REVITALISING NEWCASTLE

Newcastle Light Rail Associated Road Upgrades

Review of Environmental Factors

November 2016

NSW MAKING IT HAPPEN

NSW GOVERNMENT Transport for NSW

GHD

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Abbreviations

Abbreviation	Definition
AHD	Australian height datum
AHIMS	Aboriginal Heritage Information Management System
AHIP	Aboriginal heritage impact permit
CBD	central business district
CEMP	construction environmental management plan
CONCAWE	noise propagation algorithm used by a number of proprietary noise software modelling packages
Council	Newcastle City Council
DBH	diameter at breast height
DECCW	Former Department of Environment, Climate Change and Water
EPA	Environment Protection Authority
EP&A Act	*Environmental Planning and Assessment Act 1979*
EP&A Regulation	*Environmental Planning and Assessment Regulation 2000*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
EPL	environment protection licence
Framework	Transport Environment and Sustainability Policy Framework
GHD	GHD Pty Ltd
GREP	Government Resource Efficiency Policy
Infrastructure SEPP	*State Environmental Planning Policy (Infrastructure) 2007*
ISCA	Infrastructure Sustainability Council of Australia
the LEP	*Newcastle Local Environmental Plan 2012*
LGA	local government area
LALC	Local Aboriginal Land Council
light rail project	Newcastle Light Rail project
light rail REF	Newcastle Light Rail Review of Environmental Factors

Abbreviation	Definition
NCA	noise catchment area
OEH	NSW Office of Environment and Heritage
POEO Act	*Protection of the Environment Operations Act 1997*
RBL	rating background level (noise)
REF	review of environmental factors
Roads and Maritime	NSW Roads and Maritime Services
SEPP	state environmental planning policy
SRIV	sustainable retention index value
State and Regional Development SEPP	*State Environmental Planning Policy (State and Regional Development) 2011*
SULE	safe useful life expectancy
SWL	sound power level
TPZ	tree protection zone
TSC Act	*Threatened Species Conservation Act 1995*
VTA	visual tree assessment
WM Act	*Water Management Act 2000*
WMP	waste management plan

Definitions

Term	Definition
ecologically sustainable development	Development that uses, conserves and enhances the resources of the community so that ecological processes on which life depends are maintained, and the total quality of life, now and in the future, can be increased
emission	A substance discharged into the air
heritage listed	An item, building or place included on statutory heritage lists maintained by local, State or the Australian Government
$L_{A90(period)}$	The A-weighted sound pressure level that is exceeded for 90 per cent of the time over which a given sound is measured. This is considered to represent the background noise e.g. $L_{A90(15\ min)}$.
$L_{Aeq(period)}$	Equivalent sound pressure level: the steady sound level that, over a specified period of time, would produce the same energy equivalence as the fluctuating sound level actually occurring.
level of service	Defined by Austroads as a measure for ranking operating road and intersection conditions, based on factors such as speed, travel time, freedom to manoeuvre, interruptions, comfort and convenience
local road	Road used primarily to access properties located along the road
the proposal	The construction and operation of the roadworks as described in Section 4
proposal site	The construction footprint, including the area that would be directly affected by construction works
rating background level	The overall single-figure background level representing each assessment period (day/evening/night) over the whole monitoring period. This is the level used for assessment purposes.
relic	A relic is defined by the NSW *Heritage Act 1977* as 'any artefact, object or material evidence which relates to the settlement of the area that comprises New South Wales, not being Aboriginal settlement, and which is of State or local heritage significance.'
sensitive receivers	Land uses which are sensitive to potential noise, air and visual impacts, such as residential dwellings, schools, hospitals or other places people spend time
study area	The area including and adjacent to the proposal site, with the potential to be impacted by activities on the proposal site
vibration	The variation of the magnitude of a quantity which is descriptive of the motion or position of a mechanical system, when the magnitude is alternately greater and smaller than some average value or reference. Vibration can be measured in terms of its displacement, velocity or acceleration. The common units for velocity are millimetres per second (mm/s). Vibration velocity is also often expressed in terms of decibels (VdB re $1x10^{-6}$ inches/second in the US FTA Guideline).

Executive summary

Overview

The NSW Government has committed more than $500 million to revitalise Newcastle's city centre, through the Newcastle Urban Transformation and Transport Program (the Program).

The Program aims to bring people back to the city centre by strengthening connections between the city and the waterfront, creating job opportunities, providing more public places and spaces, and delivering better transport solutions.

The NSW Government is helping to create a city where more people want to live, work and play.

A number of transport improvements are underway to better connect the city centre to the harbour and improve the experience of moving around the city. The introduction of light rail and new modern interchange facilities at Wickham are just part of the program of transport improvements for Newcastle.

Crossings at Steel Street, Kuwumi Place, Worth Place, Civic Station, Argyle Street, Perkins Street and Wolfe Street now allow for easy pedestrian and cyclist access across the former rail corridor. Redundant rail infrastructure has been removed as we prepare for light rail and the urban renewal initiatives.

Light rail is on its way, with formal determination in August 2016 that confirmed the Newcastle light rail project (light rail project) will go ahead. The NSW Government's commitment to investment in Newcastle is paying off. Light rail will deliver superior levels of service, reliability and comfort, improved accessibility and will open up more urban renewal opportunities. It is one-step further in helping to create a truly great city.

As part of the *Newcastle Light Rail Review of Environmental Factors* (light rail REF) (GHD 2016), released for public comment in early 2016, Transport for NSW identified the need for road works to service the future delivery of the light rail project. Some roads and intersections in the city will be reconfigured and upgraded to accommodate the new light rail and to ensure traffic flows efficiently through the city centre.

In the *Newcastle Light Rail Submissions Report* (submissions report), released in August 2016, Transport for NSW committed to working with key stakeholders including the Newcastle City Council (Council), to develop a suite of additional road works that would complement the introduction of light rail and provide improved traffic conditions well into the future.

Transport for NSW also committed to undergo an additional assessment process for these road works, to ensure enhanced transparency for the community, which is being delivered through this supplementary REF process.

The proposal

As Newcastle grows and new transport initiatives are introduced, changes to existing road networks need to happen. Road capacity improvements will improve access for vehicles and help prevent and ease congestion as we prepare for light rail. Transport for NSW in conjunction with Council and NSW Roads and Maritime Services (Roads and Maritime) has developed a number of traffic improvements along and around the light rail route. These improvements include work on key intersections, changes to parking and changes to bus stops.

These improvements are designed to complement the introduction of light rail, and support transport movements within Newcastle's city centre.
This proposal will:

- refine the configuration of key intersections to increase capacity and optimise traffic movements
- alter parking arrangements in the city centre to allow traffic to use the kerbside lanes and ensure traffic continues to flow smoothly while light rail is being constructed and during its future operation
- support traffic movements by relocating and removing bus stops to allow better traffic flow.

Need for the proposal

Light rail is an investment that offers the opportunity to transform Newcastle into a modern, dynamic city centre, and is just one of the projects that will help unlock Newcastle's potential. The NSW Government's plan for Newcastle will not only improve the city centre's urban amenity but also ensure Newcastle can accommodate future population growth rather than end up in gridlock.

The NSW Government has called on the world's best transport operators to create an integrated transport system for Newcastle with one goal in mind; delivering better transport services for customers. It is important to remember that to make Newcastle a truly great city, providing a modern light rail system that encourages greater public transport use and reduces the city's heavy reliance on cars is critical.

The proposal is required to support the introduction of light rail and cater for the growing demand for access into Newcastle's city centre. Some of the roads and intersections in the city centre are already at capacity and changes are required to support both the construction and operation of light rail in Newcastle, which may change the way traffic moves, particularly on Hunter Street and King Street.

In summary, improvements are needed at several critical roads and intersections locations in the city centre to:

- allow the city centre road network to continue to function in response to anticipated changes in traffic demands, traffic priorities and travel patterns
- maintain the operational performance of the road network to support other road users
- improve road efficiency and allow quality integrated public transport services to meet future demand
- improve customer experience by improving the safety, amenity and efficiency of the road network.

Environmental impacts

A number of environmental issues have been examined and assessed throughout the design development and preparation of the REF. Consultation and engagement has been undertaken with stakeholders during the assessment to ensure the key potential impacts have been identified at an early stage, and where possible, avoided or appropriate mitigation measures developed.

The potential beneficial and adverse impacts of the proposal are described in section 5.

Strategies to avoid, mitigate and manage potential impacts have been developed to identify not only the environmental requirements, but also to ensure commitments around communicating with the local community and businesses are in place.

The proposal helps enable implementation of the light rail project and offers a way to improve road network efficiency and functionality. The long-term benefits of the proposal outweigh the short term impacts, and will allow light rail to better integrate with the road network.

Options considered

In early 2016, the proposal was first identified as part of the light rail REF. The focus was to identify the city centre roads and intersections impacted by the introduction of light rail, and to develop traffic solutions to improve road function.

Community feedback on the light rail REF was clear. Traffic flows and access to the city centre are important to the people of Newcastle. More work needed to be done to consult with key stakeholders and develop options for traffic and road solutions. Additional investigations have now been done to support the design of complementary road works included in this proposal. Feedback from key stakeholders, Council and Roads and Maritime, and the community has been considered in developing the preferred option.

Detailed investigations, feedback from the community and consultation with key stakeholders have all been used to evaluate and select the preferred option.

Key features of the proposal

Design component	Features
Changes to intersection at Stewart Avenue/ Hannell Street	• Extension of the right turn lane on Hannell Street southbound into Throsby Street. • Line marking and realignment to form a dedicated left turn lane on Throsby Street. • A new dedicated left turn lane onto Bishopsgate Street from Hannell Street northbound. • A new southbound slip lane on Hannell Street into Honeysuckle Drive. • Realignment of Honeysuckle Drive to suit the eastbound slip lane. • Dangar Street cul-de-sac realigned to suit Honeysuckle Drive realignment. • Extension of the existing left turn bay and a new access into the light rail depot off Honeysuckle Drive. • Line marking to provide an additional through lane on Hannell Street (west) just north of the light rail route. • Installation of new concrete medians between Hunter Street and Dangar Street, on Honeysuckle Drive (from the Hannell Street intersection for about 100 metres) and at the corner of Hannell Street and Honeysuckle Drive.
Changes to Hunter Street and Steel Street intersection	• A new dedicated right turn bay on Hunter Street (west) on to Steel Street. • Extension of the concrete median in Steel Street (north) into the light rail route. • Line marking and adjustments to create additional travel lanes on Hunter Street east and west of the Steel Street intersection. • Adjustment of the kerb at the intersection to allow buses to turn left off Steel Street on to Hunter Street. • Construction of 1.5 metre wide medians on Hunter Street east and west of the intersection with Steel Street to accommodate installation of signals.
Changes to King Street and Derby Street intersection	• Line marking and adjustment to extend the right turning bay on Darby Street southbound into King Street. • A new left turn slip lane on Darby Street northbound into King Street south of the intersection. • Extension of the left turning lane on Darby Street northbound into Hunter Street. • Line marking and adjustments to extend the dedicated left turn bay on King Street (south) to turn into Darby Street (east of the intersection).

Design component	Features
Changes to parking arrangements	• Removal of 110 parking spaces This is additional to the parking spaces that would be removed for the implementation of the light rail project (refer section 5.4.10). • The majority of impacted parking spaces are 2P Ticket, with some 8P Ticket and some unrestricted parking spaces. Only two accessible parking spaces and two loading zones will be impacted. • Parking space to be impacted include: – Removal of 12 parking spaces on Throsby Street at the Hannell Street intersection (seven on the northern side of the road and five on the southern side). – Removal of 20 parking spaces on the southern side of Honeysuckle Drive just east of the Hannell Street intersection. – Removal of four parking spaces on Stewart Avenue (east) between Hunter Street and Little King Street. – Removal of six parking spaces on Stewart Avenue (west) between Warrah Street and Hebburn Street. – Removal of 10 parking spaces on Hunter Street just east of the Stewart Avenue intersection (five on the northern side of the road and five on the southern side). – Removal of 15 parking spaces on Hunter Street just west of the Steel Street intersection (five on the northern side of the road and 10 on the southern side). – Removal of six parking spaces on Steel Street (two on the eastern side north of the Hunter Street intersection and four on the western side south of the Hunter Street intersection). – Removal of 18 parking spaces on Hunter Street just east of the Steel Street intersection (10 on the northern side of the road and eight on the southern side). – Removal of 10 parking spaces on King Street (four on the western side of the Darby Street intersection and six on the eastern side of the Darby Street intersection). – Removal of nine parking spaces on Darby Street just north of the King Street intersection (three on the western side of the road and six on the eastern side).
Changes to bus stops	• Removal of the bus bay on the eastern side of Hannell Street just north of the light rail route. • Relocation of the bus stop on Hunter Street (north side) just east of the Steel Street intersection approximately 90 metres eastward to near Kuwumi Place. • Removal of the bus stop on Hunter Street (south side) just east of the Steel Street intersection.

Property acquisition

About 1500 square metres of land would need to be acquired to enable the road upgrades. Negotiations have begun with land owners around this process. The land parcels to be acquired are directly adjacent to the road corridor. It is not anticipated that this acquisition would impact on the current or future use of any of the surrounding land, including Civic Park.

All land acquisitions will be undertaken in accordance with the *Land Acquisition (Just Terms Compensation) Amendment Bill 2016*.

The reforms to the NSW Government land acquisition process announced in October this year, ensure landowners will be given more information, more time and more support though the acquisition process

Recent reform to the NSW land acquisition process makes the NSW process the fairest and most generous scheme offered anywhere in the country – we now have a more sensitive and supportive acquisition process than ever before.

Construction

Road and intersection improvements are proposed to start construction in early 2017.

The NSW Government has made a commitment to minimise impacts on the community. To meet this commitment, Transport for NSW will work with the managing contractor to identify how these complementary road upgrades can be delivered at the same time as some of the light rail construction components. The work is anticipated to take around seven months to complete but would not extend the overall construction timeframe due to opportunities for construction to occur concurrently with the light rail construction.

Statutory and planning framework

The proposal may be undertaken without development consent under Part 5 of the *NSW Environmental Planning and Assessment Act 1979* (EP&A Act) in accordance with clause 79 of *State Environmental Planning Policy (Infrastructure) 2007.*

Prior to determining whether to proceed with the activity as set out in the proposal, Transport for NSW is required under Part 5 of the EP&A Act to 'examine and take into account to the fullest extent possible all matters affecting, or likely to affect, the environment by reason of that activity'. This REF documents the required assessment of environmental impacts and describes measures proposed to mitigate any adverse impacts.

Community and stakeholder consultation

Feedback on the light rail REF showed community and stakeholder support for road and intersection improvements to complement the introduction of light rail, and also highlighted the need to talk continually with local community and stakeholders about the project and proposed changes.

Since the determination to proceed with the light rail project in August 2016, the Program team has continued to keep the community informed through door knocks, one on one meetings, regular meetings with key stakeholders, responding to community enquiries and providing project information through the project website and direct mail.

To provide the public and other stakeholders with an opportunity to understand this proposal and submit feedback, the REF will be on display for four weeks from 21 November to 19 December at the following locations:

- City of Newcastle City Administration Centre, 282 King Street, Newcastle
- Newcastle City Library, Ground Floor, Laman Street, Newcastle
- Transport for NSW Newcastle office, Ground Floor, 239 King Street, Newcastle.

The REF will also be available online at http://ourtransport.revitalisingnewcastle.com.au/delivering-newcastle-light-rail/documents

The light rail REF and submissions report are also available at the above link.

How to make a submission

The view of the community and stakeholders are helping to shape the future, feedback received throughout the display period will help us finalise the design for the proposal. You can provide your feedback by sending your written comments to:

projects@transport.nsw.gov.au

haveyoursay.nsw.gov.au

Transport for NSW
PO Box 2324
Dangar NSW 2309

Submissions must be received by 5.00pm on 19 December 2016.

What happens next?

Transport for NSW will review the submissions and consider all feedback received. Your views are important and after considering community and stakeholder feedback, Transport for NSW will determine if the proposal needs any changes or if it will proceed.

We are preparing engagement plans to continue to liaise with key stakeholders and the community during the detailed design and construction of the proposal. This ongoing engagement is an important part of the overall Program commitments made by the NSW Government and will play an important role in reducing any potential impacts and enhancing the benefits of the proposal for everyone.

1. Introduction

This section provides the background and an introduction to the project, an overview of the key features of the proposal, and the scope and purpose of this report.

1.1 Background to the proposal

The NSW Government is working in partnership with local communities, the Newcastle City Council (Council), businesses and individuals to help create a vision for revitalisation that builds on the strengths of the city and its people. Through the Newcastle Urban Transformation and Transport Program (the Program), the NSW Government is investing over $500 million to bring people back to the city centre by strengthening connections between the city and the waterfront, creating employment opportunities, providing more public space and amenity, and delivering better transport.

The Program brings together a number of planning, urban renewal and transport initiatives that collectively will create a revitalised city centre in Newcastle that positions the city as a great place to live, work and play.

The Newcastle light rail project (light rail project) is one of the key transport components of the Program. Transport for NSW determined to proceed with the light rail project in August 2016 after examining, amongst other things, the *Newcastle Light Rail Review of Environmental Factors* (light rail REF) (GHD, 2016) and the *Newcastle Light Rail Submissions Report* (submissions report) (TfNSW, 2016). Early works have commenced, reflecting the NSW Government commitment to follow through on its promises to help Newcastle reach its full potential. Further information on the light rail project can be found in the light rail REF and the submissions report, which are available on the Revitalising Newcastle website.

To facilitate the operation of the light rail project, some changes to the road network along and near the light rail route are required. Feedback provided by the community on the light rail REF said that traffic and access to the city centre are very important, and further investigations and consultation with key stakeholders has helped to develop the additional detail required on the proposed roadworks.

The proposal is separate to other concurrent and enabling works being planned for the city centre, including the Hunter Street revitalisation project and the proposal to rezone the former heavy rail corridor. Key government agencies are working together to deliver and manage the implementation of these projects (including this proposal) in an integrated manner.

GHD Pty Ltd (GHD) has been engaged by Transport for NSW to prepare this supplementary REF to provide additional information on the roadworks associated with the light rail project. This information will provide more detail to the community, including an assessment of the potential impacts that might arise from the works and what measures will be adopted to mitigate any impacts.

The construction and operation of the roadworks detailed in this document is referred to as 'the proposal' for the purposes of this document. The proposal will help avoid congestion, improve traffic flows, complement the introduction of light rail project, and help integrate light rail into the existing road network.

The proposal covers three key pinch point locations in the city centre that are essential in enabling light rail. It also includes changes to parking and bus stops to optimise traffic flows during the construction and operation of the light rail project.

The proposal will also include relevant management measures to reduce the potential for impact to the community and the environment during construction and operation.

The community and stakeholders should be assured that the works involved in the proposal have been assessed in light of the light rail project as a whole. This document, therefore, forms a supplement to the light rail REF and should be read in light of that document.

The proposal is subject to assessment and determination under Part 5 of the *NSW Environmental Planning and Assessment Act 1979* (EP&A Act). Feedback from the community and stakeholders will be an important component of the assessment.

1.2 Key features of the proposal

1.2.1 Location

The proposal is described in section 3 and the location of the proposal is shown in Figure 1.1. The study area is located within the City of Newcastle local government area (LGA).

Newcastle is the second biggest city in NSW and is the economic and cultural centre of the Hunter Region. Newcastle is growing, and is home to over 500,000 people, with 20 per cent located within the city centre. The city centre is a major employment area, characterised by its culture and heritage within a growing modern city.

The proposal site (the area that would be directly affected by construction works) is located in Newcastle, Newcastle West and Hamilton East in the Newcastle city centre. The proposal site is located mainly within the existing road corridors of Stewart Avenue/Hannell Street, Parry Street, Hunter Street, King Street, Steel Street, and Darby Street.

The works that form the proposal would be undertaken at three locations:

- Stewart Avenue/Hannell Street (between Hebburn Street to the south, and Throsby Street to the north). This includes works at the following intersections with Stewart Avenue:
  - Honeysuckle Drive/Hannell Street
  - Hannell Street/Throsby Street
  - Hunter Street
  - King Street/Parry Street
- Hunter Street/Steel Street intersection
- King Street/Darby Street intersection.

The study area for the proposal is defined as the wider area surrounding the proposal site, which is the area that has the potential to be directly or indirectly affected by the proposal (for example, by noise and vibration, visual or traffic impacts).

1.2.2 Key features

This proposal generally involves upgrading a number of intersections and other roadworks to improve the traffic flow and reduce congestion and includes:

- selected areas of road widening, generally within the existing road corridor but on adjacent land in some areas
- reducing the extent of centre road medians to install new turning lanes
- realigning existing traffic lanes to allow additional lanes in some area
- adjusting kerb lines where the road is widened
- road resurfacing following widening and realignment works as required.
- changes to footpaths, parking and cycle lanes where additional lanes are created
- changes to line marking and signage where additional lanes and realignments are proposed.

A detailed description of the proposal and the works that will be undertaken at each location is provided in Section 3.

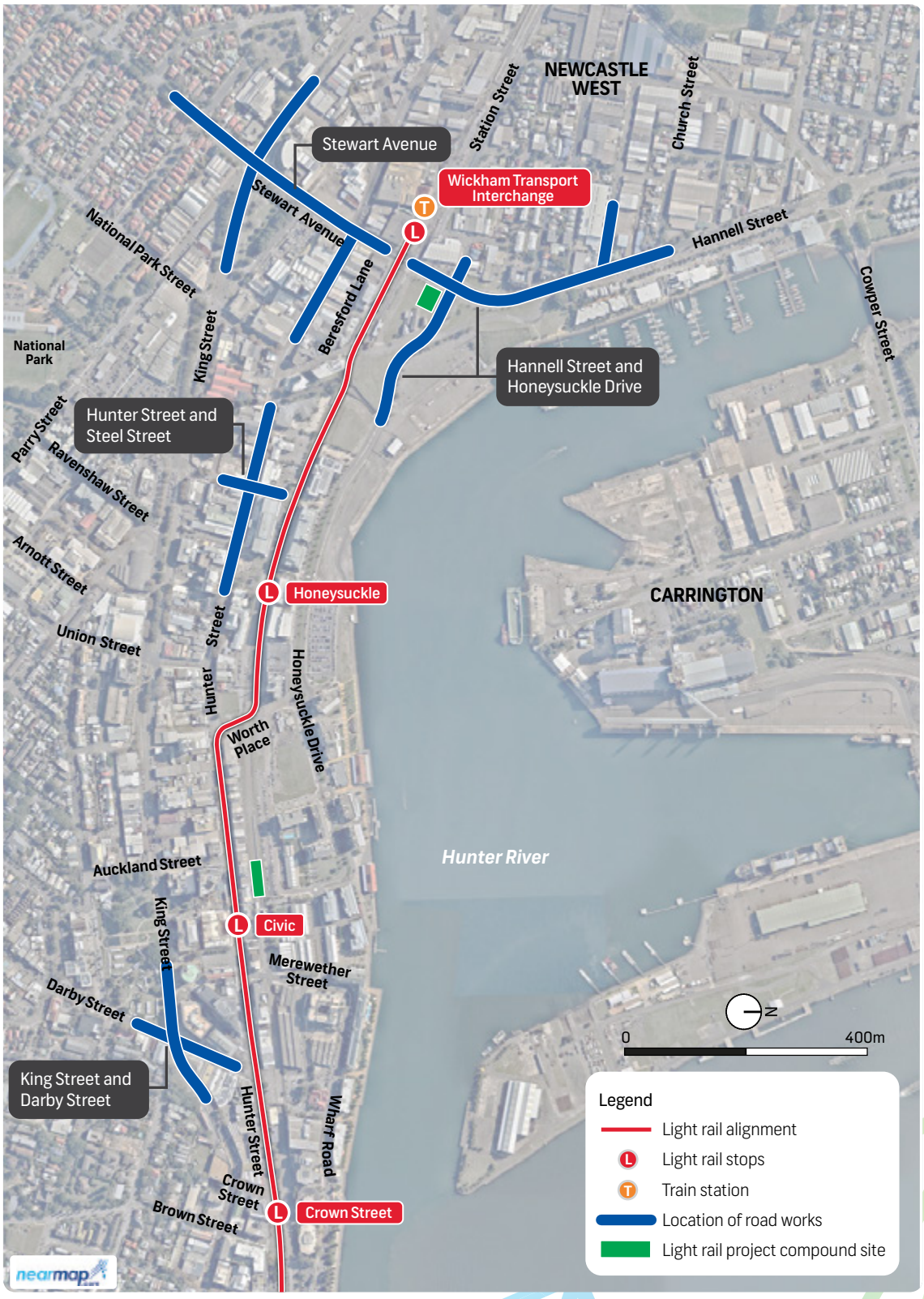

Figure 1.1 Location of the proposal

1.3 Scope of the REF

1.3.1 Purpose of the REF

Section 111 of the EP&A Act imposes a duty on Transport for NSW to 'examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment' by reason of the proposal. Under the provisions of Part 5, Transport for NSW is required to determine whether to proceed with the proposal, and what impact mitigation or environmental management measures are required.

The roadworks associated with the light rail project were initially described in an indicative fashion in the light rail REF. Subsequent to the determination of the light rail project, additional investigations and design work has been undertaken for some of these works. The purpose of this supplementary REF is to assess the impacts of the light rail project, as supplemented by the proposal, to assist Transport for NSW meet its obligations under section 111 of the EP&A Act.

This REF describes the proposal and summarises the results of an environmental impact assessment specific to the proposal. It provides information about the proposal as an input to the section 111 determination process. Transport for NSW will consider the findings of this REF as part of the determination process. In summary, the REF will assist Transport for NSW to undertake the following:

- determine whether the proposal, when examined in the context of the light rail project as a whole, is likely to have a significant effect on the environment or significantly affect threatened species, populations or ecological communities or their habitats
- identify appropriate mitigation measures, which form part of the activity as assessed
- determine whether the proposal, when examined in the context of the light rail project as a whole, should proceed to construction, taking into account to the fullest extent possible all matters affecting or likely to affect the environment (in accordance with section 111 of the EP&A Act).

1.3.2 Methodology

A number of activities have assisted in the preparation of this REF.

Listening to feedback from the local community and stakeholders as part of the light rail REF has helped shape the proposal.

Preparing the REF has involved:

- reviewing relevant information provided by Transport for NSW and publicly available
- listening to the feedback provided on the light rail REF
- visiting the proposal site
- undertaking specialist studies in relation to traffic and transport, noise and vibration, heritage and an arborist assessment of the potentially impacted trees
- desktop assessment of other potential environmental issues
- consultation with the Newcastle City Council (Council) and NSW Roads and Maritime Services (Roads and Maritime)
- meetings and discussions with Transport for NSW and the technical advisors engaged for the proposal.

1.3.3 Structure of the REF

This REF is structured as follows:

- **Section 1** – provides an introduction to the REF.
- **Section 2** – provides an overview of the statutory framework for the proposal.
- **Section 3** – provides the proposal description for the purposes of the REF and describes the strategic context.
- **Section 4** – describes the consultation undertaken for the proposal.
- **Section 5** – assesses the impacts of the proposal, and summarises the results of specialist impact assessments.
- **Section 6** – provides the environmental management requirements for the proposal and a consolidated list of the mitigation measures identified by the REF.
- **Section 7** – provides a conclusion to the REF.

2. Statutory framework

This section provides an overview of the statutory framework relevant to the proposal, including the assessment requirements, relevant environmental legislation and planning instruments.

2.1 Approvals and assessment pathway

The EP&A Act and the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation) are the main legislation relevant to planning and environmental assessment in NSW. The EP&A Act provides the framework for environmental planning and development approvals, and includes provisions to ensure that the potential environmental impacts of an activity are assessed and considered in the decision making process.

As described below, the proposal would be permissible without consent in accordance with *State Environmental Planning Policy (Infrastructure) 2007* (the Infrastructure SEPP), and is subject to the assessment requirements of Part 5 of the EP&A Act.

2.1.1 State Environmental Planning Policy (Infrastructure) 2007

Clause 8 of the Infrastructure SEPP states that if there is an inconsistency between it and any other environmental planning instrument, the Infrastructure SEPP prevails to the extent of the inconsistency.

Clause 79(1) of the Infrastructure SEPP provides that development for the purpose of a 'railway' or 'rail infrastructure facilities' may be carried out by or on behalf of a public authority without consent on any land. Under clause 78, the definitions of rail infrastructure facilities include 'railway tracks, associated track structures, cuttings, drainage systems, fences, tunnels, ventilation shafts, emergency accessways, bridges, embankments, level crossings and roads, pedestrian and cycleway facilities'. The proposal is considered to meet this definition, and as it is being carried out by a public authority, is permissible without consent.

Clauses 13 to 16 of the Infrastructure SEPP outline the requirements for consultation with councils and other public authorities for infrastructure development carried out by or on behalf of a public authority. Consultation with Council, as required under the Infrastructure SEPP, including for the proposal, was undertaken for the light rail project and is ongoing. Relevant agencies have been, and will continue to be, consulted in relation to the proposal (refer to Section 4).

The Infrastructure SEPP enables the removal of trees without development consent is ancillary or incidental to the activity. Twenty-six street trees would require removal to construct the proposal (discussed further in Section 5.2). However, the Transport for *NSW Vegetation Offset Guide* (2016) would be used to determine offsetting requirements in consultation with Council.

2.1.2 State Environmental Planning Policy (State and Regional Development) 2011

Sections 89C(2) and 115U(2) of the EP&A Act provide that a SEPP may declare any development, or any class or description of development, to be State significant infrastructure or State significant development. State Environmental Planning Policy (State and Regional Development) 2011 (the State and Regional Development SEPP) provides definitions of classes of development that are declared to be State significant infrastructure and State significant development. Subject to section 5.1.3, the proposal does not meet fall within these classes.

2.1.3 Part 5 of the EP&A Act

Section 110(1) defines a determining authority as 'a Minister or public authority and, in relation to any activity, means the Minister or public authority by or on whose behalf the activity is or is to be carried out or any Minister or public authority whose approval is required in order to enable the activity to be carried out'. Transport for NSW is the determining authority for the proposal.

For activities subject to assessment under Part 5, section 111 of the EP&A Act imposes a duty on a determining authority to 'examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment' by reason of the proposal.

Clause 228 of the EP&A Regulation lists the factors that must be taken into account when considering the likely impact of an activity under Part 5 of the EP&A Act. These factors are addressed in detail in Appendix A concerning the proposal.

Under section 112(1)(a) of the EP&A Act, an environmental impact statement is required for 'an activity that is likely to significantly affect the environment (including critical habitat) or threatened species, populations or ecological communities or their habitats'. Where an environmental impact statement is required, the State and Regional Development SEPP declares the development to be State significant infrastructure and therefore subject to Part 5.1.

At this stage and based on the matters contained in this supplementary REF, the proposal, when considered in light of the light rail project as a whole, is not considered likely to significantly affect the environment. Accordingly, an environment impact statement would not be required. However, Transport for NSW will make a final determination on whether or not the activity is likely to significantly affect the environment after this REF is placed on public display and submissions have been received and considered.

2.1.4 Local environmental plan

The Newcastle Local Environmental Plan 2012 (the LEP) applies to the land on which the proposal site is located. Irrespective of the provisions of the LEP, the proposal is permitted without consent as a result of the application of the Infrastructure SEPP. Section 115ZF(2) of the EP&A Act provides that the LEP does not apply to the proposal.

2.2 Other relevant legislative considerations

2.2.1 NSW legislation

Other environmental planning instruments and legislation that are directly relevant to the assessment of the proposal are considered in Table 2-1.

Table 2-1 Consideration of relevant legislation

Act	Potential approval requirements	Relevance to the proposal
Contaminated Land Management Act 1997	The NSW Environment Protection Authority (EPA) must be notified in writing of any contamination identified within the proposal site in accordance with the requirements of section 60 of the Act.	No known contamination sites have been identified within or in close proximity to the proposal site. Potential contamination issues are considered further in Section 5.2.1

Act	Potential approval requirements	Relevance to the proposal
Heritage Act 1977	Approval under section 57(1) for works to a place, building, work, relic, moveable object, precinct, or land listed on the State Heritage Register. The form of the application is specified by section 60. Section 57(2) provides that an exemption from the approval requirements of section 57(1) can be sought in certain circumstances An excavation permit is required under sections 139(1) and (2) to disturb or excavate any land containing or likely to contain a relic. The form of the application is specified by section 140. Section 139(4) provides that exceptions from the approval requirements of sections 139(1) and (2) can be sought in certain circumstances.	A statement of heritage impact was prepared for the proposal. The statement concluded that the proposal site is within the curtilage of one local listed heritage item and two conservation areas. Impacts are considered unlikely; however measures are provided in this REF to reduce the potential for impacts. Further information is provided in section 5.4.3.
Mine Subsidence Compensation Act 1961	Under section 15, approval is required to alter or erect improvements within a mine subsidence district.	The proposal site is located within the Newcastle Mine Subsidence District. Consultation with the Mine Subsidence Board would be undertaken by Transport for NSW prior to construction commencing.
National Parks and Wildlife Act 1974	An Aboriginal heritage impact permit (AHIP) under section 90 of the Act is required to harm or desecrate an Aboriginal heritage object.	An Aboriginal heritage due diligence assessment of the proposal was undertaken. The assessment identified four Aboriginal sites, which extend into the proposal site. The assessment concludes that there is the potential for Aboriginal objects to occur beneath the surface layer of historical disturbance. As the proposal would involve excavation and is likely to encounter Aboriginal objects, an AHIP would be required. Aboriginal consultation would be undertaken in accordance with the Aboriginal Cultural Heritage Consultation Requirements for Proponents (DECCW, 2010). This consultation has commenced, and further information is provided in Section 5.4.2.
Noxious Weeds Act 1993	Under Part 3 Division 1 of the Act, all private landowners, occupiers, public authorities and Councils are required to control noxious weeds on their land.	The approach to managing weeds during construction is discussed in Section 5.2

Act	Potential approval requirements	Relevance to the proposal
Protection of the Environment Operations Act 1997 (POEO Act)	An environment protection licence (EPL) is required for scheduled activities or scheduled development work. Scheduled activities requiring a licence relevantly include: 1. railway systems activities (clause 33) meaning: (a) the installation, on site repair, on-site maintenance or on site upgrading of track, including the construction or significant alteration of any ancillary works, or (b) the operation of rolling stock on track (c) where track means railway track that forms part of, or consists of, a network of more than 30 kms of track 2. land based extractive activities that involve the extraction, processing or storage of more than 30,000 tonnes of material per year (clause 19).	The proposal would not meet the current definition of railway systems activities. The need for an EPL would be confirmed in consultation with the EPA. The proposal would need to comply with the general obligations of the POEO Act.
Roads Act 1993	Approval under sections 138 for works within a public road. Clause 5 of Schedule 2 states that a public authority does not require consent for works on unclassified roads.	The proposal would involve impacts to classified public roads (Stewart Avenue (south of Hunter Street), Hannell Street, King Street (between Stewart Avenue and Darby Street), Hunter Street (west of Stewart Avenue), Darby Street (south of King Street) and Parry Street). Approval under section 138 of the Roads Act would be sought from the relevant roads authority (if required) for works on these roads.
Threatened Species Conservation Act 1995 (TSC Act)	The TSC Act lists threatened species, populations or ecological communities to be considered in deciding whether there is likely to be a significant impact on threatened biota, or their habitats. If any of these could be impacted by a project, an assessment of significance that addresses the requirements of section 5A of the EP&A Act must be completed to determine the significance of the impact.	The proposal would not impact on threatened flora and fauna or their habitats.

Act	Potential approval requirements	Relevance to the proposal
Water Management Act 2000 (WM Act) and *Water Act 1912*	Licences for dewatering and interception of groundwater are required under this legislation. Any dewatering activity that is estimated to exceed 3 megalitres per year (ML/yr) must obtain a licence under Part 5 of the Water Act 1912 prior to commencing the activity.	Excavation work would be undertaken as part of the proposal. Although it is possible that groundwater would be intercepted and dewatering would be required, it is highly unlikely that it would exceed 3 ML/year.

2.2.2 Commonwealth Environment Protection and Biodiversity Conservation Act 1999

Under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) proposed 'actions' that have the potential to significantly impact on matters of national environmental significance or the environment of Commonwealth land must be referred to the Australian Minister for the Environment and Energy for assessment.

An EPBC Act protected matters search was undertaken on 8 November 2016 for an area within a ten kilometre radius of the proposal site. The results of the search are summarised in Table 2-2. As impacts to matters of national environmental significance listed under the EPBC Act are not predicted, an approval under the EPBC Act would not be required.

Table 2-2 EPBC Act protected matters search results

Protected matter	Matter located within search radius	Comments	Potential impact
World Heritage Property	None	The proposal would not impact on any World Heritage properties.	None
National Heritage Places	None	The proposal would not impact on any National Heritage places.	None
Wetlands of international significance (Ramsar sites)	Hunter estuary wetlands	The proposal would not impact on any wetlands.	None
Threatened ecological communities	Central Hunter Valley eucalypt forest and woodland	The proposal would not impact on any threatened ecological communities.	None
Threatened species	64 threatened species, including 26 birds, two frogs, one fish, nine mammals, 16 plant species, six reptiles and four marine species	The proposal is located within a disturbed urban area with limited vegetation (native or otherwise) that would provide habitat for threatened or migratory species. The proposal would not result in a significant impact on any threatened or listed migratory species.	None

Protected matter	Matter located within search radius	Comments	Potential impact
Listed migratory species	70 migratory species, including 25 wetland species, 20 migratory marine birds, 18 other marine species and seven terrestrial species	The proposal is located within a disturbed urban area with limited vegetation (native or otherwise) that would provide habitat for threatened or migratory species. The proposal would not result in a significant impact on any threatened or listed migratory species.	
Nuclear actions	None	The proposal does not involve a nuclear action.	None
Commonwealth Marine Areas	None	No Commonwealth marine areas are located within the search radius.	None
Great Barrier Reef Marine Park	None	The Great Barrier Reef Marine Park is outside the search radius.	None
Commonwealth land	13 Commonwealth properties	The proposal would not directly or indirectly impact on any Commonwealth land.	None

2.3 Summary of approval requirements

The proposal is permissible without consent under the Infrastructure SEPP and is subject to assessment and determination in accordance with Part 5 of the EP&A Act.

The key steps in the assessment process under Part 5 of the EP&A Act are shown in Figure 2-1.

A section 138 approval under the *Roads Act 1993* is required for works in the following classified roads:

- Stewart Avenue (south of Hunter Street)
- Hannell Street
- King Street (between Stewart Avenue and Darby Street)
- Hunter Street (west of Stewart Avenue)
- Parry Street
- Darby Street (south of King Street).

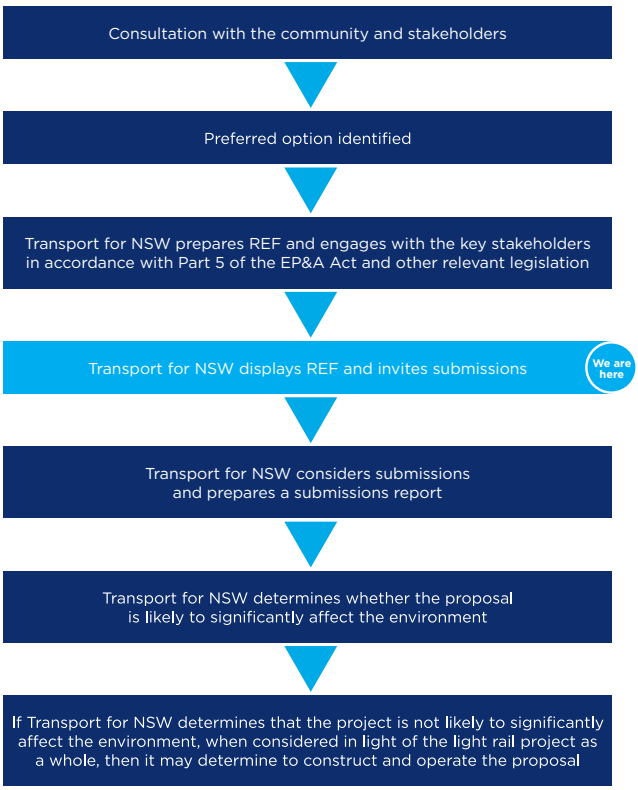

Figure 2-1 The assessment process

3. Description of the proposal

This section provides a description of the proposal including its strategic context, an overview of the key design features of the proposal, and a description of how it would be constructed.

3.1 Strategic context

3.1.1 Proposal need

The proposal is required to support the integrated transport system, specifically the introduction of light rail and cater for the growing demand for access into Newcastle's city centre. Changes to roads and intersections will be required to provide an essential function in enabling both the construction and operation of the light rail project.

The new light rail system will play a major role in Newcastle's transformation by developing infrastructure that will cater for demand for years to come.

The proposal forms part of the light rail project, which is described in the light rail REF. The strategic context and need for the light rail project are described in section 5.1 of the light rail REF.

To improve traffic flow and access to the city centre, the light rail REF identified a number of changes to roads and intersections that would be implemented to support the introduction of the light rail project. These upgrades would improve road user safety and manage changes to traffic flow as a result of the introduction of light rail, particularly on Hunter and King streets. Section 6.3.4 of the light rail REF identified that, in consultation with Council and Roads and Maritime, a package of additional road improvements to complement the introduction of light rail would be investigated. It was also a key driver in the feedback received from the local community. That feedback indicated traffic and access to the city centre were important to the local community and that more work needed to be done in this area.

Key roads that formed part of ongoing detailed investigations include Steel Street, Darby Street, Stewart Avenue/Hannell Street, Honeysuckle Drive, and King Street. Consultation with the community, businesses and key stakeholders on the proposed road improvements has been continuing since the approval of the light rail project.

The detailed investigations, feedback from the community and consultation with key stakeholders have been used to more fully define the scope of work in this proposal and this REF provides additional environmental impact assessment and information for the community.

Traffic capacity improvements are needed at several critical roads and intersections. The additional road improvements would seek to address congestion at the following locations (refer Figure 6.19 of the light rail REF):

- Hannell Street/Stewart Avenue
  - Intersection of Throsby Street/Hannell Street
  - Intersection of Bishopsgate Street/Hannell Street
  - Intersection of Honeysuckle Drive/Hannell Street
  - Vehicle queuing in Stewart Avenue at various locations, including at the Stewart Avenue/King Street/Parry Street intersection
- Hunter Street
  - Intersection of Steel Street/Hunter Street
- King Street
  - Stewart Avenue and Darby Street intersections to provide additional capacity.

These additional road improvements would seek to remove existing pinch points in the road network and ensure that traffic moves more freely, safely and efficiently through the Newcastle city centre.

3.1.2 Options considered

The proposal is needed to support growing demand for access into the city centre and to improve road network efficiency, safety and functionality over the coming years. The proposal will help maintain the operational performance of the road network, and support buses, taxies, service and freight delivery and general traffic, including during construction and operation of the light rail project.

The light rail REF outlined a number of options for various elements of the project, including activities within various roads and intersection configurations and implications on overall network performance. Wider road network actions including signal re-phasing and other road network modifications were also considered.

A description of the design and option selection process for the light rail project is provided in Sections 5.3 to 5.5 of the light rail REF.

Since approval of the light rail project, several design refinements have been made. Community feedback on the light rail REF, ongoing substantial consultation with Council and Roads and Maritime, design development and traffic modelling has refined the locations and scope of the proposal, which is now presented in this supplementary REF.

3.2 The proposal

3.2.1 Key features

The overall objective of the proposal is to improve road network functionality over the coming years, primarily for the construction and operation of the light rail project.

The proposal focuses on a number of key locations, congested and critical roads and intersections across the city centre. These were identified in developing the proposal footprint. The works that form the proposal will be undertaken in three locations:

- Stewart Avenue/Hannell Street (between Hebburn Street to the south, and Throsby Street to the north). This includes works on the following intersections with Stewart Avenue:
  - Honeysuckle Drive/Hannell Street
  - Hannell Street/Throsby Street
  - Hunter Street
  - King Street/Parry Street
- Hunter Street/Steel Street intersection
- King Street/Darby Street intersection.

The locations of proposal works are shown in Figure 1-1, summarised in Table 3-1 and described in Section 3.2.2. Concept plans for the proposal are included in Appendix B.

Table 3-1 Summary of proposal

Location	Roads mainly affected	Roads with minor affects (mainly associated with intersection works)	Intersections affected
Stewart Avenue/ Hannell Street	Hannell Street – from Throsby Street to the light rail route (about 450 m) Stewart Avenue – from the light rail route to Hebburn Street (about 550 m)	Throsby Street – for a distance of about 80 m Dangar Street – the cul-de-sac at the eastern extent Honeysuckle Drive – for about 250 m to Cottage Creek Hunter Street – between Stewart Avenue and National Park Street (a distance of about 80 m) Parry Street – between Stewart Avenue and wood Street (a distance of about 120 m) King Street – between Stewart Avenue and National Park Street (about 150 m)	Throsby Street/ Hannell Street Hannell Street/ Honeysuckle Drive Stewart Avenue/ Hunter Street Stewart Avenue/ Parry Street and King Street
Hunter Street/ Steel Street intersection	Hunter Street – between Cottage Creek and Kuwumi Place (a distance of about 270 m)	Steel Street – for about 30 m directly north and south of the intersection	Steel Street/ Hunter Street
King Street/ Darby Street intersection	Darby Street – for about 80 m north and south of the intersection	King Street – about 30 m of work to the east and west of the intersection	King Street/ Darby Street

3.2.2 Description of works in each location

Stewart Avenue/Hannell Street

Traffic improvements works on Hannell Street, north of the light rail route, include:

- Extension of the right turn lane on Hannell Street southbound into Throsby Street.
- Line marking and realignment to form a dedicated left turn lane on Throsby Street.
- A new dedicated left turn lane onto Bishopsgate Street from Hannell Street northbound.
- A new southbound slip lane on Hannell Street into Honeysuckle Drive.
- Realignment of Honeysuckle Drive to suit the eastbound slip lane.
- Dangar Street cul-de-sac realigned to suit Honeysuckle Drive realignment.
- Extension of the existing left turn bay and a new access into the light rail depot off Honeysuckle Drive.
- Line marking to provide an additional through lane on Hannell Street (west) just north of the light rail route.
- installation of new concrete medians between Hunter Street and Dangar Street, on Honeysuckle Drive (from the Hannell Street intersection for about 100 metres) and at the corner of Hannell Street and Honeysuckle Drive.

Traffic improvements works on Stewart Avenue, south of the light rail route, include:

- footpath widening on Stewart Avenue (west) north of Hunter Street
- pavement extension to form a dedicated left turn lane from Stewart Avenue northbound onto Hunter Street
- line marking and adjustments to provide a right turn bay extension on Hunter Street (west) on to Stewart Avenue
- pavement extension on Stewart Avenue to form a new left turn slip lane onto Little King Street
- extension of the right turn lane and concrete median on Parry Street on to Stewart Avenue across the Wood Street intersection
- removal of the ability to turn right off Parry Street into Wood Street
- signalisation of the left turn slip lane at the Parry Street/Stewart Avenue intersection
- line marking and realignment of Stewart Avenue (west) to extend the right turn bay on to King Street
- extension of the right turn bay and concrete median on King Street in both directions – turning on to Stewart Avenue and National Park Street.

Hunter Street/Steel Street intersection

Traffic improvements works at this intersection include:

- a new dedicated right turn bay on Hunter Street (west) on to Steel Street
- extension of the concrete median in Steel Street (north) into the light rail route
- line marking and adjustments to create additional travel lanes on Hunter Street east and west of the Steel Street intersection
- adjustment of the kerb at the intersection to allow buses to turn left off Steel Street on to Hunter Street
- construction of 1.5 metre wide medians on Hunter Street east and west of the intersection with Steel Street to accommodate installation of signals.

King Street/Darby Street intersection

Traffic improvements works at this intersection include:

- line marking and adjustment to extend the right turning bay on Darby Street southbound into King Street
- a new left turn slip lane on Darby Street northbound into King Street south of the intersection
- extension of the left turning lane on Darby Street northbound into Hunter Street
- line marking and adjustments to extend the dedicated left turn bay on King Street (south) to turn into Darby Street (east of the intersection).

3.2.3 Changes to parking and public transport arrangements

Building new infrastructure in established areas like Newcastle city centre will be complex. To understand the impacts of construction and operation of the light rail on traffic, detailed traffic studies have been undertaken. This level of detail provides us with the knowledge of where the pinch points will be and allows us to look at how these pinch pints are managed.

A key objective of the light rail project is to encourage greater public transport use and reduce the city's heavy reliance on cars by providing a modern light rail system. Transport for NSW are creating an integrated transport system that encourages people to transition to greater public transport use with less reliance on parking.

The Newcastle Light Rail Associated Road Upgrades proposal details changes to parking and public transport arrangements, which includes the removal of 110 parking spaces, the removal of two bus stops, and the relocation of one bus stop as summarised below.

The NSW Government is currently working with Newcastle City Council and other key stakeholders to develop a Parking Strategy. While parking is ultimately the responsibly of local council, the parking strategy will help inform Council's approach to managing parking requirements for their growing city. In addition, the new operator of the integrated transport system for Newcastle will review public transport services, including bus stop locations, routes and timetables, to ensure the people of Newcastle are provided with the public transport they need.

Changes to parking arrangements

The majority of impacted parking spaces are 2P Ticket, with some 8P Ticket and some unrestricted parking spaces. Only two accessible parking spaces and two loading zones will be impacted.

Changes to parking arrangements include:

- Removal of 12 parking spaces on Throsby Street at the Hannell Street intersection (seven on the northern side of the road and five on the southern side).
- Removal of 20 parking spaces on the southern side of Honeysuckle Drive just east of the Hannell Street intersection.
- Removal of four parking spaces on Stewart Avenue (east) between Hunter Street and Little King Street.
- Removal of six parking spaces on Stewart Avenue (west) between Warrah Street and Hebburn Street.
- Removal of 10 parking spaces on Hunter Street just east of the Stewart Avenue intersection (five on the northern side of the road and five on the southern side).
- Removal of 15 parking spaces on Hunter Street just west of the Steel Street intersection (five on the northern side of the road and 10 on the southern side).
- Removal of two parking spaces on the eastern side of Steel Street north of the Hunter Street intersection and four parking spaces on the western side of Steel Street south of the Hunter Street intersection.
- Removal of 18 parking spaces on Hunter Street just east of the Steel Street intersection (10 on the northern side of the road and eight on the southern side).
- Removal of four parking spaces on the southern side of King Street west of the Darby Street intersection and six east of the Darby Street intersection.
- Removal of three parking spaces on Darby Street (west) and six on Darby Street (east north of the King Street intersection.

Changes to bus stops

Changes to bus stops include:

- Removal of the bus bay on the eastern side of Hannell Street just north of the light rail route.
- Relocation of the bus stop on Hunter Street (north side) just east of the Steel Street intersection approximately 90 metres eastward to near Kuwumi Place.
- Removal of the bus stop on Hunter Street (south side) just east of the Steel Street intersection.

3.2.4 Tree removal

Transport for NSW understands that the preservation of trees is important and tree removal is avoided wherever possible. However to enable the construction of the proposal, a total of 26 street trees will need to be removed including eight mature trees and 18 young trees.

The trees are made up of a variety of species, listed in section 5.2.2. The trees are at the following locations:

- The median in Hannell Street between Throsby Street and Church Street (six trees removed).
- The southern side of King Street to the east of the Darby Street intersection (two trees removed).
- The median in King Street between Stewart Avenue and National Park Street (seven trees removed).

The trees removed for the proposal would be replaced in accordance with the *Vegetation Offset Guide* (TfNSW, 2016) and we are committed to replacing more trees than we remove, in consultation with Council.

Proposal works would be in close proximity to another 14 trees and mitigation measures are provided in Section 5.2.4 to ensure the protection of these trees during works.

No trees would be removed at Civic Park for the works at the Darby Street/King Street intersection. This is further discussed in Section 5.2.

3.2.5 Property acquisition

The amount of private property proposed to be acquired for the proposal is relatively small. The proposed property acquisition is summarised in Table 3-2.

Table 3-2 Property acquisition

Address	Lot/DP	Land owner	Approx. area of acquisition (m^2)
1 Honeysuckle Drive	Lot 2000 DP1145678 (part)	Hunter Development Corporation	752.6
834 Hunter Street	Lot 1 DP716921	private	259.2
81 Hannell Street	Lot 105 DP1015391 (part)	Hunter Development Corporation	208.2
Civic Park	Lot 11 DP1098216 (part)	Council	172.2
Civic Park	Lot 2 DP95186 (part)	Council	78.8
Civic Park	Lot 5 DP95186 (part)	Council	39.4
Civic Park	Lot 8 DP150031 (part)	Council	23.0

Transport for NSW will endeavour to acquire any property through negotiation and purchase rather than through compulsory acquisition (in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991*).

The reforms to the NSW Government land acquisition process announced in October this year, ensure landowners will be given more information, more time and more support though the acquisition process.

Recent reform to the NSW land acquisition process makes the NSW process the fairest and most generous scheme offered anywhere in the country – we now have a more sensitive and supportive acquisition process than ever before.

The land acquisition proposed is required to ensure that the proposal can be constructed and operated safely and efficiently.

3.3 Construction of the proposal

3.3.1 Indicative construction activities

The construction program for the proposal will be considered in consultation with the managing contractor to minimise the amount of time the community and businesses are impacted by construction activities. The proposed construction methodology will be for the complementary roadworks to be delivered at the same time as some of the light rail construction components.

Construction timing and activities would be finalised prior to construction commencing. Transport for NSW will work directly with individual premises to minimise potential impacts and ensure advance notice of likely impacts is available to avoid major inconvenience.

The NSW Government is committed to keeping Newcastle open for business during the construction of light rail and roadworks required to ease traffic congestion. We will work with the local business community and Council to ensure Newcastle stays open for business during construction to enable vibrant activated city spaces.

The following key stages and activities are envisaged:

- Mobilisation and site establishment – installing construction boundary hoardings/fences and traffic barriers
- Property survey, utilities adjustment – adjustment of property boundaries (where required and as identified in this document) and location, protection or relocation of services if required
- Vegetation trimming/removal – removal of ground over and trees where required, topsoil stripping and removal/stockpiling, structure removal/disposal
- Earthworks, formation of road alignment – excavation of ground surface, hammering/rock breaking, loading, haulage, compaction of fill areas and grading
- Installation of drainage infrastructure – excavation of trenches and pits, delivery and placement of precast pipes and pits, trench filling, and compacting
- Paving/asphalting – including concrete sawing, delivery of raw materials and placement of surface material
- Re-surfacing works – milling the asphalt to expose the underlying concrete, laying new asphalt
- Site restoration/removal – removal of all plant, signage, and left over materials
- Installing signage and other road furniture, and adjusting traffic signals
- Line marking.

3.3.2 Equipment

The proposal would be constructed using various plant and equipment (refer below). Some of this equipment would be in use to construct light rail. Its use will be extended to construct the proposal.

Construction plant/machinery

- Mobile crane
- Excavator
- Front end loader
- Backhoe
- roller
- dump truck
- vacuum truck
- concrete truck
- grader
- compactor
- pavement laying machine
- pavement profiler
- asphalt truck and sprayer
- scissor lift

Construction tools

- pneumatic and hydraulic hammers
- concrete saw
- chainsaw
- hand tools

Support equipment

- power generator
- truck compressor
- street sweeper
- tub grinder/mulcher
- water cart
- daymakers.

3.3.3 Earthworks

The proposal would involve the following minor earthworks:

- minor excavations for the installation of the new median along Stewart Avenue, between Parry Street/King Street and the northern edge of the light rail route
- minor excavation for relocation and/or provision of new signals and any utility relocations.

3.3.4 Construction workforce and timing

Workforce

The proposal would be serviced by around 20 workers, who would be required on-site during construction. The workforce number would be dependent on the managing contractor's schedule, but during peak construction, there would be expected to be about 20 people working onsite on average. It is likely that three separate teams of workers would undertake construction in each location concurrently to reduce the overall construction period and minimise potential impacts.

Construction timing

If approved, project planning and relay works would start in early 2017.

To help manage impacts to the community and businesses, the majority of the construction works would be undertaken concurrently with construction of the light rail project in the second half of 2017. This would be subject to the managing contractor's schedule. The work is anticipated to take around seven months to complete but may be done concurrently at different locations to minimise the overall timeframe and reduce potential impacts.

Work hours

To minimise traffic disruption on some of Newcastle's busiest roads, and to achieve the most efficient and shortest construction program, a portion of the works will need to take place outside of the recommended standard hours for construction works. These hours are prescribed by the NSW Environment Protection Authority as 7 am to 6 pm Monday to Friday and 8 am to 1 pm on a Saturday.

About 70 per cent of construction activities would be undertaken outside of standard construction hours to reduce impacts on traffic and day time amenity. Construction works are anticipated to be staged and unlikely to be continuous over consecutive nights, except in the larger areas of resurfacing. This would effectively offer affected receivers respite periods from the noise. Standard noise mitigation measures would be implemented in accordance with Transport for NSW's *Construction Noise Strategy* (2012) as well as additional measures where feasible and reasonable. Updates on traffic changes will be provided ahead of time and throughout the construction period.

The following work durations are estimated at the various locations:

- Stewart Avenue/Hannell Street for a period of three months
- Hunter Street/Steel Street for a period of two months
- Darby Street/King Street for a period of two months.

Works at the various locations would be intermittent and may be undertaken separately or in conjunction with roadworks at other locations.

3.3.5 Construction compound/s, access and vehicle movements

Construction compound

No proposal specific compounds are considered to be required due to the nature and duration of the works. There will be a requirement for plant to be parked on the side of the road overnight and the managing contractor may decide to temporarily fence off any vehicles. The proposal would be mainly serviced by the main construction compound and laydown areas established for the light rail project (refer to Figure 1-1). There would be capacity in the main construction compound/laydown areas to store additional materials and waste required and generated under this proposal.

Construction access and parking

Construction access, parking and movements will be managed under an approved traffic management plan, this will be prepared and submitted by the managing contractor prior to any construction taking place.

Construction workers will park within the light rail project construction compounds as directed by the principal contractor and will be transferred to different work sites by the contractor. The use of public transport will also be encouraged.

Vehicle movements

Construction vehicle movements will comprise heavy vehicles (including construction plant and deliveries of larger items) and light vehicles (including deliveries of smaller items and staff vehicle movements).

The estimated number of construction vehicles will be about 15 to 20 heavy vehicles and five to 10 light vehicles per day. These vehicles will be distributed over the working day and will be managed by traffic control staff.

Adjustments to bus stops

While every effort is taken to minimise any inconvenience to the community, during construction, there may be a requirement to temporarily relocate bus stops to allow the works to be done. The relocation of these stops would be confirmed in consultation with the relevant bus operators and Council. Transport for NSW would work with the managing contractor to reduce and manage impacts on bus stops as part of the proposal.

Permanent removal or relocation of bus stops are described in Section 3.2.3.

3.3.6 Utilities and services

The proposal may also involve some minor utility adjustments to enable the proposed installation of traffic signals or where services are encountered in footpaths or roadways. Potentially affected public utility companies would be consulted to confirm the location, extent and depth of any utilities and to confirm the presence of any other buried services. Any adjustments required will be undertaken in consultation with the relevant asset owner.

4. Community and stakeholder consultation

This section summarises the community and stakeholder consultation undertaken as an input to development of the proposal and the REF.

4.1 Consultation for the light rail project

A detailed overview of the consultation activities undertaken for the light rail project both before and during preparation of the REF was provided in section 4 of the light rail REF (GHD, 2016) and the submissions report (TfNSW, 2016). Ensuring local voices are heard and valued is important to the NSW Government. The REF for the light rail project was publicly displayed from 7 April to 27 May 2016. This included an additional eight days at the request of Council, and in response to the high level of public interest in the project.

Section 4 of the submissions report included an overview of the key issues raised by stakeholders and the community during consultation. This feedback helped shape the proposal and provided evidence to support the benefits of the proposal.

Consultation also occurred with project partners, a number of senior stakeholders from organisations in Newcastle and key industry, business and community groups throughout the strategic planning for the project.

The objectives of the consultation were to provide information, gather feedback, and identify potential issues to inform planning and early design.

During the light rail REF preparation, Transport for NSW consulted extensively with Government stakeholders, including Roads and Maritime, UrbanGrowth NSW and Council to confirm various aspects of the proposal, and ensure that the planning and design aligned with future plans and strategies. A summary of the activities and the tools used to achieve the engagement outcomes was provided in section 2.2 of the submissions report (TfNSW, 2016).

The key issues raised by the community through the submissions process for the light rail project fell under the following categories:

- proposal need and justification
- alternatives and options
- proposal design/features
- operation of the proposal
- construction
- consultation and communication
- assessment and approvals
- traffic, transport and access
- socio-economic/business impacts
- heritage
- urban design and visual amenity
- other environmental matters outside the scope of the project/assessment.

The community and stakeholders told us traffic and access to the city centre is important to them. The views of the community and key stakeholders are continually shaping the NSW Government's plans to revitalise Newcastle's city centre. The submissions report also identified a number of design modifications developed in response to community and stakeholder feedback. These included:

- a revised light rail alignment at Worth Place
- a revised track bed between Stewart Avenue and Worth Place
- an increased area for stabling and maintenance facilities, including a second light rail track to be installed across Stewart Avenue
- a new pedestrian crossing at Cottage Creek
- removal of the Queens Wharf pedestrian footbridge and a new pedestrian footpath across the former heavy rail corridor at Market Street
- relocation of the eastern construction compound
- an augmented light rail traction power supply.

These modifications are currently being progressed as part of the detailed design for the light rail project.

4.2 Consultation for the proposal

4.2.1 Consultation since approval of the light rail project

Consultation is continuing to keep the community and stakeholders informed. There has also been ongoing and substantial consultation with Council and Roads and Maritime to better define the proposal.

The following key activities have been undertaken:

- a doorknock of businesses alongside the light rail route immediately following determination of the light rail project to inform them that the project had been approved and provide contact details
- meetings with the Lord Mayor of Council to provide project updates
- meetings with the Member for Newcastle of Parliament to provide project updates
- regular meetings with key stakeholders, including Council, Newcastle Now, Hunter Business Chamber, Renew Newcastle and others
- responding to community enquiries about the light rail project that have been submitted via the project website or community phone line
- meetings with stakeholders and others to discuss key issues arising from enquiries
- notifications and other communications material for the community, residents and businesses when early construction works and other activities are underway.

4.2.2 Statutory consultation

Clauses 13 to 16 of the Infrastructure SEPP specify the requirements for consultation with councils and other public authorities for infrastructure development carried out by or on behalf of a public authority. Consultation is required in relation to specified development (clause 16) or development with the potential to significantly/substantially impact on:

- council related infrastructure or services (clause 13)
- local heritage (clause 14)
- flood liable land (clause 15).

Consultation in accordance with clause 13 of the Infrastructure SEPP was undertaken for the light rail project, including the associated roadworks, during preparation of the light rail REF. A letter was issued to Council in December 2015. The letter provided information on the proposal and requested the identification of any issues or concerns.

An additional letter, in accordance with clause 13 of the Infrastructure SEPP, will be issued to Council regarding this proposal prior to public display.

4.2.3 Consultation during the preparation of this supplementary REF

The following key engagement activities have been undertake during preparation of this REF:

- community updates on the project website – ourtransport.revitalisingnewcastle.com.au
- stakeholder meetings/briefings with Council and other stakeholders on the proposed works described in this REF
- advertisements will be placed in the Newcastle Herald, Newcastle Post and Newcastle Star to notify the community about the proposal
- directly impacted residents, community and businesses will be doorknocked to notify them of the REF display
- Transport for NSW's project and email contact details have been available for questions and feedback.

4.2.4 Public display of the REF

Public display of this supplementary REF will be undertaken for a period of four weeks from 21 November to 19 December 2016 at the following locations:

- City of Newcastle City Administration Centre, 282 King Street, Newcastle
- Newcastle City Library, Ground Floor, Laman Street, Newcastle
- Transport for NSW Newcastle office, ground floor, 239 King Street, Newcastle.

The REF will also be available online at: ourtransport.revitalisingnewcastle.com.au/delivering-newcastle-light-rail/documents

The light rail REF and submission report are also available online at the above address.

Submissions will only be accepted during the public display period and must be in writing.

Surrounding business owners, landowners and residents will be contacted at the beginning of the consultation period to notify them of the consultation period and how to access the REF.

4.2.5 Submission processing and reporting

Following public display of the REF, Transport for NSW will consider the issues in any submissions and develop the proposal design to respond to issues where relevant. A report will be prepared to:

- summarise and respond to the issues raised
- provide any new information concerning the proposal
- identify any changes to the proposal and the potential impacts of those changes.

Anyone who makes a submission (and provides their contact details) would be notified when the proposal's submission report is available for viewing.

4.2.6 Post determination consultation

Transport for NSW is committed to community and stakeholder engagement. We will work closely with the managing contractor to ensure accurate information on the project is delivered to the community, businesses and stakeholders throughout the life of the project.

We are preparing engagement plans for the light rail project to continue to liaise with key stakeholders and the community during the detailed design, construction, and operational phases of the project. Should the proposal be approved, these plans will include works associated with the improvements to the roads and intersections described in this REF.

This ongoing engagement process will play an important role in reducing any potential impacts and enhancing the benefits of the proposal for all stakeholders.

5. Environmental impact statement

This section summarises the environmental impact assessment undertaken for the proposal and includes summaries of the specialist studies undertaken. As this REF is supplementary to the light rail REF, the assessment in this section considers impacts in the light of the overall impact from the whole of the light rail project where relevant.

5.1 Traffic, transport and access

This section summarises the specialist report prepared by GHD which is included in full in Tecnical Paper 1.

5.1.1 Assessment approach and methodology

The scope of assessment included:

- assessing the potential changes to traffic conditions resulting from the proposed roadworks
- identifying measures to mitigate any potential impacts, if necessary.

To provide consistency with the light rail REF traffic analysis, the SIDRA model developed for the light rail REF was used for this assessment. The new geometry for the proposal site was added to the model with all other variables remaining the same.

No new signal phasing data was available to be used in the modelling and therefore, the signal phasing arrangements used in the light rail REF were adopted. This has resulted in a conservative outcome, as Roads and Maritime are currently developing a new phasing arrangement, which will improve intersection performance.

The proposal would redistribute traffic not increase volumes. The primary effect of the proposal would be changes in the intersection level of service, which is therefore the focus of this assessment.

5.1.2 Existing environment

Key roads in the study area

Roads and intersections affected by the proposal are listed in Table 3-1.

Roads and Maritime is the roads authority under the Roads Act 1993 for Stewart Avenue (as a State road) and Council is the roads authority for all other public roads (both classified and unclassified) within and in the vicinity of the proposal site. Roads and Maritime may exercise the powers of a roads authority in respect of any classified roads. Classified roads within and in the vicinity of the proposal site are:

- Pacific Highway – comprising Stewart Avenue south of Hunter Street, Hunter Street west of Stewart Avenue, and Maitland Road
- Hannell Street
- Parry Street and King Street.

Existing traffic volumes

Traffic volumes for the key roads in the study area are as reported in the light rail REF and are provided in Table 5-1.

Table 5-1 Estimated 2015 annual average daily traffic (AADT) volumes

Street	Daily traffic (vehicles per day)	AM peak (vehicles per hour)	PM peak (vehicles per hour)
Stewart Avenue south of Honeysuckle Drive	29,500	2,538	2,738
Hunter Street west of Steel Street	18,300	1,377	1,590
Hunter Street east of Steel Street	18,300	1,305	1,507
King Street east of Union Street	13,700	951	946
Hunter Street east of Darby Street	18,100	1,254	1,615
King Street east of Darby Street	12,500	934	1,473

On-street parking and loading zones

Streets in the study area are used for on-street car parking by residents, local customers and workers in the Newcastle city centre. Parking restrictions include a mixture of ticketed, time restricted (five, 15 and 30 minutes), designated railway, disabled, motorcycle, no stopping, unrestricted, bus and taxi zones, construction, and loading zones.

Other transport/road facilities

Bus services

The local and regional bus network in Newcastle is currently serviced by five operators – Newcastle Buses and Ferries, Port Stephens Coaches, Hunter Valley Buses, Rover Coaches, and Busways. Interstate coaches that stop in Newcastle are operated by Greyhound Australia, Sidd Foggs, and Premier Motor Service.

Thirty Newcastle Buses routes currently operate along Hunter Street, with 10 stops in each direction between the new interchange at Wickham and the bus interchange, located near Newcastle Station in Watt Street. Most of these buses and coaches terminate at the bus interchange.

The interstate buses operate mainly to and from towns in the Hunter, Port Stephens and Mid-North Coast regions. Greyhound Australia services stop at Newcastle on their Brisbane to Sydney route. These buses travel along Hunter Street, stopping at the Newcastle bus interchange. About 60 interstate bus services terminate at the Newcastle bus interchange per day, with eight of these using it during the AM peak.

The NSW Government has invited the world's best transport operators to create Transport for Newcastle – one major operator to plan and run light rail, buses, ferries and the interchange. The new single operator will be commissioned with one goal in mind: delivering better services for customers. A market sounding process was announced late in 2015. The new operator is expected to commence in mid-2017. This is not likely to affect the proposal.

Pedestrian facilities

Pedestrian traffic in and around the proposal site consists of city workers, visitors and shoppers walking to and from their parked cars and bus stops, and residents.

Formalised pedestrian facilities within the area of proposed works are as follows:

- Throsby Road/Hannell Street intersection – signalised crossing
- Hannell Street/Honeysuckle Drive intersection – signalised crossing
- Hunter Street/Stewart Avenue intersection – signalised crossing
- King Street/Parry Street and Stewart Avenue intersection – signalised crossing
- Hunter Street/Steel Street intersection – signalised crossing
- King Street/Darby Street intersection – signalised crossing.

Parking

While parking is ultimately a responsibly of local council, Transport for NSW is currently working with key stakeholders including Council, the Hunter Development Corporation and UrbanGrowth NSW to prepare a parking strategy that will consider:

- how parking is currently used in the Newcastle city centre (including zonings, availability, and accessibility)
- where parking is needed
- what kind of parking is needed
- the potential use of 'park and ride' facilities
- demand for parking in the future.

The parking strategy will take into account the broad program of work underway to help Newcastle reach its potential as an activated and vibrant city through the Program. It will take a holistic approach to assessing the availability and need for parking in the Newcastle city centre in light of the full spectrum of revitalisation activities currently underway or planned. Transport for NSW has engaged a specialist to prepare the parking strategy.

The parking strategy will help inform Council's approach to managing parking requirements for their growing city.

Cycle facilities

The following cycle lanes/paths are located in the study area:

- a narrow, bicycle lane (about 0.5 metres wide) is provided on Stewart Avenue/Hannell Street between Hunter Street and Honeysuckle Drive
- north of Honeysuckle Drive in Hannell Street via a foreshore shared path on the eastern side of Hannell Street
- on-road bicycle lanes on both sides of Honeysuckle Drive between Hannell Street and Workshop Way
- on-road bicycle lanes on both sides of King Street between Stewart Avenue and Darby Street
- a dedicated off-road shared pedestrian and cycle path along the foreshore between Hannell Street and Wharf Road.

Active transport including cycling is important to the overall vision for the city centre. While cycleways are ultimately the responsibility of Council, the NSW Government is committed to enhancing the cycling network in Newcastle city and is working with Council to assess options and deliver new cycleways where they are needed.

Through consultation with cyclists and the community, they have told us that they are interested in:

- providing more open space adjacent to Scott Street for that allows easy movement from the city to the harbour
- options for cycleways that suit the needs of commuter cyclists, families and recreational cyclists
- options to improve the experience of walking along Hunter Street.

The Program team is working with Council to prepare the cycleway strategy to ensure we have the right solution for both busy commuters and recreational cyclists. Cycleways and pedestrian links are currently being designed and, consideration is being given to the provision of a dedicated east-west cycleway along King Street. This cycleway would be subject to separate environmental assessment and approval. The cycleway strategy will also consider the urban renewal plans for Hunter and Scott streets, and will help inform Council's approach to managing cycleways in the future.

5.1.3 Impact assessment

Construction

Traffic impacts

The total number of light and heavy vehicle movements around the proposal site is estimated to be around 20 to 30 vehicles per day. This number of heavy and light vehicle movements on roads around the proposal site during construction would be low compared to the overall traffic volumes on these roads. Construction vehicle generation would not result in a substantial impact on local road capacity or the road network overall. There may be cumulative impacts if construction traffic coincides with that created for construction of the light rail project.

Partial road closures would also be required during construction. This could result in traffic congestion, particularly during peak hours.

Transport network

There may be a need to reposition bus stops where they would conflict with construction works areas. In these situations, bus stops would be temporarily repositioned in close proximity either east or west of the proposed worksite to avoid the potential conflict.

Parking

Changes to existing on-street parking and loading zones would be required to provide sufficient width for construction. After construction, the removal of parking spaces is required in order to allow the safe and efficient operation of the upgraded road network.

A total of 110 parking spaces would be removed during construction. These spaces would not be reinstated following completion of construction. The indicative location of these spaces is shown on Figure 5-1.

Parking and loading zones would be removed progressively within the proposal site during construction. While parking is ultimately the responsibility of local council, Transport for NSW is currently working with key stakeholders including Council, the Hunter Development Corporation and UrbanGrowth NSW to prepare a parking strategy. The parking strategy will take into account the broad program of work underway to help Newcastle reach its potential as an activated and vibrant city through the Program. Property access.

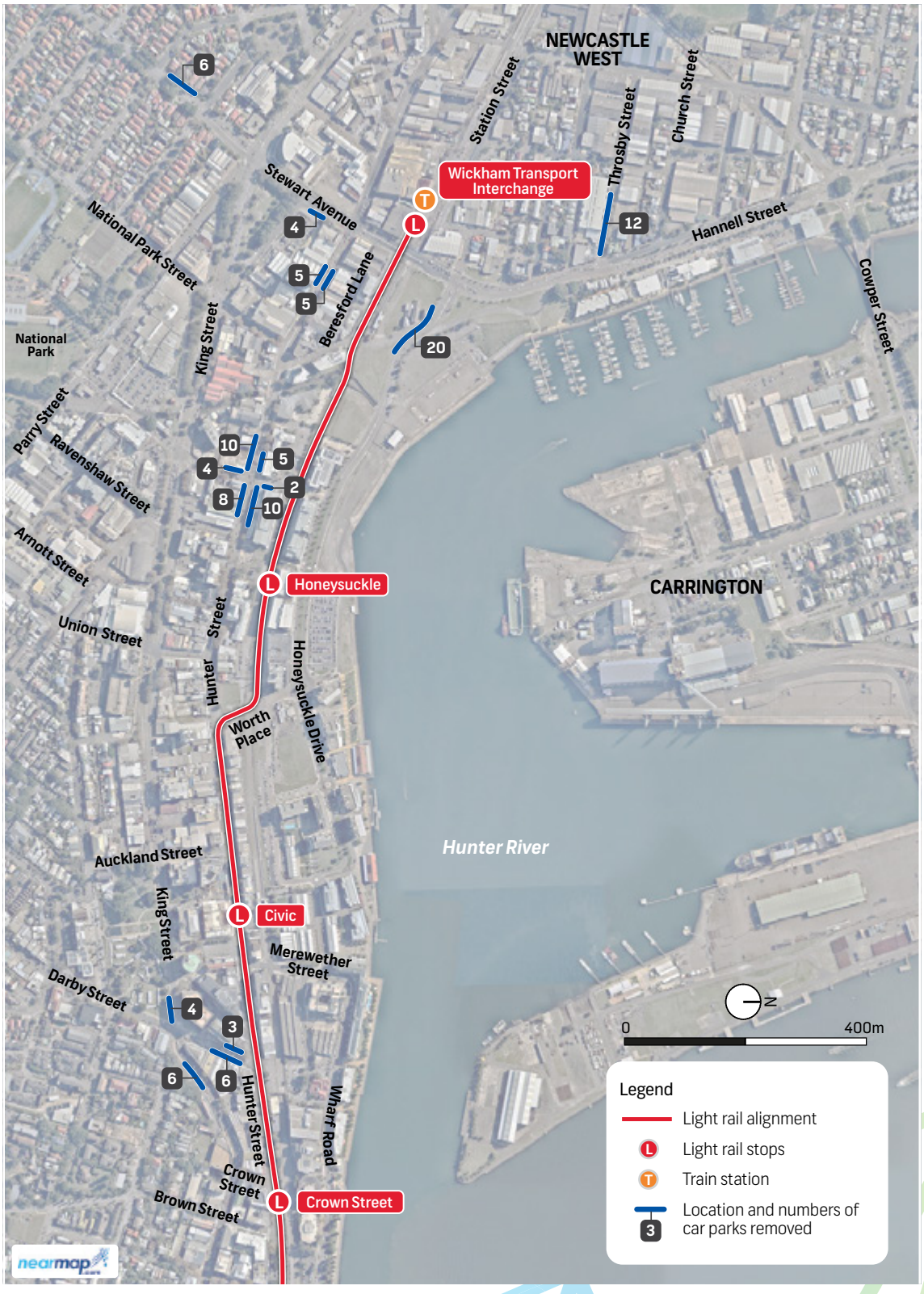

Figure 5-1 Location of car parks removed

Property access

It is not anticipated that works would significantly impact on any property access. However, if impacts are required, they will be minimised as much as possible, and alternative arrangements would be negotiated with landowners/residents/businesses prior to the works commencing in that location.

Pedestrians and cyclists

Pedestrian movements along existing footpaths in the vicinity of the proposal site would be maintained for the majority of the construction period.

Pedestrian and cyclist access in the immediate vicinity of the proposal site would be largely maintained, however temporary diversions may be required around work areas and site access points.

The main potential for impact to cyclists is where existing cycle routes need to be diverted and/or where restrictions may occur, such as at site compound access points or, more generally, where cycle routes mix with local traffic. This would be managed through communication of the changes to the community, signage and provision of alternative access and routes where required.

The NSW Government is committed to enhancing the cycling network in the Newcastle city centre and is working with Council to assess options and deliver new cycleways where they are needed. The Program team is working with Council to prepare a cycleway strategy to ensure we have the right solution for both busy commuters and recreational cyclists.

Operation

Road network impacts

Table 5-2 and Table 5-3 compare the performance of the 2018 and 2028 road networks respectively following implementation of light rail, with and without the proposal. The 2018/2028 'without light rail' and 2018/2028 'with light rail no roadworks' level of service (LoS) are the same as those shown in the light rail REF.

The results indicate that the majority of intersections would operate more efficiently in both peak periods following implementation of the proposal. An LoS of D or better is considered acceptable.

Table 5-2 Summary of intersection performance at key locations in 2018

	2018 without light rail		2018 with light rail no roadworks		2018 with light rail and roadworks	
Location	AM peak	PM peak	AM peak	PM Peak	AM Peak	PM Peak
Throsby Street/Hannell Street	A	B	B	B	B	B
Honeysuckle Drive/Hannell Street	C	F	B	C	B	B
Hunter Street/Stewart Avenue	F	F	C	C	C	D
King Street/Stewart Avenue	C	D	D	D	C	D
Hunter Street/Steel Street	A	B	B	C	B	C
King Street/Steel Street	A	C	B	B	B	C
Hunter Street/Union Street	B	C	B	B	B	B
King Street/Union Street	D	D	D	E	C	E
Hunter Street/Merewether Street	B	C	B	B	B	B
Hunter Street/Darby Street	C	B	C	C	C	C
King Street/Darby Street	C	C	B	C	B	C

Table 5.2 predicts that, compared to the 'with light rail no roadworks' scenario, there are three intersections that improve performance in 2018 following implementation of the proposal. These intersections are at:

- Honeysuckle Drive/Hannell Street (PM peak only)
- King Street/Stewart Avenue (AM peak only)
- King Street/Union Street (AM peak only).

Some deterioration is predicted at the following intersections in 2018:

- Hunter Street/Stewart Avenue (PM peak only)
- King Street/Steel Street (PM peak only).

Generally, the deterioration at the above locations is because the proposal has resulted in more traffic flowing through upstream intersections than was previously the case. For this reason, these outcomes are not considered to be adverse as they provide a benefit to the overall road network.

Overall, the traffic performance on the road network in 2018 is considered satisfactory and improved as a result of the proposal.

Table 5 3 provides a summary of predicted intersection performance in 2028.

Table 5-3 Summary of intersection performance at key locations in 2028

	2028 without light rail		2028 with light rail no roadworks		2028 with light rail and roadworks	
Location	AM peak	PM peak	AM peak	PM Peak	AM Peak	PM Peak
Throsby Street/Hannell Street	A	F	B	C	B	F
Honeysuckle Drive/Hannell Street	C	F	B	F	B	C
Hunter Street/Stewart Avenue	F	F	C	D	C	C
King Street/Stewart Avenue	C	C	E	D	E	C
Hunter Street/Steel Street	A	B	B	D	B	C
King Street/Steel Street	B	C	C	B	C	C
Hunter Street/Union Street	B	C	C	B	B	B
King Street/Union Street	D	D	D	F	D	F
Hunter Street/Merewether Street	B	C	B	B	B	B
Hunter Street/Darby Street	C	B	C	D	C	C
King Street/Darby Street	C	C	C	D	B	C

Table 5-3 indicates that the proposal results in an improved performance at seven intersections in 2028 compared to the 'with light rail no roadworks' scenario. This is greater than the 2018 improvement and indicates that the proposal would provide long term benefits. The intersections where performance improvement is identified include:

- Honeysuckle Drive/Hannell Street (PM peak only)
- Hunter Street/Stewart Avenue (PM peak only)
- King Street/Stewart Avenue (PM peak only)
- Hunter Street/Steel Street (PM peak only)
- Hunter Street/Union Street (AM peak only)
- Hunter Street/Darby Street (PM peak only)
- King Street/Darby Street (AM and PM peaks).

Deterioration is expected at the following intersections:

- Throsby Street/Hannell Street (PM peak only)
- King Street/Steel Street (PM peak only).

The intersection of Throsby Street and Hannell Street would operate at the same LoS as it would without the light rail project. Therefore, the light rail project and the proposal are not reducing the operation of this intersection. The removal of congestion at the intersection of Honeysuckle Drive/Hannell Street following proposal implementation would relocate the existing congestion issue from Honeysuckle Drive to Throsby Street.

The LoS at Hunter Street and Stewart Avenue changes from a D to a C between 2018 and 2028. This is not an indication of improvements to the intersection itself, rather a result of the poor performance of surrounding intersections that feed traffic to the Hunter Street and Stewart Avenue intersection, in this case, the poor performance at the Throsby Street/Hannell Street intersection. In such instances, SIDRA reduces the demand flows to simulate the poor performance of the upstream intersection at delivering traffic down the Stewart Avenue corridor to the intersection with Hunter Street i.e. the demand was greater than the road capacity, therefore demand was reduced to meet the capacity.

The performance at the intersection of King Street/Steel Street shows only a minor deterioration, mainly because the proposal would enable higher traffic volumes by improving flows at upstream intersections.

The intersection of King Street and Union Street in the PM peak period is estimate to operate at an LoS F in 2028 – the same as without the roadworks. This is due to the poor performance of Union Street on the southern approach to the intersection. In reality, vehicles will divert away from this intersection and utilise the better performing intersections of Darby Street and Steel Street, which is not taken into account in the modelling. Therefore, the performance of this intersection is not expected to reach LoS F as predicted.

With the exception of the Throsby Street/Hannell Street and King Street/Union Street intersections, traffic performance on the road network in 2028 is considered satisfactory for peak hour traffic volumes. Consistent with the Guide to Traffic Generating Developments (RTA 2002), LoS E conditions are acceptable where traffic signals operate with a 120 second cycle time.

Overall, the proposal is considered to improve the road network performance in both 2018 and 2028 when compared with the 'with light rail no roadworks' scenarios at these key intersections.

Impacts to parking and loading zones

The proposal would result in the removal of 110 parking spaces. This is additional to the parking spaces that would be removed for the implementation of the light rail project (refer section 5.4.10). The majority of impacted parking spaces are 2P Ticket, with some 8P Ticket and some unrestricted parking spaces. Only two accessible parking spaces and two loading zones will be impacted.

While parking is ultimately the responsibility of Council, Transport for NSW is currently working with key stakeholders including Council, the Hunter Development Corporation and UrbanGrowth NSW to prepare a parking strategy. The parking strategy will take into account the broad program of work underway to help Newcastle reach its potential as an activated and vibrant city through the Program.

Bus services

Two bus stops would be removed and one bus stop would be relocated for implementation of the proposal. The location of bus stops and bus services as a whole will be reviewed as one of the first tasks of the new integrated transport network operator for Newcastle to ensure that the network provides the services required by the community. This would include bus stops impacted by the proposal.

Pedestrians and cyclists

The proposal would not significantly impact on pedestrian or cyclist facilities during operation.

5.1.4 Mitigation measures

Pre-construction

- The parking strategy currently being prepared would be reviewed to include the proposal.
  - be undertaken in accordance with the objectives and requirements of the Program, and relevant transport and parking strategies and policies
  - be undertaken in consultation with relevant stakeholders, including surrounding businesses/ organisations and Council. The parking strategy will inform Council's approach to managing parking in the future.
- The cycleway strategy currently being prepared would be reviewed to include the proposal. The cycleway strategy would be undertaken in consultation with Council. The cycleway strategy will inform Council's approach to managing cycleways in the future.
- Project planning and construction scheduling would consider the need to minimise impacts on motorists during morning and afternoon peak hours, particularly for works on Hannell Street/Stewart Avenue, King Street and Honeysuckle Drive.
- Further design development would be undertaken by Transport for NSW, in consultation with Roads and Maritime, to address residual intersection performance issues on the wider road network.

Construction

- Consultation with relevant stakeholders would be undertaken regularly to facilitate the efficient delivery of the works and to minimise congestion and inconvenience to road users. Stakeholders would include contractors on adjacent work sites (particularly the new interchange at Wickham) and others such as Council, bus operators, Roads and Maritime, emergency services, affected businesses, and other relevant organisations (such as the University of Newcastle and major employers in the city centre).
- A construction traffic, transport and access management plan would be prepared as part of the construction environmental management plan (CEMP) including a detailed list of the measures that would be implemented during construction to minimise the potential impacts on traffic, transport and access. The management measures to be incorporated would include:
  - traffic and access would be managed in accordance with *Traffic Control at Work Sites* (RTA, 2010) and in consultation with Roads and Maritime and Council
  - adequate road signage would be provided to inform drivers of the work, timing and alternative access arrangements
  - measures to manage traffic flows around the area affected by construction would be provided, including required regulatory and directional signposting, line marking, variable message signs, and all other necessary traffic control devices
  - the plan would specify routes to be used by heavy construction-related vehicles to minimise impacts on sensitive land uses and businesses
  - the timing of deliveries would be programmed to minimise traffic and transport impacts
  - the queuing and idling of construction vehicles in residential streets would be minimised
  - designated queuing and idling areas would be determined near the work site to minimise disruption to the local community
  - adequate sight lines would be provided to allow for safe entry and exit from the construction sites
  - access to all private properties adjacent to the proposal site would be maintained during construction, unless otherwise agreed with relevant property owners
  - co-ordination with other constructors, including those responsible for constructing the new interchange at Wickham, would be undertaken, particularly regarding works at the Stewart Avenue/Hannell Street intersection

- ongoing consultation and feedback from key stakeholders including Roads and Maritime and Council would be co-ordinated by Transport for NSW to facilitate the efficient completion of the works, and ensure awareness of proposed road network or intersection changes, and the efficacy of mitigation proposed
- contractors, including transport/deliveries contractors, would be provided with a copy of the traffic, transport and access management sub-plan to ensure disruptions to the local community are minimised
- the plan would include measures to maximise safety and access for pedestrians and cyclists, including details of alternative access arrangements
- adequate road signage would be provided to inform pedestrians and cyclists of the work, including timing and alternative access arrangements, and ensure that the risk of accidents and disruption to surrounding land uses is minimised
- the plan would include details for the relocation of kiss-and-ride, taxi ranks and bus stops if required, including appropriate signage to direct patrons, in consultation with the relevant operator.
- Adequate signage would be provided at all stops along the bus routes to clearly show the location of stops and routes.
- consultation with regional and interstate bus operators would be undertaken to determine their requirements, including any rerouting of services if required.

5.2 Tree removal

This section summarises the specialist report prepared by GHD which is included in full in Technical Paper No. 2 – Arboriculture Assessment.

5.2.1 Assessment approach and methodology

All of the street trees within the proposal site were assessed for this REF. A site inspection was undertaken on 27th June 2016 by Gary Leonard (International Society of Arboriculture membership no. 212238 and Arboriculture Australia membership no. 2173).

Trees were assessed individually by conducting a ground based visual tree assessment (VTA) (see Lonsdale 2001). Each tree was assigned a number and mapped.

The height and crown spread of trees were estimated and the diameter at breast height (DBH) measured using a forestry measuring tape. The safe useful life expectancy (SULE) and sustainable retention index value (SRIV) were determined for each tree based on the health and structure of the subject tree (after Barrell, 2001; IACA 2010).

The estimate of a tree's age was based on the definitions outlined by Draper and Richards (2009). Trees were considered young (EM, or Y) if they were judged to be of an age less than 20 per cent of their life expectancy in situ. Trees of mature age (M) are defined as trees being aged between 20 and 80 per cent of their life expectancy in situ, while trees aged greater than 80 per cent of their life expectancy in situ were considered over-mature (OM) (Draper & Richards, 2009).

The indicative tree protection zone (TPZ) for each tree was calculated based on the diameter at breast height (DBH) of the tree in accordance with the *AS 4970 Protection of Trees on Development Sites* (SA, 2009), Council's *Tree Management Guidelines* (2012) and the Urban Forest Technical Manual (Council 2015).

The arboriculture assessment identified the overall health and life expectancy of the trees surveyed.

5.2.2 Existing environment

A total of 40 trees were surveyed and described within the proposal site. All trees are in moderate to good health and are considered mature. Trees are between two and 15 metres in height. For road safety reasons, some trees would require removal for construction of the proposal. This is discussed further in section 5.2.3.

The inspection identified the following tree species, which are indigenous to Newcastle LGA:

- Trees 1 to 7: Broad-leaved Paperbark (*Melaleuca quinquenervia*) – planted in the road median along King Street, east of the King Street/ Stewart Avenue intersection.

The following tree species, surveyed in the proposal site, are not indigenous to Newcastle LGA, although they are Australian natives:

- Tree 8: Hill's Weeping Fig (*Ficus hillii*) – located in Civic Park adjoining Darby Street, south of the King Street/ Darby Street intersection.
- Tree 15: Broad-leaved Lilly Pilly (*Syzygium syn. Acmena hemilampra*) – growing on the footpath at the north-eastern end of Steel Street north of the Hunter Street/Steel Street intersection.
- Trees 28 to 33 Broad-leaved Lilly Pilly (*Syzygium syn. Acmena hemilampra*) – growing on the footpath along the western side of Hannell Street, north of the Hannell Street/Honeysuckle Drive Intersection.
- Trees 34 to 40: Tulipwood (*Harpullia pendula*) – in the footpath on the eastern and western sides of Honeysuckle Drive at the intersection with Hannell Street and Stewart Avenue.

The following tree species, surveyed in the proposal site, are not indigenous to Australia:

- Trees 9 and 10: Ornamental Pear (*Pyrus ussuriensis*) – planted on the edge of the roadway on the southern side of King Street, east of the King Street/Darby Street intersection, and protected by fencing.
- Trees 11-14 and 16-21: London Plane (*Platanus x acerifolia*) and Oriental Plane (*Platanus orientalis*) – growing in open sections within the concrete footpath on the northern side of Hunter Street, east and west of the Hunter street/Steel Street intersection.
- Trees 22-27: Cook Pine (*Araucaria columnaris*) – planted in the road median along Hannell Street, north of the Hannell Street/Throsby Street intersection.

The trees listed above are shown in Figure 5-2. All trees have been planted in garden beds, footpaths, parkland or road medians.

5.2.3 Impact assessment

A total of 26 trees located within the construction footprint for the proposal would be removed, including eight mature trees and 18 young trees.

The trees removed for the proposal would be replaced in accordance with the *Vegetation Offset Guide* (TfNSW, 2016). Table 5-4 provides guidelines for offsetting individual trees from the *Vegetation Offset Guide* (TfNSW, 2016). The final number of trees required to offset those removed and the appropriate locations for planting would be determined following finalisation of the proposal design and construction methodology, and in consultation with Council.

The trees requiring removal include:

- Trees 1 to 7: Broad-leaved Paperbarks (*Melaleuca quinquenervia*) – planted in the road median along King Street, east of the King Street/Stewart Avenue intersection.
- Trees 9 and 10: Ornamental Pears (*Pyrus ussuriensis*) – planted and fenced on the roadway edge on the south side of King Street, to the east of the Darby Street Intersection.
- Trees 22-27: Cook Pine (*Araucaria columnaris*) – planted in the road median along Hannell Street, north of the Hannell Street/Throsby Street intersection.
- Trees 28-33: Broad-leaved Lilly Pilly (*Syzygium syn. Acmena hemilampra*) – growing in the footpath along the western side of Hannell Street, north of the Hannell Street/Honeysuckle Drive Intersection.
- Trees 34-38: Tulip Wood (*Harpullia pendula*) located on the eastern and western sides of Honeysuckle Drive, at the intersection with Stewart Avenue/Hannell Street.

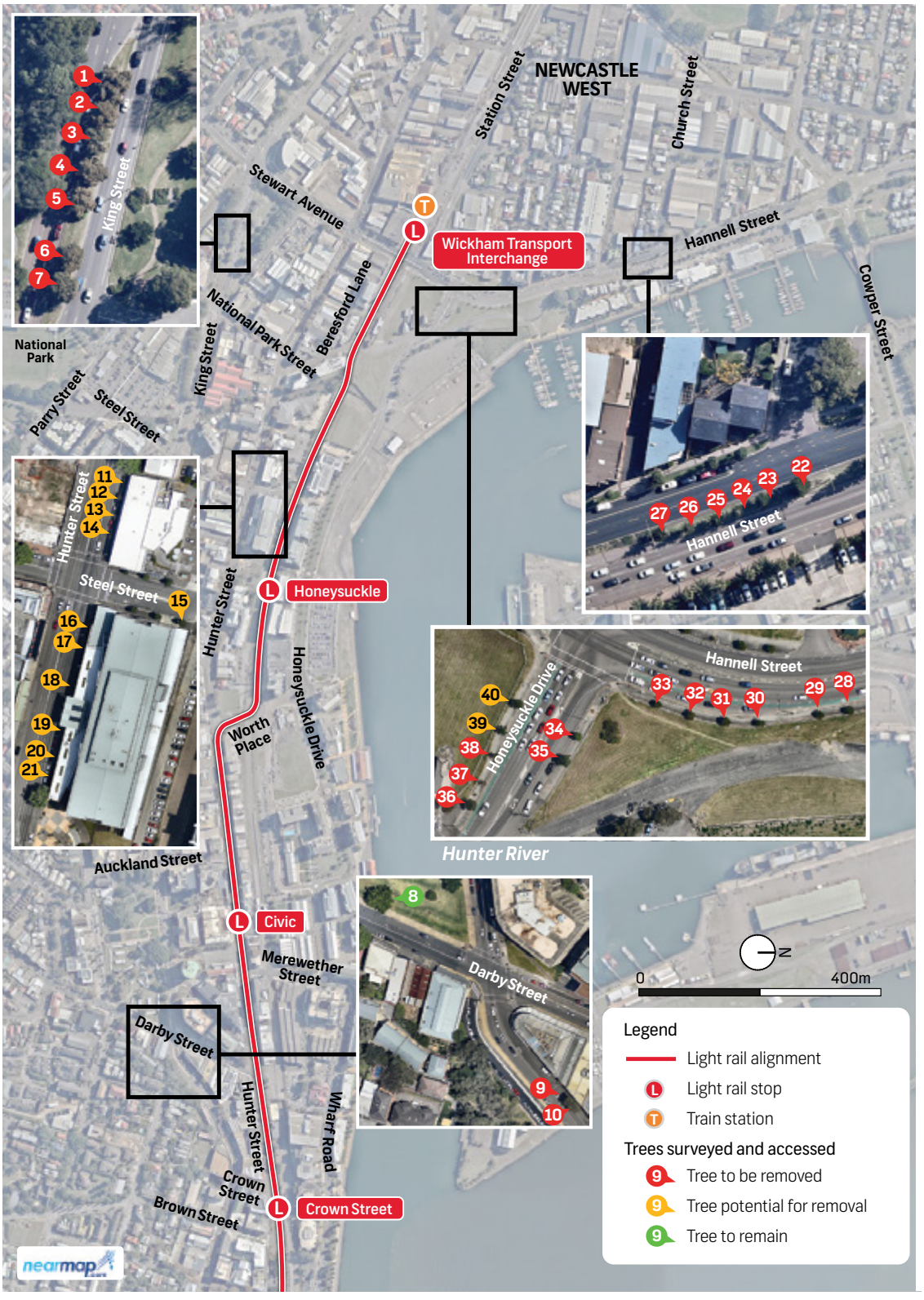

Figure 5-2 Trees surveyed and assessed within the proposal site

Table 5-4 Guidance for offsetting individual trees

Tree type	Offset
Large tree (DBH > 60 cm)	Plant minimum 8 trees
Medium tree (DBH >15 cm but < 60 cm)	Plant minimum 4 trees
Small young tree (DBH <15 cm)	Plant minimum 2 trees

Source: Transport for NSW Vegetation Offset Guide V3, 2016

A further 14 trees may require removal, depending on the extent of excavation and construction within their root zones. These trees would be protected during construction and include:

- Trees 11 to 14 and 16 to 21: London Plane (*Platanus x acerifolia*) and Oriental Plane (*Platanus orientalis*), growing in the footpath on the northern side of Hunter Street, east and west of the intersection with Steel Street.
- Tree 15: Broad-leaved Lilly Pilly (*Syzygium syn. Acmena hemilampra*) growing in the footpath and protected by fencing at the north-eastern end of Steel Street, north of the Hunter Street/ Steel Street intersection.
- Trees 39 and 40: Tulipwood (*Harpullia pendula*), growing along Honeysuckle Drive, adjacent to the intersection with Stewart Avenue/Hannell Street.

Tree 8, the Hill's Weeping Fig (*Ficus hillii*) located in Civic Park adjoining Darby Street, south of the King Street/Darby Street intersection is growing near an area of proposed construction works. This tree is not proposed for removal but will require protection during construction (see section 5.2.4).

The proposal site is located in a highly modified urban environment and has low ecological significance. Any fauna inhabiting the study area would be common to urban environments and tolerant of typical urban development. There are no aquatic habitats within or immediately adjoining the proposal site.

The proposal site does not contain any threatened ecological communities or habitat for threatened species listed under the TSC Act. Therefore, there is no likelihood of significant impacts on threatened flora and fauna due to proposal works. The proposal would not have a significant impact on threatened or migratory biota listed under the EPBC Act and there is no requirement for referral to the Commonwealth Minister for the Environment on ecological grounds.

5.2.4 Mitigation measures

Pre-construction and construction

- A vegetation management plan would be prepared as part of the CEMP including a detailed list of the measures that would be implemented during construction to minimise the potential impacts on trees to be retained. The management measures to be incorporated would include:
  - The construction plans would clearly document the location and full extent of any vegetation disturbance required. These areas would be clearly marked on the ground to avoid disturbance to adjacent retained vegetation, and exclusion fencing would be installed around trees to be retained.
  - The management of trees near the construction zone would be consistent with the *AS 4970-2009 Protection of trees on development sites* (incorporating Amendment No. 1 (March 2010)).
  - Tree protection methods would be marked on the environmental control maps.
  - Any trees proposed for removal would be replaced and/or offset in accordance with Transport for *NSW's Vegetation Offset Guide* (2016). This would be undertaken in consultation with Council.

- All tree removal, maintenance and protection work would be undertaken by a qualified arborist with appropriate competencies recognised within the Australian Qualification Framework, with a minimum of five years of continual experience within the industry of operational amenity arboriculture, and covered by appropriate and current types of insurance to undertake such works.
- Weeds would be managed and disposed of in accordance with the requirements of the *Noxious Weeds Act 1993* and/or the *Weeds of National Significance Weed Management Guide*. The African Olive growing near tree 7 is a declared noxious weed.
- Weed control and management strategies would be documented and implemented in accordance with the *Weed Management and Disposal Guide* (TfNSW, 2015). This would include procedures to reduce the spread of weeds via vehicles and machinery, such as visual inspection of vehicles prior to exit from site to ensure they are clear of plant material.
- The TPZs and associated controls, including storage and movement restrictions, would be implemented as part of the plan. If works were required within the TPZs, they would be restricted to the area outside of the structural root zone to avoid disturbing the stability and health of the trees. The specific TPZ management measures described in detail in the arboricultural assessment in Technical Paper 2 would be implemented for all of the works within the TPZs of the trees to be retained (see section 5.2.3).

5.3 Noise and vibration

This section summarises the specialist report prepared by GHD which is included in full in Technical Paper No. 3 – Noise and Vibration Assessment.

5.3.1 Assessment approach and methodology

The assessment involved:

- identifying the noise and vibration sensitive receivers within the study area
- describing the noise and vibration baseline using data acquired for the light rail REF and additional monitoring
- establishing noise and vibration criteria and management levels for the proposal
- identifying key areas of potential impact during construction and providing guidance for the development of reasonable and feasible measures to minimise the potential significance of impacts, particularly in relation to noise experienced by sensitive receivers, and the impacts of vibration on heritage items and other sensitive land uses.

The assessment was undertaken in accordance with the *Construction Noise and Vibration Guideline* (RMS, 2016) and the NSW Road Noise Policy (DECCW, 2011). While Transport for NSW projects would typically be undertaken in accordance with the *Construction Noise Strategy* (TfNSW, 2012), the proposal works are primarily within the road reserve, are not rail related, and are not dependant on track possessions. Therefore, the Roads and Maritime guidelines are more applicable in this instance.

5.3.2 Existing environment

Noise sensitive receivers and background noise monitoring

Characteristic of its city centre location, the proposal site consists of a varied mix of land uses, including commercial, residential, education, recreation, community and transport infrastructure.

Sensitive receivers are those that may potentially be affected by noise and vibration impacts. Noise and vibration sensitive receivers are identified according to the type of land use and the activities undertaken. Sensitive noise and vibration receivers include:

- residences
- educational facilities
- hospitals and medical facilities
- places of worship
- passive and active recreational areas such as parks and sporting fields – these receivers are only considered sensitive when they are in use or are occupied.

Sensitive receivers potentially affected by construction noise or vibration impacts due to the proposal have been grouped into the following three noise catchment areas (NCAs):

- NCA1 – receivers on Stewart Avenue between Warrah Street and the light rail route as well as receivers near the intersection of King Street and Stewart Avenue, and Hunter Street and Stewart Avenue.
- NCA2 – receivers near the Hunter Street/ Steel Street intersection.
- NCA3 – receivers near the King Street/ Darby Street intersection.

Background noise monitoring was previously undertaken for the light rail REF to establish a representative noise environment. Relevant unattended noise monitoring data from that report was used in this assessment. In addition, background noise monitoring was undertaken, in accordance with the *Industrial Noise Policy* (EPA, 2000) long term monitoring method, at 101/328 King Street between 25 May and 3 June 2016.

Noise monitoring locations and NCAs are shown in Figure 5-3.

Rating background level (RBL) and ambient noise levels are summarised for each monitoring location in Table 5-5. The ambient noise levels are considered typical of an inner urban area influenced by road traffic noise, commercial activities and residential urban noise.

Table 5-5 Summary of RBL and ambient noise monitoring results, dB(A)

		RBL $L_{A90(period)}$			Ambient noise level $L_{Aeq(period)}$		
NCA	Logger location	Day	Evening	Night	Day	Evening	Night
NCA11	–	50	45	40	–	–	–
NCA22	754 Hunter Street	51	49	42	58	63	52
NCA3	101/328 King Street	56	52	45	66	64	60

Note 1: An estimate of background noise levels representative of NCA 1 was sourced from estimates provided in the Construction Noise and Vibration Guideline (RMS 2016) as no measurement data is available for this area. An estimate is acceptable for projects where receivers will be impacted by construction noise for less than three weeks' duration.

Note 2: NCA2 background data has been sourced from the light rail REF.

Vibration sensitive locations

Vibration sensitive locations are structures or land uses that could be adversely affected by vibration. These locations could include residential dwellings, heritage structures, precision laboratories or hospital operating theatres.

Land uses that are particularly sensitive to vibration within 100 metres of the proposal are summarised in Table 5-6.

Table 5-6 Non-residential vibration land use within 100 metres of the proposal

Location (land use)	Address
Pathology Laboratory	780 Hunter Street, Newcastle West
Hunter Street Medical Centre	802 Hunter Street, Newcastle West
Hunter Radiology	1/710 Hunter Street, Newcastle West
Newcastle Community Health Centre/ Hunter Area Pathology Service	670 Hunter Street, Newcastle West
The Face Place (Laser surgery)	368-370 King Street, Newcastle
Medibank Health Solutions	13 Darby Street, Newcastle

Vibration sensitive heritage structures within 50 metres of the proposal are summarised in Table 5-7.

Table 5-7 Heritage structures within 50 metres of the proposal

Heritage structure	Address
Wickham Railway Station	Beresford Street
Former Newcastle Cooperative Store	854 Hunter Street
Former School of Arts	80 Honeysuckle Drive

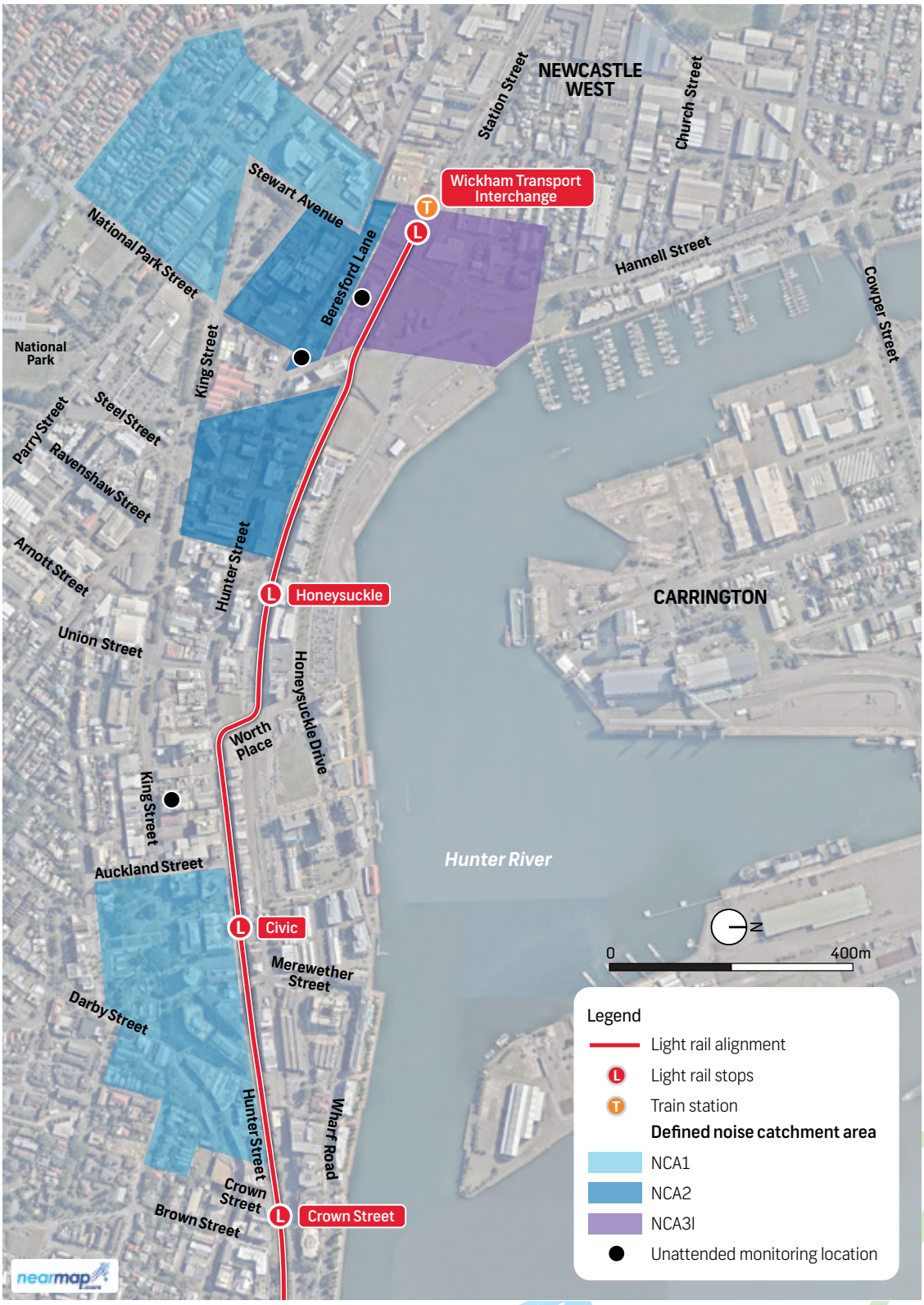

Figure 5-3 Noise monitoring locations and NCAs

5.3.3 Noise and vibration criteria

A summary of the assessment management levels and criteria developed for the proposal is provided in the following tables. Table 5-8 and Table 5.9 provide the construction noise management levels and criteria for the proposal for residential and non-residential receivers respectively.

Table 5-8 Summary of construction noise management levels at residential receivers

	Measured RBL L_{A90}			Construction noise management levels L_{Aeq}				
NCA	Day	Evening	Night	Highly noise affected	Standard construction hours	Outisde standard working hours – day	Outside standard working hours – evening	Outside standard working hours – night
NCA1[1]	56	52	45	75	66	61	57	50
NCA2[2]	51	49	42		61	56	54	47
NCA3	56	52	45		66	61	57	50

Note 1: Adopted background levels for NCA1 have been sourced from Table D1 of Appendix D of the Construction Noise and Vibration Guideline (RMS 2016) for an urban area. This is acceptable for projects where receivers will be impacted by construction noise for less than three weeks' duration.

Note 2: NCA2 background data has been sourced from the light rail REF.

Table 5-9 Construction noise management level at non-residential receivers

Land use	Management level, $L_{Aeq(15min)}$ (applies when properties are in use or occupied)
Classrooms at schools and other educational institutions	Internal noise level – 45 dB(A)
Hospital wards and operating theatres	Internal noise level – 45 dB(A)
Places of worship	Internal noise level – 45 dB(A)
Active recreation areas (characterised by sporting activities and activities which generate their own noise or focus for participants, making them less sensitive to external noise intrusion)	External noise level – 65 dB(A)
Passive recreation areas (characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion, for example, reading, meditation)	External noise level – 60 dB(A)
Industrial premises	External noise level – 75 dB(A)
Commercial premises	External noise level – 70 dB(A)

Source: DECC 2009

Table 5-10 provides traffic noise target levels for residential receivers in the vicinity of existing roads, based on the NSW Road Noise Policy (DECCW, 2011). Table 5-11, Table 5-12 and Table 5-13 provides the vibration criteria for human comfort and structural damage. Safe working buffer distances to comply with the human comfort and structural damage criteria are presented in Table 5.14. Guidance values for vibration on buried pipes and services is provided in Table 5.15.

Further information on how the criteria were derived is provided in Technical Paper 3.

Table 5-10 Construction traffic noise criteria $L_{Aeq(period)}$, dB(A)

Type of development	Day 7am to 10pm	Night 10pm to 7am
Existing residence affected by additional traffic on arterial roads generated by land use developments	60 $L_{eq(15hr)}$	55 $L_{eq(9hr)}$
Existing residence affected by additional traffic on local roads generated by land use developments	55 $L_{eq(1hr)}$	50 $L_{eq(1hr)}$
School classrooms	Internal noise level 40 $L_{Aeq(1hr)}$ dB(A) (When in use)	-
Places of worship	Internal noise level 40 $L_{Aeq(1hr)}$ dB(A) (when in use)	Internal noise level 40 $L_{Aeq(1hr)}$ dB(A) (when in use)
Open space (active use)	External noise level 60 $L_{Aeq(15hr)}$ dB(A) (when in use)	-
Open space (passive use)	External noise level 55 $L_{Aeq(15hr)}$ dB(A) (when in use)	-

Source: DECCW 2011

Table 5-11 Human comfort intermittent vibration limits

	Day time[1]		Night time[1]	
Location	Preferred value	Maximum value	Preferred value	Maximum value
Critical areas[2]	0.10	0.20	0.10	0.20
Residences	0.20	0.40	0.13	0.26
Offices, schools, educational institutions and places of worship	0.40	0.80	0.40	0.80
Workshops	0.80	1.60	0.80	1.60

Source: British Standard BS 6472:1992

Note:

1 *Day time is 7:00 to 22:00 and night time is 22:00 to 7:00.*

2 *Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. These criteria are only indicative, and there may be need to assess intermittent values against the continuous or impulsive criteria for critical areas.*

Table 5-12 Guidance on effects of vibration levels for human comfort

Vibration level	Effect
0.14 mm/s	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction.
0.3 mm/s	Vibration might be just perceptible in residential environments.
1.0 mm/s	It is likely that vibration at this level in residential environments will cause complaints, but can be tolerated if prior warning and explanation has been given to residents.
10 mm/s	Vibration is likely to be intolerable for any more than a very brief exposure.

Source: British Standard BS 5228:2009

Table 5-13 Guidance values for short term vibration on structures

		Guideline values for velocity, (mm/s)		
Line	Type of structure	1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz[1]
1	Buildings used for commercial purposes, industrial buildings, and buildings of similar design.	20	20 to 40	40 to 50
2	Dwellings and buildings of similar design and/or occupancy	5	5 to 15	15 to 20
3	Structures that, because of their particular sensitivity to vibration, cannot be classified under lines 1 and 2 and are of great intrinsic value (e.g. listed buildings under preservation order)	3	3 to 8	8 to 10

Source: German Standard DIN 4150-3:1999

Table 5-14 Vibration buffer distances

Plant	Rating/description	Safe working distance[1] (metres)	
		Cosmetic damage[2]	Human response [3]
Vibratory roller	< 50 kN (typically 1 to 2 tonnes)	5	15-20
	< 100 kN (typically 2 to 4 tonnes)	6	20
	< 200 kN (typically 4 to 6 tonnes)	12	40
	< 300 kN (typically 7 to 13 tonnes)	15	100
	> 300 kN (typically 13 to 18 tonnes)	20	100
	> 300 kN (> 18 tonnes)	25	100
Small hydraulic hammer	300 kg – 5 to 12 tonnes excavator	2	7
Medium hydraulic hammer	900 kg – 12 to 18 tonnes excavator	7	23
Large hydraulic hammer	1600 kg – 18 to 34 tonnes excavator	22	73
Vibratory sheet piling	Sheet piles	2-20	20
Boring rig	≤ 800 mm	2 (nominal)	4
Jackhammer	Hand held	1 (nominal)	2

Note 1: More stringent conditions may apply to heritage and/or other sensitive structures.

Note 2: Safe working distances for cosmetic damage based on BS7385:2 Evaluation and Measurement for Vibration in Buildings Part 2: Guide to Damage Levels from Ground-borne Vibration.

Note 3: Safe working distances for human response based on Assessing Vibration: A Technical Guideline (DEC 2006).

Table 5.15 Vibration values for short term impacts on buried services

Pipe material	Guideline values for velocity measured on the pipe (mm/s)
Steel (including welded pipes)	100
Clay, concrete, reinforced concrete, metal (with or without flange)	80
Masonry, plastic	50

Note: Consideration must also be given to pipe junctions within the building structure and potentially significant changes in mechanical loads on pipes must be considered.

5.3.4 Impact assessment

Construction noise

Construction typically requires the use of heavy machinery, which can generate high noise and vibration levels at nearby receptors. At any location, the potential impacts may vary greatly depending on factors such as the proximity of sensitive receivers, the duration of works, the magnitude of the noise levels, the time at which the construction is undertaken, and the character of the noise or vibration emissions.

Noise levels have been predicted using computer modelling software based on the preliminary list of plant and equipment and an assumed construction methodology (summarised in section 3).

In accordance with the assessment guidelines, the potential noise impacts have been predicted with a focus on those activities with the highest potential to cause noise impacts, and assuming that the loudest plant for each activity is operating continuously. It is therefore expected that the predictions identify worst case noise levels, which may not be reached or only infrequently reached during the construction period. Generally, plant and equipment would not need to be running at full power all the time, and at other times may be idling or even switched off. The other key consideration with the proposal is that construction would progress from location to location. Therefore, noise impacts would be experienced for a relatively short time at most locations.

Predicted sound power levels at a range of distances for each construction activity are presented in Table 5.16.

Based on a worst case assessment approach, Table 5.16 indicates that construction noise levels would exceed the highly noise affected level of 75 dB(A) (refer Table 5.8) for sensitive receivers at distances of up to 40 metres during all construction activities. These receivers are shown on Figure 5-4.

Table 5-16 Predicted noise levels at selected distances from construction activities

Activity	Adopted sound power level, dB(A)	Noise level at distance, dB(A)						
		10m	20m	40m	100m	200m	400m	1,500m
Mobilisation and site establishment	Leq 115	87	81	75	67	61	55	43
Utility, property, service adjustment	Leq 116	88	82	76	68	62	56	44
Corridor clearing	Leq 122	94	88	82	74	68	62	50
Drainage infrastructure	Leq 115	87	81	75	67	61	55	43
Road furniture installation	Leq 110	82	76	70	62	56	50	38
Road works	Leq 124	96	90	84	76	70	64	52
Resurfacing works	Leq 118	90	84	78	70	64	58	46

Red depicts where 'highly noise affected' criteria is exceeded.

Figure 5-4 Predicted day time construction noise exceedances

There is also the potential for sleep disturbance impacts during out of hours work. About 70 per cent of construction activities would be undertaken outside of standard construction hours to reduce impacts on traffic and day time amenity. Construction works are anticipated to be staged and unlikely to be continuous over consecutive nights, except in the larger areas of resurfacing. This would effectively offer affected receivers respite periods from the noise.

Predictive computer noise modelling was undertaken in SoundPlan (version 7.4) using the CONCAWE prediction methodology under calm atmospheric conditions, to calculate noise levels at distance from resurfacing activities at night. Resurfacing works are considered to be the noisiest possible activity to be undertaken at night due to the equipment used. This assumes that no rock hammering would be undertaken at night.

Figure 5-5 shows the location of predicted night time construction noise exceedances based on the criteria provided in Table 5.8.

Standard noise mitigation measures would be implemented in accordance with Transport for NSW's *Construction Noise Strategy* (2012) as well as additional measures where feasible and reasonable. These measures would be detailed in the construction noise and vibration management plan for the proposal and are outlined in section 5.3.5.

Construction traffic noise

The NSW Road Noise Policy (DECCW, 2011) states that an increase of up to 2 dB is representative of a minor impact that is considered barely perceptible to the average person. The proposal is not anticipated to generate enough construction traffic to increase road noise levels by 2 dB or more. The construction traffic noise criteria are therefore expected to be met at all sites.

Construction vibration

Typical vibration generating activities during construction of the proposal would include:

- general earthworks, site clearing and demolition works including the use of excavators with and without hydraulic hammer attachments
- concrete removal and ground compaction, compactor and hand tools.

Due to a number of site specific factors (e.g. ground type and topography), there is inherent variability in ground vibration predictions without site-specific measurement data. Theoretical safe working buffer distances to comply with the human comfort and structural damage criteria are presented in Table 5.14. Vibration sensitive receivers, including heritage structures, are situated within the recommended vibration buffer distances within the proposal site. Based on the assumed plant and equipment, there is potential for vibration generating construction activities and plant operating within the recommended buffer distances outlined in Table 5-14.

Vibration management and mitigation is required to avoid or reduce structural damage and human comfort impacts (refer to section 5.3.5).

Figure 5-5 Predicted night time construction noise exceedances

5.3.5 Mitigation measures

Pre-construction

- A construction noise and vibration management plan would be prepared and implemented for the proposal. The construction noise and vibration management plan would include all of the standard mitigation measures prescribed in the *Construction Noise Vibration Guideline* (RMS, 2016).
- The construction noise and vibration management plan would also include the following additional mitigation measures prescribed in Table C1 of the *Construction Noise Vibration Guideline* (RMS, 2016):
  - General letterbox drop (or equivalent) would be undertaken to the wider locality no less than five working days prior to the start of works.
  - Letterbox drop (or equivalent) would be undertaken to affected stakeholders no later than seven calendar days ahead of construction activities. Additional information, such as timing, equipment, methodology, would be provided to more highly affected receivers than covered in general letterbox drops.
  - Phone calls detailing relevant information would be made to affected stakeholders within seven calendar days of proposed work.
  - Individual briefings would be undertaken to inform affected stakeholders of the impacts of high noise activities and mitigation measures that will be implemented. Stakeholders would be visited at least 48 hours prior to potentially disturbing construction activities.
  - As a guide, all work should be carried out in continuous blocks that do not exceed three hours each, with a minimum respite period of one hour in between each block.
  - The community would be consulted prior to construction commencing on the option to implement duration respite. Duration respite would require an increase in out of hours works in order to complete construction more quickly.
  - Work carried out during week day evenings (6 pm -10 pm), on Saturday (7 am – 8 am, 1 pm – 10 pm), and Sundays or public holidays (8 am – 6 pm) would be limited to no more than three consecutive evenings per week separated by not less than one week except where there is a duration respite.
  - Work carried out during the night time on week days (10 pm – 7 am), Saturday (10 pm – 8 am), and Sundays or public holidays (6 pm – 7 am) would be limited to two consecutive nights, separated by not less than one week, except for where there is duration respite.
- Vibration monitoring would be carried out prior to construction commencing to assess the radius of potential influence of high vibration generating activities on adjacent structures. Monitoring would be undertaken in non-sensitive areas and at a range of distances from the source. Results of the monitoring would be compared against predicted vibration levels and the potential for impact refined, if appropriate.
- The effectiveness of source-based mitigation measures, such as changing the operating speed of the vibratory roller to generate a higher frequency of vibration, which may allow for a higher vibration threshold at the structure, would be confirmed once final construction equipment and methodologies have been finalised prior to construction commencing.
- Once final construction equipment and methodologies have been finalised, locations for property condition surveys would be confirmed. Survey would be required for all properties within the recommended buffer distances in Table 5-14, or where pre-construction monitoring indicates that vibration levels from construction activities would exceed the target levels. A property condition survey report should include as a minimum:
  - a visual inspection of all buildings and structures (all internal and external walls, ground level floors and external pavements, all connections of other structures above ground level and their connection at ground level and any exposed foundations)
  - photographs of all cracks and/or defects observed
  - a record of the location of all cracks and/or defects observed, and measurements of the crack width/defect size.

Construction

- The measures outlined in the construction noise and vibration plan would be implemented at all times during construction.
- Vibration measurements would be taken at the commencement of construction to determine site specific conditions and confirm potential vibration impacts and required management.
- Recommended safe working distances for vibration intensive plant taken from the *Construction Noise Vibration Guideline* (RMS, 2016) are provided in Table 5-14.
- No rock hammering would be undertaken outside of standard construction hours.

5.4 Other issues

5.4.1 Soils and water

Existing environment

Topography, geology and soils

The study area is located on a generally flat, low-lying coastal plain associated with the Lower Hunter Plain region, with rising sedimentary terrain immediately south of the Newcastle city centre. The study area slopes from the south to the north and drains to Newcastle Harbour.

The study area is underlain by quaternary deposits and the Newcastle coal measures of the late Permian age. The quaternary deposits comprise gravel, sand, silt, clay, and marine and freshwater deposits. The Newcastle coal measures comprise sandstone, siltstone, claystone, conglomerate, shale, coal, and tuff from the Lambton sub-group. The proposal site is underlain by the Hamilton soil landscape group to the west, and the Killingworth soil landscape group to the east.

Acid sulphate soils mapping for the study area indicates that there is a low probability of acid sulphate soils, with the potential to occur at depths greater than three metres below ground level.

Contamination

A search of the NSW Environment Protection Authority (EPA) contaminated land register (record of notices and notified contaminated sites) was undertaken on 25 May 2016 for the study area surrounding the proposal site.

No contaminated sites were identified within the proposal site.

The following sites are located within about a one kilometre radius of the proposal site:

- 50 Honeysuckle Drive, Newcastle – this site has been voluntarily remediated as part of the Honeysuckle development
- 26-28 Honeysuckle Drive, Newcastle – reclaimed land
- 313-317 Wharf Road, Newcastle – car park
- 40 Stevenson Place, Newcastle – other industry
- Scott Street, Newcastle – gasworks
- 113 Parry Street, Newcastle West – former Mobil service station.

Mine subsidence

The study area has been previously undermined to extract coal from the Newcastle coal measures. Mapping prepared by the NSW Mine Subsidence Board indicates that the area is variously subject to category A, B and C restrictions for surface development. Specific requirements for the assessment and management of sites within each category are specified by the Board.

Consultation with the Mine Subsidence Board would be undertaken by Transport for NSW prior to construction commencing to determine any specific requirements for the proposal.

Water, hydrology and flooding

Watercourses and drainage

Cottage Creek flows through the study area and there is a concrete lined channel located to the north of Bellevue Street. The creek flows under Hunter Street and the light rail route via culverts, and discharges to the Hunter River under Honeysuckle Drive. The existing stormwater drainage system within and near the proposal site is assumed to be fully functional and would be investigated further during detailed design where required.

Flooding risk

Newcastle has a long history of flooding, given that much of the city was developed on former wetlands and floodplains, and is located adjacent to the Hunter River and the Pacific Ocean (BMT WBM, 2012). The Newcastle city centre is subject to river flooding, flash flooding and ocean flooding/storm surge.

Flooding information indicates that, during a two-year average recurrence interval storm event, flooding would occur on either side of Cottage Creek and along Wharf Road near Queens Wharf. Flood depths during this event are expected to be up to 200 millimetres (PB/Aurecon, 2014).

Groundwater

During the geotechnical investigations undertaken as an input to the pre-concept design for light rail project (PB, 2015) groundwater inflows were recorded within the light rail route at four test pits, at depths ranging from 1.5 to 2.3 metres. Outside the light rail route, groundwater was recorded in all boreholes at depths ranging from 1.5 metres (0.35 metres Australian Height Datum (AHD)) to 4.9 metres (2.7 metres AHD) below ground level. Groundwater levels are expected to change seasonally and be influenced by the tide and major rainfall events.

Impact assessment

Construction

Soils

Construction of the proposal would not result in any changes to the existing terrain and landforms. No changes to road grades are proposed.

There is a low probability of acid sulphate soils being intercepted with the potential to occur at depths greater than three metres below ground level, which is greater than the maximum depth of excavation proposed.

Construction of the proposal would involve disturbing the ground surface and subsurface. The limit of excavation is expected to be about one metre.

If inadequately managed, excavation and stockpiling activities could have the following impacts:

- erosion of exposed soil and stockpiled materials
- dust generation from excavation and vehicle movements over exposed soil
- an increase in sediment loads entering the stormwater system and/or local runoff.

The potential for these impacts would be managed by the implementation of standard mitigation measures.

Contaminated land

As stated earlier, there are no known areas of contamination within the proposal site.

Investigations undertaken for UrbanGrowth NSW by AECOM in 2014 and 2015 included a review of 25 previous contamination investigations near the light rail project. Key issues identified in previous investigations included:

- asbestos (chrysotile) was found in soil samples at Wickham Station
- elevated concentrations of metals were found in groundwater around Wickham and Newcastle stations
- a former petrol station was located on the corner of Scott and Watt Streets (decommissioned in the 1980s)
- sources of contamination (hydrocarbons, heavy metals) were identified around Newcastle Station
- contaminated fill material was found between Civic and Wickham stations
- underground storage tanks were found north of Wickham Station
- asbestos fragments were noted, and it was considered likely that underground asbestos piping is located, in the area north of Wickham Station
- hydrocarbon contamination of fill, and copper and zinc levels, which exceeded the relevant criteria, was identified at 352-356 Hunter Street.

In light of the above, excavation for the proposal may disturb contaminated soils. If inadequately managed, the disturbance of any areas of contamination has the potential to impact on human health and water quality.

Hydrocarbon spills and leaks from construction vehicles have the potential to contaminate soils.

Water

Construction of the proposal would involve disturbance of the ground surface and minor changes to the Council stormwater drainage system where new kerb and gutter is installed. The main potential impacts to water quality relate to soil disturbance and runoff during construction.

Pollutants such as sediment, soil nutrients and other contaminants bound to soil particles have the potential to mobilise and enter the stormwater system, Cottage Creek and Newcastle Harbour, particularly during high rainfall events.

Water quality impacts could also potentially occur during construction because of the possible erosion of loose stockpiles and contamination by fuel or chemical spills from construction vehicles.

Although the proposal has the potential to temporarily reduce water quality from pollutants and run-off, it would not be expected to cause significant impacts to the overall condition of surrounding waterways with the implementation of proposed mitigation measures. Given the transient nature of the works, construction is unlikely to result in any long-term water quality impacts in the study area.

The risk of water quality impacts, and the significance of any impacts that may occur, would be managed by implementing the mitigation measures provided below.

The works would not result in significant changes to drainage or flood catchments.

The water table is not anticipated to be intercepted.

Operation

Operation of the proposal would not impact on topography, soils and geology. However, operation of the proposal would result in a minor increase in runoff from the paving of areas which are currently pervious. This is likely to be very small when considered over the entire catchment.

Mitigation measures

Pre-construction

- An erosion and sediment control plan would be prepared to manage any potential runoff resulting from the proposed works during construction (in accordance with *Managing Urban Stormwater, Soils and Construction Guidelines* (the Blue Book, Landcom, 2004)). It would include (but not be limited to) measures to:
  - prevent sediment moving off-site and sediment laden water entering any drainage lines or drain inlets
  - reduce water velocity and capture sediment on site
  - minimise the amount of material transported from site to surrounding pavement surfaces
  - divert clean water around the site.
- Erosion and sediment controls would be established prior to the start of construction works.
- Transport for NSW would consult with the Mine Subsidence Board to determine any specific requirements for the proposal in relation to land within the mine subsidence areas.

Construction

- Groundwater encountered during construction would be managed and disposed of in accordance with the *Waste Classification Guidelines* (EPA, 2014) and the *Water Discharge and Reuse Guideline* (TfNSW, 2015). Groundwater would be managed to ensure it does not cause pollution of waters in accordance with section 120 of the POEO Act.
- Erosion and sediment controls would be checked and maintained on a regular basis (including the clearing of sediment form behind the barriers).
- Construction erosion and sediment controls would not be removed until the works are complete and long term erosion and sediment controls are in place.
- All materials onsite or being delivered to the site would be wholly contained within the site. The requirements of the POEO Act would be complied with when placing/stockpiling loose material or when disposing of waste products or during any other activities likely to pollute drains or watercourses.

- Any loose material stockpiles would be stored within the temporary construction compound(s) and would be protected from possible erosion.
- All services and utilities in the area of construction must be appropriately disconnected and reconnected as required. The contractor is required (if necessary) to consult with the various service authorities regarding their requirements for the disconnection of services.

5.4.2 Aboriginal heritage

This section summarises the due diligence assessment undertaken for the proposal by RPS (September 2016). The assessment was prepared in accordance with the Due Diligence Code of Practice for the Protection of Aboriginal Objects (DECCW, 2010). A copy of the report is provided in Technical Paper 4.

Assessment approach and methodology

The assessment involved:

- searches of relevant heritage registers, including the Aboriginal Heritage Information Management System database (AHIMS)
- reviewing the proposal description and plans
- description of the environmental, Aboriginal historical and archaeological context of the study area
- reviewing previous archaeological and heritage reports that are relevant to the proposal site recommendations for management and mitigation measures for Aboriginal sites in the context of the proposal
- assessment of impacts and formulation of management measures where required.

Existing environment

The AHIMS database was searched on 21 April 2016 to identify registered (known) Aboriginal sites or declared Aboriginal places located within or adjacent to the proposal site. The results of the search indicated that 26 Aboriginal sites have been previously recorded within the search area. Many of these listed sites are located along the Newcastle foreshore region, which is an archaeologically sensitive landform. This landscape is characterised by a mix of Quaternary sand sheets, resource-rich estuarine banks and prominent ridgeline promontories. Four sites recorded on the AHIMS are within 30 metres of the proposal site (see Figure 5-6).

Evidence of past Aboriginal activities in the study area is also demonstrated by the results of several sub-surface archaeological investigations undertaken in the surrounding area. The potential for subsurface archaeological material within the proposal site is considered to be moderate to high.

Impact assessment

The proposal is limited to pavement extension, line marking and the placement of a number of new medians. These works involve limited subsurface disturbance for pavement extension and new medians. The subsurface work would be to a maximum depth of one metre and as such would not extend below the existing road pavements.

Accordingly, due to the limited nature of the proposed works and the subsurface nature of the known Aboriginal sites, an impact to Aboriginal heritage is not considered likely.

Mitigation measures

Pre-construction

- All relevant project staff and contractors would be made aware of their statutory obligations for heritage under the *National Parks and Wildlife Act 1974* and the *Heritage Act 1977*, via a heritage induction prior to commencement of work on site.

Construction

- If unrecorded Aboriginal objects are identified in the proposal site during works, then all works in the immediate area must cease and the area should be cordoned off. The Office of Environment and Heritage (OEH) must be notified by ringing the Enviroline on 131 555 so that the site can be adequately assessed and managed.
- In the unlikely event that skeletal remains are identified, works would cease immediately near the remains and the area would be cordoned off. The proponent would contact the local NSW Police who will make an initial assessment as to whether the remains are part of a crime scene or are possible Aboriginal remains. If the remains are thought to be Aboriginal, OEH would be contacted by ringing the Enviroline on 131 555. An OEH officer would determine if the remains are Aboriginal or not and a management plan must be developed in consultation with the relevant Aboriginal stakeholders before works recommence.

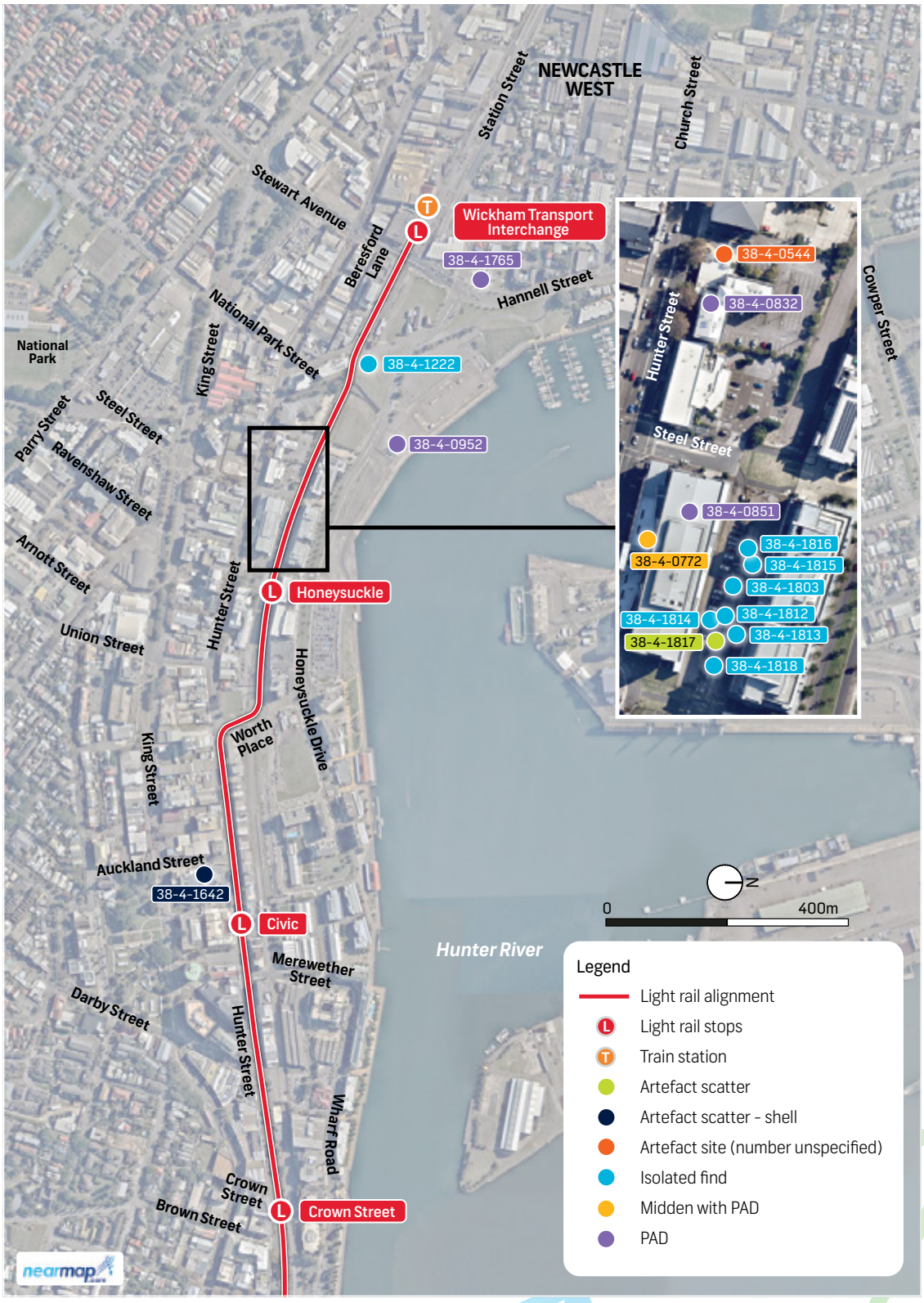

Figure 5-6 Known Aboriginal sites in proximity to the proposal site

5.4.3 Non-Aboriginal heritage

This section summarises the results of the statement of heritage impact prepared by RPS (September 2016). The assessment was prepared in accordance with *The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance* (Australia ICOMOS, 2013), *Assessing Heritage Significance* (Heritage Officer (former), 2001) and *Statements of Heritage Impact* (Heritage Office and Department of Urban Affairs & Planning (former), 1996, revised 2002). A copy of the full report is provided in Technical Paper 5.

Assessment approach and methodology

The assessment involved:

- identifying listed heritage items in the vicinity of the proposal site by searching relevant heritage databases
- a site survey and photographic inventory
- reviewing the proposal description and plans
- reviewing the *Newcastle Archaeological Management Plan* (Suters Architects, 1997), the *Newcastle Archaeological Management Strategy* (Council, 2015) and *Newcastle Archaeological Management Plan Review* (Higginbotham, 2015)
- determining whether an impact is likely
- providing mitigation measures, as required.

Existing environment

Newcastle is one of the oldest European settlements in Australia. The proposal site is located within a historically significant area of Newcastle as a result of its inner city location. The inner city area of Newcastle is based on the original settlement, which was established on the sand hills of the Hunter River delta.

The built heritage in the study area reflects the evolution and expansion of Newcastle from the arrival of the first European settlers to the present day. The city centre includes a number of built and non-Indigenous heritage features of State and/or local significance.

The heritage listed items within or adjacent to the proposal site, and those within 50 metres of the site, are described below and shown in Figure 5-7.

State heritage items

There are no items listed on the State heritage register located within the proposal site.

The Castlemaine Brewery (former) listed on the State heritage register is located within 50 metres of proposed works on Hunter Street, west of the Hunter Street/ Stewart Avenue intersection.

Section 170 register

Section 170 of the *Heritage Act 1977* requires State government agencies to keep records of heritage items they own or operate. There are no items listed on the section 170 register within the proposal site.

The Wickham Railway Station listed on the RailCorp section 170 register is located within 50 metres of the proposal site. An application to have this item removed from the register as part of the light rail project was lodged with Sydney Trains in 2015.

Local heritage items

One item and two heritage conservation areas, listed under the LEP, are located within the proposal site:

- Stewart Avenue fig trees
- Newcastle City Centre Heritage Conservation Area
- Hamilton South Garden Suburb Heritage Conservation Area.

Nineteen items and one archaeological site are located within 50 metres and have clear line of sight of the proposal. These are listed in Table 5-17 and shown in Figure 5-7.

Figure 5-7 Heritage items within and in proximity to the proposal site

Table 5-17 Local heritage items within 50 metres of the proposal site

Item	Address
Wickham Public School	54 Hannell Street
Former Infants School	64 Hannell Street
Albion Hotel	72 Hannell Street
Former School of Arts	80 Honeysuckle Drive
Former Emporium Building	517-525 Hunter Street
Former Police Station	558 Hunter Street
The Moorings (residential units)	199 King Street
Civic Park	201 King Street
Church Walk Park	203 King Street
Newcastle Technical College	590-608 Hunter Street
Hunter Water Board Building	599 Hunter Street
Theatre Royale	669 Hunter Street
Former Castlemaine Brewery	787 Hunter Street
Former Newcastle Co-op Store	854 Hunter Street
Army Drill Hall	498 King Street
Birdwood Park	502 King Street
Hamilton College TAFE	91 Parry Street
Wickham Railway Station	Hannell Street
Wickham Signal Box	Hannell Street
Palais Royale (Government Farm Archaeological Site)	684 Hunter Street

Impact assessment

Construction of the proposal is not likely to directly impact on any heritage items, conversation areas or archaeological sites in proximity to the proposal site.

However, there is potential for indirect impacts including:

- ground-bourne noise and vibration impacts to buildings located close the proposal site as a result of construction works and the movement of plant, vehicles and machinery
- inadvertent damage to items located close to the proposal site
- presence of new infrastructure associated with the operation of the proposal which may change the setting and/or character of areas.

The main potential for impact relates to vibration generated by construction works. The potential for vibration impacts is also discussed in section 5.3. Potential impacts would be minimised by adopting the recommended minimum buffer distances for specified plant items, and where necessary, monitoring levels at potentially affected structures.

For items immediately adjacent to the proposal site, the proposal would have no adverse impacts on the identified heritage significance of these items, provided that measures are taken to prevent accidental physical impact.

Mitigation measures

Construction

- A heritage induction would be developed for employees and contractors. The induction would outline the responsibilities and requirements for heritage under the *Heritage Act 1977*. All workers, contractors and visitors would be required to complete the heritage induction.
- A heritage management plan would be prepared as part of the CEMP and implemented during construction. It would include as a minimum:
  - All heritage items in the immediate vicinity of the proposal site would be marked on environmental control maps, site plans, fenced off where appropriate, and avoided.
  - The detailed construction methodologies would take into account the heritage significance of the area and mapped heritage items. Works would be undertaken in a manner that minimises the potential for damage and avoids physical impact on adjacent heritage listed buildings.
  - Sufficient protection including temporary fencing would be installed around built heritage items where works are to be undertaken in close proximity to these items, or where a thoroughfare or construction access is required.
  - The sites or items that require dilapidation survey. Dilapidation reports would be prepared prior to construction commencing.
  - Any unforeseen or accidental damage would be made good under the supervision of a qualified engineer with heritage experience following consultation with the Transport for NSW project manager. Damage would be determined based on the findings of the pre-construction dilapidation survey.
  - The construction noise and vibration management plan (refer section 6.6.5) would define the construction methods to be used in the vicinity of heritage listed items and the measures to minimise the likelihood of vibration impacts.
- If, during the course of construction works, suspected historic heritage material is uncovered, works must cease in that area immediately. The OEH must be notified by ringing the Enviroline on 131 555 and works would only recommence when an approved management strategy has been developed and approved.

5.4.4 Air quality

Existing environment

The air quality in the Newcastle LGA is generally good and meets the standards set by the *National Environment Protection (Ambient Air Quality) Measure* made under the *National Environment Protection Council (New South Wales) Act 1995* (OEH, 2012).

Impact assessment

The potential for air quality impacts would mainly result from dust generated during excavation and resurfacing works. Dust has the potential to impact on the amenity for people occupying nearby residential or commercial properties, or passing the proposal site. Due to the relatively small scale of works within a well ventilated environment that allows fast dispersion, particularly the limited need for earthworks and overall short duration of construction, the potential for adverse dust impacts is considered to be minimal.

The operation of construction plant, machinery and vehicles may also lead to short term increases in exhaust emissions in the study area. However, these impacts would be relatively minor due to the limited number of construction vehicles and the existing urban nature of the study area and other surrounding influences on air quality (such as vehicle traffic).

There would be some petrochemical odour during road paving. This would be greatest during placement of road pavement and for few days afterward and would diminish rapidly with time. This odour would be unlikely to be cause substantial disturbance.

Mitigation measures

Pre-construction

- Adjacent properties (including the local educational establishments) would be notified of the proposed works, the construction schedule and provided with contact details for any potential air quality, dust or odour issues prior to start of works.

Construction

- Construction vehicles and machinery would park as far away as practicable, from local businesses (particularly food outlets) to minimise disruption.
- Measures (including watering or covering exposed areas) are to be used to minimise or prevent air pollution and dust.
- Construction works that generate dust are not to be undertaken during strong winds or in weather conditions where high levels of dust or airborne particulates are likely.
- Vehicles transporting waste or other materials that may produce odours or dust are to be covered during transportation.
- Machinery not in use would be turned off.
- All machinery used onsite would be regularly maintained and in good operating order.

5.4.5 Land use and property

Existing environment

Characteristic of its inner urban location, the study area contains a varied and relatively dense mix of land uses, including commercial, retail, residential, recreation/ entertainment, community, health and education uses, as well as transport infrastructure.

Impact assessment

The proposed works would not change any of the existing land uses in the study area. Direct impacts on land use as a result of the proposal would mainly relate to the short term presence of construction works within the proposal site, which may temporarily restrict the use of these areas. The only other minor land use impact would result from the short term presence of construction equipment, plant, vehicles and fenced work sites within the proposal site.

There is also the potential of restrictions to access for some commercial premises as a result of construction works. Construction works that may affect property access would be undertaken during off peak hours and affected owners will be consulted and informed. Importantly works are minor and temporary in duration and nature.

Construction may temporarily impact on vehicular and pedestrian access in the immediate vicinity of the work sites. Potential traffic and access impacts are considered in section 6.1.

The works may impact on services and utilities located within the area of proposed works. Impacts would be minimised by ensuring that investigations are undertaken by the contractor to locate all underground services near the proposal site prior to construction commencing. Consultation with service providers would also be undertaken to minimise the potential for impacts, coordinate any service relocations, and ensure access to utilities is preserved for any future maintenance activities.

A small area of land would be acquired at several locations for the proposal (see Table 3.2). The land to be acquired includes about 310 square metres at the north-eastern corner of Civic Park, at the intersection of Darby and King streets. This area of the park is a separate land parcel to the balance of the site and does not include trees. It is not included in the area mapped under the local heritage listing. Typically, this area of the park is not used by visitors for recreational activities or during the monthly Olive Tree Market, as it directly adjacent to the road. Accordingly, it is not considered that acquisition of this area of land would have a significant impact on Civic Park.

Mitigation measures

Pre-construction

- Adjacent properties would be notified of the proposed works and the construction timetable, and provided with contact details to report any issues as a result of the construction activities.
- Prior to the commencement of works, any services and utilities that may be impacted by the works are to be identified and relocated or protected, if required, in consultation with asset owners.

- All acquisitions would be undertaken in consultation with landowners and in accordance with the requirements of the *Land Acquisition (Just Terms Compensation) Act 1991*.

Construction

- Access to private properties, businesses and Civic Park would be maintained at all times unless otherwise negotiated and agreed with landowners.

5.4.5 Socio-economic

Existing environment

Demographics

The proposal would be located within the general area of the Newcastle city centre. The Newcastle locality had a population of about 4,000 people in 2011. The study area has a different demographic compared with other areas of Newcastle and the wider region, with a much higher proportion of single person households, couples without children, and group households. The average age is 35 years, with around 31 per cent of the population aged 50 years and over. Households consist mainly of single persons and couples without children, living in apartments and semi-detached dwellings. Almost 60 per cent of households are renting, suggesting a high turnover of residents.

Social infrastructure

Numerous offices for various local, state and Australian Government service providers are located along or close to the proposal site. There are 36 social service providers located along or close to the proposal site, including personal counselling, employment, health and education services providers. Public spaces around the Newcastle foreshore provide a popular location for informal, recreation as well as large planned events.

Economic

Within the Newcastle city centre, Hunter Street is the traditional retail main street, hosting a diversity of retail and commercial properties and social and government services, with the Civic precinct at its centre. Retail activity is concentrated on the Hunter Street Mall, which leads into public recreation areas near the beach, and at the Marketown shopping centre located south-west of the Civic precinct. The Honeysuckle precinct, located to the north of the proposal site, is a relatively new commercial precinct.

As at the end of 2014, about 280 non-residential properties were identified adjacent to the light rail project site. About 77 per cent of these are businesses, with 13 per cent not for profit or government social services, and about 10 per cent vacant commercial space.

Newcastle has experienced growth in the knowledge industries, with the expansion of health, higher education, research centres, defence industries and professional and technical services. In 2011, the most common occupation in Newcastle was 'professionals' (25.7 per cent). The main employment sector in 2011 was 'health care and social assistance' (employing over 17 per cent of the workforce), followed by retail trade, education and training, and manufacturing.

The development of the University of Newcastle's city campus has the potential to significantly contribute to residential demand in the city centre. The number of jobs in the city centre is forecast to increase by 52 per cent between 2006 and 2031, with an increase of 10,240 jobs over the period.

Impact assessment

The proposal has the potential to result in some minor short term impacts on the amenity of the surrounding community and/or users of adjoining areas during construction and cumulatively during operation. These potential impacts include access, noise and vibration and cumulative impacts, which are considered in relevant sections of this REF.

Importantly, the local Program team would consult with the local community about the timing of the works and particularly those impacts such as any unavoidable interruptions to access and the commencement and duration of night works. These elements are embedded into various mitigation measures for relevant issues and undertaken as part of the community engagement strategy for the proposal.

The proposed works would ensure identified pinch points in the road network are removed and allow traffic to continue to move efficiently following implementation of the light rail project. This would result in a net socio-economic benefit in the long term.

Potential adverse impacts would be short term and are not considered to constitute a significant social impact. Conversely, there would be significant positive social benefits from the proposal due to reduction in traffic congestion, improved traffic flow and enhanced amenity.

Mitigation measures

Pre-construction

- Adjacent properties and the local community and other stakeholders would be notified of the proposed works and the construction timetable for night works, and provided with contact details for the project manager to report any issues as a result of the construction activities.
- Letterbox drops would be undertaken in advance of night works commencing.

Construction

- Access to local businesses, community services and social infrastructure would be maintained during construction. Where alternative access arrangements need to be made, these would be developed in consultation with relevant service providers, and communicated to businesses and service users.

5.4.7 Visual amenity

Existing environment

Visual landscape

The study area is characterised by its urban and transport infrastructure, the long and wide Hunter Street, the Newcastle Harbour and foreshore, and a mix of older commercial and residential buildings among new developments. There are several existing buildings of cultural and heritage significance and Civic Park within the study area. In addition, existing and proposed development projects, including the new university buildings on Hunter Street and King Street, the new Newcastle Courthouse on Hunter Street, the multi-storey mixed use commercial and residential development in Honeysuckle, and the redevelopment of the Hunter Street Mall, will continue to influence the character of the study area.

There is limited vegetation in the proposal site. Generally, vegetation within and around the proposal area consists of scattered street trees and the adjacent Civic Park. These provide some visual screening to adjacent properties and add to the visual landscape.

Sensitive visual receivers

As the proposal would be located within a highly developed and relatively flat urban environment, views of the proposal would be mainly experienced by those within the immediate vicinity of the proposal site. Sensitive visual receivers within the study area include:

- pedestrians, cyclists and motorists
- residents within apartment buildings or individual dwellings that adjoin and/or have clear views of the proposal site
- workers in commercial buildings that adjoin and/or have clear views of the proposal site.

Impact assessment

The proposal would generate temporary visual impacts during the construction period. These impacts would be experienced by sensitive visual receivers (including residents, pedestrians, cyclists, motorists and local workers some of whom would be transient) near the construction works. During construction, visible elements would include work sites, machinery and equipment, fencing, signage and partially constructed works.

Given the short duration of the works, the potential visual impact of the proposal would be very limited and would generally be experienced only from a relatively short distance. A small area of land would be acquired along the roadside boundary of Civic Park. However, Civic Park would retain its overall shape and character, and a significant adverse impact to the park is not anticipated.

There may also be potential for some impacts associated with night time lighting if required to carry out night works and for driver safety. However, central Newcastle is generally well lit at night and additional lighting should not result in a significant increase in light pollution. Directional lighting would be used to minimise the potential for light spill. Potential visual impacts specific to each location of works are outlined in Table 5-18 below.

Table 5-18 Summary of potential visual impacts by precinct

Location	Existing visual catchment configuration	Potential impacts
Stewart Avenue	The area along Hannell Street/ Stewart Avenue is dominated by commercial development and is a main vehicle thoroughfare for Newcastle	There is the potential for some impacts to pedestrians, motorists and nearby businesses, but this would be minor and short term.
Hunter Street/Steel Street	Hunter Street is the main thoroughfare for Newcastle city centre and is surrounded by commercial and retail premises	There is the potential for some impacts to pedestrians, motorists and nearby businesses, but this would be minor and short term.
King Street/Darby Street	The King Street/Darby Street is surrounded by commercial and service industry development. Civic Park provides an area for active and passive recreation.	There is the potential for some impacts to pedestrians and nearby businesses, but this would be minor and short term. There would also be some minor amenity impacts for users of Civic Park.

There would be a minor permanent visual impact during proposal construction and operation due to the removal of street trees. However, when considered in the context of the number of trees remaining in the streetscape and the commitment to offset tree removal with planting nearby or elsewhere in the city centre, it is not considered that this impact would be significant.

Mitigation measures

Pre-construction

- Project planning and construction scheduling would consider the need to minimise visual and other amenity impacts for recreational users of Civic Park.

Construction

- Construction debris and waste would be removed from site as quickly as is feasible.
- The construction site would be kept tidy and free of general waste from construction workers (e.g. litter).
- Any trees proposed for removal would be replaced and/or offset in accordance with Transport for NSW's *Vegetation Offset Guide* (2016). This would be undertaken in consultation with Council.

5.4.8 Resource use, hazardous materials and waste

Legislative requirements

Transport for NSW is committed to ensuring responsible management of waste and the reuse of such waste through appropriate measures, in accordance with the resource management hierarchy principles embodied in the *Waste Avoidance and Resource Recovery Act 2001*. The resource management hierarchy principles in order of priority as outlined in the Act are:

- avoidance of unnecessary resource consumption
- resource recovery (including reuse, reprocessing, recycling and energy recovery)
- disposal.

By adopting the above principles, Transport for NSW encourages the most efficient use of resources and reduces cost and environmental harm in accordance with the principles of ecologically sustainable development.

Impact assessment

Resource use

Construction of the proposal would involve the use of a number of resources, including:

- resources associated with the operation of construction plant and equipment (fuel and electricity)
- construction water (for pavement compaction and dust suppression)
- structural fill if required to meet pavement design levels
- concrete and asphalt materials
- paint for line marking
- topsoil (for landscaping) where relevant.

None of these resources are currently limited in availability. However, materials such as concrete, asphalt and fuel are non-renewable and would be used conservatively and reused/recycled wherever possible. The management measures outlined would assist in minimising the amount of resources required for construction.

Waste generation

Construction would generate the following wastes:

- surplus spoil from excavation
- surplus concrete, asphalt and materials
- waste vegetation
- general domestic litter, including glass, plastic, aluminum and paper waste.

The construction contractor would first seek to reuse excess spoil as part of any backfilling required (such as behind any modified kerb or on the roadside verge). Surplus asphalt from road milling would be collected and returned to the asphalt manufacturer where a portion would be reused to develop new product in accordance with quality specifications and procedures.

Waste vegetation would be removed to a licensed landfill facility, likely to be Summerhill Waste Management Centre operated by Council. Domestic litter would be collected and returned to the work compound/depot where it would be disposed of in accordance with standard procedures.

Careful planning and ordering of construction materials would ensure that the volume of surplus materials is minimised and disposal is undertaken in accordance with relevant guidelines and legislation.

Hazardous materials

Small quantities of hazardous materials would be used as part of the construction works. Construction equipment would be fuelled and greased as required to complete the works. Fuel and greases would not be stored at the proposal site.

Hot asphalt would be delivered to site and immediately placed into position and rolled firm. The heating of asphalt or asphaltic compounds would be undertaken prior to arriving at site.

By far the largest quantity of hazardous materials (paint) would be used for line marking, which would include reflective paint as well as thermoplastics for cats eyes, pedestrian crossings, lane arrows, etc. These would be brought to site on a purpose-designed truck and managed in accordance with standard application and waste disposal procedures. Any excess would be removed from site at the completion of works. No paint or thermoplastics would be stored at the proposal site.

Mitigation measures

Pre-construction

- Procurement would endeavour to use materials and products with a recycled content where that material or product is cost and performance effective.

Construction

- A waste management plan would be prepared as part of the CEMP including the following as a minimum:
  - resource management hierarchy principles would be followed to:
    - avoid unnecessary resource consumption as a priority
    - follow avoidance by resource recovery (including reuse of materials, reprocessing, recycling and energy recovery)
    - undertake disposal as a last resort
  - waste material, including soil and spoil to be taken off site, would be classified and managed in accordance with the *Waste Classification Guidelines* (EPA, 2014) and would be disposed of in accordance with the POEO Act
  - all waste documentation would be collated and maintained on file in accordance with these guidelines and provided to Transport for NSW as requested
  - waste material would not to be left onsite once the works have been completed.
  - working areas would be maintained, kept free of rubbish, and cleaned up at the end of each working day.
  - at least 90 per cent of construction waste generated during site preparation and construction would be diverted from landfill and either recycled or reused in accordance with Transport for NSW's Sustainability Targets.
  - 100 per cent of usable spoil material would be beneficially reused in accordance with Transport for NSW's Sustainability Targets.
  - any waste material identified as being contaminated would be managed in accordance with the *Contaminated Land Management Act 1997* and other relevant legislation and guidelines.
- The waste management plan would include measures to manage and dispose of any contaminated and/or hazardous materials and asbestos encountered during construction including:
  - the removal, handling and disposal of any asbestos containing materials would be undertaken by an appropriately licensed contractor, and in accordance with:
    - *Code of Practice for the Safe Removal of Asbestos 2005*
    - *Code of Practice for the Management and Control of Asbestos in Workplaces 2005*
  - hazards and risks associated with construction activities would be identified prior to construction
  - management measures for each identified hazard/risk would be developed
  - a process for regularly reviewing work practices/procedures would be implemented throughout construction to identify, report, and respond to any new environmental hazards/risks
  - site-specific safety management plans and safe work method statements would be developed and implemented in accordance with work health and safety requirements.

5.4.9 Climate change sustainability

Impact assessment

Sustainability in Transport for NSW

Sustainability in Transport for NSW is underpinned by the Transport Environment and Sustainability Policy Framework (the Framework). The Framework is a collective and coordinated approach to deliver the NSW Government's environmental and sustainability agenda across the transport cluster (Transport for NSW, RailCorp, Roads and Maritime, and Sydney Trains). The Framework is outcomes based and seeks to improve Transport for NSW's environmental sustainability performance.

All government projects are also required to comply with the Government Resource Efficiency Policy (GREP). The aim of the GREP is to reduce the NSW Government's operating costs and lead by example by increasing the efficiency of the resources it uses, specifically energy, water, waste and clean air.

Transport for NSW applied the *NSW Sustainable Design Guidelines* (TfNSW, 2014) and Infrastructure Sustainability Council of Australia (ISCA) Infrastructure Sustainability Rating Tool to the proposal. A dedicated sustainability strategy has also been developed by Transport for NSW for the delivery of the proposal. These issues addressed in the strategy are discussed in more detail below.

Greenhouse gas emissions

An increase in greenhouse gas emissions, primarily carbon dioxide, would be expected during proposal construction due to exhaust emissions from machinery and vehicles transporting materials and personnel to and from site. However due to the small scale and short term duration of construction activities, greenhouse gas emissions would be minimal.

A greenhouse gas and carbon footprint assessment would be undertaken during the detailed design stage, in accordance with Transport for NSW's Carbon Estimate and Reporting Tool and the *NSW Sustainable Design Guidelines* (TfNSW, 2014). This assessment would evaluate the sources of greenhouse gas emissions during the construction phase.

Sustainable Design Guidelines

The proposal would be undertaken in accordance with the principles of sustainability, including the requirements of the *NSW Sustainable Design Guidelines* (TfNSW, 2014). These guidelines require a number of mandatory and discretionary initiatives to be applied under the following key themes:

- energy management
- pollution control
- climate change resilience
- resource management
- biodiversity
- heritage
- liveable communities
- corporate sustainability.

A sustainability assessment of the proposal was undertaken. The results indicate that a gold rating under the *NSW Sustainable Design Guidelines* (TfNSW, 2014) and an excellent rating under the ISCA Infrastructure Sustainability Rating Tool, are both achievable for the proposal. The sustainability assessment would be updated as the proposal progresses

Infrastructure Sustainability Council of Australia

The ISCA Infrastructure Sustainability Rating Tool aims to:

- provide a common national language for sustainability in infrastructure
- provide a vehicle for consistent application and evaluation of sustainability in tendering processes
- help in scoping whole-of-life sustainability risks for projects and assets, enabling smarter solutions that reduce risks and costs
- foster resource efficiency and waste reduction, reducing costs
- foster innovation and continuous improvement in the sustainability outcomes from infrastructure
- build an organisation's credentials and reputation in its approach to sustainability in infrastructure.

The rating tool can be applied to many different infrastructure projects including light rail. Ratings can be undertaken on a design, as built drawings, and operation of a project. An infrastructure project is assessed in terms of how it performs in each of 15 categories that are grouped into six themes in infrastructure sustainability. These include:

- management and governance
- using resources
- emissions, pollution and waste
- ecology
- people and place
- innovation.

Depending on the initiatives and performance of a project across each theme, it will achieve a score from 1 to 100 corresponding to a rating level of commended, excellent or leading.

Mitigation measures

Pre-construction

- Design of the proposal would be undertaken in accordance with the *NSW Sustainable Design Guidelines* (V3.0, TfNSW, 2014). Initiatives recommended by the sustainability assessment to achieve a rating level of at least 'silver' would be implemented.
- The sustainability initiatives would be regularly reviewed, updated and implemented throughout the design development phases.

Construction

- Construction of the proposal would be undertaken in accordance with the *NSW Sustainable Design Guidelines*. The sustainability initiatives would be regularly reviewed, updated and implemented throughout the construction program.

5.4.10 Cumulative impacts

Current and future projects

When the impacts of a project combine with the impacts of other projects, there is the potential for cumulative impacts to result. Such impacts could include the cumulative loss of flora and fauna, an increase in noise levels, changes in traffic conditions and the demand and availability for parking. The nature and scale of any cumulative impact depends upon a number of factors, including the timing and relative scale of impacts arising from various developments, the location of the receiver, the reversibility of any impacts, and the resilience of the receiver or natural resource.

Impact assessment

Construction of the proposal would coincide with construction of the light rail project as well as other key developments currently approved, underway, or planned for the Newcastle city centre inducing the new interchange at Wickham, the NeWSpace and residential and commercial developments on Honeysuckle Drive, Stewart Avenue and King Street.

Potential cumulative impacts could include:

- loss of parking spaces
- increased construction traffic
- increased levels of construction noise including some works during the evening and night time periods
- changes to pedestrian, cyclist and vehicle routes that may require temporary or permanent closure to facilitate the works
- temporary restrictions or changes to access to some properties
- changes to visual amenity
- impacts to heritage items.

Mitigation measures to manage these impacts are provided in section 5 and summarised in section 6.2. These measures would act to avoid or reduce most impacts, however the following key impacts are addressed in further detail.

Parking

There would be a cumulative permanent reduction in on-street car parking spaces as a result of the proposal together with the other major Transport for NSW projects listed above. Table 5-19 summarises the estimated cumulative car parking losses from these projects.

Table 5-19 Estimated cumulative car parking losses

Project	Estimated parking losses
New transport interchange at Wickham	75 spaces
Light rail project	267 spaces
Associated road upgrades	110 spaces
Total	**452 spaces**

While parking is ultimately the responsibility of Council, Transport for NSW is currently working with key stakeholders including Council, the Hunter Development Corporation and UrbanGrowth NSW to prepare a parking strategy. The parking strategy will take into account the broad program of work underway to help Newcastle reach its potential as an activated and vibrant city through the Program.

This cumulative impact is not considered significant when compared to the overall net social, economic and environmental gain for the entire community that will result from the Program.

Mitigation measures to address parking loss are provided in section 5.1.4.

Construction traffic

Cumulative construction traffic movements would total approximately 90 vehicles per day (30 vehicles per day for the proposal and 60 vehicles per day for the light rail project). Overall, the total numbers of heavy and light vehicle movements during construction would be low compared to the overall traffic volumes already on these roads. Construction vehicle generation would therefore not result in a substantial impact on local road capacity or the road network overall.

The cumulative operational traffic impact from the proposal would be positive when considered as part of the overall transport network in the Newcastle city centre. The proposal would enhance operation of the light rail project, reduce congestion at key intersections in the CBD and improve overall traffic flow in the city centre.

Mitigation measures to address construction traffic impacts are provided in section 5.1.4.

Noise and vibration

There is the potential for cumulative construction noise and vibration impacts due to the overlapping construction programs and proximity of other projects nearby. In addition, the light rail project, as a whole and including the proposal, is likely to give rise to cumulative noise impacts when the potential for proposal works to be undertaken at the same time as other elements of the light rail project is considered. This could impact on residential and other receivers and heritage structures.

Construction of the light rail project, including the proposal, is anticipated to take about 2.5 years commencing in late 2016. However, in accordance with the conservative assessment conducted, noise has been predicted with a focus on those activities with the highest potential to cause noise impacts and assuming that the loudest plant for each activity is operating continuously. These predictions identify worst case noise levels, which may not be reached or only infrequently reached during the construction period. Generally, plant and equipment would not need to be running at full power all the time, and at other times may be idling or even switched off.

The other key consideration is that construction activities would progress along the light rail route, at a rate of about 50 metres per month. Therefore, noise impacts would be experienced for a relatively short time at most locations.

A small number of receivers on and near Hunter Street that would experience exceedances due to the proposal may also be impacted by the light rail project (see chapter 9 of the light rail REF). However due to the short duration of the proposal, about two to three months at each location in total (night time noise exceedances may be much less), it is not considered likely that the cumulative impact at these locations would be significant.

Mitigation measures to address construction noise and vibration impacts are provided in section 5.3.5.

Mitigation measures

Mitigation measures to address cumulative impacts would be included in the various management plans for each issue described in preceding sections. Additional mitigation measures are provided below.

Pre-construction

- The potential for cumulative impacts would be further considered as the proposal methodology develops and as further information regarding the location and timing of other potential developments is released.
- Transport for NSW would consult with the proponents of other major projects in the area (including internally) to develop strategies to address potential cumulative traffic and transport and noise impacts.
- The parking strategy, identified as a mitigation measure in the light rail REF, would be reviewed to include consideration of the cumulative parking losses outlined in this supplementary REF.
- The cycleway strategy, identified as a mitigation measure in the light rail REF, would be reviewed to include consideration of the potential cycleway impacts outlined in this supplementary REF.

Construction

- As far as practicable, works would be scheduled to minimise the potential for cumulative impacts with other projects in the surrounding area.

6. Environmental management and mitigation

This section provides a summary of the environmental management system and mitigation measures that would be implemented during proposal construction and operation.

6.1 Environmental management plans

Transport for NSW's ISO 14001 accredited environmental management system would be used to manage the proposal. The management system would provide the framework for implementing the environmental management measures documented in this REF, and any conditions of other approvals, licences or permits.

6.1.1 Construction

A Construction Environmental Management Plan (CEMP) would be prepared for the proposal. The CEMP would provide a centralised mechanism through which all potential environmental impacts would be managed. The CEMP would document mechanisms for achieving compliance with the commitments made in this REF, the submissions report (to be prepared after the REF has been placed on public display) and any other relevant statutory requirements. The plan would address (at a minimum) the following elements:

- traffic, transport and access management
- heritage management
- noise and vibration management
- vegetation management.

The CEMP would be prepared by the construction contractor(s) and would be reviewed and endorsed by Transport for NSW prior to the commencement of the construction. Implementation and compliance would be monitored by Transport for NSW for the duration of the proposal. One of the minimum requirements for the contractor(s) is that they will need to have an environmental management plan capable of meeting the requirements of ISO 14001.

6.1.2 Operation

For the operational phase, environmental issues and impacts would be managed under Transport for NSW's existing operational procedures and environmental management system and through the mitigation measures summarised in Table 6-1.

6.2 Summary of mitigation measures

The REF has identified environmental impacts with the potential to occur as a result of the proposal. Table 6-1 provides a summary of the measures proposed to mitigate and manage the potential impacts of the proposal.

These measures may be revised in response to submissions raised during public display of the REF and/or any design changes made following public display. Transport for NSW would consider the final environmental management commitments when making a determination on the proposal. Following determination, the finalised mitigation measures would guide subsequent phases of the proposal. Construction contractor(s) would be required to undertake all works in accordance with these measures.

Table 6-1 Summary of environmental mitigation measures

No.	Mitigation measure
1.0	**General**
1.1	A CEMP would be prepared for the construction phase of the proposal, either as a part of or addendum to the CEMP for the light rail project or as a standalone document. The CEMP would provide a centralised strategy through which all potential environmental impacts would be managed. The CEMP would document processes for demonstrating compliance with the commitments made in this REF, the submissions report (to be prepared), as well as any other relevant statutory approvals. An outline of the required contents of the CEMP is provided in section 16.3. The CEMP would be prepared by the construction contractor and endorsed by the project Environmental Management Representative (EMR) to the satisfaction of Transport for NSW.

No.	Mitigation measure
1.2	The CEMP would include: • The proponent's environmental policy, objectives and performance targets for construction and operation. • Reference to all relevant statutory and other obligations, including consents, licenses, approvals, and voluntary agreements required. • Management policies, procedures and review processes to assess the implementation of environmental management practices and the environmental performance of the proposal against the objective and targets. • Requirements and guidelines for management in accordance with: – conditions of the determination – mitigation measures specified by this REF – relevant construction management guidelines. • Requirements in relation to incorporating environmental protection measures and instructions in all relevant standard operating procedures and emergency response procedures. • Specific procedures, including monitoring, as defined by this REF and the conditions of the determination. • Roles and responsibilities of all personnel and contractors to be employed on site. • Procedures for complaints handling and ongoing communication with the community. • Monitoring and auditing program.
1.3	The CEMP and operational environmental management system would specify requirements in relation to ongoing monitoring during construction and operation. Regular auditing of the environmental management plans would be undertaking. In the event of a non-compliance with the management plan, it would be the proponent's responsibility to ensure appropriate investigation, reporting and implementation of corrective actions.
1.4	Incident management procedures would be developed as part of the CEMP and the operational environmental management system. The procedures would clearly outline the process to be followed in the event of an environmental incident or noncompliance.
2.0	**Traffic, transport and access**
2.1	The parking strategy currently being prepared would be reviewed to include the proposal. The strategy will review options to mitigate the loss of on-street parking and loading zones. The review would include both existing on-street and off-street parking locations as well as the opportunities provided by new or proposed developments or Government-owned land close to the proposal site. The review would: • be undertaken in accordance with the objectives and requirements of the Program, and relevant transport and parking strategies and policies • involve an audit of the use of existing spaces including turnover • include an assessment of the potential options and identification of a preferred option/s • be undertaken in consultation with relevant stakeholders, including surrounding businesses/ organisations and Council.

No.	Mitigation measure
2.2	The cycleway strategy currently being prepared would be reviewed to include the proposal. The cycleway strategy would be undertaken in consultation with Council.
2.3	Project planning and construction scheduling would consider the need to minimise impacts on motorists during morning and afternoon peak hours, particularly for works on Hannell Street/Stewart Avenue, King Street and Honeysuckle Drive.
2.4	Further design development would be undertaken by Transport for NSW, in consultation with Roads and Maritime, to address residual intersection performance issues on the wider road network.
3.0	**Tree removal**
3.1	A vegetation management plan would be prepared as part of the CEMP including a detailed list of the measures that would be implemented during construction to minimise the potential impacts on trees to be retained. The management measures to be incorporated would include: • The construction plans would clearly document the location and full extent of any vegetation disturbance required. These areas would be clearly marked on the ground to avoid disturbance to adjacent retained vegetation, and exclusion fencing would be installed around trees to be retained. • The management of trees near the construction zone would be consistent with the *AS 4970-2009 Protection of trees* on development sites (incorporating Amendment No. 1 (March 2010)). • Tree protection methods would be marked on the environmental control maps. • Any trees proposed for removal would be replaced and/or offset in accordance with Transport for NSW's *Vegetation Offset Guide* (2016). This would be undertaken in consultation with Council. • All tree removal, maintenance and protection work would be undertaken by a qualified arborist with appropriate competencies recognised within the Australian Qualification Framework, with a minimum of five years of continual experience within the industry of operational amenity arboriculture, and covered by appropriate and current types of insurance to undertake such works. • Weeds would be managed and disposed of in accordance with the requirements of the *Noxious Weeds Act 1993* and/or the *Weeds of National Significance Weed Management Guide*. The African Olive growing near tree 7 is a declared noxious weed. • Weed control and management strategies would be documented and implemented in accordance with the *Weed Management and Disposal Guide* (TfNSW, 2015). This would include procedures to reduce the spread of weeds via vehicles and machinery, such as visual inspection of vehicles prior to exit from site to ensure they are clear of plant material. • The TPZs and associated controls, including storage and movement restrictions, would be implemented as part of the plan. If works were required within the TPZs, they would be restricted to the area outside of the structural root zone to avoid disturbing the stability and health of the trees. The specific TPZ management measures described in detail in the arboricultural assessment in Technical Paper 2 would be implemented for all of the works within the TPZs of the trees to be retained (see section 5.2.3).

No.	Mitigation measure
4.0	**Noise and vibration**
4.1	A construction noise and vibration management plan would be prepared and implemented for the proposal. The construction noise and vibration management plan would include all of the standard mitigation measures prescribed in the *Construction Noise Vibration Guideline* (RMS, 2016).
4.2	The construction noise and vibration management plan would also include the following additional mitigation measures prescribed in Table C1 of the *Construction Noise Vibration Guideline* (RMS, 2016): • General letterbox drop (or equivalent) would be undertaken to the wider locality no less than five working days prior to the start of works. • Letterbox drop (or equivalent) would be undertaken to affected stakeholders no later than seven calendar days ahead of construction activities. Additional information, such as timing, equipment, methodology, would be provided to more highly affected receivers than covered in general letterbox drops. • Phone calls detailing relevant information would be made to affected stakeholders within seven calendar days of proposed work. • Individual briefings would be undertaken to inform affected stakeholders of the impacts of high noise activities and mitigation measures that will be implemented. Stakeholders would be visited at least 48 hours prior to potentially disturbing construction activities. • As a guide, all work should be carried out in continuous blocks that do not exceed three hours each, with a minimum respite period of one hour in between each block. • The community would be consulted prior to construction commencing on the option to implement duration respite. Duration respite would require an increase in out of hours works in order to complete construction more quickly. • Work carried out during week day evenings (6 pm -10 pm), on Saturday (7 am – 8 am, 1 pm – 10 pm), and Sundays or public holidays (8 am – 6 pm) would be limited to no more than three consecutive evenings per week separated by not less than one week except where there is a duration respite. • Work carried out during the night time on week days (10 pm – 7 am), Saturday (10 pm – 8 am), and Sundays or public holidays (6 pm – 7 am) would be limited to two consecutive nights, separated by not less than one week, except for where there is duration respite.
4.3	Vibration monitoring would be carried out prior to construction commencing to assess the radius of potential influence of high vibration generating activities on adjacent structures. Monitoring would be undertaken in non-sensitive areas and at a range of distances from the source. Results of the monitoring would be compared against predicted vibration levels and the potential for impact refined, if appropriate.
4.4	The effectiveness of source-based mitigation measures, such as changing the operating speed of the vibratory roller to generate a higher frequency of vibration, which may allow for a higher vibration threshold at the structure, would be confirmed once final construction equipment and methodologies have been finalised prior to construction commencing.
4.5	Once final construction equipment and methodologies have been finalised, locations for property condition surveys would be confirmed. Survey would be required for all properties within the recommended buffer distances in Table 5-14, or where pre-construction monitoring indicates that vibration levels from construction activities would exceed the target levels. A property condition survey report should include as a minimum: • a visual inspection of all buildings and structures (all internal and external walls, ground level floors and external pavements, all connections of other structures above ground level and their connection at ground level and any exposed foundations) • photographs of all cracks and/or defects observed • a record of the location of all cracks and/or defects observed, and measurements of the crack width/defect size.

No.	Mitigation measure
5.0	**Soils and water**
5.1	An erosion and sediment control plan would be prepared to manage any potential runoff resulting from the proposed works during construction (in accordance with *Managing Urban Stormwater, Soils and Construction Guidelines* (the Blue Book, Landcom, 2004)). It would include (but not be limited to) measures to: • prevent sediment moving off-site and sediment laden water entering any drainage lines or drain inlets • reduce water velocity and capture sediment on site • minimise the amount of material transported from site to surrounding pavement surfaces • divert clean water around the site.
5.2	Erosion and sediment controls would be established prior to the start of construction works.
5.3	Transport for NSW would consult with the Mine Subsidence Board to determine any specific requirements for the proposal in relation to land within the mine subsidence areas.
6.0	**Aboriginal heritage**
6.1	All relevant project staff and contractors would be made aware of their statutory obligations for heritage under the *National Parks and Wildlife Act 1974* and the *Heritage Act 1977*, via a heritage induction prior to commencement of work on site.
7.0	**Air quality**
7.1	Adjacent properties (including the local educational establishments) would be notified of the proposed works, the construction schedule and provided with contact details for any potential air quality, dust or odour issues prior to start of works.
8.0	**Land use and property**
8.1	Adjacent properties would be notified of the proposed works and the construction timetable, and provided with contact details to report any issues as a result of the construction activities.
8.2	Prior to the commencement of works, any services and utilities that may be impacted by the works are to be identified and relocated or protected, if required, in consultation with asset owners.
8.3	All acquisitions would be undertaken in consultation with landowners and in accordance with the requirements of the *Land Acquisition (Just Terms Compensation) Act 1991*.
9.0	**Socio-economic**
9.1	Adjacent properties and the local community and other stakeholders would be notified of the proposed works and the construction timetable for night works, and provided with contact details for the project manager to report any issues as a result of the construction activities.
9.2	Letterbox drops would be undertaken in advance of night works commencing.
10.0	**Visual amenity**
10.1	Project planning and construction scheduling would consider the need to minimise visual and other amenity impacts for recreational users of Civic Park.
11.0	**Resource use, hazardous materials and waste**
11.1	Procurement would endeavour to use materials and products with a recycled content where that material or product is cost and performance effective.

No.	Mitigation measure
12.0	**Climate changes and sustainability**
12.1	Design of the proposal would be undertaken in accordance with the *NSW Sustainable Design Guidelines* (V3.0, TfNSW, 2014). Initiatives recommended by the sustainability assessment to achieve a rating level of at least 'silver' would be implemented.
12.2	The sustainability initiatives would be regularly reviewed, updated and implemented throughout the design development phases.
13.0	**Cumulative impacts**
13.1	The potential for cumulative impacts would be further considered as the proposal methodology develops and as further information regarding the location and timing of other potential developments is released.
13.2	Transport for NSW would consult with the proponents of other major projects in the area (including internally) to develop strategies to address potential cumulative traffic and transport and noise impacts.
13.3	The parking strategy, identified as a mitigation measure in the light rail REF, would be reviewed to include consideration of the cumulative parking losses outlined in this supplementary REF.
13.4	The cycleway strategy, identified as a mitigation measure in the light rail REF, would be reviewed to include consideration of the potential cycleway impacts outlined in this supplementary REF.

Table 6-2 Summary of construction environmental mitigation measures

No.	Mitigation measure
1.0	**Traffic, transport and access**
1.1	Consultation with relevant stakeholders would be undertaken regularly to facilitate the efficient delivery of the works and to minimise congestion and inconvenience to road users. Stakeholders would include contractors on adjacent work sites (particularly the new interchange at Wickham) and others such as Council, bus operators, Roads and Maritime, emergency services, affected businesses, and other relevant organisations (such as the University of Newcastle and major employers in the city centre).
1.2	• A construction traffic, transport and access management plan would be prepared as part of the CEMP including a detailed list of the measures that would be implemented during construction to minimise the potential impacts on traffic, transport and access. The management measures to be incorporated would include: • traffic and access would be managed in accordance with *Traffic Control at Work Sites* (RTA, 2010) and in consultation with Roads and Maritime and Council • adequate road signage would be provided to inform drivers of the work, timing and alternative access arrangements • measures to manage traffic flows around the area affected by construction would be provided, including required regulatory and directional signposting, line marking, variable message signs, and all other necessary traffic control devices • the plan would specify routes to be used by heavy construction-related vehicles to minimise impacts on sensitive land uses and businesses • the timing of deliveries would be programmed to minimise traffic and transport impacts • the queuing and idling of construction vehicles in residential streets would be minimised • designated queuing and idling areas would be determined near the work site to minimise disruption to the local community • adequate sight lines would be provided to allow for safe entry and exit from the construction sites

No.	Mitigation measure
	• access to all private properties adjacent to the proposal site would be maintained during construction, unless otherwise agreed with relevant property owners • co-ordination with other constructors, including those responsible for constructing the new interchange at Wickham, would be undertaken, particularly regarding works at the Stewart Avenue/ Hannell Street intersection • ongoing consultation and feedback from key stakeholders including Roads and Maritime and Council would be co-ordinated by Transport for NSW to facilitate the efficient completion of the works, and ensure awareness of proposed road network or intersection changes, and the efficacy of mitigation proposed • contractors, including transport/deliveries contractors, would be provided with a copy of the traffic, transport and access management sub-plan to ensure disruptions to the local community are minimised • the plan would include measures to maximise safety and access for pedestrians and cyclists, including details of alternative access arrangements • adequate road signage would be provided to inform pedestrians and cyclists of the work, including timing and alternative access arrangements, and ensure that the risk of accidents and disruption to surrounding land uses is minimised • the plan would include details for the relocation of kiss-and-ride, taxi ranks and bus stops if required, including appropriate signage to direct patrons, in consultation with the relevant operator. • adequate signage would be provided at all stops along the bus routes to clearly show the location of stops and routes • consultation with regional and interstate bus operators would be undertaken to determine their requirements, including any rerouting of services if required.
2.0	**Tree removal**
2.1	The vegetation management plan would be implemented during construction to minimise the potential impacts on trees to be retained.
3.0	**Noise and vibration**
3.1	The measures outlined in the construction noise and vibration plan would be implemented at all times during construction.
3.2	Vibration measurements would be taken at the commencement of construction to determine site specific conditions and confirm potential vibration impacts and required management.
3.3	Recommended safe working distances for vibration intensive plant taken from the *Construction Noise Vibration Guideline* (RMS, 2016) are provided in Table 5-14.
3.4	No rock hammering would be undertaken outside of standard construction hours.
4.0	**Soils and water**
4.1	Groundwater encountered during construction would be managed and disposed of in accordance with the *Waste Classification Guidelines* (EPA, 2014) and the *Water Discharge and Reuse Guideline* (TfNSW, 2015). Groundwater would be managed to ensure it does not cause pollution of waters in accordance with section 120 of the POEO Act.
4.2	Erosion and sediment controls would be checked and maintained on a regular basis (including the clearing of sediment form behind the barriers).
4.3	Construction erosion and sediment controls would not be removed until the works are complete and long term erosion and sediment controls are in place.

No.	Mitigation measure
4.4	All materials onsite or being delivered to the site would be wholly contained within the site. The requirements of the POEO Act would be complied with when placing/stockpiling loose material or when disposing of waste products or during any other activities likely to pollute drains or watercourses.
4.5	Any loose material stockpiles would be stored within the temporary construction compound(s) and would be protected from possible erosion.
4.6	All services and utilities in the area of construction must be appropriately disconnected and reconnected as required. The contractor is required (if necessary) to consult with the various service authorities regarding their requirements for the disconnection of services.
5.0	**Aboriginal heritage**
5.1	If unrecorded Aboriginal objects are identified in the proposal site during works, then all works in the immediate area must cease and the area should be cordoned off. The OEH must be notified by ringing the Enviroline on 131 555 so that the site can be adequately assessed and managed.
5.2	In the unlikely event that skeletal remains are identified, works would cease immediately near the remains and the area would be cordoned off. The proponent would contact the local NSW Police who will make an initial assessment as to whether the remains are part of a crime scene or are possible Aboriginal remains. If the remains are thought to be Aboriginal, OEH would be contacted by ringing the Enviroline on 131 555. An OEH officer would determine if the remains are Aboriginal or not and a management plan must be developed in consultation with the relevant Aboriginal stakeholders before works recommence.
6.0	**Non-Aboriginal heritage**
6.1	A heritage induction would be developed for employees and contractors. The induction would outline the responsibilities and requirements for heritage under the Heritage Act 1977. All workers, contractors and visitors would be required to complete the heritage induction.
6.2	A heritage management plan would be prepared as part of the CEMP and implemented during construction. It would include as a minimum: • All heritage items in the immediate vicinity of the proposal site would be marked on environmental control maps, site plans, fenced off where appropriate, and avoided. • The detailed construction methodologies would take into account the heritage significance of the area and mapped heritage items. Works would be undertaken in a manner that minimises the potential for damage and avoids physical impact on adjacent heritage listed buildings. • Sufficient protection including temporary fencing would be installed around built heritage items where works are to be undertaken in close proximity to these items, or where a thoroughfare or construction access is required. • The sites or items that require dilapidation survey. Dilapidation reports would be prepared prior to construction commencing. • Any unforeseen or accidental damage would be made good under the supervision of a qualified engineer with heritage experience following consultation with the Transport for NSW project manager. Damage would be determined based on the findings of the pre-construction dilapidation survey. • The construction noise and vibration management plan (refer section 6.6.5) would define the construction methods to be used in the vicinity of heritage listed items and the measures to minimise the likelihood of vibration impacts.
6.3	If, during the course of construction works, suspected historic heritage material is uncovered, works must cease in that area immediately. The OEH must be notified by ringing the Enviroline on 131 555 and works would only recommence when an approved management strategy has been developed and approved.

No.	Mitigation measure
7.0	**Air quality**
7.1	Construction vehicles and machinery would park as far away as practicable, from local businesses (particularly food outlets) to minimise disruption.
7.2	Measures (including watering or covering exposed areas) are to be used to minimise or prevent air pollution and dust.
7.3	Construction works that generate dust are not to be undertaken during strong winds or in weather conditions where high levels of dust or airborne particulates are likely.
7.4	Vehicles transporting waste or other materials that may produce odours or dust are to be covered during transportation.
7.5	Machinery not in use would be turned off.
7.6	All machinery used onsite would be regularly maintained and in good operating order.
8.0	**Land use and property**
8.1	Access to private properties, businesses and Civic Park would be maintained at all times unless otherwise negotiated and agreed with landowners.
9.0	**Socio-economic**
9.1	Access to local businesses, community services and social infrastructure would be maintained during construction. Where alternative access arrangements need to be made, these would be developed in consultation with relevant service providers, and communicated to businesses and service users.
10.0	**Visual amenity**
10.1	Construction debris and waste would be removed from site as quickly as is feasible.
10.2	The construction site would be kept tidy and free of general waste from construction workers (e.g. litter).
10.3	Any trees proposed for removal would be replaced and/or offset in accordance with Transport for NSW's Vegetation Offset Guide (2016). This would be undertaken in consultation with Council.
11.0	**Resource use, hazardous materials and waste**
11.1	A waste management plan would be prepared as part of the CEMP including the following as a minimum: • resource management hierarchy principles would be followed to: – avoid unnecessary resource consumption as a priority – follow avoidance by resource recovery (including reuse of materials, reprocessing, recycling and energy recovery) – undertake disposal as a last resort • waste material, including soil and spoil to be taken off site, would be classified and managed in accordance with the *Waste Classification Guidelines* (EPA, 2014) and would be disposed of in accordance with the POEO Act • all waste documentation would be collated and maintained on file in accordance with these guidelines and provided to Transport for NSW as requested • waste material would not to be left onsite once the works have been completed. • working areas would be maintained, kept free of rubbish, and cleaned up at the end of each working day. • at least 90 per cent of construction waste generated during site preparation and construction would be diverted from landfill and either recycled or reused in accordance with Transport for NSW's Sustainability Targets.

No.	Mitigation measure
	• 100 per cent of usable spoil material would be beneficially reused in accordance with Transport for NSW's Sustainability Targets. • any waste material identified as being contaminated would be managed in accordance with the *Contaminated Land Management Act 1997* and other relevant legislation and guidelines.
11.2	The waste management plan would include measures to manage and dispose of any contaminated and/or hazardous materials and asbestos encountered during construction including: • the removal, handling and disposal of any asbestos containing materials would be undertaken by an appropriately licensed contractor, and in accordance with: – *Code of Practice for the Safe Removal of Asbestos 2005* – *Code of Practice for the Management and Control of Asbestos in Workplaces 2005* • hazards and risks associated with construction activities would be identified prior to construction • management measures for each identified hazard/risk would be developed • a process for regularly reviewing work practices/procedures would be implemented throughout construction to identify, report, and respond to any new environmental hazards/risks • site-specific safety management plans and safe work method statements would be developed and implemented in accordance with work health and safety requirements.
12.0	**Climate changes and sustainability**
12.1	Construction of the proposal would be undertaken in accordance with the NSW Sustainable Design Guidelines (V3.0, TfNSW, 2014). The sustainability initiatives would be regularly reviewed, updated and implemented throughout the construction program.
13.0	**Cumulative impacts**
13.1	As far as practicable, works would be scheduled to minimise the potential for cumulative impacts with other projects in the surrounding area.

7. Conclusion

This section outlines the justification for the proposal, a summary of REF findings considered against the key legislative requirements, and the conclusions of the report.

7.1 Justification of the proposal

The light rail REF included a comprehensive assessment of the likely environmental impacts as a result of the project. The light rail REF identified that due to road network changes associated with the light rail project, some surrounding roads would attract higher volumes of traffic. These roads include Hannell Street, Stewart Avenue, Steel Street, Honeysuckle Drive, Darby Street and King Street.

Introducing traffic improvements on some of the city's roads and at critical intersections will complement the introduction of light rail and assist in achieving the overall benefits of a revitalised city. These 'pinch points' will be unable to cope with existing traffic volumes if we do nothing. By 'doing nothing' congestion will increase across the city centre and the network will be unlikely to continue to function effectively in the future.

The proposal will ensure that the road network in the Newcastle city centre provides sufficient capacity to meet expected increases in demand, ease potential congestion and ensure that traffic is able to move freely and efficiently around and through the city centre.

The proposal supports the changes to traffic that are expected to occur within the city centre with the construction and operation of the light rail project.

Since the planning for the light rail project began, a number of options for improvements to the Newcastle road network were considered. These options were discussed in detail with key stakeholders during preparation of the light rail REF. Due to increased traffic, that will divert to roads and intersections identified in the proposal with the introduction of light rail, the proposal was identified as the preferred option.

The proposal will supplement the light rail project by reducing traffic congestion and increasing capacity across the city centre road network.

The proposal is expected to achieve its objectives, but will result in short-term temporary environmental and social impacts during construction that will be managed through the detailed mitigation measures described in section 6.

7.2 Summary of REF findings

7.2.1 Clause 228 factors

Clause 228(2) of the EP&A Regulation specifies the factors that must be taken into account when assessing the likely impact of an activity on the environment for the purposes of Part 5 of the EP&A Act. The potential impacts of the proposal have been considered in section 6 of this REF. The clause 228 factors and how they relate to the proposal are also addressed in Appendix A.

7.2.2 Ecologically sustainable development

Transport for NSW is committed to ensuring that its projects are implemented in a manner that is consistent with the principles of sustainable development. These principles would be incorporated into the management systems for the proposal.

Appendix A summarises how the principles of ecologically sustainable development outlined in the EP&A Act have been addressed by the REF.

7.3 Conclusion

Environmental investigations were undertaken during preparation of this REF to assess the potential impacts of the proposal in conjunction with the assessments underpinning the August 2016 determination. No significant environmental issues are considered to be associated with the proposal.

The main potential impacts that would require further consideration and management during the detailed design process, construction and operation are summarised below.

- **Transport, traffic and access** – The proposal would require the removal of some on-street parking spaces and loading zones along the proposal site. Options to address city centre parking requirements are currently being developed in consultation with Council and local businesses as part of the light rail project. Construction traffic will be managed via approved traffic management plans.
- **Tree removal** – About 26 street trees will need to be removed for implementation of the proposal. The tree removal would be replaced and/or offset in accordance with Transport for NSW's *Vegetation Offset Guide* (2016) and in consultation with Council. A further 14 trees near the works would be managed to reduce the potential for terminal impacts during construction.
- **Noise and vibration** – Feasible and reasonable mitigation measures will be implemented during the construction phase as outlined in the construction noise and vibration management plan. Out of hours work will be undertaken in accordance with the requirements of the *Construction Noise Strategy* (TfNSW, 2012).
- **Cumulative** – The proposal will be constructed within a landscape of substantial change in Newcastle as the revitalisation of the city centre progresses. The proposal would contribute to a net benefit in conjunction with the objectives of the various urban renewal projects currently planned or underway as part of the Program. While parking is ultimately the responsibility of Council, the cumulative loss of car parking will be taken into account in the parking strategy.

The key benefits of the proposal will assist in meeting expected future increases in demand, ease potential congestion and ensure that traffic is able to move freely and efficiently around and through the city centre. The proposal will benefit Newcastle's community by supporting growing demand and the integration of traffic flows following the implementation of the light rail project. These benefits support the overall vision for Newcastle that the NSW Government has committed to helping deliver through a number of improvements. This proposal is one of those improvement initiatives.

Having regard to the provisions of section 111 of the EP&A Act and based on the matters contained in this supplementary REF, the proposal, when considered in light of the light rail project as a whole, is not likely to significantly affect the environment. Accordingly, an environment impact statement would not be required. However, Transport for NSW will make a final determination on whether or not the activity is likely to significantly affect the environment after this REF is placed on public display and submissions have been received and considered.

Furthermore, a referral to the Commonwealth will not be required under the EPBC Act.

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Appendix A – Consideration of clause 228(2) factors and the principles of ecologically sustainable development

Table A1 Clause 228 factors

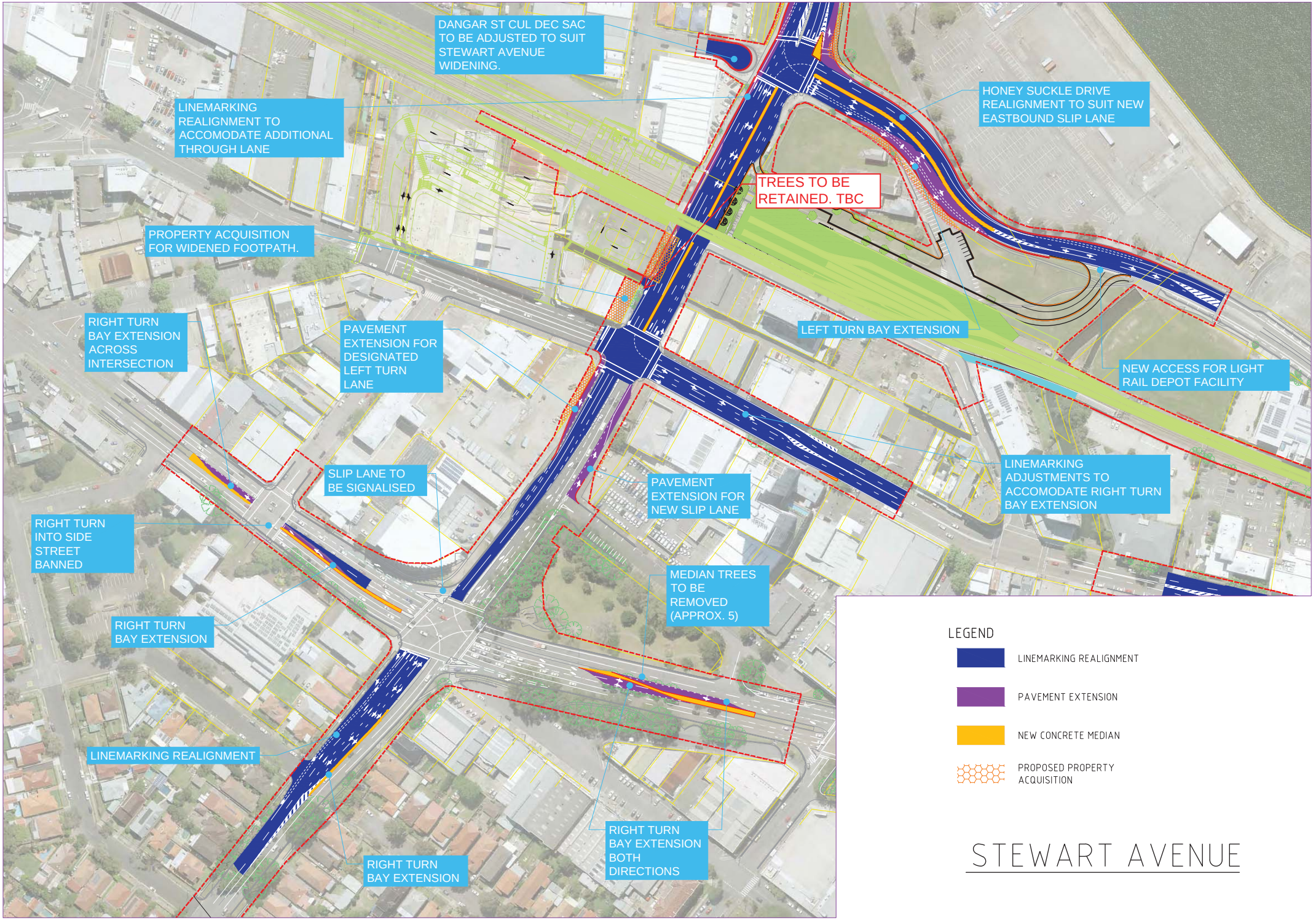
Clause 228 factor		Summary of results	Potential impact
(a)	Any environmental impact on a community	The proposal has the potential to result in amenity related impacts in the vicinity of the works during construction. These impacts would be managed through the implementation of appropriate measures in the CEMP.	Short-term – amenity impacts to be managed by the CEMP
(b)	Any transformation of a locality	The proposal would be predominantly located within an existing road corridor. It would not result in the transformation of this locality.	None
(c)	Any environmental impact on the ecosystems of the locality	No environmental impact on ecosystems is predicted.	None
(d)	Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality	Minor changes associated with footpath works are anticipated at the boundary of Civic Park. The proposal would not result in any reduction of these qualities or values.	None
(e)	Any effect on a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present or future generations	The proposal site is located in the vicinity of a number of heritage items. One local heritage item and two conservatism areas are located within the proposal site. There is the potential for impacts during construction as a result of vibration, which would be managed through the implementation of appropriate measures in the CEMP.	Short-term – vibration impacts to be managed by the CEMP, potential for other impacts to be managed by the implementation of mitigation measures Long-term – none
(f)	Any impact on the habitat of protected fauna (within the meaning of the *National Parks and Wildlife Act 1974*)	No impacts on protected fauna within the meaning of the *National Parks and Wildlife Act 1974* are predicted.	None
(g)	Any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air	The proposal would not endanger any species of plant, animal or other form of life.	None
(h)	Any long-term effects on the environment	The proposal would not have any long-term impacts on the environment.	None
(i)	Any degradation of the quality of the environment	The proposal has the potential to result in minor impacts to environmental quality during the construction period. These impacts would be managed through the implementation of mitigation measures. No long-term impacts to the quality of the environment are predicted.	Short-term – minor negative Long-term – none

Clause 228 factor		Summary of results	Potential impact
(j)	Any risk to the safety of the environment	The construction of the proposal is not considered to result in any risk to the safety of the environment. Safety in the vicinity of the proposal site would be managed by the construction contractor(s).	None
(k)	Any reduction in the range of beneficial uses of the environment	The proposal would not result in any reduction in the range of beneficial uses of the environment.	None
(l)	Any pollution of the environment	The proposal has the potential to result in minor short-term erosion and air quality impacts during construction. These impacts would be managed through the implementation of the CEMP. Operation of the proposal would not produce significant additional emissions and no long-term pollution impacts are predicted.	Short-term – minor negative Long-term – none
(m)	Any environmental problems associated with the disposal of waste	Waste created during construction would be removed from site and recycled where possible.	None
(n)	Any increased demands on resources (natural or otherwise) that are, or are likely to become in short supply	The proposal would not increase the demand on any resources that are or are likely to become in short supply.	None
(o)	Any cumulative environmental effect with other existing or likely future activities	Construction of the proposal would need to be managed to ensure that the potential for cumulative impacts with other projects, particularly the construction of the light rail project, is minimised.	Short-term – potential impacts to be managed by the CEMP, and in consultation with relevant agencies with respect to other Newcastle projects Long-term – none
(p)	Any impact on coastal processes and coastal hazards, including those under projected climate change conditions	Coastal inundation associated with king tides and coastal processes occurs to a limited degree around Maryville, Wickham, Stockton and Carrington. Although the Newcastle city centre (including the proposal site) is largely protected from coastal inundation, the combination of heavy rainfall events and high coastal water can exacerbate flood levels.	The proposed works are unlikely to affect flood patterns in the Newcastle city centre.

Table A.2 Principles of ecologically sustainable development

Principle	Definition	Comment
Precautionary principle	This principle states that 'if there are threats of serious or irreversible damage, lack of scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation'.	A range of environmental assessments have been undertaken during the preparation of this REF to ensure that the potential environmental impacts can be understood with a high degree of certainty. There are not considered to be any threats of serious or irreversible environmental damage. The proposal has been designed to avoid environmental impact where possible and mitigation measures would be implemented to minimise or avoid impacts. No mitigation measures have been deferred due to a lack of scientific certainty. The proposal is therefore considered to be consistent with the precautionary principle.
Intergenerational equity	The principle states, 'the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations'. In other words, we should ensure that future generations do not inherit a degraded environment.	The proposal site has been previously disturbed during long term urban development. The proposal would not result in any impacts that are likely to impact on the health, diversity or productivity of the environment for future generations.
Conservation of biological diversity and ecological integrity	This principle states that the 'diversity of genes, species, populations and communities, as well as the ecosystems and habitats to which they belong, must be maintained and improved to ensure their survival'.	The study area is located in a modified urban environment. No potential impacts to biological diversity and ecological integrity were identified.
Improved valuation, pricing and incentive mechanisms	This principle requires that 'costs to the environment should be factored into the economic costs of a project'.	The cost of environmental resources includes the costs incurred to protect the environment. The mitigation measures imposed to minimise the adverse impacts of this proposal would result in economic costs to the construction and operation of the proposal. This indicates the valuation of environmental resources has been assigned. The proposal has been designed to minimise adverse impacts on the environment by confining work to a defined area and implementing appropriate mitigation measures when impacts are expected.

Appendix B – Proposal concept plans



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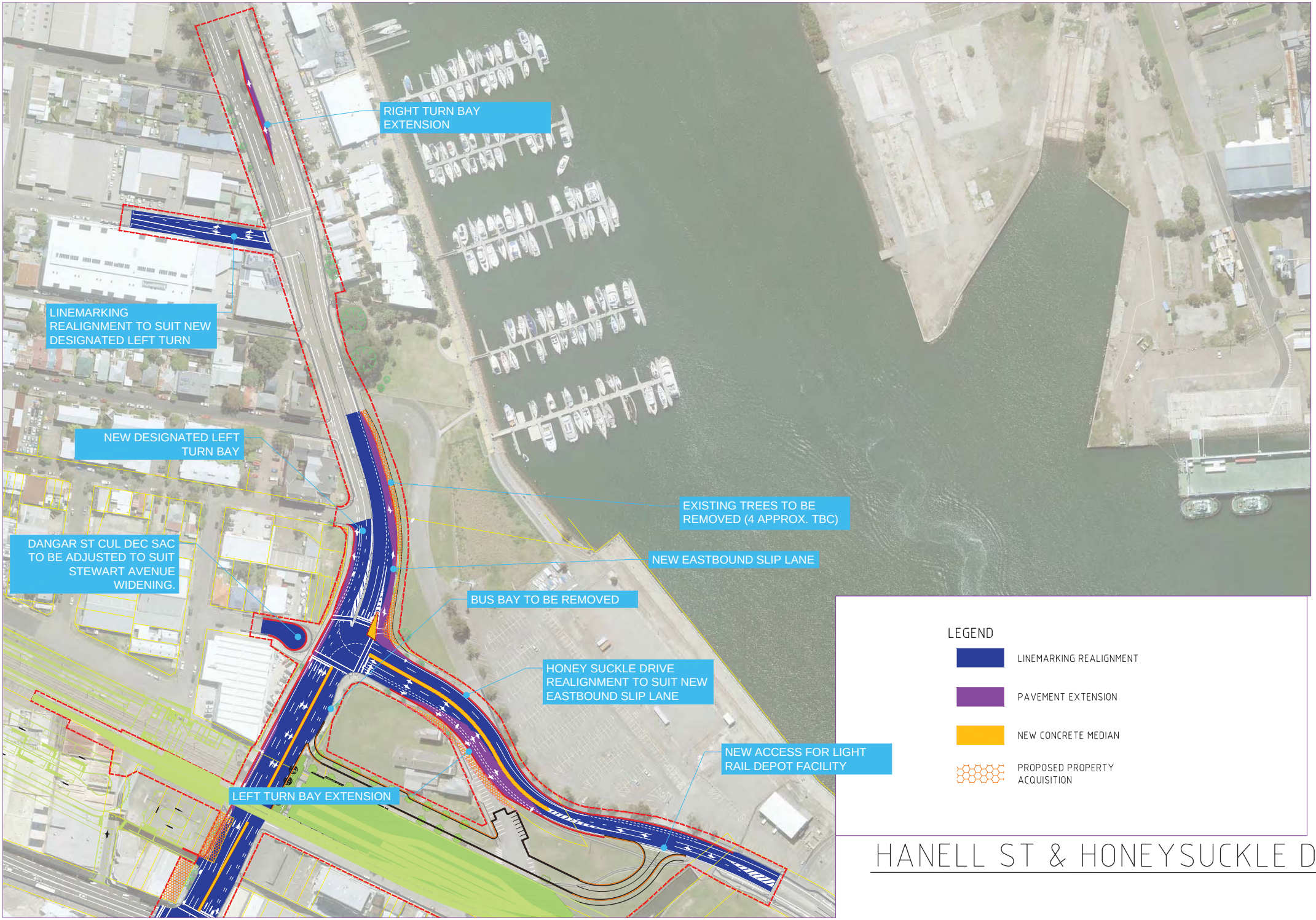

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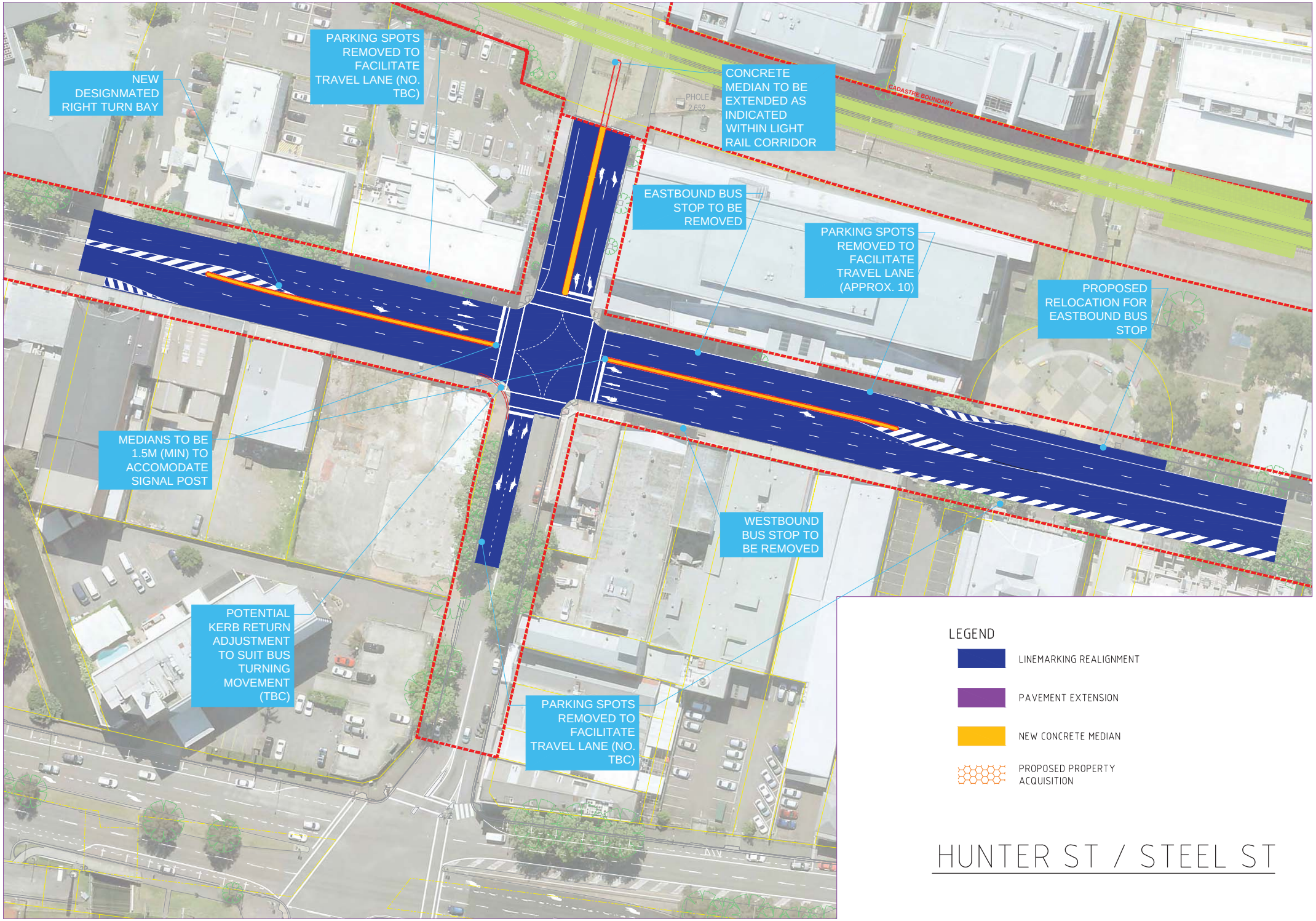
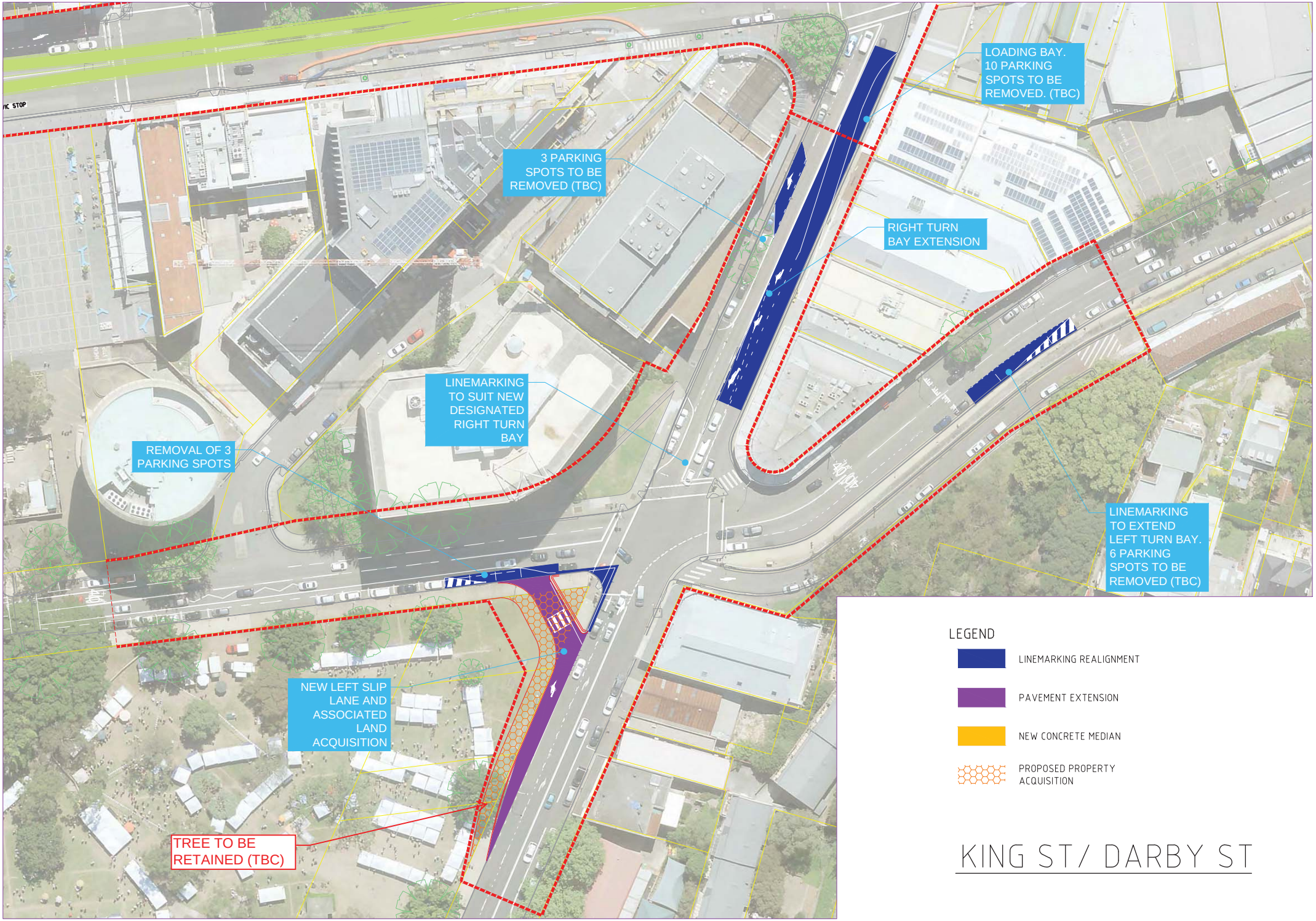


HUNTER ST / STEEL ST



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