal	Yes	The project involves the construction of a linear light rail corridor of approximately 50 metres in width through all part of the existing golden sun moth population. The corridor will likely form an obstructive barrier to dispersal, thereby fragmenting existing populations within the study area.

9 Summary

This Chapter summarises the self-assessment process, confirming if the Project should be referred to the Australian Government.

This PEA has identified the key issues associated with the Project under the EPBC Act.

9.1 Matters of national environmental significance

Nationally threatened species: critically endangered golden sun moth

The self-assessment made against the Significant Impact Guidelines 1.1 determined that the Project's actions are "*likely to have a significant impact on the critically endangered golden sun moth as there is a real chance or possibility that it would*":

- At worst:
  - Result in the loss of a single small and fragmented population.
  - Result in the removal of up to 6.9 hectares of habitat occupied by the species.
- If any of the population remains viable after future design refinements:
  - Be further fragmented to the point of the adults becoming "*isolated by more than 200 metres, with the additional likelihood that any sites from which the species had gone extinct would be unlikely to be naturally recolonised*" (Significant Impact Guidelines for the critically endangered golden sun moth *Synemon plana,* 2009)
- Independent of the above outcomes:
  - Adversely affect habitat at London Circuit, Commonwealth Avenue and Parkes Way that is critical to the survival of a small and fragmented golden sun moth population where "*any habitat loss, degradation and fragmentation*" is considered significant (Significant Impact Guidelines for the critically endangered golden sun moth *Synemon plana,* 2009)
  - Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the golden sun moth, as a species, would likely decline.
  - Interfere with the recovery of the golden sun moth as a species.
  - Disrupt the breeding cycle of the identified golden sun moth population.

Despite the aim to reduce habitat loss it could not be avoided. This means there would still be a significant impact under the guidelines. Major Projects Canberra would therefore work with key stakeholders to establish an appropriate treatment that would involve offsets and other controls aligned with the Australian Government's *Environment Protection and Biodiversity Conservation Act 1999: Environmental Offset Policy 2012* and its supporting guidance documents.

For the Project to go ahead, its actions would need controlling under the EPBC Act in light of the unavoidable significance of its impacts on a golden sun moth population and its supporting habitat.

9.2 Commonwealth Land

The self-assessment made against the Significant Impact Guidelines 1.2 determined that the Project's actions are not likely to have a significant environmental impact on Commonwealth Land.

While the construction works would involve some notable impacts, which at times may cause disruption and inconvenience, they would be short-term and temporary. While the vegetation and tree removal needed to construct the Project would be permanent, the impact would be mitigated through introducing an effective urban landscape and vegetation planting strategy that would improve the public realm and amenity of the route. This would include the replacement of all trees on at least a one-for-one basis. The landscape and vegetation planting strategy would also be prepared to respect the values of the National Capital Plan, Designated Areas, and Commonwealth Heritage Management Plans. The objective would be to reinforce and supplement the existing amenity character of the area.

Commonwealth heritage place: Reserve Bank of Australia

The Reserve Bank of Australia is on leased territory land. It is a Commonwealth heritage place, and therefore it should be managed according to the provisions of Appendix B of the Significant Impact Guidelines 1.2, which state that there must be "*no contravention of a [management] plan made under the EPBC Act….or authorise persons to do so, or omit to do, anything that would be inconsistent with such a plan*".

In the case of the Project, its only 'contravention' of the plan would be to the brick paving detail at the front of the bank, which may be impacted through utility and other infrastructure work in the footpath. While this is the case, the paving in this area was replaced in 2010 and 2011 to improve drainage and remove a trip hazard. As such, it is not original; something recognised in the current plan of management (Eric Martin and Associates, 2012). This means any impact can be effectively managed through a similar replacement process.

The introduction of light rail, removal and replacement of vegetation and tree planting would change the aesthetic and appearance of London Circuit. Despite this, the road would continue to operate as a transport corridor. There is also opportunity to design and align the infrastructure to minimise its visual prominence and to avoid them blocking key heritage values and views. The infrastructure can also be designed to respect the heritage characteristics of the values in the study area, while the tree species and their planting location and density can also be selected to respond to Canberra's Living Infrastructure Plan and the National Capital Plan precinct codes and the Territory Plan development codes.

It is also possible to restrict the types and size of equipment used near the bank to prevent any vibration impacts consistent with German Standard DIN 4150-3: 1999-02 on Structural Vibration – Part 3: Effects of vibration on structures.

The potential impacts associated with the Project's construction and operation are not expected to significantly affect the bank's commonwealth heritage values and attributes. Notwithstanding, a range of mitigation and management measures have been developed to guide the ongoing planning, design, construction and operation of the Project.

Commonwealth heritage place: Parliament House Vista

The Parliament House Vista is a Commonwealth heritage place. Given that the introduction of light rail would still see Commonwealth Avenue function as a transport corridor there would be no principal change in its context, setting or relationship with the vista other than visually and indirectly through the introduction of light rail infrastructure and the Commonwealth Park stop. While this infrastructure would be visible from within the vista, the existing tree planting bordering Commonwealth Park would continue to act as a suitable visual buffer. Also, these design elements would not be visible from within the

vista to the south of the lake due to the separation distances, flat-to-undulating topography, and intervening planting.

The apex of the Commonwealth Avenue bridge also is likely higher than the maximum height of the Commonwealth Park stop infrastructure. The stop would also be located at a natural low point along Commonwealth Avenue.

The only direct impact on the vista would be from possibly locating the traction power substation in Commonwealth Park. However, it would be placed in a well-hidden area in the park next to an existing substation. This is unlikely to impact on views and the area's heritage amenity to the extent that it would materially or negatively impact the values of the vista.

The only direct impact on the Parliament House Vista would result from installing the traction power substation next to Regatta Place. Its final location has been selected to reduce the impact on important viewscapes while respecting the area's heritage amenity. This decision has been taken to avoid any materially significant negative impact on the vista's values.

Environmental impacts

Commonwealth Avenue is also National Land, which under the EPBC Act is considered Commonwealth Land. Significant Impact Guidelines 1.2 describes the need to identify if any actions would significantly impact on defined Commonwealth land environmental values. Specifically, these are: ecosystems and their constituent parts; natural and physical resources; qualities and characteristics of locations places and areas; heritage values of places; and/or social, economic and cultural values.

While it is evident that there would be impacts on Commonwealth Land during the Project's construction and operation, the assessment concludes that mitigation is available to avoid, minimise and manage actions to ensure there would be no significant residual effects on the receiving environment as described in Table 7.1. Table 7.2 also confirms that the severity of the residual risk on Commonwealth Land environmental values after introducing the proposed mitigation would be minor.

Specifically, the Project can be sensitively and carefully designed to ensure the landscape and amenity character the route and surrounding area would at least be maintained or enhanced in accordance with the Territory Plan and National Capital Plan. This includes seeking opportunities to minimise impacts on the cultural values within the broader setting of the Central National Area and would be something developed in consultation with Territory and Australian Government stakeholders.

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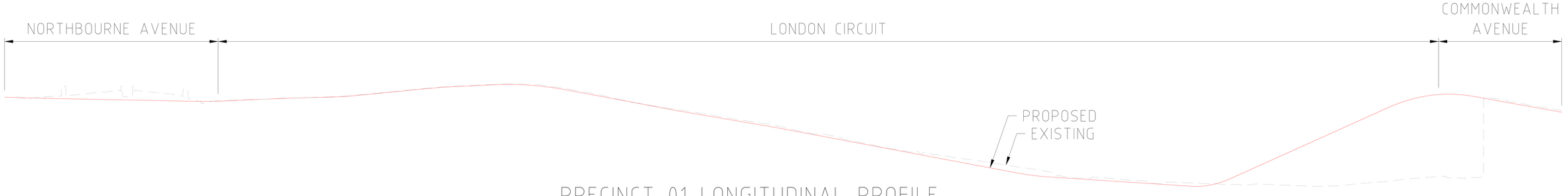

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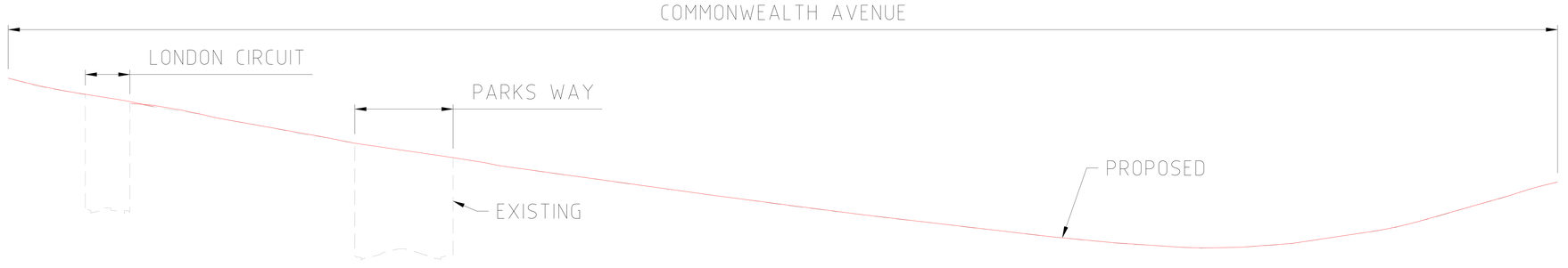

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