Transport for NSW

Revitalising Newcastle

Wickham Transport Interchange

Review of Environmental Factors - Main Volume

July 2014

Artist's impression of new transport interchange at Wickham (indicative only)

Hamilton Station

Honeysuckle Foreshore Public Domain by Terras Landscape Architects

The new state of business

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Technical papers

The following technical papers informed the preparation of the Newcastle Transport Interchange Project Review of Environmental Factors. These papers are available on the Transport for NSW website at http://www.transport.nsw.gov.au/projects.

Technical Paper 1 – Traffic and transport assessment, prepared by GHD

Technical Paper 2 – Non-Aboriginal heritage assessment, prepared by Urbis

Technical Paper 3 – Noise and vibration assessment, prepared by GHD

Technical Paper 4 – Socio-economic assessment, prepared by GHD

Technical Paper 5 – Visual and urban design assessment, prepared by GHD

Abbreviations

Abbreviation	Definition
AEP	annual exceedance probability
AHIMS	Aboriginal Heritage Information Management System
CBD	central business district
CEMP	construction environmental management plan
EPA	Environment Protection Authority
EP&A Act	*Environmental Planning and Assessment Act 1979*
the Regulation	*Environmental Planning and Assessment Regulation 2000*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
GHD	GHD Pty Ltd
Infrastructure SEPP	*State Environmental Planning Policy (Infrastructure) 2007*
the LEP	*Newcastle Local Environmental Plan 2012*
LGA	local government area
LoS	level of service
LALC	Local Aboriginal Land Council
NCA	noise catchment area
NEPM	National Environment Protection Measure
OEH	NSW Office of Environment and Heritage
POEO Act	*Protection of the Environment Operations Act 1997*
REF	review of environmental factors
RMS	Roads and Maritime Services
SEPP	state environmental planning policy
TSC Act	*Threatened Species Conservation Act 1995*

Definitions

Term	Definition
buffer stop	A cushioning device mounted at the end of a rail line to stop train movement
crossover	A track component which provides a connection between two parallel tracks using two sets of points
decant	Removal of wastewater from train carriage toilet facilities
Down	The direction away from Newcastle Station on the Newcastle Branch Line
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
head shunt track	A short length of track that allows a locomotive to uncouple from its train, move forward, and then run back past it on a parallel track. Typically installed at a terminal station to allow the locomotive of an arriving train to move to the opposite end of its train, so that it can then haul the same train out of the station in the other direction.
LAE	The 'sound exposure level', which is used to indicate the total acoustic energy of an individual noise event. This parameter is used in the calculation of LAeq values from individual noise events.
LAeq(24 hour)	The 'equivalent continuous noise level', sometimes also described as the 'energy-averaged noise level' LAeq(24hour) may be likened to a 'noise dose', representing the cumulative effects of all the train noise events occurring in one day
LAeq(15 hour)	The daytime 'equivalent continuous noise level' the LAeq(15hour) represents the cumulative effects of all the train noise events occurring in the daytime period from 7.00am to 10.00pm
LAeq(9 hour)	The night-time 'equivalent continuous noise level', the LAeq(9hour) represents the cumulative effects of all the train noise events occurring in the night-time period from 10.00pm to 7.00am
LAeq(1 hour)	The busiest 1-hour 'equivalent continuous noise level', the LAeq(1hour) represents the typical LAeq noise level from all the train noise events during the busiest 1-hour of the assessment period
layover	Putting a train temporarily out of service
level crossing	A place where rail lines and a road cross at the same location
level of service	Defined by Austroads as a qualitative 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
points	A rail track component where a track divides in two
the proposal	The construction and operation of the Wickham Transport Interchange Project
proposal site	The construction footprint, including the area that would be directly affected by construction works
rolling stock	Refers to train cars or carriages
sensitive receivers	Land uses which are sensitive to potential noise, air and visual impacts, such as residential dwellings, schools and hospitals
stabling	The act of taking a train out of service and parking it in a siding or stabling yard, usually overnight or longer

Term	Definition
study area	The area including and adjacent to the proposal site, with the potential to be impacted by activities on the proposal site
traction power	Power required to operate trains on the rail network
turnout	A point at which a railway track diverges
Up	The direction towards Newcastle Station on the Newcastle Branch Line

Executive summary

Overview

Transport for NSW has completed a Review of Environmental Factors (REF) to consider the potential benefits and impacts of the construction and operation of the Wickham Transport Interchange (the proposal). The REF has been prepared in accordance with the provisions of Part 5 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) and will be used to assist Transport for NSW determine whether to proceed with the implementation of the proposal. Feedback from the community and other key stakeholders received during the public exhibition of the REF will also be considered when making this determination.

The need for change?

Newcastle is the second biggest city in NSW and, by 2036, its city centre is expected to accommodate an additional 10,000 jobs and 6,000 homes.

In 2012, the NSW Government announced the *Newcastle Urban Renewal Strategy*, a 25 year plan to revitalise Newcastle, reinforce its role as a 21st century regional centre and provide a framework to create the jobs and homes needed by 2036. The key issues and requirements for undertaking urban renewal in the Newcastle city centre have also been considered by the *Newcastle City Centre Plan* (City of Newcastle Council, 2008) and the *Hunter Regional Transport Plan* (Transport for NSW, 2014c). The *Newcastle Urban Renewal Strategy* identifies transport, access and connectivity as a guiding principle for the urban renewal of Newcastle.

One of the major renewal initiatives currently underway is Newcastle Light Rail which includes the delivery of a new transport interchange at Wickham. Together, these initiatives are set to revitalise Newcastle and are part of the *Newcastle Urban Renewal and Transport Program*.

In summary, the program would:

- provide a new transport interchange at Wickham, which is a key area for renewal and future urban growth and development under the renewal strategies
- provide the opportunity to reconnect the city centre to the waterfront and make it easier to move around the city centre
- allow for the removal of the heavy rail line between Wickham and Newcastle stations, which would provide the foundation for introducing light rail to Newcastle.

The proposal

The proposal involves:

- constructing and operating a new station at Wickham, and a transport interchange for heavy rail, local buses, taxis and private vehicles (short term parking for passenger pick up and drop off) to the west of Stewart Avenue
- ceasing train services between Wickham and Newcastle stations
- providing for the future introduction of light rail.

To continue operating the rail network to the west of Stewart Avenue, a number of modifications to existing rail infrastructure and services would also be required, including:

- terminating services on the Newcastle Branch Line at Hamilton Station for about two years during construction of the new transport interchange at Wickham
- constructing and operating a new train stabling yard to the north of Hamilton Station

- constructing and operating a new head shunt (third) rail track, about 700 metres long, between the Maitland Road overbridge and the new station at Wickham
- installing new rail crossovers and turnouts to facilitate the movement of trains between the three rail tracks
- making changes to roads in the vicinity of the new station and transport interchange at Wickham
- ancillary infrastructure, including power supply, signalling and overhead wiring.

The boom gates and manually-controlled train signals at the level crossing on Stewart Avenue would be removed. Also, Railway Street would be closed and the level crossing would be removed.

The design of the transport interchange allows for the future provision of light rail. The Newcastle Light Rail project will be subject to a separate environmental impact assessment process and there will be further community consultation at this time.

The key features of the proposal are shown in Figure E.1.

From 26 December 2014, all trains will terminate at Broadmeadow Station so that work can be undertaken at Hamilton Station. During this time, shuttle buses would operate between Newcastle, Civic, Wickham, Hamilton and Broadmeadow stations.

During the construction period from early January 2015, trains would terminate at either Broadmeadow or Hamilton stations. Shuttle buses would enable customers to travel easily to Newcastle and other locations. Return bus services would be provided from the city centre stations to Broadmeadow and Hamilton. The interim bus arrangements will be reliable, convenient and quick for transport customers. The bus services would be timetabled to meet trains in both directions wherever possible. More information will be provided later in 2014.

When construction is complete, a shuttle bus would operate between the new interchange at Wickham and the city centre, until the light rail system is operational.

There is no current plan to change existing public bus routes during construction.

Construction timeframe

Construction of the proposal is forecast to start in late 2014. The proposal would take about 24 months to complete, and would be complete in late 2016.

Environmental impact assessment

The first stage of the environmental impact assessment process involved preparing a preliminary environmental review report (the *Preliminary Environmental Review - Newcastle Urban Renewal and Transport Program* (URS Australia Pty Ltd (URS), 2014a)), which included contamination, heritage and flora and fauna studies.

The second stage involved preparing the REF. The purpose of the REF is to provide information about the proposal and summarise the results of the environmental impact assessment. The REF has been prepared in close consultation with Transport for NSW, Urban Growth, technical advisors, government agencies and stakeholders. Input to the REF has included:

- specialist technical papers:
  - Technical Paper 1 – Traffic and transport assessment
  - Technical Paper 2 – Non-Aboriginal heritage impact assessment
  - Technical Paper 3 – Noise and vibration assessment
  - Technical Paper 4 – Socio-economic impact assessment
  - Technical Paper 5 – Visual and urban design assessment.
- desktop review of other information.

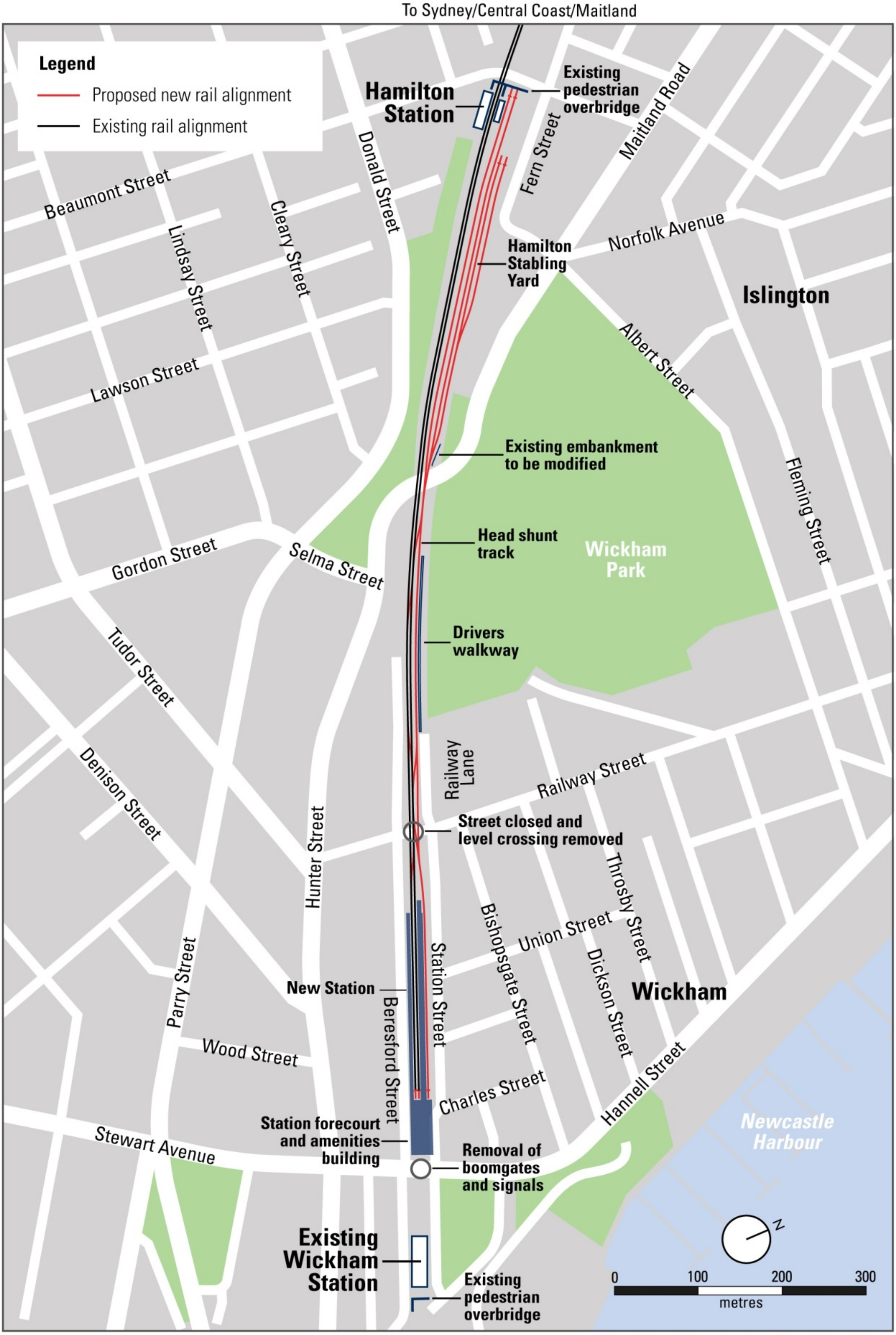


Figure E.1 Key features of the proposal

Alternatives

URS reviewed a number of alternatives to the proposal as part of preparing the *Heavy Rail Truncation Scoping Report.* The URS study considered two distinct project elements:

- new station at Wickham and transport interchange
- stabling yard and track infrastructure.

The location and general configuration of the new station at Wickham has been guided by:

- the availability of public land in the vicinity of the proposed rail termination point
- operational rail requirements
- the opportunity to remove the boom gates and signals on Stewart Avenue.

Four options for the station and interchange were developed and workshopped with key stakeholders. The preferred option, which forms the basis for the proposal, was selected as an outcome of these workshops.

A review of potential sites and layout options for the stabling yard was also undertaken. Five options were considered for the location of the facility. The preferred option was considered to perform best in relation to the key assessment criteria of operational flexibility and reliability.

Community and stakeholder consultation

Community and stakeholder consultation for the proposal is being undertaken in two stages: during REF preparation; and in conjunction with the public display of the REF.

Consultation activities to date have included:

- stakeholder identification and analysis
- establish community contact and feedback mechanisms
- key stakeholder workshops
- station precinct and stabling location workshops
- meetings with the City of Newcastle Council.

Key issues raised

Key issues raised by stakeholders during the preparation of the REF included:

- traffic, parking and access impacts
- ease of connectivity and integration with other transport modes
- noise impacts
- visual amenity impacts and opportunities to enhance the public domain
- impacts to listed heritage items
- potential impacts of the closure of the rail line on passengers, businesses and tourists.

Transport for NSW will continue to work closely with key stakeholders and the community to minimise any impacts.

Current consultation

Formal consultation with stakeholders and the community is being undertaken in accordance with the requirements of *State Environmental Planning Policy (Infrastructure) 2007* during the public display of the REF. Key engagement activities during the REF display period include advertisements, posters, community information sessions, stakeholder briefings, letterbox drops and information at rail stations.

The community and other stakeholders are invited to make written submissions to Transport for NSW on the Wickham Transport Interchange proposal.

Following the REF display, issues raised in submissions will be summarised in a submissions report. Transport for NSW will consider the issues raised and may make changes to the proposal as a result. A determination will then be made whether to proceed with the proposal.

Transport for NSW will continue to liaise with key stakeholders and the community during detailed design development, construction, and operational phases of the proposal. This ongoing engagement process will play an important role in reducing the potential impacts and enhancing the benefits of the proposal for all stakeholders.

Summary of the key findings of the REF

Traffic and transport

The study area is located within a busy and complex traffic and transport environment, with a large number of roads and a range of other transport facilities and infrastructure, including the railway, train stations, bus stops, pedestrian and cycle facilities.

The proposed removal of the boom gates and manually-controlled train signals on Stewart Avenue is expected to improve traffic flows, especially during peak periods. A survey conducted for this REF indicates that the existing boom gate closures result in a substantial interruption to traffic movements along Stewart Avenue. Movements are interrupted for 22 per cent and 19 per cent of the AM and PM peak hours respectively. The removal of the boom gates and train signals at Stewart Avenue would ease congestion created by the boom gate closures.

The proposal would result in a change in public transport conditions for train customers travelling to, from and within the area currently serviced by the Newcastle Branch Line. Heavy rail services would not operate east of Wickham Station, and customers wishing to travel to and from the Newcastle city centre would need to change transport modes to bus (and the future light rail system) at the new station at Wickham. This would result in travel time increases for some rail customers, depending on their origin and destination (Transport for NSW, 2014b).

The Railway Street level crossing would need to be removed to construct and operate the proposal. As a result, the road would also be closed on both sides of the existing railway corridor. This would change access arrangements for vehicles, pedestrians and cyclists who currently use this crossing. Removing the level crossing would result in the diversion of traffic to other crossing locations.

However, the preliminary findings of the traffic and transport assessment (refer to Technical Paper 1) indicates that the resulting impact on traffic conditions of closing the Railway Street level crossing is likely to be acceptable. This is because the existing volume of traffic using Railway Street is much less than the capacity of the Stewart Avenue crossing, and the proposed removal of the boom gates and signals at Stewart Avenue is expected to improve traffic flow. Detailed modelling of the traffic diverted from Railway Street is currently being undertaken to confirm these preliminary findings. The results of this modelling will be provided in the submissions report.

Construction traffic would be minimal, and would be unlikely to impact on traffic in the study area. Potential construction impacts would be mitigated and managed by implementing the mitigation measures identified in this REF, including a detailed traffic management plan.

Changes to some local roads in Wickham would be required to construct and operate the proposal. Traffic flow along some sections of Charles Street and Station Street would become one-way. The width of Station Street would need to be reduced to accommodate the proposal, which would result in the loss of up to about 75 on-street car parking spaces. However, there is considered to be sufficient parking in surrounding areas to accommodate this loss.

Heritage

The heritage impact assessment identified that the following listed items, located within or in the immediate vicinity of the proposal site, have the potential to be impacted:

- Hamilton Railway Station Group/Hamilton Station Buildings and Signal Box
- Wickham Railway Station
- Former Newcastle Cooperative Store
- Sydney Junction Hotel
- Residence at 22 Maitland Road, Islington.

The Hamilton Railway Station Group is listed on the State Heritage Register and is located within the proposal site. The only work proposed within the curtilage of this item is minor track realignment. This would not impact any of the items that form part of the heritage listing, or the significance of the item.

The design of the new interchange at Wickham would take into account its location within the Newcastle City Centre Heritage Conservation Area.

Construction may result in vibration impacts to other items. Potential impacts would be minimised by adopting the recommended minimum offset distances for specified plant items, monitoring vibration levels at potentially affected structures where necessary, and responding appropriately to the results of monitoring.

Archaeological relics may be uncovered during the works. The potential for impacts on any unidentified relics or items would be minimised by implementing the measures provided in the REF.

Noise and vibration

The truncation of the heavy rail line at Wickham would result in a reduction in operational noise at receivers adjacent to the current heavy rail line between Wickham and Newcastle stations, benefitting residents and businesses in this area.

The results of the assessment of operational rail noise indicate that, without mitigation, noise levels from the stabling yard would exceed the operational noise criteria at the nearest residences. A more detailed assessment of noise mitigation strategies would be undertaken during the detailed design phase to ensure that acceptable noise levels would be achieved at the nearest residences.

The public address systems and mechanical plant at the new station at Wickham would be designed to comply with the operational noise criteria at the nearest residences.

Construction activities have the potential to exceed the construction noise criteria at residences closest to the proposal site. The potential significance of these impacts would be managed by implementing the measures provided in the *Construction Noise Strategy* (Transport for NSW, 2012a), where feasible and reasonable. The construction noise impacts would be short-term and temporary, and limited to the duration of the construction period.

The potential impacts of construction vibration were assessed, and offset distances for plant and equipment causing high vibration levels are provided to minimise the potential for significant vibration impacts.

Air quality

The proposal would result in diesel trains ceasing to operate between Hamilton and Newcastle stations during construction, and between the new station at Wickham and Newcastle Station during operation. The removal of these emissions would improve air quality in these areas.

The potential for adverse air quality impacts during operation would be associated with the movement and layover of diesel trains at the new station at Wickham and the stabling yard. The proposal is not likely to result in impacts on local air quality for the following reasons:

- there would be no increase in the number of diesel trains compared to the existing situation
- the same types of locomotives would be used
- only electric trains would be stabled overnight at the proposed stabling yard
- the prevailing winds are primarily from the north-west, which would assist in dispersing locomotive emissions away from the nearest sensitive receivers.

The generation of dust during construction would be managed by implementing the air quality management controls specified in the Construction Environmental Management Plan. During construction, the clearance of ground vegetation would be minimised to reduce the potential for airborne dust impacts.

Socio-economic impacts

The proposal is likely to result in the following socio-economic benefits:

- long term benefits for some businesses in the vicinity of the new station at Wickham, which may experience increases in patronage as a result of people using the new station and interchange
- future growth and investment in the Wickham area generated by the new interchange and station facilities
- revitalisation of the city centre by providing opportunities for better connections to the waterfront and through the city centre
- increase in customers for businesses in the vicinity of the proposal site and at Broadmeadow and Hamilton stations during construction
- employment for up to 150 people in peak periods during construction.

The proposal may result in the following main socio-economic impacts:

- changes to public transport access within the study area during and following construction
- travel time increases for train customers wishing to travel to the Newcastle city centre.

Management measures are provided in the REF to minimise the impacts of the proposal. A number of measures to enhance the customer experience of the proposal are also outlined, including working to provide a seamless interchange to customers.

Urban design and visual amenity

The existing visual environment is characterised by its highly developed urban nature which includes a range of built form, paved areas and transport infrastructure.

The design of the new station and associated facilities provides an opportunity to reinforce the role of the Wickham area in the city centre urban renewal process. The design would continue to be refined during future design phases. The final design of the station and associated facilities would take into account all relevant considerations, including its future role as a gateway to the Newcastle city centre, heritage, urban design and visual impacts.

The proposal would generate temporary visual impacts during construction. Impacts would be experienced in the vicinity of work sites. Visible elements would include machinery and equipment, waste materials and the structures being constructed.

Sustainability

A sustainability assessment of the proposal was undertaken in accordance with the *NSW Sustainable Design Guidelines* (Transport for NSW, 2014a). The results of the assessment indicate that a silver rating should be achievable for the proposal, and it may also be possible to achieve a gold rating by incorporating additional discretionary measures subject to further investigation. The sustainability assessment would be updated as the proposal progresses

A greenhouse gas and carbon footprint assessment would be undertaken during the detailed design stage, in accordance with Transport for NSW's *Greenhouse Gas Inventory Guide for Construction Projects* and the *NSW Sustainable Design Guidelines*. This assessment would evaluate the sources of greenhouse gas emissions during the construction and operation phases.

Other issues

In addition to the above, a range of other environmental issues were also considered to develop a comprehensive environmental management framework for the proposal. These issues included water quality, flooding, soils, contamination and hazardous materials, flora and fauna, Aboriginal heritage, cumulative impacts, and infrastructure impacts. These impacts would be managed by the implementation of appropriate environmental management measures included in the Construction Environmental Management Plan for the proposal.

Next steps

During the public display period, stakeholders and the community are encouraged to make submissions to Transport for NSW in relation to the proposal. Following the display period, Transport for NSW will consider the issues raised in submissions and will respond to community feedback in a submissions report. Transport for NSW will then determine whether to proceed with the proposal. If the proposal proceeds, it would be undertaken in accordance with the mitigation measures proposed in the REF, the submissions report, and any conditions that form part of the determination.

Part A Introduction and context

1. Introduction

This section provides an introduction to the report including an overview and key features of the proposal and the purpose and structure of the REF.

1.1 Overview

The NSW Government is revitalising the Newcastle city centre to boost economic activity and reinforce the city's role as a 21st century regional centre. The *Newcastle Urban Renewal Strategy*, a 25 year plan to revitalise Newcastle, was released by the NSW Government in December 2012. A key direction of this strategy is to achieve an integrated transport solution to help drive urban renewal and improve the linkage between the Newcastle city centre and the Newcastle Harbour waterfront.

Following detailed analysis, the NSW Government identified key actions necessary to accelerate its vision for a revitalised Newcastle. These include:

- removal of the heavy rail line between Wickham and Newcastle stations to reunite the city centre with the waterfront
- delivering the first stage of a light rail system in Newcastle.

As part of the process towards delivering on these actions, Transport for NSW is the proponent of the Wickham Transport Interchange Project. This project involves closing the railway and ceasing train services on the Newcastle Branch Line east of the existing Wickham Station, and constructing a new station and transport interchange west of Stewart Avenue, Islington. The construction and operation of the Wickham Transport Interchange Project is referred to as 'the proposal' in this document.

GHD Pty Ltd (GHD) was commissioned by Transport for NSW to undertake an assessment of the potential environmental impacts of the proposal and prepare a review of environmental factors (REF) in accordance with the provisions of Part 5 of the *Environmental Planning and Assessment Act 1979* (the EP&A Act).

Further information on the background to, and need for, the proposal is provided in section 4.

1.2 Key features of the proposal

1.2.1 Location

The location of the proposal site (the area that would be directly affected by construction works) is shown in Figure 1.1.

The proposal site is generally located within the Newcastle Branch Line rail corridor, between Hamilton Station to the north-west, and the western edge of Stewart Avenue to the south-east. A small area to the west of Hamilton Station would be required to provide an electrical power connection to the NSW TrainLink substation located near Beaumont Street.

The location of the construction compound would be confirmed by the construction contractor. At this stage, it is anticipated that the compound would be located within the area between Wickham Park and the railway corridor, and between Maitland Road and the rear of premises fronting Railway Street. This area was formerly occupied by the Morrow Park Bowling Club.

Further information on the location and setting for the proposal is provided in section 2.

1.2.2 Key features

The proposal involves:

- removal of train services between Wickham Station and the Newcastle central business district (CBD)
- constructing and operating a new train stabling yard to the north of Hamilton Station
- constructing and operating a new station at Wickham and transport interchange for heavy rail, kiss and ride, and taxis to the west of Stewart Avenue.

To continue operating the rail network to the west of the new station at Wickham, a number of modifications to rail infrastructure and services between the new station and Hamilton Station would also be required, including:

- terminating services along the Newcastle Branch Line at Hamilton Station for about two years during construction of the new station at Wickham and transport interchange
- constructing and operating a new head shunt rail track, about 700 metres in length, between the Maitland Road overbridge and new station at Wickham
- installing new crossovers and turnouts to facilitate the movement of trains between the three rail tracks
- ancillary infrastructure, including power supply, signalling and overhead wiring.

Some modifications to the road network would also be required, involving the removal of the railway crossing boom gates and signals at Stewart Avenue and the closure of Railway Street at the rail corridor.

The interchange design makes allowance for the future provision of light rail. The Newcastle Light Rail project will be subject to a separate environmental impact assessment/planning approval process.

The key features of the proposal are shown in Figure 1.2. Further information on the proposal is provided in section 5.

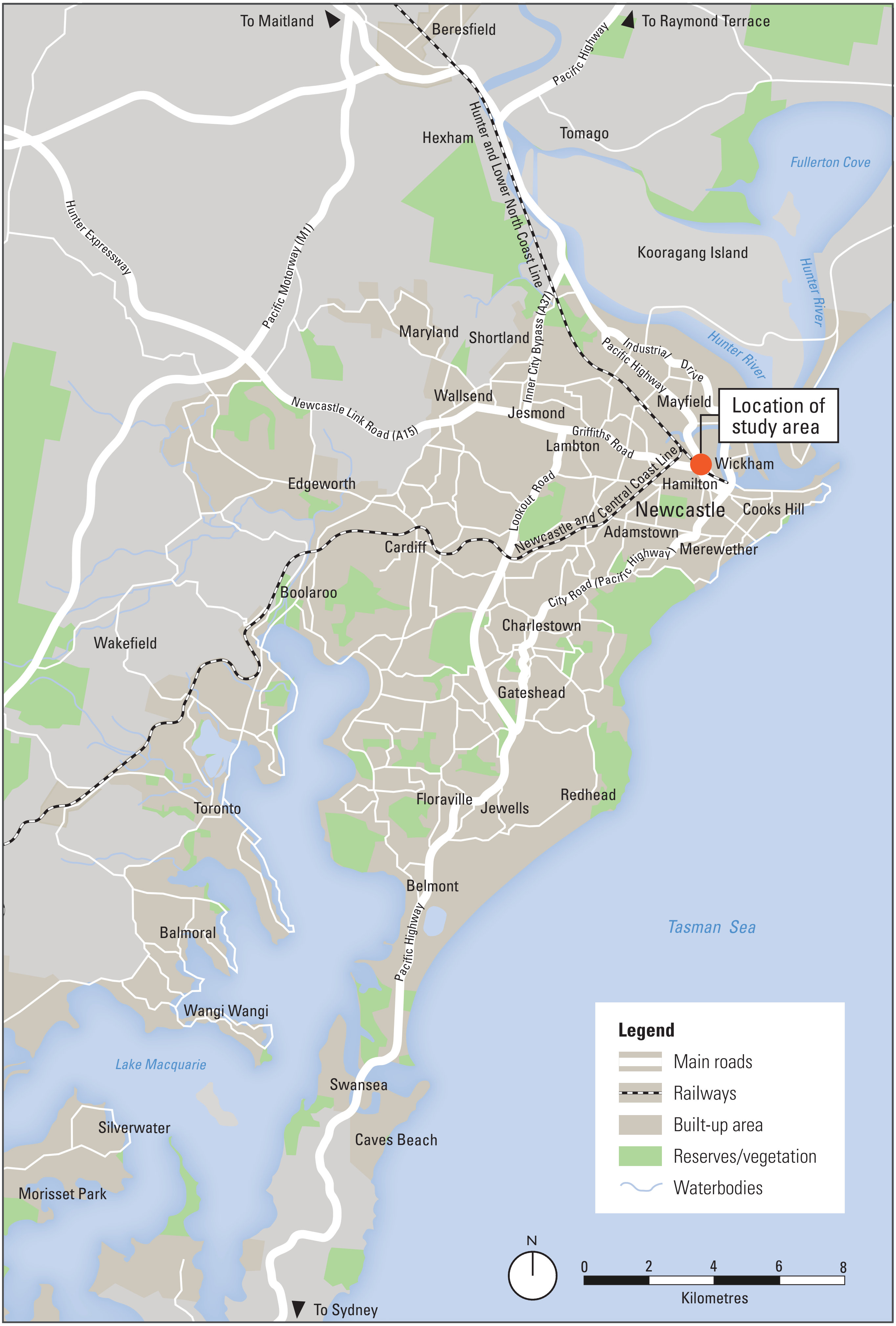
1.3 Purpose of this REF

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 purpose of this REF is to summarise the results of the environmental impact assessment and provide 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.

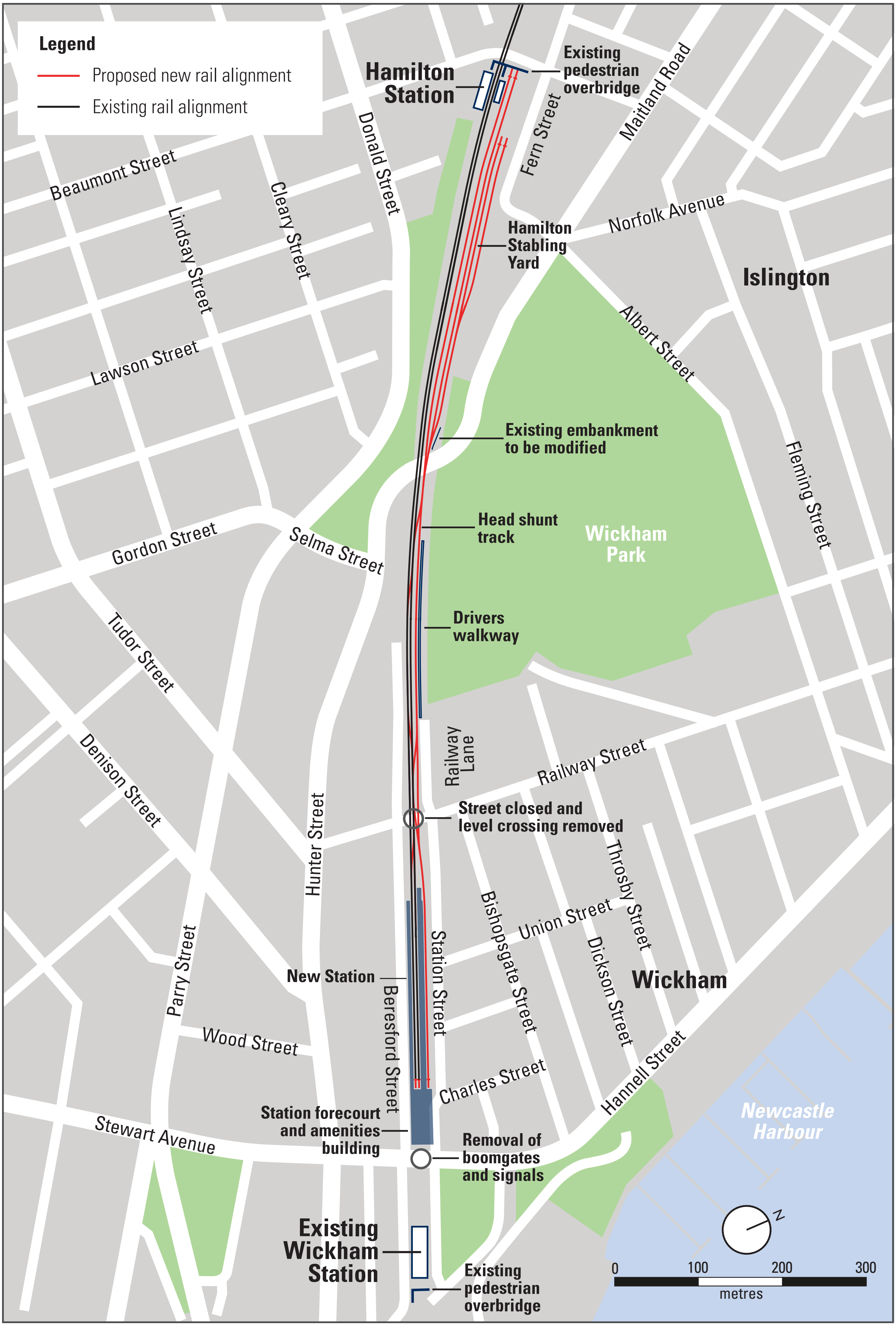
In summary, the REF will assist Transport for NSW to undertake the following:

- determine whether the proposal 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)
- determine whether the proposal is likely to have a significant effect on the environment or significantly affect threatened species, populations or ecological communities or their habitats, and identify appropriate mitigation measures.



1.1 Location of the proposal

To Sydney/Central Coast/Maitland



1.2 Key features of the proposal

1.4 REF structure, scope and methodology

1.4.1 REF structure

The structure of the REF is outlined below:

Part A – Introduction and context

- Section 1 – provides an introduction to the REF.
- Section 2 – describes the location of the proposal, the proposal site and study area.
- Section 3 – summarises the statutory requirements for the proposal, including the requirements of relevant environmental planning instruments and legislation.

Part B – The proposal

- Section 4 – defines the strategic context for the proposal, need, and the options development process.
- Section 5 – provides a description of the construction and operation of the proposal.
- Section 6 – describes the community and stakeholder consultation process and the key issues raised to date.

Part C – Environmental impact assessment

- Sections 7 to 13 – summarises the results of the assessment of the key environmental impacts, including the results of technical papers prepared as an input to the REF.
- Section 14 – considers other potential environmental impacts associated with the proposal and how these would be managed.

Part D - Conclusion

- Section 15 – provides an outline of the requirements for the proposal's environmental management plan, and a summary of the mitigation measures identified by the REF.
- Section 16 – provides a conclusion to the REF.

1.4.2 Scope and methodology

The REF has been prepared in close consultation with Transport for NSW, technical advisors, government agencies and stakeholders. Preparing the REF has involved the following tasks:

- attending a project inception meeting/briefing
- receiving relevant information from Transport for NSW
- reviewing information on the concept design for the proposal provided by URS Australia Pty Ltd (URS) (URS, 2014b and URS, 2014c)
- undertaking a site visit
- undertaking specialist impact assessment studies in relation to traffic and transport, noise, heritage, socio-economic impacts and visual amenity/urban design
- desktop assessments of other potential environmental issues
- attending meetings and workshops with key agencies, technical advisors engaged for the proposal, and other stakeholders

The REF is supported by the following specialist technical papers:

- Technical Paper 1 – Traffic and transport assessment, prepared by GHD
- Technical Paper 2 – Non-Aboriginal heritage assessment, prepared by Urbis
- Technical Paper 3 – Noise and vibration impact assessment, prepared by GHD
- Technical Paper 4 – Socio-economic impact assessment, prepared by GHD
- Technical Paper 5 – Visual and urban design assessment, prepared by GHD.

Input to the REF has included the following information, provided in May and June 2014:

- the technical papers listed above
- conceptual information on the proposal and the options considered, provided by URS
- desktop review of information readily available online and/or provided by Transport for NSW.

2. Location and setting

This section provides information on the existing rail facilities in the study area, the proposal site and the study area.

2.1 Existing rail line and rail operations

Existing rail line and facilities

The Newcastle Branch Line extends from the Main North Line at Broadmeadow and travels in an easterly direction from Woodville Junction for about 3.6 kilometres through Newcastle's inner suburbs to Newcastle Station in the city centre. The line comprises the following stations (from west to east):

- Hamilton Station
- Wickham Station
- Civic Station
- Newcastle Station.

The Newcastle Branch Line opened in 1857. The line was duplicated in 1864, connected to the Main North Line in 1887, and electrified in 1984. The terminus was located at various sites through the years, moving to its current location at Newcastle Station in 1872. The terminus took its final name of Newcastle Station in 1935 when Wickham and Civic stations were opened.

The line comprises a twin track railway with three level road crossings, at Beaumont Street, Stewart Avenue and Merewether Street. Maitland Road also crosses the rail corridor by means of a road overbridge. The existing track configuration is shown in Figure 2.1.

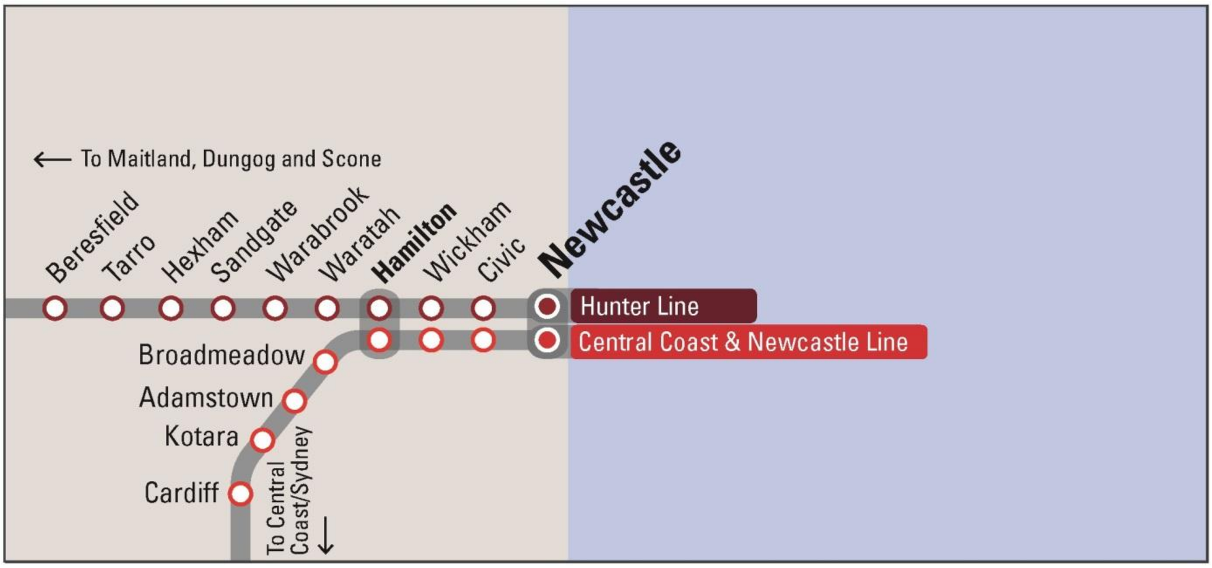


Figure 2.1 Newcastle Branch Line

Train stabling is currently provided at Newcastle Station, which can accommodate one four carriage train, two eight carriage trains, and one two carriage diesel train (or alternatively another four or two carriage train) at night, with daytime stabling in the Engine road.

There are four footbridges within the vicinity of Newcastle Station providing access across the rail line as well as the station concourse which is available to the public.

Existing operations

NSW TrainLink operates passenger train services along the Newcastle Branch Line as part of the Central Coast and Newcastle Line, and Hunter Line services. The Hunter Line runs from Newcastle Station in the east, to Scone in the west (on the 'Southern Branch' of the Hunter Line) and Dungog in the north-west (on the 'Northern Branch'). The Central Coast and Newcastle Line runs between Newcastle Station to Central Station in Sydney via Epping Station.

The Newcastle Branch Line accommodates electric and diesel train services from Sydney and diesel train services from the Hunter Line. About 115 trains run along the line each day. Over much of the day there is typically a half hour service frequency for both services, however the service frequency is significantly higher during the morning and evening peak periods.

Station barrier counts indicated that in 2012, more than 1,000 passenger movements were recorded during an average weekday at Hamilton (1,490 movements) and Newcastle stations (1,070 movements), with fewer movements at Wickham (560 movements) and Civic (850 movements) stations.

2.2 Site description and location

The proposal site is located in the suburbs of Hamilton, Wickham and Islington in the City of Newcastle local government area (LGA). The proposal site is located on the edge of the Newcastle city centre, about two kilometres to the west of the Hunter Street Mall. The site surrounds the rail corridor and extends from just to the north-west of Hamilton Station to just to the east of Stewart Avenue, Wickham.

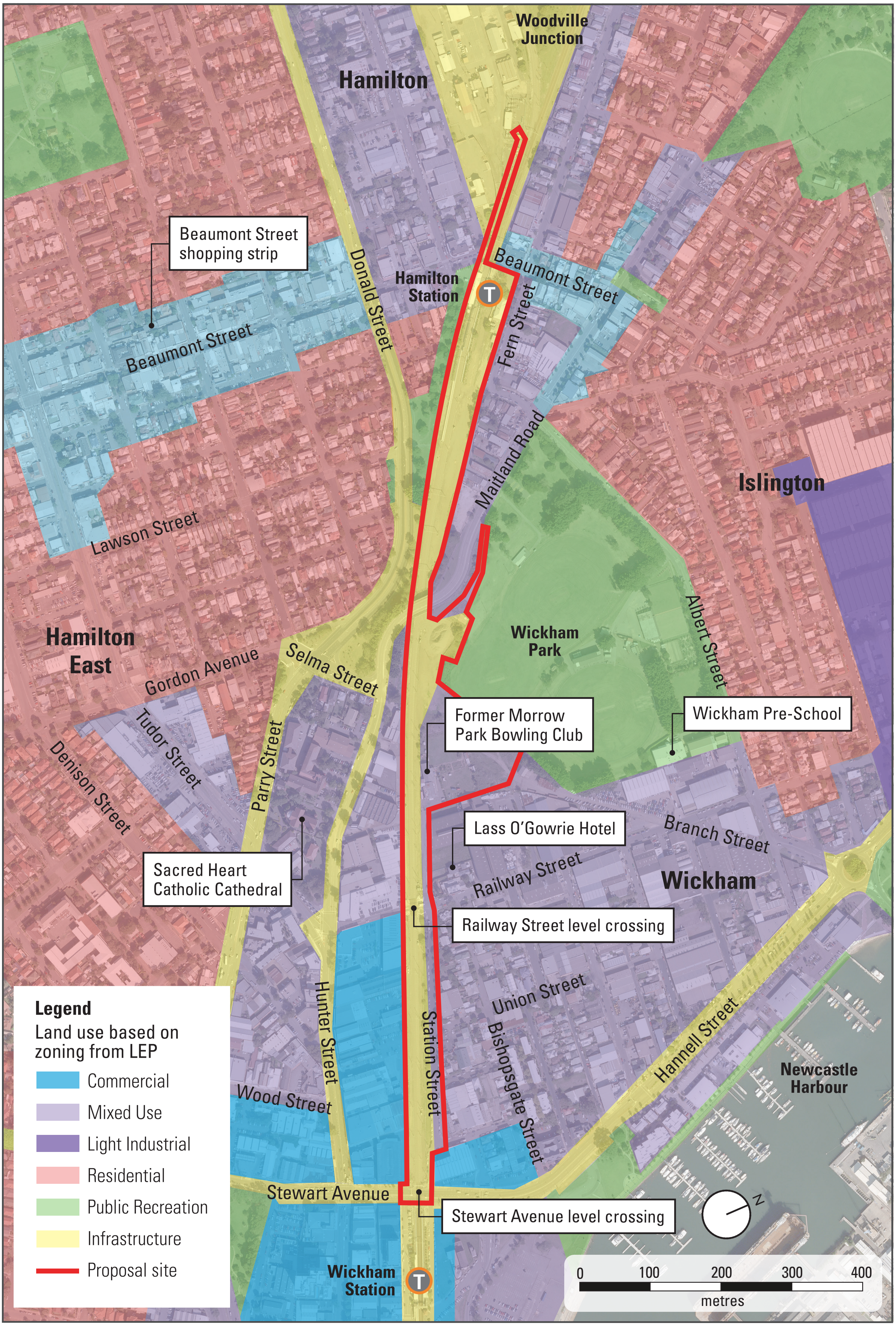
The proposal site for the purposes of the REF is shown in Figure 2.2 and is described below.

The proposal site has an overall area of about 8.5 hectares. The eastern boundary of the proposal site is Stewart Avenue. The proposal site continues for about 1.5 kilometres west along the existing rail corridor, which runs parallel to Station Street and Railway Lane. The rail line passes under Pacific Highway/Maitland Road and continues towards Hamilton Station. The western boundary of the proposal site is located where the rail line splits at Woodville Junction, about 150 metres west of Hamilton Station.

The existing Hamilton Station precinct includes two platforms; station buildings; a pedestrian overbridge; a public car park on the southern side of the rail line; and a staff car park, control building and work compound on the northern side of the rail line.

The western extent of the proposal site includes a buried cable trench to the traction power supply substation west of Beaumont Street, Hamilton.

The northern extent of the proposal site is bounded by the railway corridor in the vicinity of Hamilton Station, and by the northern extent of Railway Street at the proposed location for the new station at Wickham. The proposal site also includes the site of the former Morrow Park Bowling Club. The land previously occupied by the bowling club (which adjoins Wickham Park to the south) is currently vacant.



2.2 The proposal site, land use and key features of the study area

2.3 The study area (site context)

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

The study area is within the City of Newcastle, which is located about 160 kilometres north of Sydney, within the Lower Hunter region. Newcastle is the second largest city in NSW, and is the major centre for the Lower Hunter. The city supports a range of services focused around transport, education and health.

Characteristic of its urban location, the study area for the proposal consists of a varied mix of land uses, including commercial, retail, residential, recreation, community and transport infrastructure.

Key features of the study area and the main land uses are shown in Figure 2.2.

Land uses immediately surrounding the proposal site include:

- rail corridor to the west and south
- Wickham Park to the north
- employment generating uses, including retail, light industrial, and automotive services, are located in the vicinity of the proposal site, particularly in Station, Fern, Beaumont and Hunter streets.
- residential land uses, including detached residential dwellings and medium density apartment buildings.

Land uses in the broader area include:

- Newcastle Harbour, located about 300 metres to the north-east of the proposal site
- foreshore development along Honeysuckle Drive, located about one kilometre to the east
- the CBD and Hunter Street mall, located about two kilometres to the east
- residential, commercial and industrial land use in the surrounding suburbs (see below)
- religious and other community uses, including the Sacred Heart Catholic Cathedral and the Diocese of Newcastle buildings on Hunter Street, about 120 metres to the south-west of the proposal site.

The suburb of Wickham is located to the north of the rail corridor. It comprises a mix of commercial, light industrial and residential development. Key land uses include the heritage listed Wickham Park, which is a large public recreation area containing three sports fields. The KU Wickham Preschool is located on the eastern side of Wickham Park. Residential development fronts the rail corridor along Station Street east of Wickham Park.

The suburb of Islington is located to the west and north-west of the rail corridor. It also comprises a mix of land uses characteristic of its urban location. Residential areas are concentrated mainly to the north of the suburb. Sensitive receivers near the proposal site include residences on Fern Street, which front the existing rail corridor north of Hamilton Station. The local centre is situated on Beaumont Street. A number of local businesses are located in this area, including a variety of restaurants and hotels.

The Beaumont Street rail crossing extends south-west into the suburb of Hamilton, which is mainly residential in character.

Hunter Street, which is one of the main roads into the Newcastle city centre, is located to the south-east of the proposal site and runs in an east-west direction through the study area. The Pacific Highway travels north through the study area along Stewart Avenue, and then west along Hunter Street.

A portion of the area to the east of Wickham Park and west of Stewart Avenue/Hannell Street (to the north of the proposal site), is designated as the 'Wickham Redevelopment Area' by the *Newcastle Local Environmental Plan 2012*.

Further information on the key features of the environment is provided in Part C of the REF.

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3. Statutory considerations

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

3.1 Environmental Planning and Assessment Act 1979

3.1.1 Requirements under the EP&A Act

The EP&A Act and the *Environmental Planning and Assessment Regulation 2000* (the Regulation) provide the framework for development assessment in NSW. The EP&A Act and the Regulation include provisions to ensure that the potential environmental impacts of a development considered in the decision making process prior to proceeding to construction.

3.1.2 Permissibility of the project

As a result of the application of *State Environmental Planning Policy (Infrastructure) 2007* (the Infrastructure SEPP) the proposal is permissible without development consent and is subject to assessment under Part 5 of the EP&A Act (refer to section 3.2.1). 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 that activity'.

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'.

In accordance with clause 79 of the Infrastructure SEPP, Transport for NSW is the proponent and determining authority for the proposal. This REF has been prepared to address Transport for NSW's duty under the EP&A Act.

3.1.3 Ecologically sustainable development

One of the objectives of EP&A Act is to 'encourage 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 ecologically sustainable development. The principles of ecologically sustainable development are generally defined by clause 7(4) of schedule 2 to the Regulation as:

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

Transport for NSW has applied, and will continue to apply, the principles of ecologically sustainable development throughout the development and assessment of the proposal. Section 5.2.2 summarises how ecologically sustainable development has currently been considered and incorporated in the design development of the proposal.

A sustainability assessment of the proposal was undertaken in accordance with the *NSW Sustainable Design Guidelines* (Transport for NSW, 2014a), as outlined in section 13.

3.2 Environmental planning instruments

The environmental planning instruments that are relevant to the assessment of the proposal are considered below.

3.2.1 State environmental planning policies

State Environmental Planning Policy (Infrastructure) 2007

The Infrastructure SEPP outlines the permissibility and development controls for infrastructure works and facilities. Clause 79 of the Infrastructure SEPP makes provision for railway infrastructure facilities to be permissible without the need for development consent under the EP&A Act. As the proposal meets the definitions of rail infrastructure facilities provided by clause 78, it is permissible without consent.

Clauses 13 to 16 of the Infrastructure SEPP outline the requirements for consultation with councils and other public authorities for any infrastructure development carried out by or on behalf of a public authority that meets the requirements under these clauses. A summary of the statutory consultation undertaken is provided in section 6.3.

Environmental Planning Policy No 55 – Remediation of Land (SEPP 55)

Environmental Planning Policy No 55 – Remediation of Land (SEPP 55) outlines the matters that planning and consent authorities need to take into account in relation to contamination during land use planning and the assessment of development applications. It also specifies the consent requirements for remediation activities.

As noted in section 14.4, some potential evidence of contamination was identified by initial site investigations, and the need for further investigation to adequately characterise the potential for contamination was noted (URS, 2014d). There is the potential that any remediation required may be defined as 'category 1 remediation' under clause 9 of the SEPP. Category 1 remediation work requires consent under SEPP 55. However, clause 19 of SEPP 55 provides that if another SEPP permits remediation work without development consent, then SEPP 55 does not impose a consent requirement on a proposal'. Environmental management works are permitted without consent under clause 79(2)(d) of the Infrastructure SEPP. It is considered that any remediation work would meet the definition of environmental management works, and would not require consent.

3.2.2 Local environmental plan

The *Newcastle Local Environmental Plan 2012* (the LEP) applies to the land on which the proposal site is located. The proposal site is located within land subject to a variety of zoning, including SP2 Infrastructure.

Clause 5.12 of the LEP states that '…this Plan does not restrict or prohibit, or enable the restriction or prohibition of, the carrying out of any development, by or on behalf of a public authority, that is permitted to be carried out with or without development consent, or that is exempt development, under State Environmental Planning Policy (Infrastructure) 2007'.

Further, as described above, given the proposal is permissible without consent under the Infrastructure SEPP, the consent requirements of the LEP do not apply to the proposal.

3.3 Approvals under other NSW legislation

Other environmental legislation that is directly relevant to the approval and/or assessment of the proposal is considered in Table 3.1.

Table 3.1 Consideration of approval requirements under relevant NSW Acts

Act	Potential approval requirement for rail infrastructure	Relevance to the proposal
Contaminated Land Management Act 1997	The Act requires land owners and persons who carry out contaminating activities to notify contamination of land in circumstances specified in section 60. The EPA must be notified as soon as soon as practicable after the person becomes aware of the contamination.	The 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. Further information is provided in section 14.3.
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. An excavation permit under section 139 to disturb or excavate any land containing or likely to contain a relic.	The proposal site includes the Hamilton Railway Station Group, which is listed on the State Heritage Register. The only work proposed within the curtilage of the Hamilton Railway Station Group is minor track realignment. These works would not directly impact any of the items that form part of the listing or the significance of the item. Transport for NSW would seek exemption from approval of the works under standard exemptions 7 and 8. Archaeological relics may be uncovered during the works. A section 139(4) excavation exception application under the Heritage Act would be sought prior to undertaking any works with the potential to disturb the land. Further information is provided in section 8.
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 partly located within the Newcastle Mine Subsidence District. If Transport for NSW determines to proceed with the proposal, it would consult with the Mine Subsidence Board and seek any approvals necessary, prior to commencement of construction.

Act	Potential approval requirement for rail infrastructure	Relevance to the proposal
National Parks and Wildlife Act 1974	A heritage impact permit under section 87 of the Act to harm or desecrate an Aboriginal heritage object.	An Aboriginal heritage due diligence assessment of the proposal was undertaken. The nearest listed Aboriginal heritage item is located about 250 metres to the north of 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, an archaeological survey report would need to be prepared as part of the detailed design process. Further information is provided in section 14.6.
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 provided in section 14.5.3.
Protection of the Environment Operations Act 1997	An environment protection licence (EPL) is required for scheduled activities or scheduled development work.	The proposal is considered to meet the definition of a scheduled activity under clause 33 ('railway systems activities') of schedule 1 of the POEO Act, and therefore an EPL would be required for construction. NSW TrainLink operates under the EPL for the operation of the rail network (EPL no. 12208). The EPL would need to be varied to ensure that the premises that the EPL applies to includes the proposal. The proposal would comply with the requirements of this EPL as well as the general obligations of the POEO Act.
Roads Act 1993	Approval under section 138 for works to a classified public road.	The proposal would involve removing boom gates and signals on Stewart Avenue (a classified road). If Transport for NSW determines to proceed with the proposal, it would seek approval from RMS prior to commencement of construction.
Threatened Species Conservation Act 1995	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 the 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 flora and fauna assessment has addressed these requirements. An assessment of significance was prepared to assess the potential significance of the proposal on the little bent-wing bat. The assessment concluded that the proposal would not significantly impact any listed flora, fauna or communities, and a species impact statement is not required. Further information is provided in section 14.5.2.

Act	Potential approval requirement for rail infrastructure	Relevance to the proposal
Transport Administration Act 1988	Approval under section 99B to close a level crossing.	If Transport for NSW determines to proceed with the proposal, it would seek approval from the Minister for Transport prior to the commencement of construction to close the Railway Street level crossing.
Water Management Act 2000 and *Water Act 1912*	Licence for dewatering and interception of groundwater. Any dewatering activity that is estimated to exceed 3 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 (piling for the station). Although it is likely that groundwater would be intercepted and dewatering would be required, it is unlikely that it would exceed 3 ML/year. Transport for NSW would consult with the NSW Office of Water following detailed design should any approvals be required.

3.4 Approvals under Commonwealth legislation

Commonwealth Environment Protection and Biodiversity and Conservation Act 1999

An *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) protected matters search was undertaken on 13 May 2014 for an area within a ten kilometre radius of the proposal site. The results of the search are summarised in Table 3.2. As no impacts are predicted, an approval under the EPBC Act would not be required.

Table 3.2 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	Coal River (Mulubinba) and Government Domain Newcastle	The proposal would not impact on this property, which is not located in the vicinity of the proposal site.	None
Wetlands of international significance (Ramsar sites)	Hunter estuary wetlands	The proposal would not impact on any wetlands.	None
Threatened ecological communities	Lowland Rainforest of Subtropical Australia Subtropical and Temperate Coastal Saltmarsh	The proposal would not impact on any threatened ecological communities.	None
Threatened species	60 threatened species, including 6 birds, two frogs, one fish, seven mammals, 13 plant species, one reptile and 40 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
Listed migratory species	70 migratory species, including 25 wetland species, 20 migratory marine birds, 18 other marine species and seven terrestrial species		None

Protected matter	Matter located within search radius	Comments	Potential impact
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	16 Commonwealth properties	The proposal would not directly or indirectly impact on any Commonwealth land.	None
A water resource, in relation to coal seam gas development and large coal mining development	Not relevant	Not relevant	None

3.5 Summary of approval requirements

The proposal is permissible without consent under the provisions of the Infrastructure SEPP. Accordingly the proposal is subject to assessment and determination in accordance with Part 5 of the EP&A Act. The following approvals/licences and exemption applications are considered to be required:

- approval from the Mine Subsidence Board under section 15 of the *Mine Subsidence Compensation Act 1961* for works within a mine subsidence area
- exemption from approval under section 57(1) of the *Heritage Act 1977* for potential impacts to an item listed on the State Heritage Register
- a section 139(4) excavation exception application under the *Heritage Act 1977*
- a section 138 approval under the *Roads Act 1993* for works in Stewart Avenue.
- an EPL under the *Protection of the Environment Operations Act 1997* for construction
- approval under section 99B of the *Transport Administration Act 1988* to close the Railway Street level crossing.

3.6 The assessment process

The first stage of the assessment process has involved preparing the REF in consultation with Transport for NSW. An outline of the REF methodology was provided in section 1.4. Preparation of the REF has been supported by consultation with the community and stakeholders, including relevant government agencies, as described in section 6.

The REF will be displayed and made publicly available. During the display period, key stakeholders and the community are encouraged to make submissions to Transport for NSW on the proposal and any potential environmental impacts.

Following the display period, Transport for NSW will consider issues raised in submissions and will respond to community feedback in a submissions report. If required, Transport for NSW may also propose changes to the proposal and detail these in the submissions report. These documents will be available to the public on the Transport for NSW website.

Following preparation of the submissions report, Transport for NSW will determine whether to proceed with the proposal. If Transport for NSW proceeds with the proposal, it would be carried out in accordance with the mitigation measures outlined in this REF and submissions report, and any conditions of approval that form part of the determination under 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 3.1.

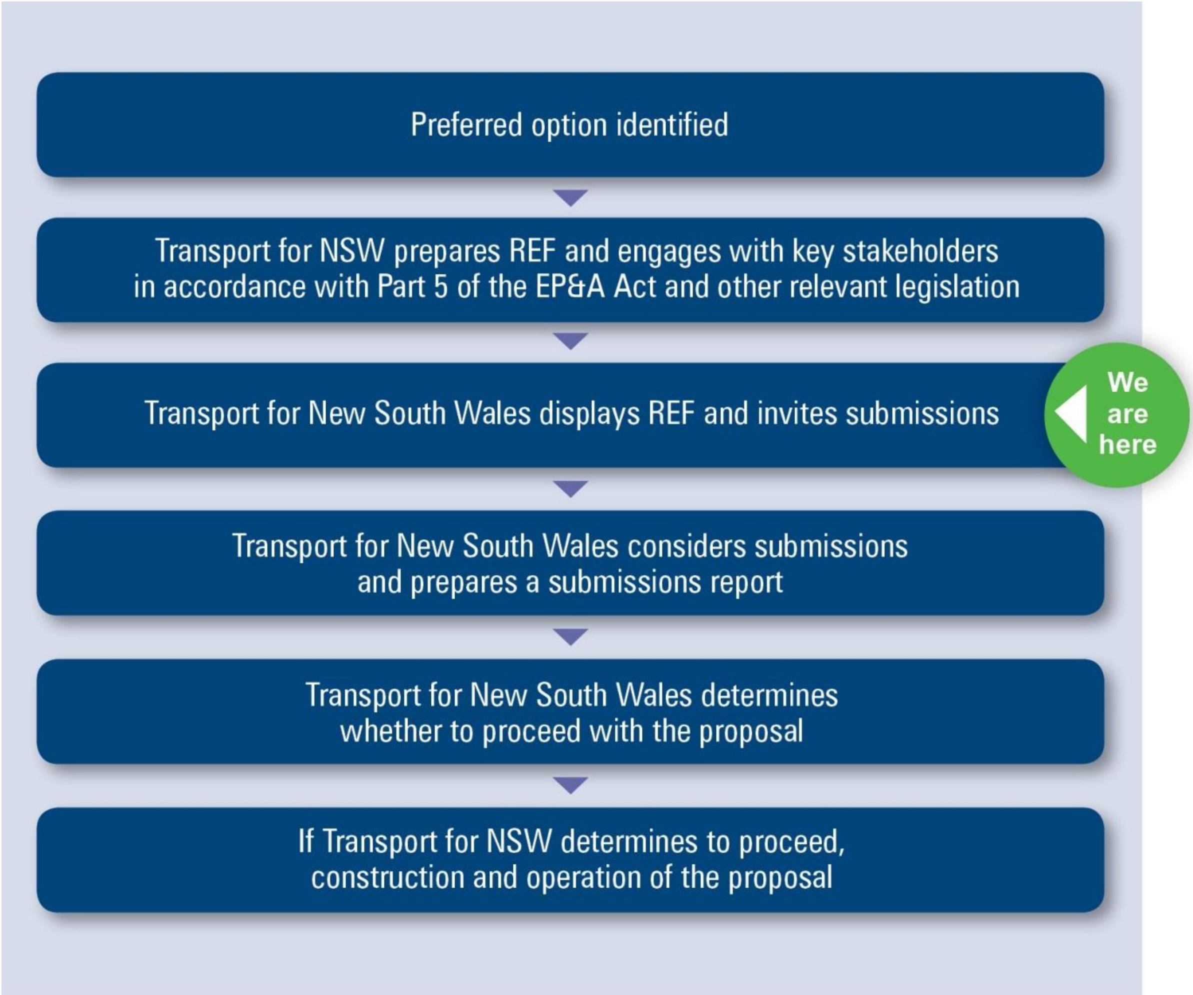

Figure 3.1 The assessment process

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Part B The proposal

4. Strategic context, need and options considered

This section provides background information on the need and strategic context for the proposal, including an overview of the relevant strategic planning studies that have been undertaken. It also includes a description of the design development process and the alternative design options considered.

4.1 Need for the proposal

4.1.1 Overview

The Lower Hunter region is experiencing sustained population and economic growth, which in turn will drive growth in Newcastle city centre and surrounding localities. The strategic planning that has been undertaken for Newcastle indicates that the city centre will have an additional 10,000 jobs and 6,000 homes by 2036. As a result, the NSW Government plans to transform and revitalise Newcastle's city centre over the next 25 years to accommodate these changes (Department of Planning and Infrastructure, 2012).

The key issues and requirements for undertaking urban renewal in the Newcastle city centre have been considered by a number of planning studies and reports undertaken by the City of Newcastle Council (Council) and the NSW Government. In December 2012 the NSW Government released the *Newcastle Urban Renewal Strategy* (Department of Planning and Infrastructure, 2012). The key issues identified include:

- physical barriers, including geographical constraints (mainly the existing rail line) have caused the city centre to become elongated and poorly connected, especially to the waterfront.
- the physical and perceived barrier created by the rail line impedes investment and growth, and prevents the centre from functioning in a cohesive manner.
- Newcastle lacks a centre that is capable of generating critical mass, catering for the higher order functions expected of a regional city.

Further to the issues raised, the *Newcastle Urban Renewal Strategy* detailed the key priorities for renewal of Newcastle’s city centre (refer to section 4.1.2).

In July 2013 the NSW Government announced that train services along the Newcastle Branch Line would cease between Wickham and Newcastle stations, and a new light rail link between Wickham and the Newcastle city centre would be provided along the rail corridor.

The *Hunter Regional Transport Plan* (Transport for NSW, 2014c) was released in April 2014. The removal of the heavy rail line between Wickham and Newcastle stations, and the development of a new transport interchange at Wickham, are key actions provided under the plan.

The proposal is required to proceed with the revitalisation program proposed by the urban renewal strategy. It will also enable the key recommendations of the other relevant strategies and plans to be achieved.

In summary, the proposal is needed to:

- allow for the removal of the heavy rail line between Wickham and Newcastle stations, which will provide opportunities to reconnect the city to the waterfront
- provide a new transport interchange at Wickham, which is a key area for renewal and future urban development under the renewal strategies
- act as a catalyst for urban renewal in the Newcastle city centre, the adaptive reuse of the former rail corridor for public domain improvements, and the supporting development of activity precincts
- provide the foundation for introducing light rail within Newcastle.

The following sections provide further information on the strategies and plans referred to above, and a summary of other policies and strategies that provide the context for the proposal.

4.1.2 Strategic context

The strategic context and need for the proposal is influenced by a wide range of strategic planning that has been undertaken at the national, state and regional levels. UrbanGrowth, the Department of Planning and Environment, Transport for NSW and Council are working together to revitalise the Newcastle city centre. Key plans, policies and strategies to achieve these strategic objectives are summarised below.

NSW 2021 – A Plan to Make NSW No 1

NSW 2021 – A Plan to make NSW No 1 (Department of Premier and Cabinet, 2011) is a ten year plan to guide policy and budget decision making in NSW. In relation to transport, the plan notes that ‘an integrated transport system is required to ensure different transport modes work together and the interests of the travelling public are put first.’

The main goals of the plan that are relevant to the proposal are to:

- drive economic growth in regional NSW
- grow patronage on public transport by making it a more attractive choice.

NSW Long Term Transport Master Plan

The NSW Government released the *NSW Long Term Transport Master Plan* (Transport for NSW, 2012b) on 13 December 2012. The master plan sets the direction for Transport in NSW for the next 20 years, bringing together all modes of transport across all regions of the state into a world class, integrated network that puts the customer first.

The plan notes the following challenges for Newcastle that are relevant to the proposal:

- planning for and managing strong demand for car travel and solutions for the low levels of public transport use
- addressing the declining or static levels of bus use
- developing an urban renewal program that creates an attractive, accessible city centre
- providing better public transport connectivity across the city, between modes, and to major service centres.

The master plan includes the following actions that are relevant to the proposal:

- strengthen bus operations in the region’s major centres
- increase the proportion of commuter trips on public transport to the Newcastle city centre.

The master plan also recognises the links with the Newcastle Urban Renewal Strategy, by stating that 'the Department of Planning and Infrastructure is preparing a land use plan for Newcastle and the Hunter which will assess the rail corridor as part of the future transport solutions to support renewal in the Newcastle city centre.'

Hunter Regional Transport Plan

The Hunter Regional Transport Plan was released in April 2014 to support the *NSW Long Term Transport Master Plan* (Transport for NSW, 2012b). The plan identifies a range of short, medium and long term actions to deliver key transport and infrastructure projects to the Hunter region.

Key relevant actions include:

- deliver public transport improvements
- improve public transport interchanges
- transform transport in the CBD.

In relation to the action proposing to transform transport in the CBD, the plan notes the following:

- Wickham has been selected as the location for the removal of the heavy rail line and the creation of a new transport interchange through detailed analysis and assessment.
- The new, fully-accessible interchange will encourage more people to travel by public transport into the city centre with all bus, heavy rail, light rail and taxi services located on one level for easy customer interchanges.
- The Wickham interchange will provide the potential for urban revitalisation at the centre of this emerging business district.
- Light rail in Newcastle will support the city's renewal, and will include public domain improvements to enhance connections between the city centre and the waterfront.

The Lower Hunter Regional Strategy

The *Lower Hunter Regional Strategy 2006-2031* was released by the NSW Government in 2006. The strategy established a 25-year planning framework to guide the growth and spatial development of the Lower Hunter region. The strategy has a particular focus on increasing the supply of housing, particularly affordable housing, in the region. It also aims to maintain the Lower Hunter region's economic growth and prosperity, while simultaneously protecting areas of conservation significance.

A comprehensive review of the strategy commenced in 2011, and a revised regional strategy (2011-2036) is currently being prepared. The discussion paper for the new strategy was released in March 2013. The discussion paper notes that the recent decision to replace train services with bus services from a new transport interchange at Wickham will support urban renewal in the CBD by encouraging new development and enhancing physical and visual connections between the city centre and the waterfront. The discussion paper also commits to ensuring that the rest of the city centre is still well serviced by public transport.

The discussion paper also notes that the existing rail line, originally built to move freight to the harbour, now divides the city centre. The NSW Government's commitment to remove the rail line recognises that:

- the commercial core of Newcastle is no longer close to Newcastle Station

- with future development, the emerging commercial core will be at the western end of the city centre
- the rail line creates a physical barrier between this future development area and the Honeysuckle development area.

Newcastle City Centre Plan

During 2007, the NSW Government and Council developed a suite of documents to outline the planning framework for development of the city centre. These were adopted and gazetted in February 2008, and are referred to as the Newcastle City Centre Plan. The plan was reviewed in 2010, with the review report proposing additional future actions, including (The City of Newcastle, 2010):

- promote development in the city centre
- enhance transport links to and from the city centre
- improve transport management facilities near Wickham Station for future growth
- work with the state government to provide additional pedestrian/vehicular crossings across the rail corridor.

Newcastle 2030 Community Strategic Plan

The Newcastle 2030 Community Strategic Plan is the guiding document upon which all future planning decisions relating to economic growth, transport, housing, lifestyle and the environment will be made in the City of Newcastle LGA. The plan was released by Council in 2011. A review of this plan is currently underway.

Relevant strategic directions contained within the plan are:

- connected city
- liveable and distinctive built environment.

Newcastle Urban Renewal Strategy

The Department of Planning and Infrastructure released the *Newcastle Urban Renewal Strategy* for public comment in December 2012. The strategy considers the suitability of the Newcastle city centre for urban renewal. It outlines an overall strategy underpinned by a range of initiatives and an implementation plan to support the revitalisation of Newcastle over the next 25 years.

The strategy proposes a framework for the city to grow and identifies initiatives to improve the city's economy, access, connections and the quality and attractiveness of the public domain, all of which are catalysts for encouraging development. The strategy was prepared in accordance with clause 9(2) of *State Environmental Planning Policy (Urban Renewal) 2010*.

The strategy supports the NSW Government's decision to build a new transport interchange at Wickham and replace heavy rail services between Wickham and the Newcastle city centre with bus services.

The strategy identifies the following relevant initiatives:

- promoting enhanced connections across the rail corridor
- attracting more residents into the city centre
- promoting a higher mode shift to public transport
- Wickham Station relocation and termination of train services west of Stewart Avenue.

Honeysuckle Master Plan review

Redevelopment of the Honeysuckle area commenced in 1992. In 2011, the Hunter Development Corporation undertook a review of the existing master plan after a series of workshops identified that the community were not satisfied with the delivery of waterfront public space. After testing various use and density scenarios, a preferred option was identified for the Cottage Creek Precinct (which is where Wickham Station is located).

The plan for the precinct proposes that Wickham Station would be transformed to provide a gateway to the city, with elevated views over the Hunter River and ocean.

Newcastle Urban Renewal and Transport Program, UrbanGrowth NSW

In June 2012 the NSW Minister for Planning and Infrastructure announced the creation of UrbanGrowth NSW, a government initiative to drive investment in key locations in NSW and help underpin the future prosperity of urban and regional centres. One of the key priorities of UrbanGrowth NSW is to unlock private sector investment by coordinating and delivering lead-in infrastructure and services in development areas, and by planning and fast tracking urban renewal projects.

UrbanGrowth NSW's portfolio of projects includes the Newcastle Urban Renewal and Transport Program. The Newcastle Urban Renewal and Transport Program consists of the following priority projects:

- developing a transport interchange at Wickham
- developing a light rail service between Wickham interchange and Newcastle beach by way of the city centre
- use of rail corridor land for public domain purposes, connecting the city centre to the waterfront and supporting the development of three key activation precincts
- redeveloping landholdings around Hunter Street Mall.

In 2013, the NSW Government announced that it would introduce light rail to the city centre between Wickham and Newcastle Beach. Light rail in Newcastle will support urban renewal and improve connections to the waterfront as well as increasing public transport choice. The future light rail project will be assessed as part of a separate environmental impact assessment process.

UrbanGrowth is working closely with Transport for NSW, the Department of Planning and Environment, Hunter Development Corporation, and Council, on the Urban Renewal and Transport Program.

Transport for NSW is undertaking the Wickham Transport Interchange project as an integral part the Newcastle Urban Renewal and Transport Program.

4.2 Concept design development process

In December 2013, Transport for NSW engaged URS as the Engineering and Operational Technical Advisor for the heavy rail truncation and transport interchange component of the Newcastle Urban Renewal and Transport Program.

The scope of the design engagement undertaken by URS included:

- strategy – including a review of needs, objectives, technical requirements and selection of a preferred option
- development – including definition of the preferred option and development of a concept design.

Prior to the appointment of URS, significant work had been undertaken during the strategy phase to identify a preferred stabling location and station layout to enable decision making on the location for the truncation of the Newcastle Branch Line. As part of the design development, URS were engaged to address all relevant engineering, urban design, operational, environmental and functional requirements identified by Transport for NSW.

URS developed a preferred option incorporating:

- a terminus for Sydney Trains and NSW TrainLink operations allowing efficient station operations
- an interchange between heavy rail services and other forms of transport, including the proposed light rail
- a stabling yard for passenger trains.

The development and evaluation of options involved consideration of:

- operational suitability
- community impact
- functionality
- infrastructure requirements
- railway system modification
- urban design
- environmental issues
- constructability.

To support the preferred option, the following aspects where also considered by URS:

- risk assessment
- cost estimate, including contingency evaluation
- operational and public safety during construction and operation
- construction schedule
- minimising impact on existing operations and customers
- continuity of transport services during construction.

4.3 Overview of the options considered

An overview of the key options considered by URS is provided below. Further information is available in the *Heavy Rail Truncation Scoping Report (URS, 2014b)*.

The URS study considered two distinct project elements:

- stabling facilities and track infrastructure
- new station at Wickham and transport interchange.

4.3.1 Stabling facilities and track infrastructure

A review of potential sites and layout options for the proposed stabling facilities was undertaken during options development. The functional requirement of all options was to provide a level of operational flexibility and capacity similar to the existing Newcastle Station. Five options were considered for the location of the facilities:

- Option 1 – four stabling tracks provided on land immediately to the north of Hamilton Station and west of the Maitland Road overbridge
- Option 2 – the stabling yard would be split between two land parcels on either side of the Maitland Road bridge, with stabling for four train sets to the west of the bridge, and stabling for two train sets to the east of the bridge.
- Option 3 – six stabling tracks would be located on the site of the former Morrow Park Bowling Club between Wickham Park and the rail corridor
- Option 4 – similar to Option 3, however the stabling tracks would fully conform with minimum standards and the acquisition of a small amount of private land would be required.
- Option 5/5A – the stabling yard would be located adjacent to the south-east of Woodville Junction on land currently subject to rail use.

Following an initial assessment process, options 1, 4 and 5A were shortlisted for further evaluation, as these were the only options which would provide an efficient facility which maximised operational flexibility. A multi-criteria analysis workshop was held in February 2014 to assess the three shortlisted options using the following criteria:

- customer experience
- design and construction
- operations
- environment and sustainability
- cost.

The cost estimates prepared did not provide a basis for differentiating options, and so the cost criterion was not used further.

As an outcome of this workshop, refinements to both options 1 and 4 (options 1A and 4A) were developed. At a subsequent workshop in May 2014, a similar multi-criteria analysis process was undertaken with a larger group of stakeholders. This reconsidered the two shortlisted options using similar criteria and incorporating the results of more detailed operational analysis.

The preferred option selected from this final process was option 1A which was considered superior in terms of operational reliability, flexibility and ease of maintenance. Whilst option 4A may have had environmental and constructability benefits, it was not clearly demonstrated that it could effectively achieve the functional requirements.

4.3.2 New station and interchange at Wickham

The location and general configuration of the new station at Wickham has been guided by the availability of public land in the vicinity of the proposed rail termination point. Development of the preferred design for the overall form of the station and the facilities to be provided has considered:

- station requirements, such as patronage, capacity and staff facilities

- pedestrian connections and desire lines
- interchange and capacity requirements for local and regional transport
- interchange with the proposed light rail line
- property boundaries, adjacent buildings and infrastructure
- requirements of all relevant stakeholders
- capacity of adjacent roads and intersections to provide access to the proposed interchange.

Four options for the station and interchange were developed and workshopped with key stakeholders in April and May 2014. The preferred option incorporates the following key features/benefits:

- incorporates train management and crewing facilities within the station concourse
- provides station facilities north of the concourse, maintaining the north/south pedestrian desire line to heavy rail from Hunter Street and Station Street.
- supports a staged urban regeneration concept
- safeguards space for a potential future fourth heavy rail platform as well as a future light rail interface
- locates taxi and kiss and ride facilities in close proximity to the new station
- provides strong connectivity with local buses on Hunter Street
- allows the existing facilities at Wickham Station to be used for stabling of light rail vehicles
- does not require acquisition of private property
- facilitates the incorporation of a signature roofing element to provide a modern, vibrant design for the new facility.

4.3.3 Do nothing

The 'do nothing' option would mean that the Newcastle Branch Line would remain in place. The issues identified by the *Newcastle City Centre Renewal Report* and the *Newcastle Urban Renewal Strategy* would continue to impact on the functioning and future development of the city centre. The 'do nothing' option would mean that the Newcastle Urban Renewal and Transport Program would not be able to proceed.

The NSW Government has committed to reconnecting the city to the waterfront and making it easier to move around the city centre; providing a new transport interchange at Wickham; and developing light rail in Newcastle. The proposal is required to implement these commitments, accordingly the 'do nothing' option has not been considered further.

5. Description of the proposal

This section provides a description of the key features of the proposal and an outline of the indicative construction activities that may be used. It also includes information on how the proposal would be operated. The information provided in this section is based on that included in the Heavy Rail Truncation Definition Report (URS, 2014b).

5.1 Key features of the proposal

As noted in section 1.2, the key features of the proposal which are the subject of this REF include:

- a new station and transport interchange at Wickham, including the cessation of train services east of Wickham Station
- a new stabling yard at Hamilton and other changes to rail infrastructure
- roadworks
- ancillary infrastructure.

A description of these key project features is provided in the following sections. An overview of the concept design for the proposal is shown in Figure 5.1 and Figure 5.2.

5.1.1 New station and transport interchange at Wickham

Early works

Fencing

The rail corridor would be temporarily fenced with secure fencing along the eastern and western sides of Stewart Avenue to prevent unauthorised entry. The existing platform entrances from the overhead pedestrian bridges at Civic and Newcastle stations would be blocked to prevent unauthorised entry.

Overhead wiring

Overhead wiring would be terminated on both sides of Stewart Avenue and the wires over Stewart Avenue would be removed.

Stewart Avenue level crossing

The Stewart Avenue level crossing facilities would be removed, including boom gates, warning lights, signalling facilities and signage. The road surface would also be made level. Cars would no longer need to stop at the crossing.

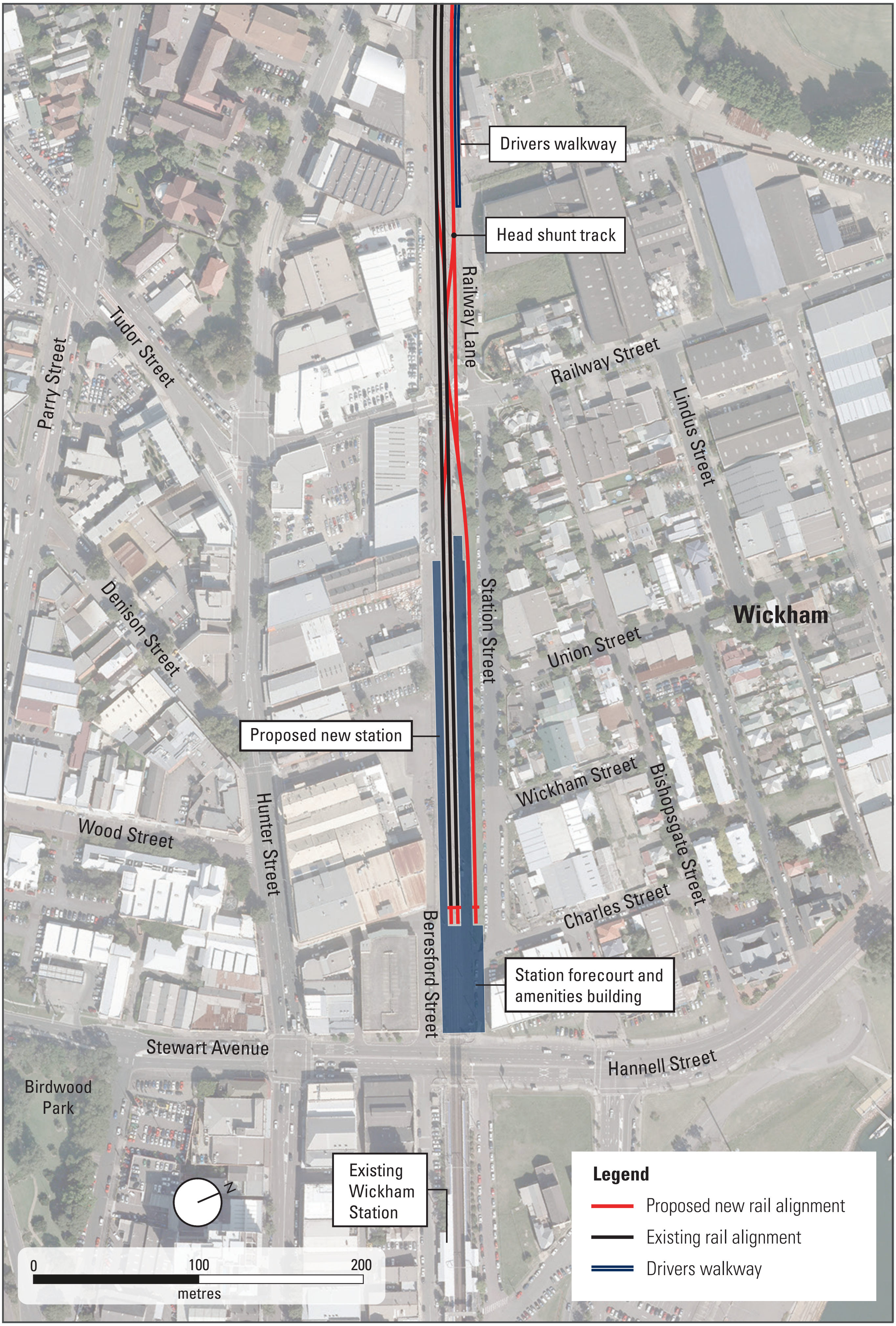
Other main line rail infrastructure

Four new turnouts would be installed on the Up and Down Main tracks to the east and west of the Railway Street level crossing. This would facilitate the turning around of trains between the existing tracks during construction.

JOINS FIGURE 5.2

5.1 The proposal (west)

JOINS FIGURE 5.1



5.2 The proposal (east)

New station at Wickham

The new station at Wickham would be constructed immediately to the west of Stewart Avenue, on railway land between Station Street to the north and Beresford Street to the south. The station would comprise a two storey structure with a single level station concourse and three platforms for boarding/alighting trains, staff facilities and circulation areas. It would directly integrate with the proposed interchange precinct. A conceptual image of the new station is shown in Figure 5.3. The proposed station layout is shown in Figure 5.4.

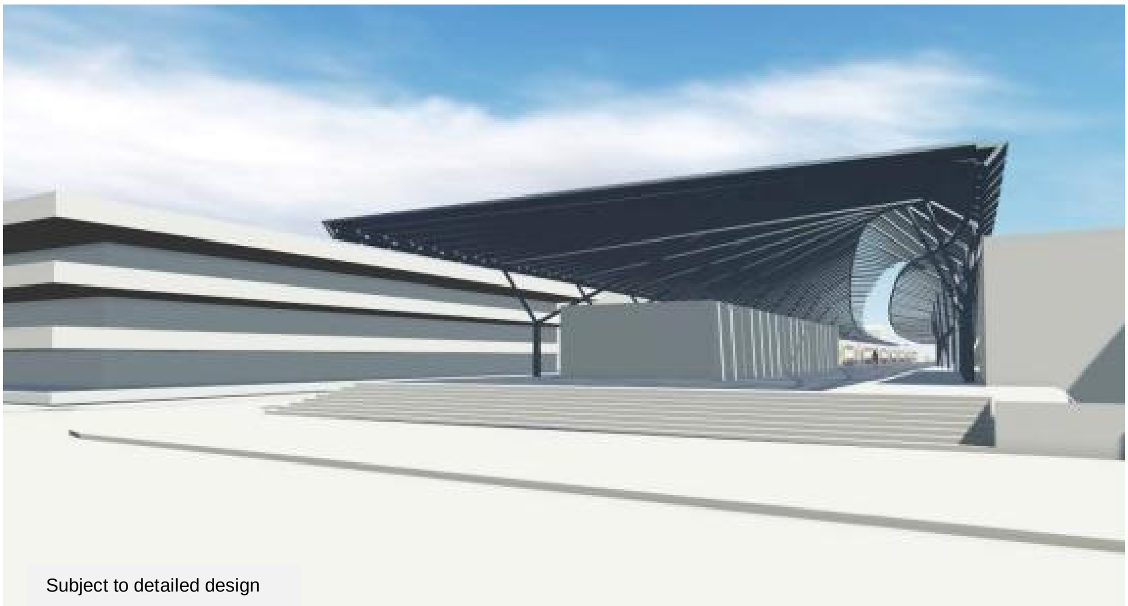


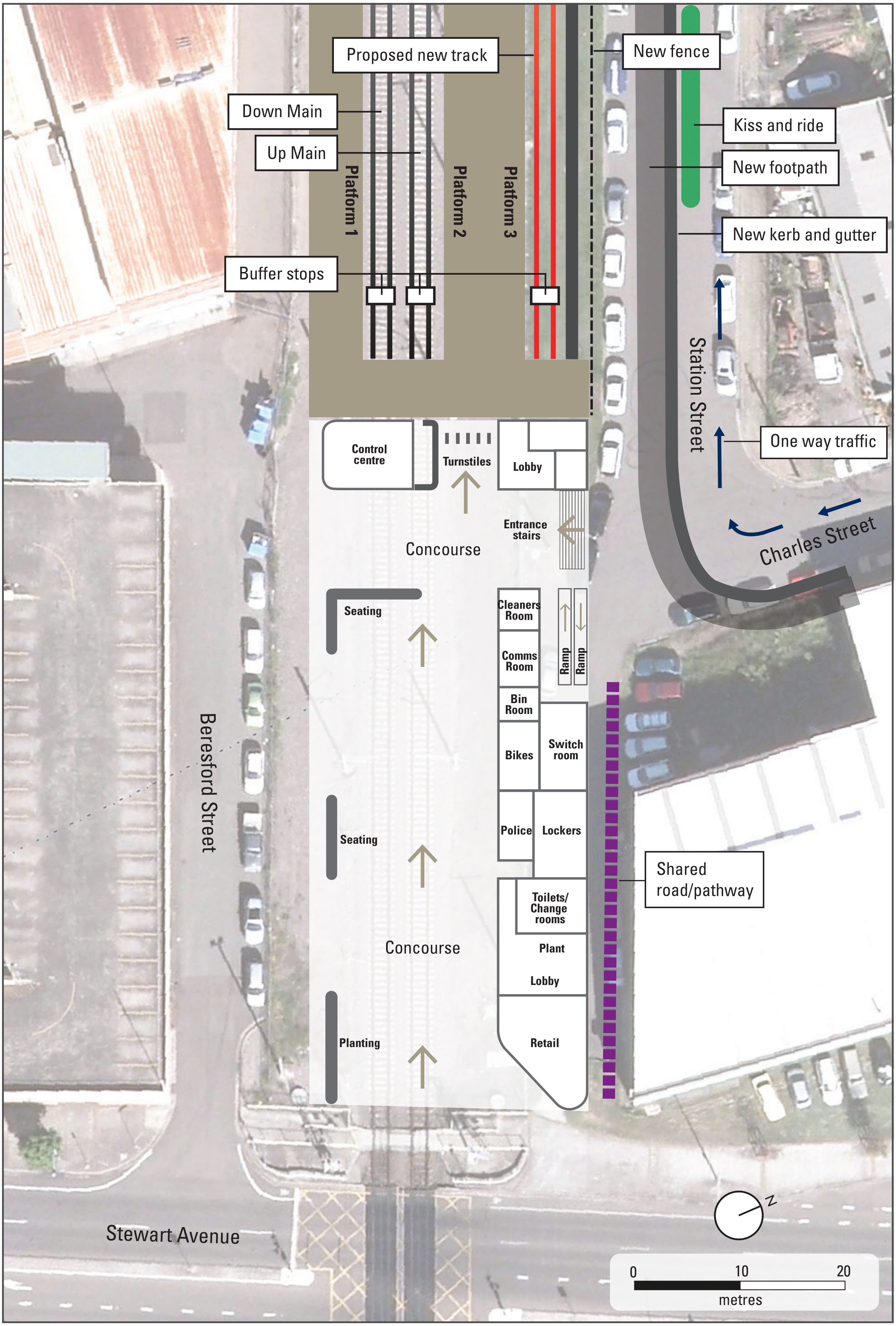
Figure 5.3 Conceptual drawing of the new station at Wickham

As the existing road levels of Station Street are about 1.2 metres below the proposed level of the station, ramps would be incorporated into the design on the station's northern side to facilitate pedestrian and passenger entry.

The station building would be an unenclosed structure comprising:

- station facilities
- NSW TrainLink crew and management facilities
- ticket vending machines (opal card enabled)
- ticket gates
- passenger shelter and seating
- bicycle racks and lockers.

As the rail lines end at the new station at Wickham, a buffer stop for the trains would be installed at the end of each track.



Subject to detailed design

5.4 Proposed station concourse layout

Transport interchange

The interchange would include:

- a taxi rank on the southern side of Station Street
- a bus stop at the eastern end of the new station concourse
- a kiss and ride area for private vehicles also on the southern side of Station Street
- provision for a future light rail interchange connection in Beresford Street.

The footpath would be upgraded on the southern side of Station Street and the western side of Stewart Avenue leading towards Hunter Street. This would involve the use of paving, street furniture and street trees to improve the link between the new station at Wickham and bus stops in Hunter Street.

Wayfinding and signage would be provided to help train passengers navigate the station and interchange easily and intuitively.

5.1.2 Stabling yard and main line infrastructure

Stabling yard

The proposed stabling yard would be located in the rail corridor immediately north of Hamilton Station, between Beaumont Street and the Maitland Road overbridge (refer to Figure 2.2). This area has historically been used for rail uses before the former sidings were removed. The stabling yard would:

- allow trains to be stabled overnight (electric trains only)
- provide a facility for trains to be cleaned, decanted and prepared before re-entering service.

The stabling yard would include four tracks west of the Maitland Road overbridge, between the existing tracks and Fern Street. Two of the southernmost tracks would accommodate two eight carriage trains, and the other two northernmost tracks would accommodate one eight carriage train each. Train crew walkways at ground level would also be provided between the stabling tracks.

To facilitate crew movements, a train crew walkway would also be provided adjacent to the head shunt track between the Maitland Road overbridge and the new station at Wickham.

The proposed layout of the stabling yard is shown in Figure 5.5.

Subject to detailed design

5.5 Hamilton stabling yard

Other main line infrastructure

The stabling yard tracks would pass under an existing span of the Maitland Road overbridge. Some minor excavation would be required under the northern portion of the span to provide sufficient clearance for the stabling track turnout. This modification would involve realigning the north-western wing wall of the bridge.

Between the new station at Wickham and the Maitland Road overbridge, the Down Main track would need to be slewed by up to about 340 millimetres to ensure there is sufficient clearance for opposing train movements.

Along Railway Lane, a section of the rail corridor fence line is currently recessed adjacent to an industrial premise. This would be relocated to the rail corridor boundary to provide sufficient width for the head shunt track.

As part of the construction of the new station and stabling yard, additional crossovers and a 700 metre long head shunt (third) track would be installed on the northern side of the railway corridor, between the Maitland Road overbridge and the new station. This would provide flexibility to service the three new station platforms, and use the stabling yard and the existing main lines.

To provide for trains to turn back at Hamilton during construction, a crossover would be installed between the existing Up Main and Down Main tracks, east of the Maitland Road overbridge.

5.1.3 Road works

The proposed changes to the road network are described below and are shown in Figure 5.6.

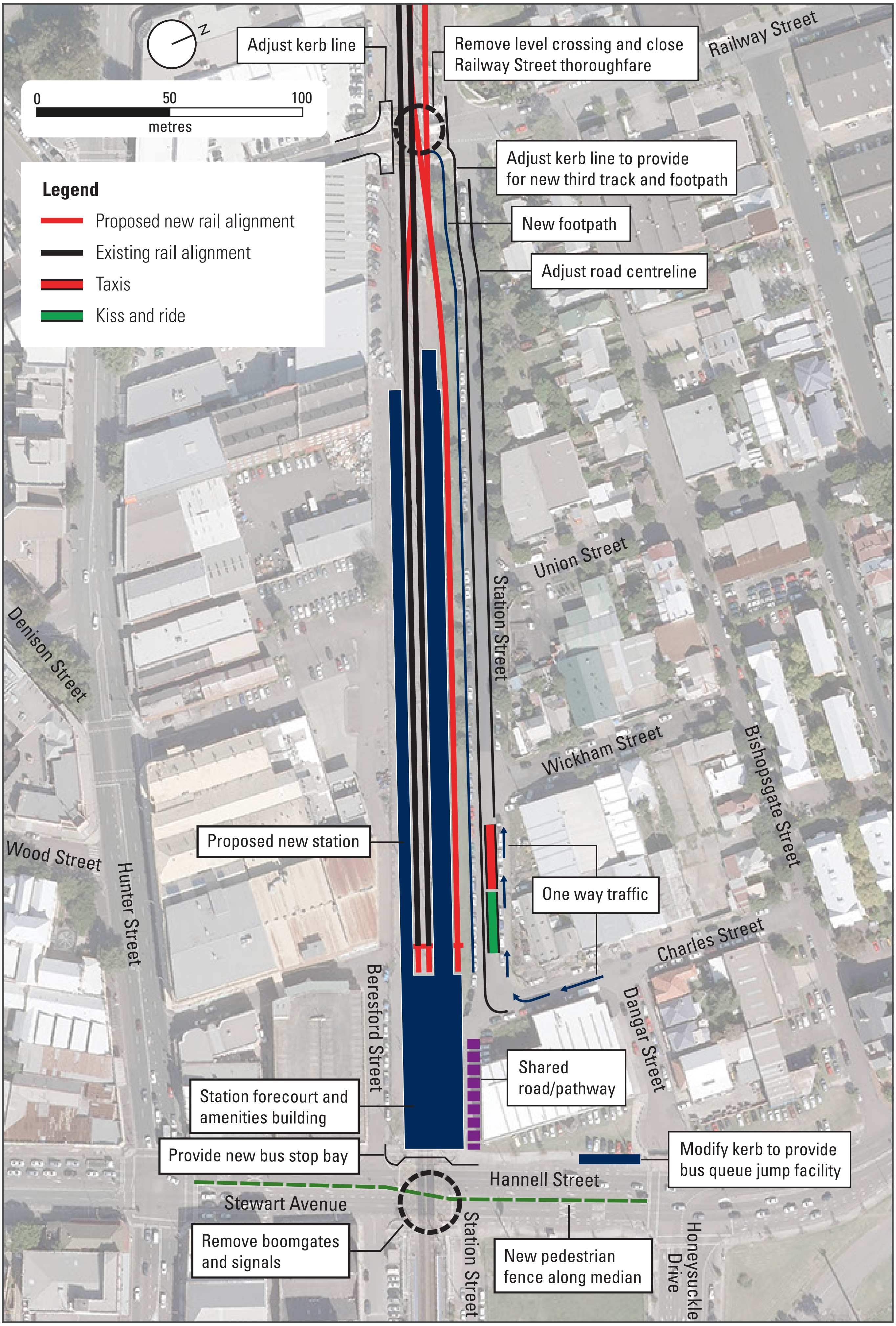
Closure of the Railway Street level crossing

The Railway Street level crossing would be permanently closed. This closure is required as, during construction, trains would need to turn back between Hamilton and Wickham stations, and some trains would need to be stabled on the main line. During operation, train movements on the three tracks could not operate safely with an active road crossing remaining in place.

Changes to roadways and traffic direction

The following changes would be undertaken as part of the proposal:

- the section of Charles Street south of Dangar Street would become one-way southbound
- Station Street would become one-way westbound between Charles Street and Wickham Street
- a new footpath and kerb and gutter would be provided on the eastern side Charles Street (south of Dangar Street) and also along the southern side of Station Street
- Station Street would be narrowed on the southern side, from about 80 metres east of Railway Street to Dangar Street and parking would be removed on both sides
- provide a bus bay on the western side of Stewart Avenue at the new station entrance
- a bus lane, ‘queue jump’ facility and bus priority signal would be provided on the western side of Stewart Avenue, between the existing railway level crossing and Dangar Street, for shuttle bus movements from Stewart Avenue into Honeysuckle Drive
- a pedestrian fence would be installed along the median of Stewart Avenue, between Hunter Street and Dangar Street, to encourage pedestrians to cross safely at the intersections of Stewart Avenue/Honeysuckle Drive and Stewart Avenue/Hunter Street.



5.6 Proposed roadworks at Wickham

5.1.4 Ancillary infrastructure

Power supply

Additional electrical power supply would be required to operate the proposal. The additional electrical power would be required to operate the trains (referred to as traction power supply), the new station and stabling yard facilities, lighting, emergency equipment, signalling, and support/ancillary systems.

Additional power would be provided by means of trenched connections to the existing substations at Hamilton and Wickham.

Signalling

Various trackside signalling infrastructure would be provided along the rail corridor within the proposal site. This would generally include cabling, galvanised steel troughs, signal cabinets, and signal masts.

Overhead wiring

The existing overhead wiring at Hamilton Station would be largely unaffected by the proposal. The detailed design for the new station at Wickham would take into account the positioning of the stanchions required to support overhead wiring for the new tracks at the station. These would need to span from the southern side of the corridor to the mid-point of platforms two and three. Stanchions would also be positioned at the northern side of the corridor to support wiring to the third platform track.

Overhead wiring and catenary protectors would also be provided on the underside of the Maitland Road overbridge span above the proposed third track.

5.2 Design and development requirements

5.2.1 Urban design

The appearance and visual form of the main above ground features have been important considerations in the options assessment and design definition process. The definition design for the new station has been prepared in accordance with the urban design requirements and objectives of the overall Newcastle Urban Renewal and Transport Program, and the key design requirements and visual considerations for the proposal (refer to section 12). An indication of the proposed design is provided in Figure 5.3.

The design of the new station would continue to be refined during the detailed design phase. The final design of the station would integrate all relevant considerations, including:

- functional and operational requirements
- access and maintenance
- security and safety
- urban design and visual impacts
- environmental constraints and sustainability
- community and stakeholder input.

5.2.2 Sustainability in design

As noted in section 3, Transport for NSW has applied the principles of ecologically sustainable development throughout the development and assessment of the proposal. The design of the proposal is being undertaken in accordance with the *NSW Sustainable Design Guidelines* (Transport for NSW, 2014a).

Under the sustainable design guidelines, projects can achieve a rating of bronze, silver, gold, or platinum based on their choice of discretionary initiatives. A minimum rating of silver is being targeted for the proposal. Subject to further consideration and inclusion of various discretionary initiatives during the detailed design phase, the proposal could also achieve gold rating.

Transport for NSW also intends to seek certification of the proposal from the Infrastructure Sustainability Council of Australia. The infrastructure sustainability rating tool would be applied, and a rating of 'excellent' would be sought for both the 'design' and 'as built' stages under the tool. This rating is equivalent to a best practice outcome for sustainability performance and would be pursued as the design progresses.

A sustainability assessment of the proposal has been undertaken, and the results are summarised in section 12.

5.2.3 Design standards

All stabling facilities, track, civil, power, signalling, overhead wiring, lighting works and facilities would be designed, constructed and operated in accordance with the current standards of the following agencies, as applicable:

- Australian Standards
- Building Code of Australia
- Asset Standards Authority
- Transport for NSW
- NSW TrainLink
- Sydney Trains
- Council (for the public domain)
- Roads and Maritime Services
- utility companies or asset owners.

The design would only depart from the specified standards with the agreement of the relevant authority.

5.2.4 Property acquisition

The land within the proposal site is owned by the NSW Government and Council. No acquisition of private property is required for the proposal.

5.3 Construction of the proposal

5.3.1 Timing and staging

Construction of the proposal is currently forecast to commence in late 2014. It is anticipated that the proposal would take about 24 months to complete, and it would be commissioned in late 2016.

Construction would involve the following main stages, which would overlap:

- Stage 1: site establishment – establish site compound at the location of the former Morrow Park Bowling Club south of Wickham Park.
- Stage 2: cease train services on the Newcastle Branch Line – passenger train services would terminate at Hamilton Station.
- Stage 3: stabling yard – construct the stabling yard and associated facilities.
- Stage 4: station and interchange – construct the new station at Wickham and transport interchange.

Table 5.1 shows the indicative schedule of these construction stages.

Table 5.1 Indicative construction stages and program

	Timing								
	2014	2015				2016			
Stage	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Receive all necessary approvals									
Stage 1: site establishment									
Stage 2: cease train services									
Stage 3: stabling yard									
Stage 4: station and interchange									
New facilities open to public									

5.3.2 Construction work hours

Work hours

Construction would generally occur during the standard working hours set out in the *Interim Construction Noise Guideline* (DECC, 2009a):

- Mondays to Fridays between 7am and 6pm
- Saturdays between 8am and 1pm
- no work would normally occur on Sundays or public holidays.

Out of hours works (including work on Sundays) would be limited mainly to scheduled rail close down periods, however some works would be required outside of these periods. Works that may need to be undertaken during these periods and/or out of hours include:

- connections to the overhead wiring system
- installation of certain electrical equipment and connections
- delivery and/or removal of oversized equipment
- works required by utility service providers or where impacts to services cannot be reasonably managed during standard working hours

- where works that need to be undertaken so as to be inaudible at the nearest residential receivers
- some signalling and trackwork
- installation of track drainage
- installation of new crossovers
- signalling commissioning
- any other works within safe working clearances to the existing operational tracks.

If out of hours work is required, the contractor would obtain permission from Transport for NSW. All of out of hours work would be undertaken in accordance with the *Construction Noise Strategy* (Transport for NSW, 2012a).

Rail closedowns

Rail closedowns (also known as track possessions) are periods when part of the rail network is temporarily shut down to facilitate maintenance, construction or emergency works in a safe manner when trains are not operating. During these periods, train services and access to train services would be suspended, and replacement buses would operate. Rail closedowns usually occur during weekends or holiday periods. These periods are traditionally quieter with lower patronage demand and less potential for travel disruptions.

The local community (including residents and businesses) would be notified in advance of any out of hours works likely to be audible at sensitive receivers, including mid-week, night time and weekend rail closedowns.

5.3.3 Plant and equipment

Plant and equipment used to construct the proposal may include (but not be limited to):

- water cart
- concrete saws
- backhoes
- hand tools
- mobile cranes
- scaffolding
- vibratory rollers
- excavator
- rail saw
- concrete agitator trucks
- concrete pumps
- air compressors
- generators
- road sweepers
- piling rig
- front end loaders
- grader
- rail grinder and regulator
- dump trucks
- tip trucks.

5.3.4 Construction workforce

It is anticipated that up to about 100 construction staff (peak numbers during normal working days) and up to about 150 staff (during rail closedown periods) would be required on-site during the construction period.

5.3.5 Construction traffic access and vehicle movements

Construction access

The proposed locations for construction site access are shown in Figure 5.7 and are listed below:

- Fern Street – left-in, left-out
- Maitland Road – left in only
- Railway Street (former Branch Street) – left-in, left-out
- Railway Lane – left-in, left-out
- Station Street – left-in, left-out
- Donald Street, opposite Lawson Street – left-in, left-out.

Vehicle movements would be limited to the above at each location to maintain satisfactory levels of safety and to minimise traffic congestion. Maximum speed limits would be imposed and signage used to limit unnecessary vehicle movements, in accordance with the construction traffic management plan.

Construction parking

Designated parking areas for construction staff would be provided either within the site compound or the rail corridor safe zone. Where parking is provided within the rail corridor, safety arrangements would be implemented to minimise the potential risks of pedestrian movements near active rail operations.

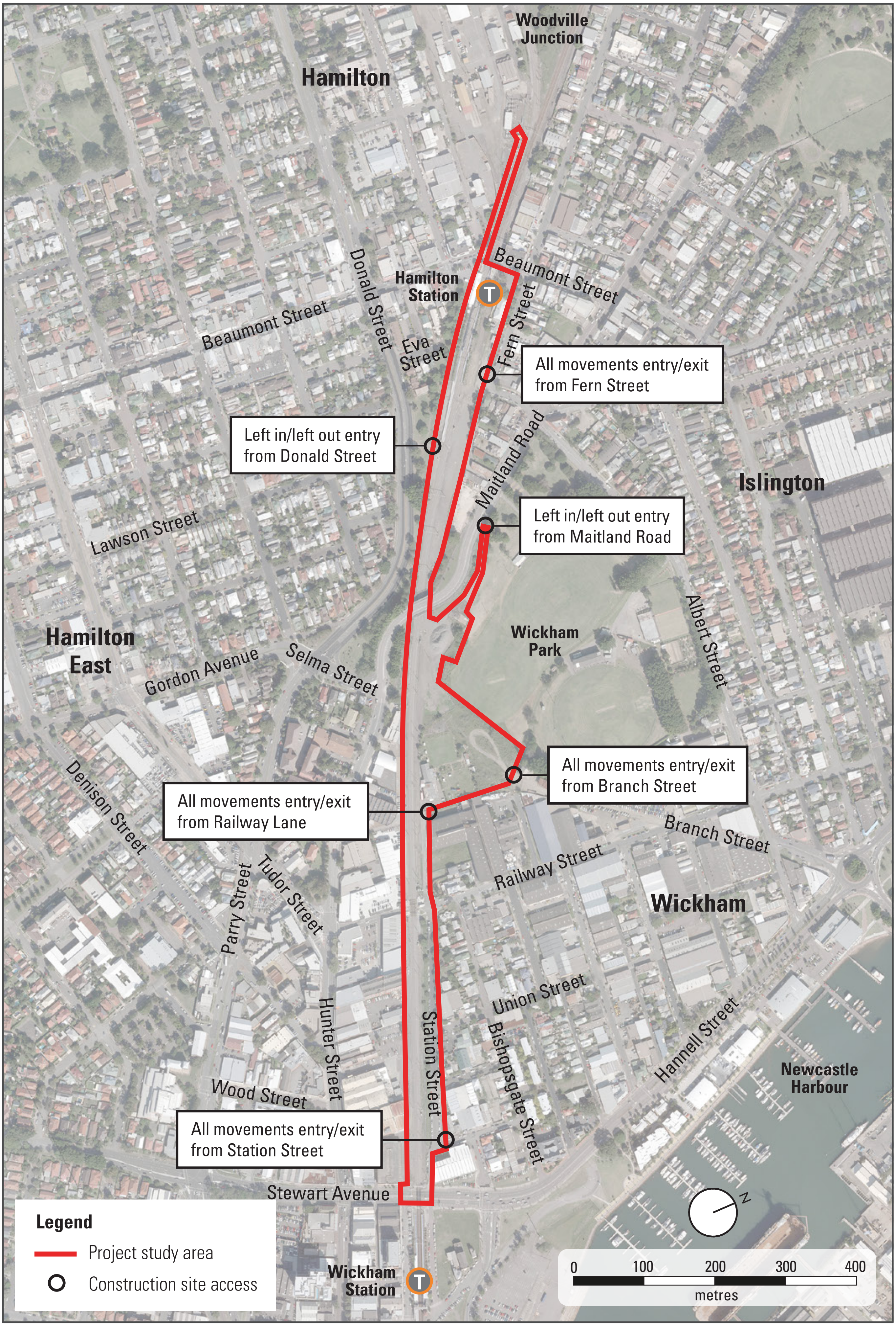
Vehicle movements

Construction vehicle movements would comprise heavy vehicles (including construction plant and deliveries of larger items, removal of spoil/waste etc) and light vehicles (including deliveries of smaller items and staff vehicle movements). An indicative estimate and location breakdown of vehicle movements is provided in Table 5.2.

Table 5.2 Estimated construction vehicle movements

	Peak hour traffic volumes (two way)					
Type	**Station Street**	**Ivy Street**	**Wickham Park**	**Railway Lane**	**Railway Street**	**Total**
Heavy vehicles	32	12	8	28	2	**82**
Light vehicles	15	15	16	90	15	**151**

The delivery of some building components, such as station roofing panels and beams, may be by way of oversized deliveries. These deliveries would be undertaken in accordance with the requirements of relevant authorities.



5.7 Construction site access

5.3.6 Construction compound

The proposed location for the construction compound (including stockpile sites and laydown areas) is south of Wickham Park, between the park and the railway corridor, including the former Morrow Park Bowling Club site. The proposed site for the construction compound extends from the eastern side of the Maitland Road overbridge to Railway Lane, and adjoins the railway corridor. Subject to confirmation, it is expected that entry to the site from Maitland Road would be left-in only, and exit from the site would be from Railway Lane.

Once a construction contractor has been selected, the location of the construction compound would be reviewed. Should the location differ from the location considered by this REF, consultation would be undertaken with Transport for NSW to confirm the suitability of the proposed location and whether any additional environmental impact assessment is required.

5.3.7 Site fencing

The proposal site would be securely fenced with temporary fencing. Signage would be erected advising the general public of access restrictions. Upon completion of construction, the construction compound, work areas and any stockpiles would be removed, the site would be cleared of all rubbish and materials, and it would be rehabilitated.

5.3.8 Public utility adjustments

The following utilities may be impacted by the proposal:

- electrical
- water and sewer
- communications
- gas
- roads

The potential impacts on services and utilities are considered in section 14.

5.4 Public transport arrangements during construction

5.4.1 Rail

At the beginning of the construction phase, trains would no longer proceed east of Hamilton Station. Trains operating along both the Hunter Line and the Newcastle and Central Coast Line would terminate at either Broadmeadow or Hamilton stations.

During construction, people who currently travel by train to and from the Newcastle city centre (to Wickham, Civic or Newcastle stations) would need to change transport modes at Broadmeadow or Hamilton stations.

Upon commencement of the interim transport arrangements, trains would use the main line tracks between Hamilton and Wickham stations to turn back prior to re-entering service in the westbound direction at Hamilton (at Platform 1). These trains may also layover on the main lines for short periods (up to several hours) during the day. Electric trains would stable there overnight. Diesel trains would stable overnight near Broadmeadow Station.

5.4.2 Shuttle buses

From 26 December 2014, all trains will terminate at Broadmeadow so that work can be undertaken at Hamilton Station. During this time, shuttle buses would operate between Newcastle, Civic, Wickham, Hamilton and Broadmeadow stations.

During the construction period from early January, trains would terminate at either Broadmeadow or Hamilton stations. Shuttle buses would enable customers to travel easily to Newcastle and other locations. Return bus services would be provided from the city centre stations to Broadmeadow and Hamilton. The interim bus arrangements will be reliable, convenient and quick for transport customers. The bus services would be timetabled to meet trains in both directions wherever possible. More information will be provided later in 2014.

A detailed timetable, which would show the relevant train and bus connections and the bus routes and stops, would be provided to the public prior to the start of construction. Any upgrades to bus facilities including shelters, layovers and stops would also be undertaken prior to the start of construction and would be subject to separate environmental impact assessment.

There is no current plan to change existing public bus routes during construction.

5.4.3 Taxis

Broadmeadow and Hamilton stations have existing facilities for taxis and kiss and ride and no changes are proposed.

5.5 Operation, management and maintenance

5.5.1 Operation

Operation of the stabling yard

The stabling yard would operate 24 hours per day, seven days a week. It would provide for

- overnight stabling of electric trains only (diesel trains would be stabled at existing facilities near Broadmeadow Station)
- temporary train layover for all trains (see below).

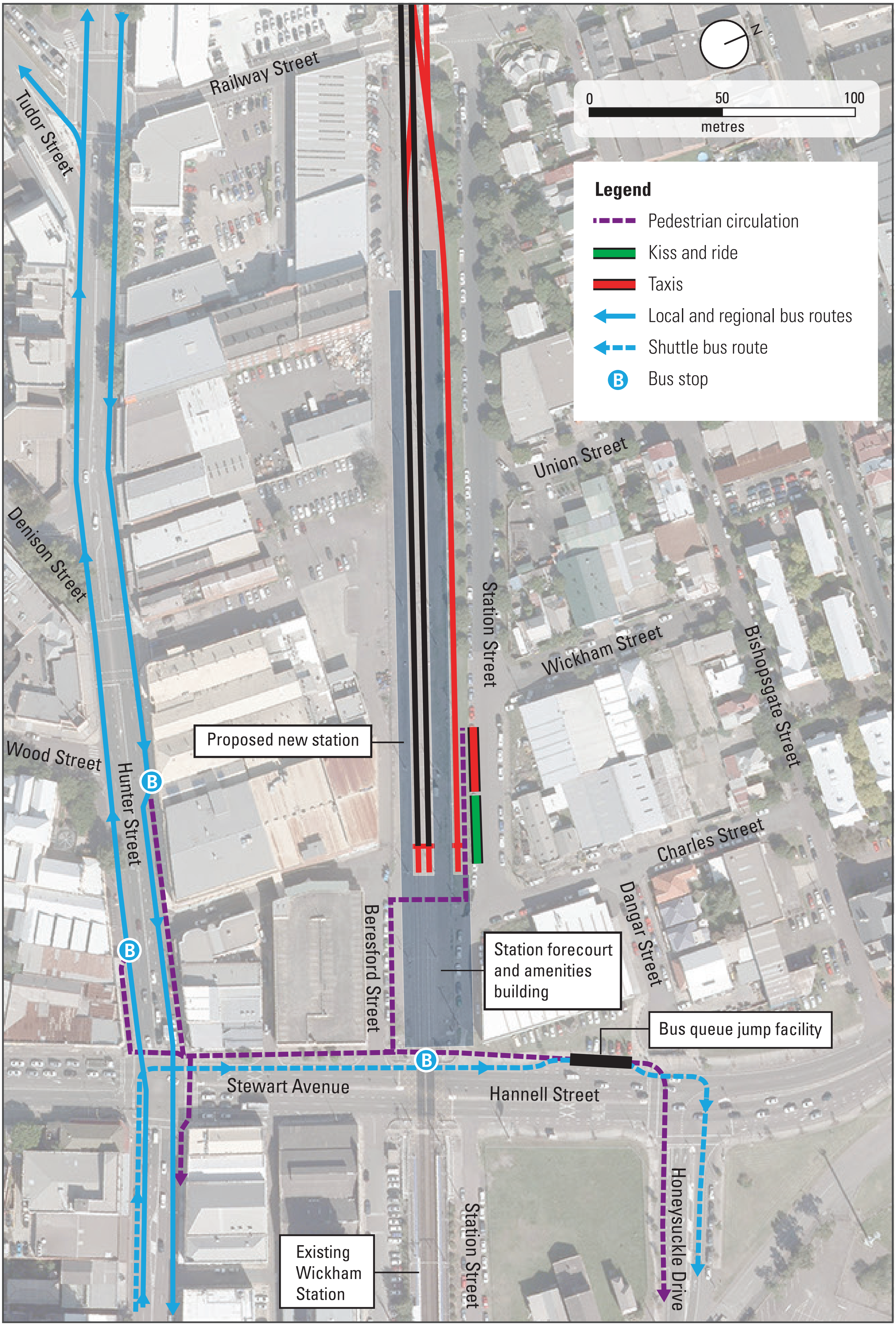
The activities carried out at the stabling yard would include:

- internal train cleaning performed by train presentation staff
- spot cleaning of train exteriors by train presentation staff
- shunting of trains in preparation for departure or to accommodate arriving trains
- decanting of trains
- train preparation performed by the train crew
- division and amalgamation of trains by train crew
- minor rolling stock repairs performed by train technicians.

Operation of the new station and the interchange

The new station at Wickham and interchange would operate 24 hours per day, seven days a week. Passengers would arrive and depart from the station, and change to and from other modes of transport via the transport interchange.

Figure 5.8 shows the key operational aspects of the transport interchange.



5.8 Transport interchange operation

Rail

Following completion of the new station at Wickham and interchange, trains from the Hunter Line and the Central Coast Line would terminate at the new station at Wickham.

Shuttle buses

When construction is complete, a shuttle bus would operate between the new interchange at Wickham and the city centre, until the light rail system is operational.

Taxis

A taxi stand would operate adjacent to the new station at the interchange.

Train layover and servicing

Trains would temporarily layover during the day in the stabling yard, head shunt track, and at Platform 3 at the new station at Wickham. The activities that would be undertaken during layover would include cleaning, decanting, maintenance inspections, amalgamation and division, prior to re-entering service.

5.5.2 Management and maintenance

Management of remaining heavy rail infrastructure

A Residual Corridor Management Plan would be prepared by Transport for NSW to guide the ongoing maintenance of assets and other aspects associated with the remaining heavy rail infrastructure. The Residual Corridor Management Plan would include consideration of:

- asset protection and maintenance
- railway heritage
- opportunities to improve pedestrian and vehicle connectivity across the former corridor
- public safety and anti-social behaviour (eg graffiti, theft and vandalism)
- environmental risks, such as contaminated land, hazardous materials, etc.

Ongoing maintenance

Generally, the proposed new tracks would have standard components, and normal inspection and maintenance methods would be adopted, in accordance with Transport for NSW/ NSW TrainLink standards.

Maintenance activities during operation would include the use of petrol and diesel-powered vehicles and plant. Where feasible, infrastructure would be maintained (planned and unplanned) without affecting timetabled train services.

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6. Community and stakeholder consultation

This section summarises the community and stakeholder consultation undertaken during preparation of the REF, and the proposed consultation activities to be undertaken during the public display period. It also includes reference to issues raised during the preparation of the REF that are relevant to the proposal.

6.1 Consultation objectives and approach

The purpose of consultation is to encourage stakeholder and community involvement in the proposal. The team's approach to consultation is based on providing best practice consultation consistent with Transport for NSW's Community Engagement Policy. The objectives of consultation for the proposal are to:

- ensure that a diverse range of the local community and stakeholders are informed about the proposal and given the opportunity to provide feedback
- provide stakeholders with an opportunity to ask questions and identify areas of concern
- ensure that concerns and issues raised by the community and key stakeholders are considered during the REF process
- implement a planned approach to community and stakeholder communications
- effectively and proactively identify and manage local issues.

6.1.1 Consultation strategy

Community and stakeholder consultation for the proposal is guided by the Stakeholder Engagement Plan. The plan:

- provides background information about the proposal
- identifies the community and key stakeholders with the potential to be affected by the proposal
- identifies the potential nature and extent of stakeholder issues/concerns and relevant strategies to manage these proactively
- defines key messages, and identifies the communication tools and techniques to disseminate information and provide opportunities for feedback
- documents the policies and procedures implemented to record and respond to enquiries, complaints, and issues
- identifies and allocates roles and responsibilities
- provides an overview of how the effectiveness of the strategy will be evaluated.

The consultation strategy provides for consultation to be undertaken in two stages:

- during REF preparation
- during the public display of the REF.

An overview of the activities proposed for each stage of consultation is provided in the following sections, and includes prior relevant consultation undertaken as part of the Newcastle Urban Renewal and Transport Program.

6.2 Consultation prior to REF preparation

Consultation has also been undertaken as part of the planning for the Newcastle Light Rail project. This consultation included provision of information about the proposal. Consultation was undertaken with the local community, including community organisations, businesses and focus groups in Newcastle and Maitland. Issues raised that are relevant to the proposal are summarised in section 6.4.

6.3 Consultation during REF preparation

6.3.1 Consultation activities

Table 6.1 lists the key engagement activities and tools, outlines their purpose, and describes how each tool/activity has been used to engage the community and stakeholders.

Table 6.1 Consultation activities during REF preparation

Activity	Purpose and detail
Stakeholder identification and analysis mapping	A desktop search and site visit was undertaken to identify stakeholders located in close proximity to project.
Community contact and feedback mechanisms	Contact details were established to enable stakeholders to provide feedback on the proposal and ask questions of the proposal team. The following contact mechanisms were advertised in all communication material: • Project information phone line: 1800 684 490 • E-mail: projects@transport.nsw.gov.au • Website: http://www.transport.nsw.gov.au/projects • All details of community members and stakeholders who made contact with the proposal team, issues raised, and responses provided have been recorded in the consultation database.
Stabling location workshop	A workshop was held on 2 May 2014 to discuss options and requirements in relation to the location of the new stabling yard. Attendees included: • UrbanGrowth NSW • NSW TrainLink • Sydney Trains • Roads and Maritime Services
Station precinct workshop	A workshop was held on 6 May 2014 to discuss options and requirements in relation to the location of the new station at Wickham. Attendees included: • UrbanGrowth NSW • NSW TrainLink • Sydney Trains • Roads and Maritime Services • light rail planning and design team
Meeting with Council	A meeting was held with Council representatives on 16 May 2014 to identify the key groups and individual stakeholders likely to have a direct and/or significant interest in the proposal.

6.3.2 Infrastructure SEPP consultation

Consultation with councils and other public authorities is provided for by clauses 13 to 17 of the Infrastructure SEPP. These clauses apply to development carried out by, or on behalf of, a public authority that the Infrastructure SEPP provides may be carried out without consent. Consultation is required in relation to specified development (clause 16) or development that impacts on:

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

As the proposal has the potential to impact on the above matters, as well as classified roads, consultation will be undertaken with Council in accordance with Infrastructure SEPP requirements and additionally with RMS. A letter will be sent to Council and RMS providing information on the proposal and requesting the identification of any issues or concerns immediately prior to public display. The Infrastructure SEPP specifies that any response received within 21 days must be taken into consideration by Transport for NSW prior to determining to proceed with the proposal.

6.4 Summary of issues identified to date

A summary of the key issues raised during consultation activities undertaken to date, and a reference to where they are addressed in the REF, is provided in Table 6.2.

Table 6.2 Issues summary

Issue category	Key issues raised	Where addressed
Links with the Newcastle Urban Renewal and Transport Program	• staging and integration of the transport and urban renewal elements of the program	Section 4.1
Traffic, transport and access	• pedestrian and traffic disruption and safety during construction • loss of on street parking including along Station Street • impacts on other modes of transport, particularly pedestrian and vehicular traffic, due to the closure of the Railway Street level crossing. • ease of connectivity between transport modes, including single level platforms (and to ferry services) • availability of short and long term parking • bicycle facilities and secure storage • accessibility • coordinated timetables and integrated ticketing • the capacity of Stewart Avenue to accommodate traffic to the interchange • how well buses and light rail would accommodate large events in the city	Section 7
Noise	• noise impacts to sensitive receivers such as residents and local businesses	Section 9

Issue category	Key issues raised	Where addressed
Visual amenity	• overall enhancement of the public domain • opportunity to improve the overall streetscape	Section 12
Heritage	• potential impacts and benefits to heritage items along the route • recognition of the heritage/cultural value of Wickham, Civic and Newcastle stations	Section 8
Socio-economic issues	• potential impact of the closure of the rail line on businesses and tourist attractions near the existing Wickham, Civic and Newcastle stations, where the railway has provided an important means of access • amenities that would be provided, including shops and cafes, security and lighting	Section 11.3
Air quality, other amenity matters	• generation of dust	Section 10

6.5 Consultation during public display

The REF will be placed on public display for a period of four weeks, during which time written submissions will be accepted. The REF will be displayed at the following locations:

- The City of Newcastle City Administration Centre, 282 King Street, Newcastle
- Newcastle City Library, Ground Floor, Laman Street Newcastle
- Hamilton Library, 44 James St, Hamilton
- Transport for NSW, Level 5, Tower A, 821 Pacific Highway, Chatswood
- Transport for NSW Community Information Centre, 388 George Street (at the corner of King Street), Sydney.

Ongoing discussions will be held with key stakeholders during the display period, including:

- Roads and Maritime Services and Council in relation to pedestrian access, traffic management and future parking strategies
- Council in relation to events management and coordination in the Newcastle city centre
- residents and businesses along the project route in relation to the program of works and operational impacts.

The tools and activities listed in Table 6.3 will be used to provide the community and stakeholders with a range of methods to find out more about the proposal and provide comment.

Table 6.3 Consultation activities during public display of the REF

Activity	Purpose and detail
Contact mechanisms	The community contact and feedback mechanisms listed in Table 6.1 will continue to operate throughout the display period. All details of community members and stakeholders who make contact with the proposal team, issues raised, and responses provided will be recorded in the consultation database.
Community information flyer	A flyer will be prepared and distributed. The flyer will provide information on: • the status of the proposal • details of the public display locations and community information sessions. The flyer will be distributed along streets facing the proposal site between Wickham and Hamilton stations, and it will also be made available at Wickham, Civic and Newcastle stations.
Website	Information about the public display of the REF will be posted on the Transport for NSW, 'Have Your Say' and Wickham Transport Interchange websites.
Letter to government agencies and utility providers	A letter will be distributed to key agencies to provide them with information on the public display of the REF and invite submissions. Agencies to be consulted will include: • Roads and Maritime Services • Sydney Trains • NSW TrainLink • Department of Planning and Environment • Mine Subsidence Board • Hunter Water Corporation • utility providers
Letter to the Awabakal Local Aboriginal Land Council (LALC)	A letter will be issued to the Awabakal LALC informing them of the preliminary findings of the due diligence assessment and seeking their involvement in further assessments.
Poster	A poster will be developed to advertise the community information sessions. The posters will be displayed at train stations and in the shopfronts of businesses close to the stations.
Community information sessions	Four community information sessions will be held. The information sessions will be conducted as informal drop-in sessions, staffed by project representatives from GHD and Transport for NSW. The sessions will provide participants with an opportunity to speak with the proposal team, raise issues and concerns and provide feedback on the REF.
Advertisement	An advertisement will be placed in local papers and online media to provide information about the display locations and information sessions.

6.5.1 Submissions processing

All written feedback received during the public display period will be treated as a formal submission and will be recorded on the consultation database. Submissions will be numbered, and the contact details and key issues raised in each submission will be recorded in the database. A letter of acknowledgement will be sent to people/groups who make submissions to inform them about their submission number and where to find it in the submissions report. Submissions will not be responded to individually.

6.5.2 Submissions report

Following the REF display period, a submissions report will be prepared to:

- summarise issues raised in submissions and respond to the issues raised
- provide any new information about the proposal in addition to that included in the REF
- identify any changes to the proposal and the potential impact of those changes.

Transport for NSW will consider the issues raised and the content of the submissions report prior to determining to proceed with the proposal.

6.6 Post-determination consultation activities

Should Transport for NSW determine to proceed with the proposal, consultation with the community and key stakeholders would be ongoing in the lead up to, and during the construction phase of the proposal. The consultation activities would ensure that:

- the community and stakeholders have a high level of awareness of all processes and activities associated with the proposal
- accurate and accessible information is made available
- a timely response is given to issues and concerns raised by the community
- feedback from the community is encouraged
- opportunities for input are provided.

The proposal information line and email address would continue to be available during construction. Targeted consultation methods, such as letters, notifications, signage and verbal communications, would continue to occur. The website would also include updates on the progress of the proposal.

Part C Environmental impact assessment

7. Traffic and transport

7.1 Assessment approach and methodology

A traffic and transport impact assessment of the proposal was undertaken by GHD. A comprehensive technical report is available as 'Technical Paper 1 – Traffic and Transport Assessment' on the Transport for NSW website (www.transport.nsw.gov.au). A summary of the assessment is provided in the following sections.

The assessment involved:

- reviewing the concept design for the proposal
- reviewing traffic and pedestrian count data
- investigating the transport network in the study area, current rail patronage and travel characteristics, and existing road traffic performance
- a site visit to identify land use, properties and access adjacent to the proposal site
- assessing the potential impacts of the proposal on transport using the road network model developed for the Newcastle Light Rail project and modelling traffic performance at the key intersections
- identifying mitigation measures to address the impacts identified.

7.2 Existing environment

7.2.1 Road network

Main roads and level crossings

The road network in the vicinity of the proposal site is shown in Figure 2.2. In Newcastle West and Wickham, key roads include Hunter Street, King Street, Parry Street, Honeysuckle Drive, Stewart Avenue/Hannell Street, Railway Street, Albert Street and Station Street. There are also a number of local streets that provide access between Hannell and Railway Streets.

In the Hamilton and Islington areas, key roads include Tudor Street, Donald Street, Maitland Road and Beaumont Street. There are also a number of local streets on the eastern side of the rail corridor which that provide access between Beaumont Street from Maitland Road and Albert Street.

There are three railway level crossings within the study area, along Beaumont Street, Railway Street and Hannell Street/Stewart Avenue. The location of these level crossings is shown in Figure 2.2. The level crossing at Hannell Street/Stewart Avenue is a key route across the rail corridor for north-south movements.

Detailed descriptions of the key roads and crossings are provided in Technical Paper 1.

Existing traffic volumes

Traffic volumes on key roads within the study area are listed in Table 7.1.

Table 7.1 Traffic volumes

Road	Traffic volumes (vehicles per day)	Data source
Albert Street (east of Railway Street)	4,000	Calculated based on intersection data
Albert Street (west of Railway Street)	2,500	Calculated based on intersection data
Donald Street (railway overbridge)	30,591	2013 AADT
Hannell Street (north of Greenway Street)	28,994	2013 AADT
Maitland Road (north of Mary Street)	20,852	2008 AADT
Railway Street	3,500	Calculated based on intersection data
Station Street	500	Calculated based on intersection data
Stewart Avenue (north of Parry Street)	18,589	2010 AADT
Throsby Street	1,000	Calculated based on intersection data
Tudor Street (north of Parry Street)	8,669	2008 AADT

Intersection performance

The performance of the road network is largely dependent on the operating performance of intersections which form critical capacity control points on the road network.

The level of service is the standard measure used to assess the operational performance of the network and intersections. Level of service is defined by the Austroads *Guide to Traffic Management Part 3: Traffic Studies and Analysis* (2009) as a qualitative measure of features that include speed, travel time, freedom to manoeuvre, interruptions, comfort and convenience. There are six levels of service, ranging from level of service A to level of service F. Level of service A represents the best performance, and level of service F the worst. A level of service D or better is considered to be an acceptable level of service.

Paramics modelling was undertaken for the main intersections within the study area for the existing conditions. The results of modelling, which are summarised in Table 7.2, indicate that:

- during the morning peak, the intersection of Hunter, Tudor and Railway streets operates with a level of service F
- during the afternoon peak, the intersection of Honeysuckle Drive and Hannell Street operates with a level of service F
- all other intersections operate with an acceptable level of service of D or better.

One of the contributing factors to traffic congestion in central Newcastle is the operation of railway level crossings, which causes delays for pedestrians and motorists.

Table 7.2 Intersection performance

Intersection	AM peak		PM peak	
	Level of service	Average delay (secs)	Level of service	Average delay (secs)
Honeysuckle Drive/Hannell Street (three way traffic signals)	C	29	F	103
Hunter Street/Stewart Avenue (four way traffic signals)	E	58	D	50
King Street/Parry Street/Stewart Avenue (four way traffic signals)	D	47	D	52
Hunter Street/Tudor Street/Railway Street (four way traffic signals)	F	71	C	30
Hunter Street/Steel Street (four way traffic signals)	A	11	A	12

Source: Table 2.8 Technical Paper 1

Parking

Streets in the Wickham area are used for on-street car parking by residents, local customers and workers in the Newcastle city centre. Parking is mainly unrestricted, however some restrictions occur on Throsby, Grey, Bishopsgate, Dangar, Union and Wickham Streets.

A parking survey was undertaken for the Wickham area. It indicated that there are 771 on-street car parking spaces available in the area, with the majority of these (728 spaces) unrestricted. On average, the demand for parking was 75 per cent of available spaces, with an average stay of just over six hours. A detailed breakdown of the availability of on-street car parking by street is provided in Technical Paper 1.

7.2.2 Transport network

Existing rail operations and patronage

The existing rail network in the study area is described in section 2.1 and shown in Figure 2.1. As noted in section 2.1, the Newcastle Branch Line currently provides a direct, single mode connection between stations within the study area and other areas in Newcastle, the Hunter, Central Coast and Sydney. A summary of data relating to the use of the Newcastle Branch Line is provided as follows:

- station barrier counts taken in 2012 indicated the following passenger movements for each station on an average weekday:
  - Hamilton Station – 1,490
  - Wickham Station – 560
  - Civic Station – 850
  - Newcastle Station – 1,070 movements
- since 2004, passenger movements at Wickham and Hamilton stations have grown, whereas movements at Civic and Newcastle stations have remained static or declined:
  - Hamilton Station – increase of 17 per cent
  - Wickham Station – increase of 60 per cent
  - Civic Station – static, with a slight increase of 0.08 per cent
  - Newcastle Station – decrease of 30 per cent

- journey to work data from the 2011 census indicates that about six per cent of people employed in central Newcastle use the train to get to work
- the main origins of commuters to the Newcastle city centre are the Maitland (31 per cent), Lake Macquarie (29 per cent) and Newcastle (16 per cent) LGAs
- the data indicates that Civic and Wickham stations mainly function as journey-to-work commuter stations, with arrivals peaking during the morning peak, and departures during the evening peak.

Bus network

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

Thirty Newcastle Buses routes currently operate along Hunter Street with 10 stops in each direction. These routes terminate at the Newcastle bus interchange, which is located adjacent to Newcastle Station.

The regional buses operate mainly to and from towns in the Hunter, Port Stephens and Mid-North Coast regions. These buses travel along Hunter Street, stopping at the Newcastle bus interchange. About 60 regional bus services terminate at the Newcastle bus interchange per day, with eight of these using it during the morning peak.

Cyclists

There are no dedicated bicycle paths in the study area. A small non-separated bicycle lane (about 0.5 metres wide) is provided on Stewart Avenue/Hannell Street near the proposal site. However it is not heavily used. Cyclists tend to use the Railway Street level crossing for north–south movements, as it has much lower traffic volumes, and develops into a wide street north of the rail corridor.

Pedestrians

Pedestrian traffic in and around the proposal site consists of:

- city workers walking to and from their parked cars
- residents
- customers of the various businesses and hotels in the area
- bus and train passengers walking to and from Broadmeadow, Hamilton and Wickham stations.

7.3 Impact assessment

7.3.1 Construction

Construction traffic impacts

Traffic generation

A summary of potential construction traffic numbers at the main site accesses is provided in Table 7.3. The site access from Donald Street would only be used for a short period and has therefore not been considered further in the estimation of construction vehicle movements.

Table 7.3 Estimated construction vehicle movements

Type	Peak hour traffic numbers (two way)					
	Total	Ivy Street	Wickham Park	Railway Lane	Railway Street	Station Street
Heavy vehicles	82	14	6	28	2	32
Light vehicles	150	15	15	90	15	15

Table 7.4 summarises the estimated number of heavy vehicle movements on roads surrounding the construction site access points.

Table 7.4 Additional heavy vehicles movements on surrounding streets

Street	Additional heavy vehicles (peak hour)	Additional heavy vehicles (daily)
Railway Street/ Albert Street	62	186
Station Street	32	96
Maitland Road	20	60

The additional construction traffic on Railway and Albert streets would be offset to a certain extent by the closure of the Railway Street level crossing, which would eliminate through traffic along Railway and Albert Streets. Maitland Road is a busy arterial road. Accordingly, the expected increase in traffic on this road would be small compared to existing traffic levels.

The intersections in and around the proposal site would experience an increase in heavy and light vehicle movements during the construction period.

Potential construction traffic impacts would be managed by the implementation of the measures provided in section 7.4.

Workforce parking

Vehicles would park in designated areas provided within the construction compound to limit impacts on train passengers, local businesses and residents.

Transport network impacts

Public transport

Public transport arrangements during construction are summarised in section 5.4. As noted in section 5.4, train services would terminate at either Hamilton or Broadmeadow stations until the new station at Wickham is operational.

The proposal would result in a change in the public transport environment for residents, workers and visitors travelling to, from and within the area currently serviced by the Newcastle Branch Line. Train passengers wishing to travel to and from Newcastle Station would need to change transport modes to buses at Hamilton or Broadmeadow stations. This could result in travel time increases for some passengers, depending on their origin and destination.

Shuttle bus services would be provided during construction. Further information is provided in section 5.4.

Other local Newcastle and regional bus services would be unaffected and would continue to operate according to their current timetable, with coaches terminating at the Newcastle bus interchange. The Newcastle bus interchange would also continue to be used as a layover area for local buses.

Pedestrians and cyclists

The main potential for impacts to pedestrian and cyclists relates to the movement of construction vehicles and the closure of the Railway Street level crossing.

Pedestrian and cyclist access in the immediate vicinity of the proposal site would be maintained, however temporary diversions may be required around work areas and site access points. Potential impacts to pedestrians and cyclists would be managed by implementation of the measures provided in section 7.4.

Closing the Railway Street level crossing would change access arrangements for vehicles, pedestrians and cyclists who currently use the crossing, redistributing the existing traffic to surrounding routes. Pedestrians and cyclists would need to travel longer distances to cross the rail corridor, with a maximum increase of about 750 metres. This level of increase would only be experienced by a small proportion of the 300 or so people who currently use the crossing every day. Vehicles would use alternatives crossings on Maitland Road or Stewart Avenue.

In summary, closing the Railway Street level crossing would have the following potential impacts on pedestrian movements:

- employees and customers of local businesses, and local residents and their visitors, would need to walk up to an additional 750 metres via Stewart Avenue to cross the rail corridor
- users of the Sheddon Street bus stop (bus routes 104 and 111) would need to walk a further 620 metres
- users of the Parry Street bus stop (route 111) would need to walk a further 240 metres
- users of Hunter Street bus stops would need to walk a further 20 metres.

Cyclists would need to cross the rail corridor via either Stewart Avenue/Hannell Street or Maitland Road.

Station access and facilities

Access to all station platforms, entrances and passenger facilities at Hamilton Station would be maintained throughout construction.

All public entrances to Wickham, Civil and Newcastle stations would be closed.

Rail closedowns

Impacts to train services would be minimised where practicable by scheduling works in the active rail corridor in accordance with scheduled rail closedowns. The timing of rail closedowns is co-ordinated by NSW TrainLink.

During closedowns, rail replacement buses would operate in accordance with standard NSW TrainLink replacement bus arrangements. The community would receive advance notice of any scheduled rail closedowns and alternative travel arrangements. Community notifications of scheduled rail closedowns would be managed by NSW TrainLink.

7.3.2 Operation

Traffic and road network impacts

Traffic generation

The proposal would result in a redistribution of traffic in the Wickham area. Additional private vehicles, taxis and buses would use the road network in the study area to access the transport interchange and the new station at Wickham. Table 7.5 lists the estimated daily volumes of traffic along key roads in the vicinity of the new station at Wickham.

Table 7.5 Estimated traffic generation around the new station at Wickham

Street	Operational traffic (vehicles per day)	
	Taxis	Private vehicles
Station Street	100	500
Railway Street, south of Throsby Street	100	500
Railway Street, north of Throsby Street	50	250
Throsby Street	50	250
Albert Street, east of Railway Street	30	150
Albert Street, west of Railway Street	20	100

Removal of the Stewart Avenue level crossing facilities

As outlined in section 5.1.1, the manually-controlled train priority level crossing facilities at the Stewart Avenue crossing would be removed. The removal of this level crossing is expected to substantially improve traffic congestion at the following intersections:

- Honeysuckle Drive/Hannell Street
- Hunter Street/Stewart Avenue
- Parry Street/Stewart Avenue.

Based on a survey conducted over three consecutive weekdays in May 2014, the existing boom gate closures at Stewart Avenue resulted in the interruption of traffic movements for about 22 per cent and 19 per cent of the AM and PM peak hours respectively.

Removing the level crossing facilities would result in the following benefits:

- increased time for traffic flows in Stewart Avenue, and through the intersections at Honeysuckle Drive and Hunter Street, especially during peak hours
- reduced queue lengths and delay times, with the main improvements being along Stewart Avenue/Hannell Street, and for the left turn onto Honeysuckle Drive during the afternoon peak
- additional road storage capacity (for up to three vehicles in each direction) over the existing railway level crossing area, which would help ease traffic congestion in the north-south direction.

Closure of the Railway Street level crossing

Closing the Railway Street level crossing would impact on the operation of the road network in the study area. Traffic volumes at the following intersections are expected to increase as a result of the redistribution of existing traffic resulting from the closure:

- Maitland Road/Albert Street
- Hunter Street/Stewart Avenue
- Hannell Street/Throsby Street
- Honeysuckle Drive/Hannell Street.

The closure of Railway Street would change the access arrangements for vehicles, pedestrians and cyclists who currently use this crossing.

Closing the level crossing would result in the diversion of traffic onto surrounding roads and to other crossing locations, such as Beaumont Street in Hamilton, the Maitland Road overbridge and Stewart Avenue. This impact is considered to be acceptable for the following reasons:

- the existing volume of traffic using Railway Street (about 3,500 vehicles per day) is much less than the capacity of the Stewart Avenue crossing
- traffic flows in Stewart Avenue would improve following the removal of the level crossing facilities.

Detailed traffic modelling to confirm the redistributed traffic and the performance of key intersections is currently being undertaken to confirm these preliminary findings. The results of this modelling will be provided in the Submissions Report.

Availability of on-street parking

The proposal would have the potential to reduce the availability of on-street car parking in the vicinity of the new station and transport interchange at Wickham. This is a result of the need to narrow Station Street from a point about 80 metres west of Union Street to provide sufficient space for the new head shunt rail track and station platform. To maintain two-way traffic flows along Station Street, it would be necessary to remove on-street parking along both sides of the street.

These changes would result in the loss of about 71 on-street parking spaces. An additional four spaces would also be lost on the eastern side of Charles Street near the intersection with Station Street. This loss would be a result of the need to provide a new kerb line and paving.

In total, it is estimated that the proposal would result in a loss of about 75 on-street car parking spaces, which would decrease the supply of on-street parking in the Wickham area to about 696 spaces (a 10 per cent decrease).

However, there is considered to be sufficient availability of on-street parking in the surrounding area to accommodate this loss. As noted in section 7.2.1, the current demand for parking is about 75 per cent of available spaces (that is, a maximum of about 578 parking spaces are used at any one time). This number is less than the 696 spaces that would continue to be available during operation.

Public transport network impacts

Public transport

The operation of existing bus services would not be impacted by the proposal.

During operation, train services would terminate at the new station at Wickham. As noted in section 7.3.1, the proposal would result in a change in the public transport environment for residents, workers and visitors travelling to, from and within the area currently serviced by the Newcastle Branch Line. Train passengers wishing to travel to and from Newcastle Station would need to change transport modes at the new station at Wickham. This would result in travel time increases for some passengers, depending on their origin and destination.

As noted in section 5.5, until the light rail is operational, a shuttle bus would operate between the new interchange at Wickham and the city centre.

Pedestrians and cyclists

The main impacts during operation would be the additional travel time for people who previously crossed the rail corridor via the Railway Street level crossing. These potential impacts are summarised in section 7.3.1.

7.4 Mitigation measures

7.4.1 Construction

The following measures would be implemented during construction:

- Prior to the commencement of construction, a construction traffic management plan would be prepared in consultation with relevant stakeholders as part of the construction environmental management plan (CEMP). It would address the following as a minimum:
  - Adequate road signage to inform motorists and pedestrians of the work and ensure that the risk of accidents and disruption to surrounding land uses is minimised.
  - A pedestrian management plan to maximise safety and access for pedestrians and cyclists, including details of alternative access arrangements.
  - Adequate sight lines to allow for safe entry and exit from the site.
  - Impacts and changes to on and off street parking and requirements for any temporary replacement provision.
  - Routes to be used by heavy construction-related vehicles to minimise impacts on sensitive land uses and businesses.
  - 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.
  - Measures to manage traffic flows around the area affected by the proposal, including required regulatory and directional signposting, line marking and variable message signs and all other traffic control devices necessary.
  - Traffic and access would be managed in accordance with *Traffic Control at Work Sites* (RTA, 2010) and in consultation with Roads and Maritime Services and Council.
  - Construction vehicles would park within the construction compound/rail corridor safe zone.
  - The timing of deliveries accessing the site would need to be considered to ensure there is sufficient space within the proposal site to accommodate deliveries.
  - The queuing and idling of construction vehicles in residential streets would be minimised.

- Road occupancy licences would be obtained from Council for any works within the road reserve of local roads.
- Access to all private properties adjacent to the proposal site would be maintained during construction, unless otherwise agreed by relevant property owners.
- Adequate signage would be provided at Broadmeadow and Hamilton stations to direct users to shuttle buses. Signage would also 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 to either Broadmeadow and/or Hamilton stations.

8. Non-Aboriginal heritage

8.1 Assessment approach and methodology

A heritage impact assessment of the proposal was undertaken by Urbis. A technical report is available as 'Technical Paper 2 – Heritage Impact Statement' on the Transport for NSW website (www.transport.nsw.gov.au). A summary of the assessment is provided in the following sections.

The assessment involved:

- identifying listed heritage items in the vicinity of the proposal site by searching relevant databases, including the Australian Heritage Places Inventory and the NSW State Heritage Inventory
- a site survey and photographic inventory
- reviewing the proposal description
- preparing a heritage impact statement in accordance with the following guidelines:
  - *Assessing Heritage Significance* (Heritage Office, 2001)
  - *Statements of Heritage Impact* (Heritage Office, 2002)
  - *The Burra Charter* (Australia ICOMOS, 1999).

This section considers the potential impacts of the proposal on items within the proposal site, and those items that are located within 50 metres of the site.

8.2 Existing environment

The proposal site is located within a historically significant area of Newcastle as a result of its inner urban location. Items within the proposal site and those that directly adjoin and/or are located within 50 metres of the site are considered to be those items with the potential to be impacted by the proposal. These items are described below.

8.2.1 Heritage listed items

State heritage items

The Hamilton Railway Station Group is listed on the State Heritage Register and Sydney Trains' Section 170 Heritage Register. As shown in Figure 8.1, this item is located at the north-western end of the proposal site. The following components of the station form part of the listing:

- Station Building, Platform 1 – type 4 (circa 1875, altered 1898)
- Station Building and Toilet Block, Platform 2 - type 11 (1898)
- Toilet Block
- Store Room (circa 1898)
- Signal Box (1898)
- Platforms (circa 1984)
- Level Crossing
- Footbridge (1976)
- 4 Fern Street and Former Sidings and Good Yard
- Landscaping.

During the heritage assessment, a timber relic was identified about 40 metres to the south-east of the end of the station platform, in the vicinity of the Donald Street corridor access gate. This item is located outside the curtilage of the State Heritage Register listing, however the item was considered as part of the station group for the purpose of the assessment.

Section 170 of the *NSW Heritage Act* 1977 requires NSW government agencies to maintain a register of items of heritage significance within their estate. The following items are listed on Sydney Trains' Section 170 Heritage Register:

- Hamilton Railway Station Group
- Wickham Railway Station Group
- Hamilton Rail Depot and Triangle, located to the north-west of the site along the rail corridor.

Local heritage items

- In addition to being listed on the State Heritage Register and Sydney Trains' Section 170 Heritage Register, the Hamilton Station Buildings and Signal Box are listed on the Newcastle LEP.

The following local heritage items are located within 50 metres of the proposal site:

- Hamilton Station Hotel
- Residence at number 22 Maitland Road
- Former Newcastle Cooperative Store
- Hawkins Oval and Memorial (part of Wickham Park)
- Wickham Station
- Lass O'Gowrie Hotel
- Residences at number 15 Charles Street, Wickham
- Dairy Farmers Building
- Sydney Junction Hotel.

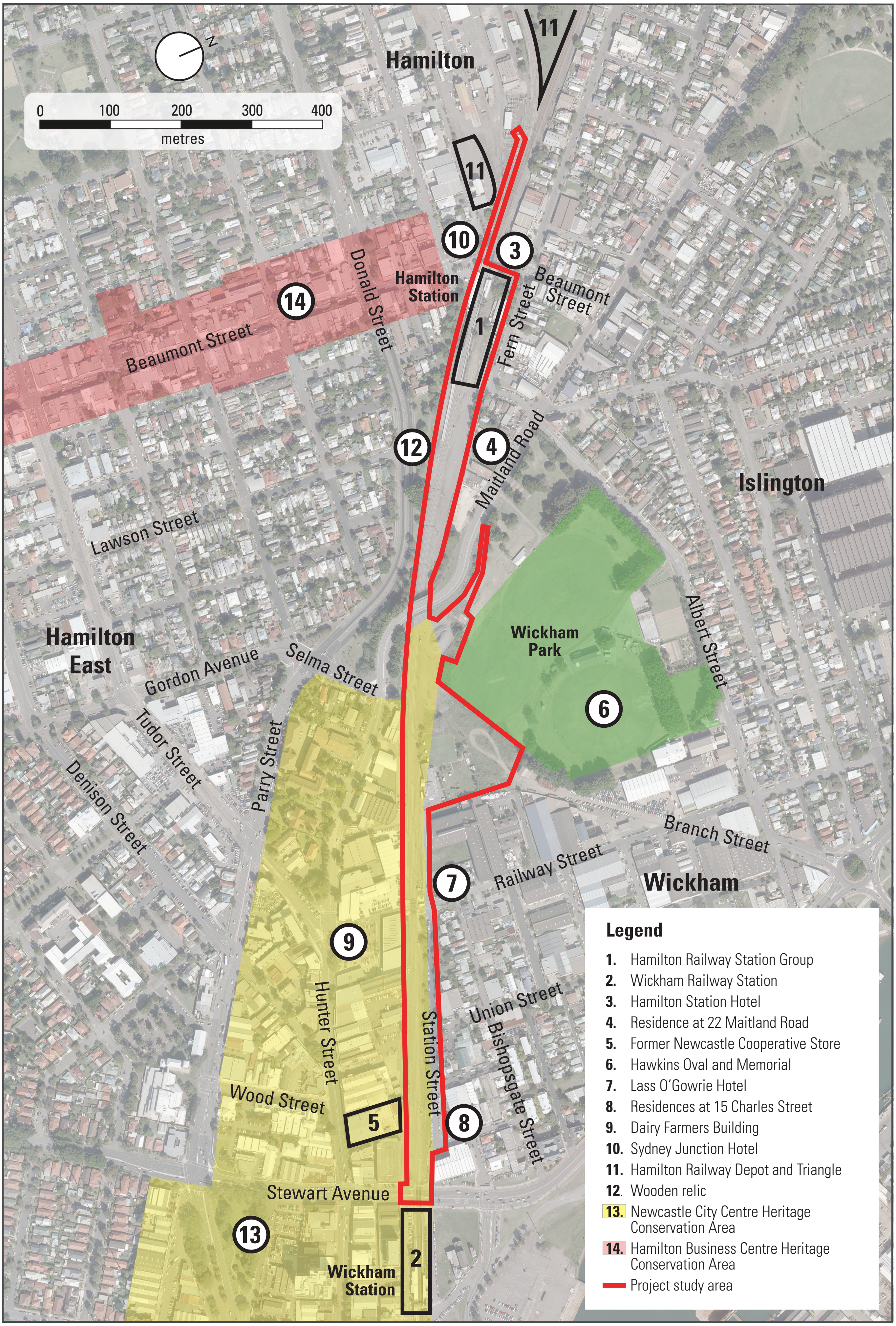
The listing details and a summary of significance of these local heritage items are provided in Table 8.1. The locations of these items are shown in Figure 8.1.

8.2.2 Heritage conservation areas

The eastern portion of the proposal site is located within the Newcastle City Centre Heritage Conservation Area (Newcastle LEP). The Hamilton Business Centre Heritage Conservation Area (Newcastle LEP) is located about 30 metres south-west of Hamilton Station. Further information is provided in Table 8.1. The locations of these conservation areas are shown in Figure 8.1.

8.2.1 Archaeological potential

The archaeological potential of the proposal site is considered to be moderate, as there may be evidence remaining of early rail tracks and relics located below the surface, or other historic structures on the site.



8.1 Heritage items in the vicinity of the proposal site

Table 8.1 Heritage items with the potential to be impacted by the proposal

Item name	Map ref (Figure 8.1)	Location	Listing	Significance of item (extract from listing)
State heritage items				
Hamilton Railway Station Group	1	Within the proposal site	State Heritage Register Newcastle LEP Sydney Trains Section 170 Register	Hamilton Railway Station Group has significance at a state level as part of the wider Hamilton and Woodville Junction railway precinct, formerly one of the most important railway junctions in the State. It was established in 1873 before the construction of the Short North and as such has direct associations with operation of the Great Northern Railway, which was one of the first railway lines in Australia. While there was some limited settlement in the area prior to this date, the construction of the railway encouraged the rapid subdivision and development of the township. Hamilton Station is significant as the junction station between the Great Northern Railway and the Short North, and for its association with the former Hamilton locomotive depot between 1892 and 1924. The platform buildings are good examples of highly intact Victorian railway buildings in their original setting which form part of an excellent example of a late 19^{th} century suburban railway junction, with a range of items still intact including signal box, level crossing, sidings, depot and surrounding hotels and shops. The signal box is considered to be historically rare as an excellent example of a historic signalling installation and retains much original fabric, including the signal lever frame, and has been in constant use for over 110 years.
Hamilton Rail Depot and Triangle	11	Located to the north-west of the proposal site	Sydney Trains Section 170 Register	The Hamilton Railway Depot has historical significance at a local level for its long association with the provision of tramway and railway services for over 100 years. This significance is demonstrated in the through goods shed (1890s) and the substation (1923). The through goods shed is the last remaining such shed dating from the 19^{th} century on the former Great Northern Line. As a purpose-designed shed, the through goods shed has technical significance as an increasingly rare example of such railway structures in NSW, which demonstrates through its construction the design parameters and use patterns for the handling of goods at the end of the 19th century. The shed represents the end of a particular technical design for such sheds, which was phased out at the end of the 19^{th} century. The former substation has historical significance at a local level as a near intact and rare example of a tramway substation in NSW. The building has significance for continuing the link with railway operation in the Hamilton Goods yard, which came into operation in 1890. The former substation has aesthetic significance as an example of a substation designed to be viewed 'in-the-round' and therefore great care has been taken in its Egyptian inspired Art Deco design.

Item name	Map ref (Figure 8.1)	Location	Listing	Significance of item (extract from listing)
				The former substation retains a high degree of integrity externally and marks a change in design approach for such structures, which through their design proclaimed a 'new era' for the 20th century in Newcastle and the introduction of tram services to the city. The triangle site has archaeological research potential as the site of the former 10-road brick through shed, chargemen's office, store, fitting shop, turntables and tracks which may provide information not available from other sources about the operation of this significant servicing hub in the northern rail network.
Wickham Railway Station	2	About 50 metres east of the proposal site	Newcastle LEP Sydney Trains Section 170 Register	Demonstrates the importance of the railway site to the evolution and shaping of Wickham. Illustrates the type of station construction used in a variety of townships and suburbs throughout NSW. The Wickham Railway Station Group has local heritage significance. Having been constructed much later than most of the neighbouring stations, Wickham Railway Station demonstrates increasing urban development in Newcastle during the first few decades of the 20th century. The site has aesthetic significance associated with the station buildings, being examples of small railway station buildings dating from the 1930s, with simple and traditional materials and details. While many railway stations constructed during this period were designed in a contemporary interwar architectural style, Wickham Railway Station is unusual in that it was designed with a striped Federation character.
Local heritage items				
Hamilton Station Hotel	3	About 30 metres north-west of Hamilton Station	Newcastle LEP	An interesting example of an inter-war period hotel in an art deco style.
Residence at 22 Maitland Road, Islington	4	About 10 metres north east of the proposal site	Newcastle LEP	Associated with a prominent local citizen. Demonstrates the development of social class and the economic growth of the region. An important element within the streetscape.
Former Newcastle Cooperative Store	5	About 10 metres south of the proposal site	Newcastle LEP	Important and dominant townscape element. Represents a significant phenomenon in the socioeconomic development of the Hunter Valley – the cooperative movement. The interiors are of significance. It is noted that the rear of the building has a four storey later addition.
Hawkins Oval and Memorial (part of Wickham Park)	6	About 10 metres north of the proposal site	Newcastle LEP	Oval: An important open space area within the townscape. Memorial: Located in prominent parkland. An unusual monument recording an event of historical and social significance.

Item name	Map ref (Figure 8.1)	Location	Listing	Significance of item (extract from listing)
Lass O'Gowrie Hotel	7	About 10 metres north of the proposal site	Newcastle LEP	Reflects the social life of local community. Illustrates form and style of hotel development in the late 19th century and early 20th century.
Residences at 15 Charles Street, Wickham	8	About 45 metres north of the proposal site	Newcastle LEP	The cottage at 15 Charles Street appears to be one of the oldest surviving cottages in the Wickham area, and is a rare example of a building from the mid to late 19th century, retaining most of its decorative features largely intact. It is a conspicuous feature of the streetscape, being a rare remaining house surrounded by industrial/commercial buildings.
Dairy Farmers Building	9	About 50 metres south of the proposal site	Newcastle LEP	Forms an important visual termination of Tudor Street and is a landmark. The interiors are of significance.
Sydney Junction Hotel	10	About 10 metres south of the proposal site	Newcastle LEP	Illustrates the form and style of hotel development in the early 20th century. Reflects social life of the local community. Internal fabric of note. Two-storey face brickwork building with flat-top clock tower emphasizing the hotels corner position.
Heritage Conservation Areas				
Newcastle City Centre Heritage Conservation Area	13	Intersects the southern half (Wickham) of the proposal site at the new station site.	Newcastle LEP	The Newcastle City Centre Heritage Conservation Area is significant on many levels. The assemblage of commercial and civic buildings is a powerful reminder of the city's rich history and its many phases of development. The number of historic buildings surviving is quite remarkable for a city of this size, with a number of pre-1840s buildings surviving (Rose Cottage, c1830, Newcomen Club, 1830, Parts of James Fletcher Hospital). All of these are associated with the city's penal heritage. It is also known to be a city with a rich archaeological record of national significance, for its potential to yield information about the early convict settlement and early industrial activities. The city area is known to have been a place of contact between colonists and the indigenous population, who owned the land on the southern shores of the Hunter river. This evidence is available in historical accounts and in the archaeological record surviving beneath the modern city. The high numbers of commercial and civic buildings of the 19th and 20th centuries gives the city a historic character which is notable and allows an understanding of the importance of the city as a place of commerce, governance and city building. The historical foundation of the city was the discovery and exploitation of coal with good shipping access via a safe and navigable harbour. The town's layout by Surveyor General Henry Dangar in 1828 is still visible in the city's streets, and is an element of historical value.

Item name	Map ref (Figure 8.1)	Location	Listing	Significance of item (extract from listing)
Hamilton Business Centre Heritage Conservation Area	14	About 30 metres south west of Hamilton Station	Newcastle LEP	Hamilton (Beaumont Street) Heritage Conservation Area is of heritage significance for its role in the economic and social life of the local Hamilton community. It contains many examples of two storey shops and commercial premises that serve to reflect the various periods of economic growth and social history. The area is representative of the waves of immigration during the 20th century and the eastern European immigrants who came to Newcastle established businesses in the street. Newcastle's earliest examples of Italian and Greek eateries opened on Beaumont Street during the 1950s. The Newcastle Earthquake of December 28 1989 dramatically changed Beaumont Street. There was widespread damage and loss of life and major social dislocation. However, in terms of the buildings that survived, they were revitalised and many of the two storey shopfronts were saved by judicious planning and urban design. Beaumont Street is now a thriving urban centre with a cosmopolitan character. Many of the buildings have been compromised by unsympathetic signage and later shopfronts however the two storey scale is important in defining the character of the street.
Significance unknown				
Wooden relic at Hamilton Station		Within the proposal site (40 metres south of Hamilton Station platforms on southern side of rail corridor	Identified during field survey	Significance of this item is not known.

8.3 Impact assessment

Table 8.2 summarises the potential impacts of the construction and operation of the proposal on heritage items and conservation areas. Generally, the greatest potential for impact relates to those items within or immediately adjacent to the proposal site. The Hamilton Railway Station Group (including the wooden relic) is the only item located within the proposal site.

The only work proposed within the curtilage of the Hamilton Railway Station Group is minor track realignment. These works would not directly impact any of the items that form part of the listing (refer to section 8.2.1) or the wooden relic. As a result, the assessment concludes that the proposal would not impact on the significance of this item. Transport for NSW would seek exemption from approval for the works under section 57(1) of the *Heritage Act 1977* under standard exemption 7 'Minor activities with little or no adverse impact on heritage significance' and exemption 8 'Non-significant fabric'.

Construction may result in indirect impacts to other items located in the vicinity of the proposal site (as summarised in Table 8.2). The main potential for impact relates to vibration generated by construction works. The potential for vibration impacts is considered further in section 9.3. 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.

Archaeological relics may be uncovered during the works. The potential for impacts on any unidentified relics or items would be minimised by the implementing the measures provided in section 8.4. Transport for NSW would seek a section 139(4) excavation exception application under the *Heritage Act 1977* prior to undertaking any works with the potential to disturb the land.

The proposal involves ceasing train services to the existing Wickham Station, Civic and Newcastle stations. Newcastle Station is listed on the State Heritage Register. Wickham and Civic stations are local heritage items. The heritage significance of these items includes reference to their association with heavy rail services. As a result, the proposal has a potential to impact on the existing significance of these items. This potential impact would be subject to further assessment during preparation of the Residual Corridor Management Plan, which would be undertaken during the detailed design phase, prior to commencement of construction.

Table 8.2 Summary of potential impacts on heritage items and conservation areas

Item	Summary of potential construction impacts	Summary of potential operation impacts
Heritage items in the study area		
Hamilton Railway Station Group/ Hamilton Station Buildings and Signal Box	**Potential for impact** There is potential for archaeological impact as minor track work is proposed in and around the station buildings and works would be undertaken at the site of former goods yard.	**No impact** The location of the proposed stabling yard is on land previously used for rail stabling. Accordingly, operation of the proposal would result in similar heritage impacts as the existing (and historical) situations. While the sight lines to the structures may be changed, the new stabling yard would not affect the significance of the existing station structures or other group items.

Item	Summary of potential construction impacts	Summary of potential operation impacts
Wickham Railway Station	**No impact** The item is located a sufficient distance from the site and is unlikely to be impacted.	**Potential for impact to significance** The design and operation of the new station and interchange would not affect the significance of the existing station. Ceasing train services may affect the significance of the item – this would be subject to further assessment.
Hamilton Station Hotel	**No impact** The item is located a sufficient distance from the site and is unlikely to be impacted.	**No impact** The item does not directly adjoin the site, and as rail uses in the vicinity would continue, no operational impacts are predicted.
Residence at 22 Maitland Road, Islington	**Potential minor impact** The rear boundary of the lot on which the item is located is adjacent to the proposal site. Minor potential for indirect impact from construction activities.	**No impact** No operational impacts are predicted, as the rail corridor near the site is already subject to active rail use.
Former Newcastle Cooperative Store	**Potential minor impact** The rear boundary of the lot on which the item is located is adjacent to the proposal site. Minor potential for indirect impact from construction activities.	**No impact** The rear boundary of the lot faces the existing rail corridor, whereas the significant elements face towards Hunter Street. No operational impacts are predicted, as the rail corridor near the site is already subject to active rail use.
Hawkins Oval and Memorial (Wickham Park)	**No impact** The site is located in close proximity to the works and the proposed site compound. Built items within the park are located towards the centre of the park well away from the proposal site. Construction works are unlikely to directly or indirectly affect users of the oval or the memorial.	**No impact** No operational impacts are predicted, as the rail corridor near the site is already subject to active rail use.
Lass O'Gowrie Hotel	**No impact** Whist the site is located in close proximity to the proposal site, there is a public road (Railway Lane) between the site and the item. Some additional construction traffic on Railway Lane, however this is unlikely to affect the significance of the item.	**No impact** No operational impacts to the significance of the item are predicted.
Residences at 15 Charles Street, Wickham	**No impact** The item is located a sufficient distance from the site and is separated from the site by another building. No impacts are predicted.	**No impact** No operational impacts to the significance of the item are predicted.
Dairy Farmers Building	**No impact** The item is located a sufficient distance from the site. No impacts are predicted.	**No impact** No operational impacts to the significance of the item are predicted.

Item	Summary of potential construction impacts	Summary of potential operation impacts
Sydney Junction Hotel	**Potential minor impact** The rear boundary of the lot on which the item is located is adjacent to the proposal site. The impact potential has been assessed as low, as this area of the site would be subject to trenching only.	**No impact** No operational impacts are predicted, as the rail corridor near the site is already subject to active use.
Wooden relic at Hamilton Station	**Potential minor impact** Minor potential for indirect impact from vehicle movements. The likelihood of such impacts is considered to be low as the item is located on the opposite side of the rail corridor to proposed stabling yard.	**No impact** The item is located on the opposite side of the tracks from the proposed stabling yard, and the surrounding environment would be unchanged.
Hamilton Railway Depot and Triangle	**Potential minor impact** The rear boundary of the lot on which the item is located is adjacent to the proposal site. If inadequately managed, there is potential for indirect impact from construction activities	**No impact** No operational impacts are predicted, as the rail corridor near the site is already subject to active use.
Heritage conservation areas		
Newcastle City Centre Heritage Conservation Area	**No impact** The existing and new stations at Wickham are located within the conservation area. Construction activities are temporary, and would not impact on the significance of the conservation area.	**No impact** The design of the new station at Wickham is sympathetic to its location within a heritage conservation area. Detailed design of the station would minimise the potential impacts on the significance of this area. Operation of the station would involve continuing heavy rail activities within the conservation area, no impacts to the significance of the area are predicted.
Hamilton Business Centre Heritage Conservation Area	**No impact** The conservation area is located a sufficient distance from the proposal site, and no construction impacts on the significance of the area are predicted.	**No impact** No operational impacts are predicted, as the rail corridor near the site is already subject to active use.
Heritage items outside the study area		
Civic and Newcastle stations	**No impact** These items are located a sufficient distance from the proposal site, and would not be impacted during construction.	**Potential for impact to significance** The statement of significance for these items notes that their significance is based on their historical connection to train services. Ceasing train services therefore would have the potential to affect the stated significance.

8.4 Mitigation measures

8.4.1 Detailed design

The following measures would be implemented during the detailed design phase:

- Potential impacts on the significance of Wickham, Civic and Newcastle stations as a result of ceasing rail operations at these stations would be addressed as part of the Residual Corridor Management Plan.
- Detailed design of the new station at Wickham, including materials selection would be sympathetic to the surrounding heritage items/elements and the significance of the Newcastle City Centre Heritage Conservation Area, while clearly marking the building as contemporary.

8.4.2 Construction

The following measures would be implemented during the construction phase:

- All heritage items in the immediate vicinity of the proposal site would be marked on site plans, fenced off where appropriate, and avoided.
- The construction noise and vibration management plan prepared as part of the CEMP 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.
- Vibration management measures provided in section 9.5 would be implemented to minimise the potential for structural vibration impacts to heritage items.
- Dilapidation surveys would be undertaken for heritage buildings/structures located on or within 25 metres of the proposal site.
- The environmental site induction would inform construction workers of the location of heritage items within and adjoining the proposal site, and guidelines to follow if unanticipated heritage items or deposits are located during construction.
- If previously unidentified heritage/archaeological items are uncovered during the works, all works would cease in the vicinity of the material/find and Transport for NSW would be contacted immediately. Works in the vicinity of the find would not re-commence until clearance has been received from Transport for NSW.
- 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.

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9. Noise and vibration

9.1 Assessment approach and methodology

A noise and vibration impact assessment of the proposal was undertaken by GHD. A comprehensive technical report is available as 'Technical Paper 3 – Noise and Vibration Assessment' on the Transport for NSW website (www.transport.nsw.gov.au). A summary of the assessment is provided in the following sections.

The assessment involved:

- identifying noise sensitive receivers and noise catchment areas
- background noise monitoring at seven representative locations to determine existing noise levels
- establishing noise and vibration criteria based on relevant guidelines and the results of background noise monitoring
- assessing the potential noise and vibration impacts of the proposal
- specifying mitigation and management measures to reduce identified impacts.

The noise and vibration impact assessment was undertaken with consideration of the following guidelines:

- *Interim Construction Noise Guideline* (DECC, 2009)
- *Construction Noise Strategy* (Transport for NSW, 2012)
- *Rail Infrastructure Noise Guideline*, (EPA, 2013)
- *Environmental Management System Guide Noise and Vibration from Rail Facilities* (Sydney Trains, 2013)
- *Industrial Noise Policy* (EPA, 2000)
- *Road Noise Policy* (DECCW, 2011)
- *Assessing Vibration: a Technical Guideline* (DEC, 2006)
- German Standard *DIN 4150-3: 1999 Structural Vibration – Part 3: Effects of vibration on structures*
- British Standard *(BS) 6472-1992, guide to evaluation of human exposure to vibration in buildings (1 Hz to 80 Hz).*

A description of the acoustic terms used in this section can be found in the glossary at the start of the REF.

9.2 Existing environment

9.2.1 Sensitive receivers and land uses

Potentially sensitive receivers are those that may be impacted by noise and vibration impacts. There are a number of potentially sensitive receivers and land uses in the study area, with the main potentially sensitive receivers being those located in close proximity to the proposal site.

For assessment purposes, the study area was divided into noise catchment areas. Noise catchment areas are areas that are likely to have similar noise exposures on the basis of factors such as topography, land uses, setbacks and types of residences or other noise receptors. Nine noise catchment areas and 38 potentially sensitive receivers were identified, as summarised in Table 9.1. Noise catchment areas are shown on Figure 9.1.

A full description of the catchment areas and a list of the potentially sensitive receivers identified are provided in the technical report.

9.2.2 Background noise monitoring

Ambient noise monitoring was undertaken from 15 May to 23 May 2014 in accordance with the Industrial Noise Policy to determine background noise levels for the noise assessment. Monitoring was undertaken at the locations listed in Table 9.1 and shown on Figure 9.1. Rail noise and vibration monitoring was also undertaken to determine the pass-by noise and vibration levels from train movements between Hamilton and Wickham stations.

Table 9.1 Noise catchment areas, receiver types and monitoring locations

NCA[1]	Identified residential receivers[2]	Noise monitoring logger location	Approximate distance to proposal site	Land use	Non-residential land uses
1	R1-R4	L1	20 metres	Mixed residential and commercial	Businesses on Fern Street and Beaumont Street
2	R5-R7	L2	8 metres	Mixed residential and commercial	Businesses on Ivy Street and Maitland Road
3	None	L1	95 metres	Mixed residential and commercial	Dental surgery and other businesses on Maitland Road
4	None	L4	140 metres	Mainly residential, some commercial	KU Wickham Preschool, Christian Science Church
5	R8-R20	L5	On site boundary	Mainly residential, some commercial	Various commercial and industrial businesses, Wickham Public School
6	R21-R23	L6	On site boundary	Mixed residential and commercial	Various businesses, Hunter Street Medical Centre
7	None	-	On site boundary	Commercial	Various businesses, Newcastle Dental Laser Clinic
8	R24	L3	42 metres	Mixed residential and commercial	Sacred Heart Catholic Cathedral, Newcastle Community Arts Centre
9	R25-R38	L7	20 metres	Mainly residential, some commercial	Various businesses

Notes: 1 NCA – noise catchment area
2 Residential receiver – the full list of receivers and locations is provided in Technical Report 3

9.2.3 Noise monitoring results

Rating background and ambient noise levels are summarised in Table 9.2 for each monitoring location. The measured background noise levels are considered to be typical to be of a busy, inner urban area, influenced by road and rail traffic noise, and commercial noise from local businesses and industry.

Table 9.2 Average background and ambient noise levels

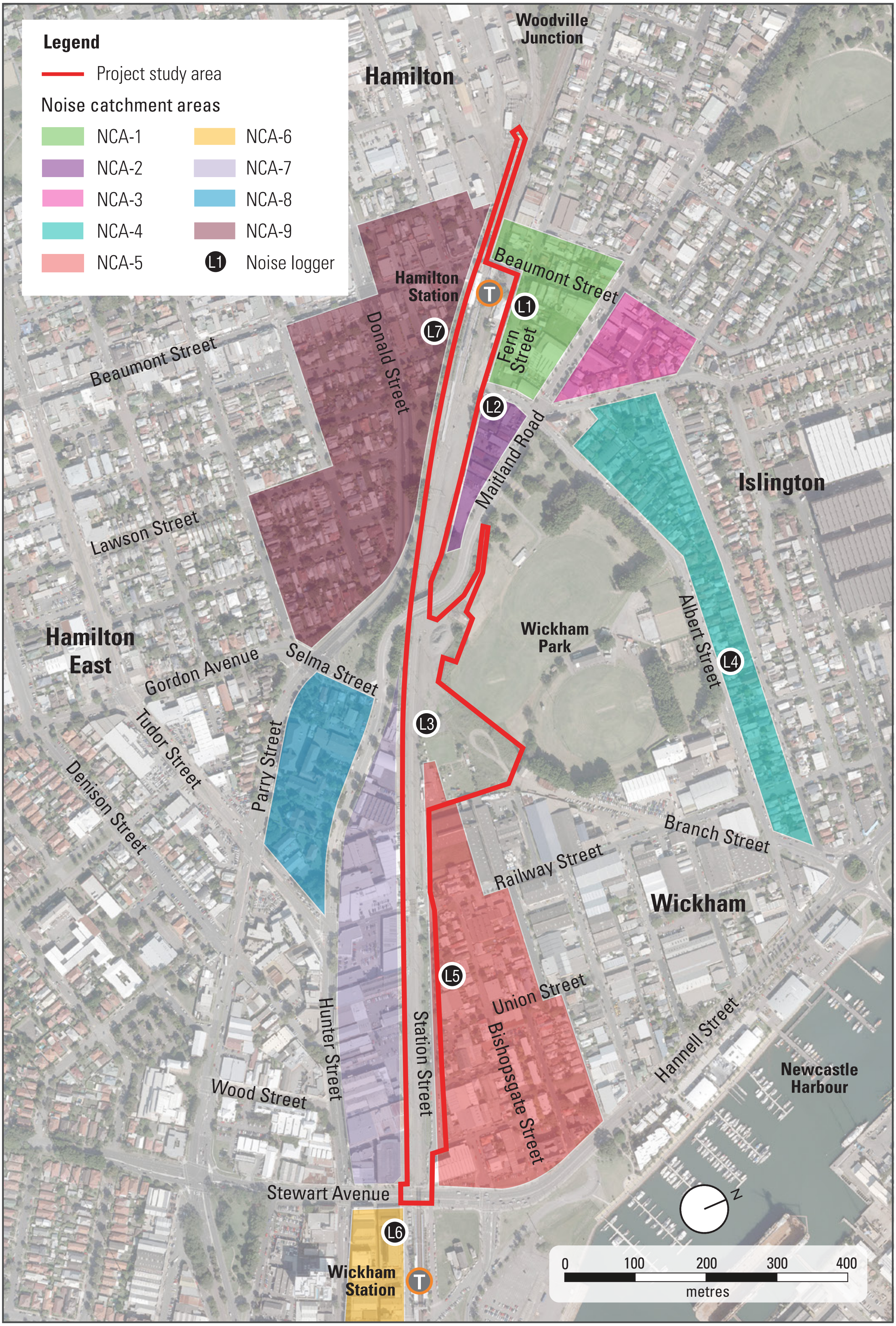
Location of noise logger	NCA	Rating background level[1] $L_{A90(15min)}$ (dB(A))			Average ambient noise levels, $L_{Aeq(period)}$[2] (dB(A))		
		Day	Evening	Night	Day	Evening	Night
L1	1 and 3	48	43	37	59	57	53
L2	2	47	46	42	58	56	53
L3	8	45	46	44	60	59	62
L4	4	45	40	36	64	60	56
L5	5	40	40	38	59	59	56
L6	6	56	52	45	64	63	60
L7	9	44	44	40	53	52	49

Notes: 1 The rating background level (RBL) noise level is representative of the 90th percentile background noise level calculated in accordance with the Industrial Noise Policy.
2 The $L_{Aeq(period)}$ is considered to represent the average noise level over the period.

A summary of the results of rail noise and vibration monitoring is provided in Table 9.3 and Table 9.4.

Table 9.3 Summary of rail pass-by noise levels

Source	Descriptor	Measured noise level 11.5 metres from nearest rail line (dB(A))
Total rail track noise	$L_{Aeq(15hr)}$	55.5
	$L_{Aeq(9hr)}$	52.3
Passenger trains	Sound exposure level	80.5 (day – average)
	Sound exposure level	79.7 (night – average)
	L_{Amax} (95 percentile)	81.3
	L_{Amax} (50 percentile)	72.6
	Events per day (average)	172
	Events per night (average)	58



9.1 Noise catchment areas and monitoring locations

Table 9.4 Summary of train pass-by vibration levels

Descriptor	Measured vibration level 5 metres from track	Measured vibration level 10 metres from track
Maximum train pass-by peak particle velocity	4.8 mm/s	4.2 mm/s
Average train pass-by peak particle velocity	3.0 mm/s	2.5 mm/s
Average train pass-by vibration dose value	0.032 $m/s^{1.75}$	0.027 $m/s^{1.75}$

9.3 Assessment criteria

The guidelines for, and derivation of, the assessment criteria are detailed in Technical Paper 3. A summary of the assessment criteria is provided in the following tables:

- construction noise (refer to Table 9.5)
- construction vibration buffer distances (refer to Table 9.6 and Table 9.7)
- operational rail noise from train movements between stations (refer to Table 9.8)
- noise from the operation of the stabling yard and the new station at Wickham (refer to Table 9.9)
- sleep disturbance during construction and operation (refer to Table 9.9)
- road traffic noise during construction and operation (refer to Table 9.10).

For construction noise criteria, standard construction work hours are defined as:

- Monday to Friday: 7 am to 6 pm
- Saturday: 8 am to 1 pm
- No work on Sundays or public holidays.

For standard construction work hours:

- The ‘noise affected level’ represents the point above which there may be some community reaction to noise. Where the predicted or measured $LA_{eq(15min)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. The proponent should also inform all potentially affected residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
- The ‘highly noise affected level’ represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority may require respite periods by restricting the hours that very noisy activities can occur, taking into account:
  - times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences)
  - if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.

Table 9.5 Proposal-specific construction noise criteria for residential receivers

NCA	Nearest potentially affected receiver	Construction noise management levels L_{Aeq} (dB(A))[1]				Sleep disturbance screening level (LAmax) (dB(A))
		Highly noise affected	Standard hours *Mon-Fri (7am-6pm), Sat (8am-1pm)*	Outside standard hours *Mon-Fri (6pm-10pm), Sat (7am-8am) & (1pm-10pm), Sun/Pub Hol (8am-6pm)*	Outside standard hours *Mon-Fri (10pm-7am), Sat (10pm-8am), Sun/ Pub Hol (6pm- 7am)*	
1	R1-R4	75	58	48	42	52
2	R5-R7	75	57	51	47	57
5	R8-R20	75	50	45	43	53
6	R21-R23	75	66	57	50	60
8	R24	75	55	51	49	59
9	R25-R38	75	54	49	45	55

Note: 1 Derivation of noise management levels is as per the *Interim Construction Noise Guideline* (DECC, 2009)

Table 9.6 Recommended safe working distances for vibration-intensive plant

Plant	Rating/description	Safe working distance (metres)	
		Cosmetic damage[1]	Human comfort[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)	n/a
Jackhammer	Hand held	1 (nominal)	Avoid contact with structure

Notes: 1 based on BS 7385-2:1993 Evaluation and measurement for vibration in buildings. Guide to damage levels from groundborne vibration

2 based on *Assessing Vibration: A Technical Guideline* (DEC, 2006).

Table 9.7 Estimated safe working distance for heritage structures

Activity	Safe working distance (metres)
15 tonne compactor	35
Roller\rock hammer	30
Dozer	15
Excavators, scrapers, graders, etc	7

Note: 1 based on German Standard DIN 4150-3: 1999 Structural Vibration – Part 3: Effects of vibration on structures

Table 9.8 Operational noise trigger levels for rail operations

Type of development	Noise trigger levels for residential land uses (dB(A))	
	Day (7am-10pm)	Night (10pm-7am)
Redevelopment of existing rail line (external)	Development increases existing $L_{Aeq(period)}$ rail noise levels by 2dB or more, or existing L_{Amax} rail noise levels by 3 dB or more and predicted rail noise levels exceed	
	65 $L_{Aeq(15h)}$ or 85 L_{AFmax}	60 $L_{Aeq(9h)}$ or 85 L_{AFmax}

Table 9.9 Operational noise criteria for stabling yards and stations

NCA	Nearest potentially affected receiver	Noise criteria			Sleep disturbance screening test (L_{Amax})
		Day *Mon-Sat 7am-6pm, Sun and Pub Hol 8am-6pm*	Evening *6pm to 10pm*	Night *Mon-Sat 10pm-7am, Sun and Pub Hol 10pm-8am*	
1	R1-R4	53	48	42	52
2	R5-R7	52	50	45	57
5	R8-R20	45	45	43	53
6	R21-R23	60	50	40	60
8	R24	50	50	45	59
9	R25-R38	49	49	45	55

Table 9.10 Traffic noise criteria at sensitive receivers and land uses (external noise levels)

Category	Day (7am-10pm)	Night (10pm-7am)
Existing residences affected by additional traffic on existing sub-arterial/arterial roads	60 $L_{Aeq(15hr)}$) dB(A)	55 $L_{Aeq(9hr)}$ dB(A)
Existing residences affected by additional traffic on existing local roads	55 $L_{Aeq(1hr)}$ dB(A)	50 $L_{Aeq(1hr)}$ dB(A)
Note: The Road Noise Policy states that for existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise level as a result of the development should be limited to 2 dB above that of the noise level without the development. This limit applies wherever the noise level without the development is within 2 dB of, or exceeds, the relevant day or night noise assessment criterion.		

9.4 Impact assessment

9.4.1 Construction

Construction noise

The results of modelling indicate that the noise generated by construction activities is predicted to exceed the 'noise affected' noise management levels at the majority of residential receivers. A summary of the potential impacts relevant to the indicative activities at the main work areas is provided in Table 9.11. A full list of the results for each receiver is provided in Technical Report 3.

The predicted exceedances are based on assumptions made in relation to the plant and equipment that may be used by the construction contractor, and are based on a scenario where all plant is in use at any one time. Therefore, the predicted exceedances are considered to represent a worst case scenario. Some works would be short term and progressive (such as trenching for cables) whereas other works would continue for the majority of the construction period.

Potential exceedances of the construction noise criteria would be managed by implementing the measures provided in the *Construction Noise Strategy* (Transport for NSW, 2012) where feasible and reasonable (refer to section 9.5).

Table 9.11 Summary of potential construction noise impacts

Main work area	Activity	Summary of potential impacts
Substation connection	Trenching	Noise levels are predicted to exceed noise management levels at a number of residential receivers in NCAs 1 and 9 during standard construction hours. Residential receivers in Fern, Hudson and Beaumont Streets would be particularly affected during standard hours.
Stabling yard	Earthworks	Noise levels are predicted to exceed noise management levels at a number of residential receivers in NCAs 1, 2 and 9 during standard construction hours. Residential receivers in Donald, Fern, Hudson and Eva Streets would be particularly affected during standard hours.
	Track laying and turnouts	Noise levels are predicted to exceed noise management levels at a number of residential receivers in NCAs 1, 2, 5, 8 and 9 during standard construction hours. Residential receivers in Donald, Fern, Hudson, Eva and Selma Streets and Railway Lane would be particularly affected during standard hours.
	Out of hours works	Noise levels are predicted to exceed noise management levels at a number of residential receivers in NCAs 1, 2, 5, 8 and 9 outside standard construction hours. Residential receivers located on Donald, Fern, Hudson, Eva and Selma Streets and Railway Lane would be particularly affected by these works during the evening and night time periods.

Main work area	Activity	Summary of potential impacts
New station	Piling works	Noise levels are predicted to exceed noise management levels at a number of residential receivers in NCA 5 during standard construction hours. Residential receivers located on Railway Lane and Railway, Station, Union, Wickham and Chapel Streets would be particularly affected during standard hours.
	Station works	Noise levels are predicted to exceed noise management levels at a number of residential receivers in NCA 5 during standard construction hours. Residential receivers located on Railway Lane and Railway, Station, Union, Wickham and Chapel Streets would be particularly affected during standard hours.
	Track laying and turnouts	Noise levels are predicted to exceed noise management levels at a number of residential receivers in NCAs 5, 8 and 9 during standard construction hours. Residential receivers located on Railway Lane and Railway, Station, Union, Wickham, Chapel, Donald and Selma Streets would be particularly affected during standard hours.
	Out of hours works	Noise levels are predicted to exceed noise management levels at a number of residential receivers in NCA 5 outside standard construction hours. Residential receivers located on Railway Lane and Railway, Station, Union, Wickham and Chapel Streets would be particularly affected by these works during the evening and night time periods.

Temporary stabling of trains during construction

During construction, trains would be temporarily stabled on the main lines between Hamilton and Wickham stations. The predicted noise levels during this interim stabling period are shown in Table 9.12.

Table 9.12 Interim stabling yard operating noise levels (dB(A))

NCA	Most affected residential receivers	Residential criterion L_{Aeq}			Highest predicted L_{Aeq}	Highest exceedance		
		Day	Evening	Night		Day	Evening	Night
2	R5, R6, R7	57	51	47	45	-	-	-
8	R24	55	51	49	49	-	-	-
9	R25 – R32	54	49	45	**55**	1	6	10

Note: **Bold and blue text** above indicates an exceedance of the criteria

The results indicate that the noise levels within noise catchment areas two and eight (Fern Street and Selma/Hunter Street) would comply with the day, evening and night-time noise criteria. Noise received by residential receivers within noise catchment nine (Donald Street) is predicted to exceed the noise criteria during the evening and night-time periods by up to 10 dB(A). The identified exceedances would be managed by implementing the measures provided in section 9.5.

Construction traffic noise

In accordance with the *Road Noise Policy* (DECCW, 2011), construction traffic noise is considered to be acceptable when it is within two dB(A) of existing noise levels. As a general indication, the doubling of traffic on a road is considered likely to result in an increase in noise levels of about three dB(A).

As noted in section 5.3.5, the proposal would generate additional traffic on public roads. The results of the noise assessment indicates that construction traffic would be unlikely to result in noise impacts on the surrounding road network, particularly in relation to traffic on busy, higher capacity roads, such as Maitland Road, Hannell Street/Stewart Avenue and Albert Street.

Construction traffic accessing the site during peak hours by Station Street has the potential to increase existing traffic noise by more than two dB(A) at residential receivers along Station Street, mainly due to the low existing traffic volumes.

Construction traffic, and any resulting increases in noise levels, would be managed by implementing the traffic management plan (as outlined in section 7.4) which would detail preferred routes for construction traffic. These routes would, where practicable, avoid residential areas and other sensitive receivers. Other measures, such as speed limit restrictions, would also reduce potential noise impacts at adjacent premises.

Construction vibration

There would be the potential for cosmetic and human comfort vibration impacts at sensitive receivers if work is undertaken within the safe working distances listed in Table 9.6. Depending on the plant and equipment used, there is a potential for human comfort vibration impacts for receivers located within about 100 metres of the proposal site, and cosmetic damage to buildings located within about 25 metres of the site.

As noted in section 8.2, there are six heritage listed buildings located within 25 metres of the proposal site, including the Hamilton Railway Station Group which is listed on the State Heritage Register.

The potential for impacts would be managed by the careful selection of equipment to be used, and/or by maintaining the safe working distances outlined in Table 9.6. The implementation of mitigation measures provided in section 9.5, such as dilapidation surveys and (where necessary) monitoring, would also reduce the potential for impacts. Potential impacts would be limited to the duration of the construction period.

9.4.2 Operation

Rail operational noise

The predicted noise levels for each noise catchment area are listed in Table 9.13. The results indicate that the noise levels at the nearest sensitive receivers would not exceed the operational noise criteria.

To the east of Stewart Avenue, noise levels experienced by receivers (in noise catchment area six) would decrease significantly, as train services would no longer operate through this area.

Removing the level crossing at Railway Street is predicted to reduce noise levels at nearby receivers within noise catchment area five. However, the introduction of the head shunt track and the reduction of the separation distance between the rail lines and residences (by about 10 metres) would result in a marginal increase in noise levels for the nearest receivers.

The assessment also indicates that the introduction of turnouts/crossovers between the new station at Wickham and the Maitland Road overbridge would also marginally increase rail noise levels for the nearest receivers in noise catchment area eight.

Table 9.13 Operational rail noise levels at residential receivers

NCA	Receivers	Design noise levels (dB(A))		
		L_{Aeq} day	L_{Aeq} night	L_{Amax}
1	R1 to R4	45 to 46	42 to 44	67 to 71
2	R5 to R7	51 to 52	49 to 50	75 to 75
5	R8 to R20	47 to 57	45 to 55	74 to 80
6	R21 to R23	36 to 38	34 to 36	50 to 52
8	R24	49 to 49	47 to 47	73 to 73
9	R25 to R38	45 to 50	43 to 48	64 to 73

Stabling yard

Four operational scenarios were modelled to assess the potential worst-case noise impacts of the operation of the stabling yard:

- scenario 1: train entering and idling in siding 4, no other trains in stabling yard
- scenario 2: train in siding 4 is turned off, train idling in siding 3
- scenario 3: train in siding 4 is turned off, trains idling in sidings 2 and 3
- scenario 4: train in siding 4 is turned off, trains idling in sidings 1, 2 and 3
- scenario 5: diesel train enters then idles at the western end of siding 1 during the day.

The results of modelling are summarised in Table 9.14.

Table 9.14 Predicted stabling yard operating noise levels (dB(A))

Scenario	NCA	Most affected receivers	Residential criteria L_{Aeq}			Highest predicted L_{Aeq}	Highest exceedance		
			Day	Evening	Night		Day	Evening	Night
1	1	R4	53	48	42	**45**	-	-	3
	2	R5, R6, R7	52	51	47	**67**	15	16	20
	9	R33, R34, R35	49	49	45	**46**	-	-	1
2	1	R4	53	48	42	41	-	-	-
	2	R5, R6, R7	52	51	47	**52**	-	1	5
	9	R33, R34, R35	49	49	45	**48**	-	-	3
3	1	R4	53	48	42	**51**	-	3	9
	2	R5, R6, R7	52	51	47	**53**	1	2	6
	9	R33, R34, R35	49	49	45	**51**	2	2	6
4	1	R4	53	48	42	**53**	-	5	11
	2	R5, R6, R7	52	51	47	**54**	2	3	7
	9	R33, R34, R35	49	49	45	**52**	3	3	7

Scenario	NCA	Most affected receivers	Residential criteria L_{Aeq}			Highest predicted L_{Aeq}	Highest exceedance		
			Day	Evening	Night		Day	Evening	Night
5	1	R1, R2, R3, R4	53	48	42	**57**	4	n/a	n/a
	2	R5, R6, R7	52	51	47	52	-	n/a	n/a
	9	R33, R34, R35, R36, R37, R38	49	49	45	**55**	6	n/a	n/a

Note: **Bold and blue text** indicates an exceedance of the criteria

The results shown in Table 9.14 show that without mitigation, operational noise from the stabling yard would exceed the operational noise criteria in noise catchments areas one, two and nine. These impacts are greatest during the scenario where a train enters and idles within siding four (the northernmost siding). However, following shutdown, this train would provide a barrier to noise emitted by other trains entering and stabling in the other sidings.

Noise mitigation options would be finalised during the detailed design phase. An initial assessment of an option to mitigate potential noise impacts was undertaken as part of the noise and vibration assessment. This option involved modelling the noise impacts of the stabling yard incorporating a three metre high noise barrier along the boundary fence adjacent to Ivy and Fern streets, and a three metre high noise barrier along the southern boundary fence, adjacent to residences near Hamilton Station and Donald Street.

The results of modelling with the barriers indicated that the barriers would

- have a small mitigating effect at the nearest residential receivers in Fern and Eva streets, with a reduction in noise levels of less than two dB(A)
- reduce noise levels at residential receivers along Ivy Street, achieving reductions of eight to 10 dB(A) at the most affected receiver.

Another option is to implement noise control at affected residences, such as architectural treatments.

The results of modelling indicate that it may be possible to reduce operational noise from the stabling yard to acceptable levels during the day and evening period, however it would be difficult to achieve compliance with the external night-time noise criteria. More detailed investigation of suitable noise mitigation options would be undertaken as part of the detailed design phase.

Sleep disturbance impacts

Short-term events generating high noise levels, such as train horns and brake air releases, have the potential to cause sleep disturbance impacts at sensitive receivers Table 9.15 shows the predicted LAmax noise levels in noise catchment areas one, two and nine for horn and brake air release noise. The assessment results indicate that, without mitigation, significant exceedances of the sleep disturbance criteria are predicted at the most affected residential receivers, particularly as a result of the use of train horns within the stabling yard.

Based on the current daily train schedule, there would be up to 15 movements within the stabling yard at night, each with the potential for brake air release noise. There is the potential for sleep disturbance impacts at the nearest identified receivers from brake air release noise, particularly for those receivers within noise catchment area two on Ivy Street.

The identified exceedances would be managed by implementing the measures provided in section 9.5.

Table 9.15 Stabling yard predicted sleep disturbance impacts

Noise source	NCA	Most affected residential receiver(s)	L_{Amax} (dB(A))	
			Sleep disturbance criteria	Predicted noise level
Brake air release	1	R4	52	**63**
	2	R5, R6, R7	57	**77**
	9	R33, R34, R35	55	**56**
Horn	1	R4	52	**74**
	2	R5, R6, R7	57	**98**
	9	R33, R34, R35	55	**76**

Note: **Bold blue text** indicates an exceedance of the noise criteria

Table 9.16 shows the predicted results of the sleep disturbance assessment during the interim stabling period. The results indicate that the sleep disturbance criteria would be achieved for brake air release operations, however the criteria would be exceeded for horn operations at the most affected receivers in noise catchment areas 2, 8 and 9. The identified exceedances would be managed through implementation of the measures provided in section 9.5.

Table 9.16 Predicted interim stabling yard sleep disturbance impacts

Noise source	NCA	Most affected residential receiver(s)	L_{Amax} dB(A)	
			Sleep disturbance criteria	Predicted noise level
Brake air release	2	R5, R6, R7	52	47
	8	R24	57	52
	9	R25 – R32	55	53
Horn	2	R5, R6, R7	52	**63**
	8	R24	57	**77**
	9	R25 – R32	55	**79**

Note: **Bold blue text** indicates an exceedance of the noise criteria

New station at Wickham

The nearest residential receivers to the new station would be located on Station Street, about 20 metres from the station. However, most residences would be located at least 50 metres from the new station and platforms. Without mitigation, the nearest receivers would have the potential to be impacted by noise associated with the operation of the new station, including operation of the public address systems and mechanical plant operation. The design of these facilities would take into account the potential for noise impacts on the nearest receivers.

Traffic noise

Operation of the proposal would generate additional traffic in the study area as a result of the operation of the new station and interchange. In accordance with the *Road Noise Policy* (DECCW, 2011), traffic noise is considered to be acceptable when it is within two dB(A) of the existing noise levels.

The assessment indicates that the increase in noise levels for residences on Railway, Throsby and Albert streets would not exceed two dB(A). The traffic assessment predicts that there would be a 120 per cent increase in vehicle volumes on Station Street. The results of the noise assessment indicate that road traffic noise levels are predicted to increase by more than three dB(A) in Station Street. While this noise increase could be noticeable, due to the relatively low vehicle volumes on Station Street (even with the addition of the proposal), it is expected that the road traffic noise criteria would continue to be achieved.

Rail vibration

Vibration estimates indicate that the human comfort and cosmetic damage vibration criteria would be achieved at five metres from the railway for residential structures. Between the Maitland Road overbridge and the new station at Wickham, all receivers and buildings are further than five metres from the railway therefore, vibration impacts are not anticipated.

West of the Maitland Road overbridge, all residential receivers are located further than five metres from the proposal, and vibration impacts are not anticipated. However the development at 12 Maitland Road will be located about four metres from the nearest siding where trains may travel at slower speeds (around 10 to 25 kilometres per hour). As vibration is a function of train speed, and the relevant vibration criteria is 15 millimetres per second for buildings of this nature, cosmetic damage is not anticipated at this location.

In summary, operation vibration impacts are not anticipated at any sensitive receivers.

9.5 Mitigation measures

9.5.1 Detailed design

The following measures would be implemented during the detailed design phase:

Stabling yard

- The acceptability of any operational limitations associated with the use of ‘barrier’ trains to shield noise from other trains within the stabling yard would be confirmed.
- Other feasible and reasonable operational measures to minimise noise emissions (such as the use of horns, powering down trains overnight) would be assessed.
- Detailed analysis of any potential noise barriers would be undertaken, including location, structural considerations, and a cost-benefit analysis.
- The effectiveness of architectural treatments on noise affected premises would be assessed.
- An assessment of the potential for sleep disturbance impacts would be undertaken in accordance with Sydney Trains’ Environmental Management System

New station at Wickham

- Public address systems would be designed to comply with the operational noise criteria. The use of measures such as speaker selection, orientation and placement would be considered.
- Mechanical plant would be designed to comply with the operational noise. Placement of plant, acoustic enclosures, silencers and acoustic barriers and treatments would be considered.

9.5.2 Construction

The following measures would be implemented during construction:

- A noise and vibration management plan would be prepared as part of the CEMP in accordance with the *Construction Noise Strategy* (Transport for NSW, 2012). The noise and vibration mitigation measures detailed in Table 9.17 would be incorporated in the CEMP and implemented.
- Where the noise levels are predicted to exceed the criteria after implementation of the general work practices, the additional mitigation measures detailed in Table 9.18 would be implemented.
- The recommended safe working distances for vibration-intensive plant in the *Construction Noise Strategy* would be implemented.
- Temporary hoarding would be installed close to the stabling areas to minimise noise levels at residential receivers within noise catchment area nine.
- The use of train horns would be minimised during the night, or alternative warning systems would be used.

Table 9.17 Standard mitigation measures for construction noise and vibration

Action required	Details
Management measures	
Implement community consultation measures	• periodic notification (letterbox drop or equivalent) • website • project info-line • construction response line • email distribution list • community-based forums (if required by approval conditions).
Site inductions	All employees, contractors and subcontractors are to receive an environmental induction. The induction must at least include: • all relevant project specific and standard noise and vibration mitigation measures • relevant licence and approval conditions • permissible hours of work • any limitations on high noise generating activities • location of nearest sensitive receivers • construction employee parking areas • designated loading/ unloading areas and procedures • construction traffic routes • site opening/closing times (including deliveries) • environmental incident procedures.
Behavioural practices	No swearing or unnecessary shouting or loud stereos/radios on site. No dropping of materials from height, throwing of metal items and slamming of doors.
Monitoring	A noise monitoring program is to be carried out for the duration of the works in accordance with the Construction Noise and Vibration Management Plan and any approval and licence conditions.
Attended vibration measurement	Attended vibration measurements are required at the commencement of vibration generating activities to confirm that vibration levels are within the acceptable range to prevent cosmetic building damage.

Action required	Details
Source controls	
Construction hours and scheduling	Where reasonable and feasible, construction should be carried out during the standard daytime working hours. Work generating high noise and/or vibration levels should be scheduled during less sensitive time periods.
Construction respite period	If highly noise affected impacts are predicted, high noise and vibration generating activities may only be carried out in continuous blocks, not exceeding three hours each, with a minimum respite period of one hour between each block. If highly noise affected impacts are predicted no more than four consecutive nights of high noise and/or vibration generating work may be undertaken over any seven day period, unless otherwise approved by the relevant authority.
Equipment selection	Use quieter and less vibration emitting construction methods where reasonable and feasible.
Maximum noise levels	The noise levels of plant and equipment must have operating Sound Power or Sound Pressure Levels compliant with the criteria listed in Table 2 of the *Construction Noise Strategy* (Transport for NSW, 2012a)
Rental plant and equipment	The noise levels of plant and equipment items are to be considered in rental decisions and in any case cannot be used on site unless compliant with the criteria in Table 2 of the Construction Noise Strategy (Transport for NSW 2012)
Use and siting of plant	Simultaneous operation of noisy plant within discernible range of a sensitive receiver is to be avoided. The offset distance between noisy plant and adjacent sensitive receivers is to be maximised. Plant used intermittently to be throttled down or shut down. Noise-emitting plant to be directed away from sensitive receivers.
Plan worksites and activities to minimise noise and vibration	Plan traffic flow, parking and loading/ unloading areas to minimise reversing movements within the site.
Non-tonal reversing alarms	Non-tonal reversing beepers (or an equivalent mechanism) must be fitted and used on all construction vehicles and mobile plant regularly used on site and for any out of hours work.
Minimise disturbance arising from delivery of goods to construction sites	Loading and unloading of materials/deliveries is to occur as far as possible from sensitive receivers. Select site access points and roads as far as possible away from sensitive receivers. Dedicated loading/unloading areas to be shielded if close to sensitive receivers. Delivery vehicles to be fitted with straps rather than chains for unloading, wherever possible.
Path controls	
Shield stationary noise sources such as pumps, compressors, fans etc.	Stationary noise sources should be enclosed or shielded whilst ensuring that the occupational health and safety of workers is maintained.
Shield sensitive receivers from noisy activities	Use structures to shield residential receivers from noise such as site shed placement; earth bunds; fencing; erection of operational stage noise barriers (where practicable) and consideration of site topography when situating plant.

Source: *Construction Noise Strategy* (Transport for NSW, 2012a)

Table 9.18 Additional construction mitigation measures

Time period		$L_{Aeq(15\,min)}$ noise level above rating background level			
		0 to 10 dBA	10 to 20 dBA	20 to 30 dBA	>30 dBA
		Noticeable	Clearly audible	Moderately intrusive	Highly intrusive
Standard	Weekday (7am-6pm)	-	-	LB, M	LB, M
	Saturday (8am-1pm)				
Evening	Weekday (6pm-10pm)	-	LB	M, LB	M, IB, LB, PC, SN
	Saturday (1pm-10pm)				
	Sunday (8am-6pm)				
Night	Weekday (10pm-7am)	LB	M, LB	M, IB, LB, PC, SN	AA, M, IB, LB, PC, SN
	Saturday (10pm-8am)				
	Sunday (6pm-–7am)				

Notes:

M - Monitoring: Compliance noise monitoring

IB - Individual briefings: Individual briefings are used to inform stakeholders about the impacts of high noise activities and mitigation measures that will be implemented. Communications representatives from the contractor would visit identified stakeholders at least 48 hours ahead of potentially disturbing construction activities. Individual briefings provide affected stakeholders with personalised contact and tailored advice, with the opportunity to comment on the proposal.

LB - Letterbox drops: Letter box drops or media advertisements.

PC - Phone calls: Phone calls detailing relevant information would be made to identified/affected stakeholders within seven days of proposed work. Phone calls provide affected stakeholders with personalised contact and tailored advice, with the opportunity to provide comments on the proposed work and specific needs.

SN - Specific notifications: Specific notifications are letterbox dropped or hand distributed to identified stakeholders no later than seven days ahead of construction activities that are likely to exceed the noise objectives. This form of communication is used to support periodic notifications.

AA - Alternative accommodation: Provide alternative accommodation for residents.

Source: *Construction Noise Strategy* (Transport for NSW, 2012a)

9.5.3 Operation

The following measures would be implemented during operation:

- Transport for NSW would liaise with NSW TrainLink to revise their horn testing procedure such that horns would be tested east of Maitland Road, west of Railway Street, remote from sensitive receivers.
- Additional options for managing the potential noise impacts of the stabling yard would be considered in accordance with Sydney Trains' *Environmental Management System Guide Noise and Vibration from Rail Facilities* (Sydney Trains, 2013), which provides best practice options for managing noise emissions from stabling facilities. Potential options include:
  - ensure that horns are used only to the extent required to meet safety and engineering procedures and criteria (i.e. no excessive use of horns)
  - educating employees to bear in mind neighbouring properties (keep voices down, stand away from receivers to talk).
  - the use of alternative horn test and warning procedures or removing the requirement to test the horn altogether
  - powering down trains whenever possible, rather than idling
  - the use of 'barrier trains' where shown to be feasible
  - scheduling noisy activities to less sensitive times, such as day or evening times.

10. Air quality

10.1 Assessment approach and methodology

A qualitative assessment of the potential air quality impacts of the proposal was undertaken with reference to existing data, including meteorological data from the Bureau of Meteorology's Nobbys Head weather station; air quality monitoring conducted at the Newcastle Number 1 Sportsground; and the *Lower Hunter Ambient Air Quality Review of Available Data* (OEH, 2012).

10.2 Existing environment

10.2.1 Ambient air quality

As outlined in the *Lower Hunter Ambient Air Quality Review of Available Data* (OEH, 2012), air quality in the Newcastle LGA is generally good and meets the standards set by the National Environment Protection (Ambient Air Quality) Measure (NEPM) made under the *National Environment Protection Council (New South Wales) Act 1995*. The report also identifies that industrial, commercial and transportation sources are all significant contributors to adverse air quality in Newcastle.

The closest air quality monitoring station to the proposal site is located at the Newcastle Sportsground, about one kilometre south of the proposal site. The data collected at this station is considered to be representative of the ambient air quality of the study area.

A review of published data collected from this monitoring station over the past five years indicates that the NEPM standards have been met for the recorded pollutants and no exceedances of the NEPM standards have been recorded, with the exception of PM_{10}. Concentrations of PM_{10} were observed to exceed the 24-hour standard on 13 days during 2008, and on one day in 2009. It is likely that these exceedances were associated with regional pollution events such as smoke from bush fires or dust storms.

The Newcastle Branch Line accommodates diesel train services from Maitland as part of the operation of the Hunter Line. Diesel train emissions would contribute to the existing air quality characteristics of the study area, particularly for areas in the immediate vicinity of the rail corridor.

10.2.2 Local meteorology

The transport and dispersion of air emissions from the proposal would be influenced by local weather conditions.

Meteorological data was obtained from the Bureau of Meteorology's Nobbys Head weather station, which is the nearest station to the proposal site and is located about two kilometres to the east. Hourly weather data was collected for the years 2008 to 2012. This data is considered to be representative of the weather conditions of the study area.

Generally, the prevailing winds are from the south, east and north-west. Low wind speeds, which are associated with poor dispersion conditions for ground-based sources, are also most common from the north-west. The annual average wind speed is six metres per second. This suggests that strong wind events occur and have the potential to cause wind erosion of particulate matter.

10.2.3 Sensitive receivers

Key sensitive receivers around the proposal site include residences around Hamilton Station on Eva, Fern and Ivy streets. These residences are close to the proposed location of the new stabling yard. Sensitive receivers also include residences along Station Street, which are close to the proposed location for the new station at Wickham.

A number of these receivers are located in the path of the dominant wind direction from the proposal site. For example, during north-westerly winds, residences on Eva and Donald streets would be downwind of the stabling yard.

10.3 Impact assessment

10.3.1 Construction

The main potential for air quality impacts associated with the proposal would be as a result of dust generated during activities involving large mechanical disturbances of soil surfaces. However, it is not expected that large amounts of earthworks would be required, as the proposal site is generally flat.

Other dust sources may be produced by material handling activities associated with track construction and movement of construction vehicles on unsealed surfaces. Wind erosion of unconsolidated surfaces, such as stockpiled material, could also cause localised emissions of dust.

Dust impacts have the potential to impact on the amenity of people using local facilities, occupying nearby properties or passing the proposal site (such as workers, nearby residents and pedestrians/cyclists). Due to the relatively low intensity of construction, the small amount of earthworks required, and the relatively short duration of construction works, the potential for adverse impacts is considered to be minimal.

Implementation of standard construction air quality management controls (listed in section 10.4 would minimise the potential for air quality impacts.

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 car traffic and rail movements).

10.3.2 Operation

The main potential for detrimental air quality impacts during operation would be associated with the movement of trains at the new station at Wickham and at the proposed stabling yard at Hamilton. The key potential emissions associated with train movements would be exhaust emissions from diesel-powered locomotive engines, including fine particulate material (products of combustion). Diesel exhaust emissions have been identified as a potential carcinogen by the World Health Organisation. Exhaust emissions include:

- carbon monoxide
- nitrous oxides
- sulfur dioxide
- benzene
- trace hydrocarbons
- fine particulate matter.

Emission rates from diesel trains depend on:

- the locomotive type
- operating power, which depends on train load and speed
- track gradient.

The introduction of the new head shunt track and third platform on the northern side of the new station at Wickham would result in air emissions from train operations, such as exhaust emissions during departures. Residential receivers along Station Street would be within about 20 to 40 metres of the new third platform.

During operation, as noted in section 5.5, diesel trains would temporarily layover during the day in the head shunt track, and at the new station at Wickham (at Platform 3). Diesel trains would operate in idle mode during layover periods, which may be up to a few hours at a time. During this time, there is potential for short term air quality impacts at receivers located close to the idling train. However, analysis of local metrological conditions indicates that low wind speeds, which are associated with poor dispersion conditions, are most commonly from the north-west. This would minimise the potential for impacts to be experienced by the sensitive receivers located close to the stabling yard and the head shunt track, as the receivers are located to the north and north-east.

In addition, atmospheric conditions during the day provide a higher level of dispersion for air emissions (due to increased thermal mixing) compared to the more stable night-time period. The limited duration of layovers means that over a 24-hour period, average emissions (such as particulate matter) would be very low, as an individual receiver would only be exposed to potential air emissions intermittently.

In summary, the proposal is not expected to result in significant additional impacts on local air quality for the following reasons:

- there would be no increase in the number of diesel trains
- the same types of locomotives would be used
- only electric trains would be stabled overnight in the proposed stabling yard
- the prevailing winds primarily are from the north-west, which would assist in dispersing diesel emissions away from the nearest sensitive receivers.

The proposal would result in diesel trains ceasing to operate between Hamilton and Newcastle stations during construction, and between the new station at Wickham and Newcastle Station during operation. This would be a positive impact on air quality.

10.4 Mitigation measures

10.4.1 Construction

An air quality management sub-plan would be prepared as part of the CEMP. It would include the following measures:

- All plant and machinery would be fitted with emission control devices complying with relevant Australian Standards.
- Machinery would be turned off when not in use and not left to idle for prolonged periods.
- Vehicle movements would be limited to designated entries and exits, haulage routes (to be determined during preparation of the traffic management plan, and in consultation with RMS and Council) and parking areas.

- Dust generation would be monitored visually, and where required, dust control measures such as water spraying would be implemented to control the generation of dust.
- Materials transported to and from the site would be covered to reduce dust generation in transit.
- Access points would be inspected to determine whether sediment is being transferred to the surrounding road network. If required, sediment would be promptly removed from roads to minimise dust generation.
- Stabilisation of any exposed surfaces as soon as practicable, including implementation of final landscaping as early as possible.
- Shade cloth would be fastened to the perimeter fence on the proposal site to minimise dust transported from the site during construction.
- Daily inspections and regular surveillance would be undertaken to identify any vehicle, plant or equipment that is causing visible emissions. If any defective vehicles, plant or equipment are identified, operation of this machinery would cease and service/maintenance would be undertaken.
- Works (including the spraying of paint and other materials) would be suspended during strong winds or in weather conditions where high levels of dust or airborne particulates are likely.
- Any exposed surfaces would be stabilised, and final landscaping implemented, as soon as practicable.

10.4.2 Operation

The following measures would be implemented during operation:

- All trains, particularly those that are diesel-powered, would be regularly maintained to ensure efficient operation.
- Diesel-powered trains that layover within the stabling yard would use siding 1, which is furthest away from the sensitive receivers.
- Where practicable, the layover duration of diesel-powered trains would be minimised.

11. Socio-economic impacts

11.1 Assessment approach and methodology

A socio-economic impact assessment of the proposal was undertaken by GHD.
A comprehensive technical report is available as 'Technical Paper 4 – Socio-economic Assessment' on the Transport for NSW website (www.transport.nsw.gov.au). A summary of the results of the assessment is provided in the following sections.

The assessment involved the following tasks:

- reviewing background information on the proposal and the socio-economic environment of the study area
- undertaking a site inspection to review local conditions
- analysis of available community survey data, including data from Australian Bureau of Statistics (ABS) Census 2011, NSW Bureau of Crime Statistics and Research, Bureau of Transport Statistics, and Council
- analysis of the outcomes of previous community consultation undertaken by UrbanGrowth NSW for the Newcastle light rail project
- consultation with Council's community and strategic planners
- preparing a profile of the existing community that may be impacted by the proposal
- undertaking a desktop analysis of the potential negative and positive impacts, and direct and indirect impacts of the proposal on the community
- developing mitigation measures, including strategies for monitoring and managing the impacts identified.

11.2 Existing environment

The key socio-economic features of the study area are summarised below.

11.2.1 Social environment

Community profile

The study area for the purposes of the socio-economic assessment focussed on two precincts:

- East End, which is located to the east of the proposal site, includes the Newcastle city centre, Newcastle East and areas of Wickham east of Wickham Station,
- West End, which surrounds the proposal site, includes the suburbs of Hamilton, Islington and other areas of Wickham.

The socio-economic characteristics of these areas are summarised below.

East End

- the main employment area in Newcastle and the regional hub for tourists and visitors, providing a variety of retail, hospitality, education, cultural and commercial services
- a number of areas within the East End are subject to urban renewal and revitalisation projects and proposals consistent with the various renewal strategies listed in section 4
- located within walking distance of local beaches, cultural precincts (including the Newcastle Art Gallery), the foreshore and several public parks

- resident population of 3,699
- has experienced population growth since 2006 of about 20 per cent
- has a relatively older population, with around 35 per cent of the population aged 50 years and over (compared to around 33 per cent for the Newcastle LGA as a whole), and an average age of 36 years
- relatively low levels of disadvantage with average individual incomes of $847 per week, low rates of unemployment (5.2 per cent), a labour force consisting of a high proportion of professionals and managers (54.5 per cent), and high levels of education
- the proportion of family households (46.9 per cent) is lower than for the Newcastle LGA as a whole (63.8 per cent)
- has a significantly higher proportion of flats/units/apartments (64.5 per cent) and significantly less separate houses (4.1 per cent) than the Newcastle LGA as a whole (13.9 and 73.5 per cent respectively)
- 16.6 per cent of households do not own a car, compared with 11.9 per cent of households in the Newcastle LGA as a whole
- the proportion of people who travelled only by train or bus to work was 3.9 and 3.6 per cent respectively, compared with 1.4 and 3.1 per cent for the Newcastle LGA as a whole.

West End

- although the suburbs of Wickham and Islington are rapidly gentrifying, with a growing emphasis on retail and hospitality services, there continues to be a strong industrial manufacturing and services trade in the West End
- resident population of 1,542
- has a relatively younger population, with 61.3 per cent of the population aged between 18 and 49 years, compared to 45.4 per cent in the east end
- low incomes (average individual incomes of $547 per week), high rates of unemployment (8.1 per cent), a labour force consisting mainly of community and personal services (16.1 per cent) and technicians/trades (14 per cent), and lower levels of education
- the proportion of family households (46.7 per cent) is similar to that of the East End
- the most common dwelling types are separate houses (45.1 per cent), followed by flats/units/apartments (27.8 per cent)
- 19.8 per cent of households do not own a car
- the proportion of people who travelled only by train or bus to work was 6.9 and 6.5 per cent respectively, which is a higher proportion than the east end and the Newcastle LGA as a whole.

11.2.2 Economic environment

The study area consists of a wide range of business and employment generating uses.

East End

The East End precinct is the business centre of Newcastle. There are several large professional service providers, such as legal and banking services, located near Newcastle Station. There are also a number of long and short term accommodation providers in the area.

There are several smaller professional service and business education and training providers located near Civic Station, along Hunter Street. The Civic Theatre is located opposite Civic Station on Hunter Street with several small retail and dining businesses located in close proximity. Newcastle Museum is located north of Civic Station and is surrounded by a number of businesses including professional service providers, dining, some retail and personal services (including a fitness centre) along the harbour foreshore.

The east end has a workforce population of 12,972 people.

West End

The West End precinct has a mix of residential and business uses, including light industrial, dining and retail. The main business type in Wickham is light industrial goods and services, which includes automotive servicing and supply businesses, as well as industrial storage and trades. There are also a number of professional and personal service providers, including a gym and yoga studio.

A number of community service providers are located near the industrial precinct in Wickham. These providers are located on Albert Street adjacent to Wickham Park and to the east of the precinct, near Hannell Street. These include:

- Wickham KU preschool (Albert Street)
- Awabakal Newcastle Aboriginal Co-operative child care centre (Grey Street)
- The Mission to Seafarers (Hannell Street)
- Hunter Badminton courts (Albert Street)
- Canteen Australia and other youth services (Albert Street)
- Goodlife Church (Albert Street).

The main Newcastle diocesan centre for the Catholic Church, and the Sacred Heart Cathedral, are located on Hunter Street to the south-west of the proposal site.

11.3 Impact assessment

The main potential socio-economic impacts of the proposal include:

- impacts to the overall connectivity of the study area for train passengers
- impacts to access within the study area
- amenity impacts
- community safety
- impacts to local businesses
- broader economic impacts.

These potential impacts are considered below.

11.3.1 Construction

Rail passenger access and connectivity

At the beginning of the construction phase, passenger train services would cease operating east of Hamilton Station. As noted in section 5.4, people who currently travel by train to and from Wickham, Newcastle and Civic stations would need to change to buses at Broadmeadow or Hamilton stations. This could result in travel time increases for some passengers, depending on their origin and destination.

This increase in travel time may be compounded by confusion associated with the change in travel patterns. Providing adequate information and signage, and implementing a well designed and convenient shuttle bus system, would help to reduce these impacts

Further information on the impacts of the proposal on transport and access is provided in 7.3.1.

Access within the study area

During construction, local residents and businesses may have concerns about potential disruption and disturbances. Traffic impacts and route changes (e.g. as a result of the closure of the Railway Street level crossing) may result in impacts to access to residences, businesses, community and educational facilities located in the study area. However, these potential impacts would be temporary in nature and would be managed by the implementation of appropriate traffic control and access management measures contained in the CEMP. Communication and information provision would assist in minimising the impacts of the need to change travel modes. A comprehensive community and stakeholder consultation program would be implemented (as outlined in section 6) to assist in managing these impacts.

Amenity impacts

Construction of the proposal has the potential to result in short term impacts to the amenity of surrounding residents, visitors, customers and employees, particularly those occupying buildings located in close proximity to the proposal site. These potential impacts, which include traffic and access, noise and vibration, visual amenity and air quality impacts, are assessed in sections 7, 9, 10 and 13 respectively. Implementation of a comprehensive approach to environmental management during construction, together with a rigorous monitoring regime, would assist in minimising the potential significance of impacts to amenity. Further information on the approach to environmental management during construction is provided in section 15.

Community safety

The presence of construction activities can create a risk for people moving in the vicinity of construction sites and vehicles.

NSW workplace safety laws require construction sites to have adequate site security, which includes appropriate fencing. Construction of the proposal would be managed in accordance with the requirements of the WorkCover Authority of NSW and the *Work Health and Safety Act 2011* and the *Work Health and Safety Regulation 2011*.

All construction work would be isolated from the general public. The construction contractor would ensure that construction sites are secure at all times, and would take all possible actions to prevent entry by unauthorised persons.

Other potential safety impacts identified by the socio-economic assessment include the risk of anti-social behaviour and physical safety risks associated with changing transport modes at night time. The creation of well designed, located and equipped transport mode transfer areas would be the key to managing potential personal safety risks.

Local business impacts

Access would be maintained to businesses surrounding the proposal site during construction.

Local workers and customers may experience an increase in competition (with construction workers) for available parking spaces. This potential impact would be minimised by ensuring (as noted in section 7.4.1) that construction workers park their vehicles within the construction compound.

Broadmeadow and Hamilton stations would experience an increase in passengers during construction. This has the potential to generate positive impacts in terms of increased patronage for some local businesses in the vicinity these stations.

Businesses located in the vicinity of the proposal site and/or those on access routes to the site, particularly those providing goods and services (such as retail shops, take-away shops and cafes), may experience an increase in patronage as a result of the influx of the construction workforce to the study area.

Shuttle buses would replace train services during construction. The shuttle buses would operate until the light rail system is operational. Accordingly, no adverse impacts on businesses which currently rely on train passengers for custom are anticipated.

Broader economic impacts

As noted in section 5.3.4, the proposal would generate up to about 100 to 150 construction jobs. This would benefit both the local and regional economy. These jobs are only limited to the workforce that would be directly employed to construct the proposal and do not include jobs created through the supply of materials and delivery of materials (e.g. truck drivers). The industries which support the construction of the proposal would also experience economic benefits, through providing their services and personnel (e.g. trucks or materials).

11.3.2 Operation

Rail passenger access and connectivity

As noted in section 7.3.2, the proposal would result in a change in the public transport environment for residents, workers and visitors travelling to, from and within the area currently serviced by the Newcastle Branch Line. Train passengers wishing to travel to and from the Newcastle city centre would need to change transport modes (to bus and the future light rail system) at the new station at Wickham. The need to change modes results in increases to travel time. Similar travel time increases to those during predicted during construction would be experienced by travellers.

This potential impact needs to be viewed in the context of the decline in passenger numbers to and from Newcastle Station that has been experienced since 2004. Stations that have experienced significant increases in patronage would remain operational. The role of Wickham Station (which has experienced a growth in passenger numbers of about 60 per cent) would be reinforced through the provision of improved station facilities and the proposed transport interchange. The implementation of the various city centre urban renewal strategies and projects will continue to reinforce the increasingly important role of Wickham Station, and the proposal is consistent with these strategies.

Access within the study area

The proposal would have the potential to generate positive impacts in terms of local access and connectivity. It would provide the opportunity to open multiple, key at-grade access points across the rail corridor east of the new station at Wickham, linking Hunter Street to the foreshore, Queens Wharf and Honeysuckle Drive. These changes are expected to significantly improve access and travel for city residents, workers and visitors, and particularly those with limited mobility. Users of prams/strollers, mobility scooters and wheelchairs, whose access across the rail corridor is currently constrained by the existing pedestrian bridges, would particularly benefit.

Pedestrian links across the rail corridor would also improve linkages within and between local communities and businesses.

These access arrangements would be further developed and specified in the Residual Corridor Management Plan, which would be prepared during the detailed design phase.

Amenity impacts

Operation of the proposal has the potential to result in some impacts to the amenity of the community surrounding the new station at Wickham and the stabling yard, particularly those located in close proximity to the proposal site. These potential impacts include traffic, noise and vibration, and visual amenity impacts. These impacts are assessed in sections 7, 9 and 13 respectively.

Positive amenity impacts would be experienced by sensitive receivers surrounding the rail corridor and stations east of Wickham Station. These receivers are likely to experience a reduction in amenity impacts (such as noise, traffic and air quality) previously experienced as a result of the operation of the rail line.

Community safety

Existing community safety concerns related to the southern boundary of Wickham Park adjoining the railway corridor, including poor surveillance and the likelihood of increased pedestrian activity in the area, would be addressed during the detailed design phase.

Safety for users of the interchange, particularly during the night, would also be an important consideration during the detailed design phase. Crime prevention through environmental design (CPTED) features would be incorporated into the design. This would include consideration of the following four main CPTED principles:

- surveillance
- access control
- territorial reinforcement
- space management.

Economic impacts

The proposal would have the potential to create long term benefits for businesses in the vicinity of the new station at Wickham, which may experience increases in patronage as a result of people using, and travelling to and from, the new station and interchange.

As noted in section 7.3.2, the road changes that form part of the proposal would result in the loss of about 75 on-street car parking spaces in the vicinity of the new station at Wickham. Businesses near the new station may experience reduced parking availability in Station Street. However, there are considered to be sufficient on-street car parking spaces available in the overall area to offset these loses.

The proposal has the potential to generate broader positive economic impacts. It would contribute towards addressing the issues identified by, and achieving the urban renewal objectives of, the *Newcastle Urban Renewal Strategy* (Department of Planning and Infrastructure, 2012) and the Newcastle Urban Renewal and Transport Program. As noted in section 4.1, the proposal is needed to proceed with the revitalisation program proposed by the *Newcastle Urban Renewal Strategy*. It would also enable the key recommendations of other relevant strategies and plans to be achieved.

Consistent with these strategies, the proposal would provide for the future implementation of enhanced connections across the rail corridor in the city centre. Previous studies have identified that removing the physical barrier imposed by the heavy rail line has the potential to enhance investment and growth, and promote the efficient and cohesive functioning of the city centre.

The proposal would provide a new transport interchange at Wickham, which is a key area for renewal and future urban growth and development under the renewal strategies. The new interchange and station facilities would have the potential to generate future growth and investment in this area.

11.4 Mitigation measures

11.4.1 Detailed design

The following measures would be implemented during the detailed design phase:

- The design of the proposal would have regard to crime prevention through environmental design features, and the design features recommended by the socio-economic impact assessment report (Technical Paper 4).
- During detailed design, local businesses and the community would continue to be consulted regarding the potential impacts of the proposal. Where practicable, measures to address these impacts would be incorporated into the design.

11.4.2 Construction

The following measures would be implemented during construction:

- Community and stakeholder consultation would continue to be undertaken in accordance with the Community and Stakeholder Engagement Strategy.
- The shuttle bus routes would be finalised in consultation with key stakeholders.
- Further consultation with relevant stakeholders would be undertaken during development of the detailed construction methodology.
- Further consultation with the Transport for NSW Accessible Transport Advisory Committee would be undertaken during development of the detailed methodology.
- Potentially impacted stakeholders, and those with an interest in the proposal, would continue to be consulted in accordance with the community and stakeholder engagement strategy developed for the proposal. This would include notifications and advice regarding alternative arrangements to address accessibility.
- Contact details for a 24-hour project response line and email address would be provided for ongoing stakeholder contact throughout the proposal.

11.4.3 Operation

The following measures would be implemented during operation:

- The shuttle bus routes would be finalised in consultation with key stakeholders to maximise passenger transfer efficiencies and safety.
- The residual corridor management plan would be developed with consideration of the recommendations of the socio-economic assessment to enhance future access within the city centre.

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12. Visual impact and urban design assessment

12.1 Assessment approach and methodology

A visual impact and urban design assessment of the proposal was undertaken by GHD. A technical report is available as 'Technical Paper 5 – Visual and Urban Design Assessment' on the Transport for NSW website (www.transport.nsw.gov.au). A summary of the results of the assessment is provided in the following sections.

The assessment involved:

- a desktop study and site visit
- photographic inventory
- discussion of urban character areas
- identification of representative viewing locations
- review of relevant urban design considerations
- a discussion of the potential impacts of the proposal
- provision of mitigation measures to minimise the potential for negative impacts and enhance the potential for positive impacts of the proposal.

12.2 Existing environment

12.2.1 General visual character

The existing visual environment of the study area is characterised by its highly developed urban nature and railway uses. Key viewing locations include view corridors (mainly along roads and through open areas) and elevated structures on Maitland Road and Beaumont Street. The key features of the existing visual environment relevant to the assessment include:

- narrow roads to the north of Station Street with a mix of residential and commercial land uses, which are generally single storey in height
- a multi-storey car park to the south of the proposed location of the new station at Wickham, adjacent to the heritage listed (refer to section 8.2.1) former Newcastle Co-Operative Building (both buildings are three storeys in height)
- Stewart Avenue to the east, comprising a major road level crossing
- Cooper Street, which visually connects Hunter Street to the proposal site
- Beaumont Street and the existing Hamilton Station precinct to the west
- Wickham Park to the north.

The vegetation in the study area varies from grassed ovals with ornamental trees (Wickham Park), planted exotic street trees, exotic grasses and hedges. Some landscaping also occurs along streets and private open space in adjacent residential and commercial areas. Generally, vegetation within the rail corridor consists of scattered trees with exotic grasses. These provide some visual screening to adjacent properties. The proposal site has very limited vegetation cover, comprising a few scattered trees and some limited grassed areas.

12.2.2 Urban character areas

For the purposes of the assessment, two visual character areas were identified. These are areas with similar visual and urban design characteristics. These character areas are described briefly below. Further information is provided in Technical Paper 5.

Wickham

The character of this area is influenced by the mixed use nature of its built form. Long vistas are generally defined by the wide, straight, rail corridor and by building heights of up to three storeys to the south. The visual amenity of the area is influenced by extensive road and rail infrastructure, guard rails and fencing, wide pavements, side roads lined with parked cars, and intermittent street trees.

Views are dominated by traffic infrastructure, signage and some pedestrian activity along Stewart Avenue. Views to the north/north west are generally more open than to the south/south-east.

In general, this area is characterised by:

- an open urban setting and public realm of average quality
- some pedestrian linkages at the street level
- a partial sense of place
- limited landscape elements
- a number of heritage buildings, including Wickham Station.

This area is considered to be moderately sensitive to change.

Hamilton

The character of the area surrounding the station is influenced by the footbridge, level crossing, car parking, and built form of the heritage listed Hamilton Station. In general, this area is characterised by:

- the main road, railway station and associated infrastructure, which dominate views within the area.
- the public domain, which is mostly limited to footpaths on either side of the road, a footbridge at Hamilton Station, and parkland to the south of the station
- footpath finishes, which are variable in quality
- buildings lining Beaumont Street, which are generally two stories in height with some areas of uniform frontages.
- The Sydney Junction Hotel and Hamilton Junction Hotel are notable contributors to the urban form.
- Hamilton retains a visually distinctive ‘village’ character, pedestrian scale and local sense of place, particularly in the vicinity of Beaumont Street.

This area is considered to be moderately sensitive to change.

12.2.3 Representative viewing locations and sensitive receivers

The sensitive receivers for the proposal include:

- commercial properties that adjoin the proposal site
- residential dwellings that adjoin the proposal site

- road users, train passengers and pedestrians
- users of recreation areas near the proposal site.

The identified representative viewing locations are listed below and shown in Figure 12.1:

- **Beaumont Street near the rail corridor** – views from this location are experienced by pedestrians and occupants of vehicles
- **Eva Street, Hamilton** – views from this location are experienced by residents in close proximity to the rail corridor
- **Fern/ Ivy Street, Hamilton**– views from this location are experienced by pedestrians, occupants of vehicles, and residents in close proximity to the rail corridor, including those on Fern Street
- **Maitland Road overbridge** – views from this location are experienced by vehicle occupants and pedestrians
- **Wickham Park** – views are experienced by park users, with short term views and low visual sensitivity
- **Station Street, Wickham** – views from this location are experienced by pedestrians, occupants of vehicles, and residents in close proximity to the rail corridor
- **Stewart Avenue, Wickham** – views from this location are experienced by vehicle occupants and pedestrians, and local residents.

In general, pedestrians and vehicle occupants have short term views and low visual sensitivity. Users of recreation areas have short to medium term views and medium visual sensitivity. Residents have longer term views and high visual sensitivity.

Further information on the characteristics of the viewing locations is provided in the technical report.

12.2.4 Relevant urban design principles

The urban design principles to be adopted during the design process are outlined in the *Newcastle Light Rail Project Definition Report* (GHD, 2014). The design of the proposal would:

- be consistent with the principles and strategies of the *Newcastle Urban Renewal Strategy*
- recognise the future significance of the Wickham area in the Newcastle city centre urban renewal process
- enhance the immediate and broader urban context
- take into account heritage considerations
- provide for an activated public domain, improved transport opportunities and pedestrian connectivity to existing and proposed local precincts.

12.1 Representative viewing locations

12.3 Impact assessment

12.3.1 Construction

The proposal would generate temporary visual impacts during the construction period. Impacts would be experienced in the vicinity of work sites, and from the identified viewing locations. During construction, visible elements would include work sites, machinery and equipment, waste materials and partially constructed structures.

The potential impact on the identified receivers would depend on the nature and intensity of the works at a particular time. Impacts would be more significant at locations where residential or other sensitive receivers have an unscreened view of the proposal site.

Construction of the proposal would have the potential to generate visual impacts, mainly due to the proximity and presence of sensitive residential receivers in the vicinity of the proposal site. The change in visual environment is generally likely to be viewed from a relatively short distance. However, impacts would be temporary and limited to the construction period. In addition, construction would be viewed within the context of a highly developed and dynamic urban environment, where construction and associated works are frequent occurrences. The site is also an existing railway.

There may also be potential for some light spill impacts associated with lighting required to carry out any night works and for driver safety. However the rail corridor is currently generally well lit at night and additional lighting would not result in a significant increase in light spill. In addition, directional lighting would be used to avoid any unnecessary light spill.

Tree removal would be avoided where possible. In the event that removal is required, the contractor would obtain approval from Transport for NSW by submitting an ‘Application for Removal or Trimming Vegetation’. Any trees subject to removal would be replaced in accordance with Transport for NSW’s *Vegetation Offset Guide*.

12.3.2 Operation

Key design features of the proposal are described in section 5.2. An indication of the proposed design for the new station at Wickham is provided in Figure 5.3. A photomontage of the proposed Hamilton stabling yard is provided in Figure 12.2.

Once constructed, the visual impacts of the proposal would be mainly associated with:

- the presence of the new station building and facilities at Wickham, and trains using the new station
- an increase in passengers, buses and cars using the interchange and surrounding area
- the new stops and infrastructure associated with the interchange, including additional paving, signage and landscaping
- the new stabling facilities near Hamilton Station and trains using these facilities.

The following potential impacts may result during operation:

- re-introduction of a stabling yard at Hamilton with prolonged viewing opportunities of trains in the yard
- increased light levels in areas subject to artificial lighting
- decreased solar access as a result of overshadowing from the new station buildings
- loss of privacy due to the proximity of vehicles and pedestrians to dwellings
- obstruction of locally important views by structures or vehicles
- some loss of existing landscaping vegetation and street trees within the rail corridor, on Station Street north of the new station, and in Fern Street to the north of the stabling yard.

Figure 12.2 Photomontage of stabling yard viewed from Fern/Ivy Street

Potential visual impacts may arise from the construction of new structures and associated infrastructure in the landscape. As noted in section 5.2, the appearance and visual form of the main above ground features have been, and would continue to be important considerations in the design process. The new station structure would be designed to be consistent with the existing visual environment, which is dominated by rail infrastructure and nearby multi-storey buildings in the vicinity.

The design of the new station at Wickham would continue to be refined during the detailed design phase. The final design would continue to take into account all relevant considerations, including urban design and visual impacts. The design would also take into account the location of the station within the Newcastle City Centre Heritage Conservation Area (refer to section 8.2).

The design of the new station and infrastructure facilities provides an opportunity to reinforce the role of the Wickham area in the city centre urban renewal process. These facilities would provide an important focus for the area, enabling the implementation of a visually cohesive and legible form, or sequential areas and streetscape/public realm themes around the new station at Wickham. This may include provision for new and better quality open spaces of a ‘people scale’ with pedestrian priority and linkages.

12.4 Mitigation measures

12.4.1 Detailed design

An urban design and landscaping plan would be developed during the detailed design phase to address the following:

- Strategic use of materials that blend, enhance and/or complement existing surfaces and minimise additional visual clutter.
- Materials, finishes, colour schemes and maintenance procedures including graffiti control for new walls, barriers and fences.
- Directional lighting mounted to avoid unnecessary direct light spill into sensitive receivers such as residences.
- Preservation of trees, landscape treatments and street tree planting to integrate with surrounding streetscape design detail that is sympathetic to the amenity and character of the local heritage items.
- Strategic location of signage and lighting to avoid unnecessary impact on views.
- Total water management principles to be integrated into the design where considered appropriate.
- Barriers, railings, fences and walls would be design to complement the visual environment.
- Heritage significance of the Newcastle City Centre Heritage Conservation Area.
- Design measures included to meet the *NSW Sustainable Design Guidelines* (Transport for NSW, 2014a).

12.4.2 Construction

The following measures would be incorporated into the CEMP and implemented during construction:

- Work sites would be screened by fencing or placement of hoardings where practicable. Machinery, plant and equipment would be contained within these hoardings where practicable.
- Work sites would be maintained in a clean and tidy condition at all times.
- Work methods for excavation and other works with the potential to impact on trees would be developed to avoid street trees and their roots where practicable.
- Any pruning or removal of trees would be undertaken by a qualified arborist.
- Any trees requiring removal would require an approval through the Transport for NSW Application for Removal or Trimming of Vegetation.
- In the event that trees are removed, they are to be replaced in accordance with Transport Project Division’s vegetation offset guide and in consultation with Council as required.
- Directional lighting would be mounted to avoid light spill into adjoining residences.

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13. Sustainability and waste

13.1 Assessment approach and methodology

This section considers the application of sustainability principles to the proposal, and the opportunities to achieve Transport for NSW's sustainability targets and outcomes. A sustainability assessment of the proposal against the *NSW Sustainable Design Guidelines* (Transport for NSW, 2014a) was undertaken by URS (URS, 2014a). The results of the assessment are summarised in the following sections.

This section also considers the potential opportunities that the proposal presents in terms of managing the waste, materials and emissions that would be produced, and the opportunities to take into account the potential impacts of climate change.

13.2 Sustainability context for the proposal

13.2.1 Ecologically sustainable development

The *National Strategy for Ecologically Sustainable Development* (Ecologically Sustainable Development Steering Committee, 1992) defines ecologically sustainable development as 'using, conserving and enhancing the community's resources so that the ecological processes, on which life depends, are maintained and the total quality of life, now and in the future, can be increased'.

The concept of ecologically sustainable development gives formal recognition to environmental and social considerations in decision-making to ensure that current and future generations enjoy an environment that functions as well as, or better than, the environment they inherit.

As noted in section 3.1.3, the principles of ecologically sustainable development are generally defined by clause 7(4) of schedule 2 to the Regulation as

- the precautionary principle
- inter-generational equity
- conservation of biological diversity and ecological integrity
- improved valuation and pricing of environmental resources.

Sustainability in Transport for NSW

Transport for NSW's approach to sustainability is underpinned by a series of themes and objectives which define the approach to the delivery of sustainable assets. The following themes form the basis of the sustainability indicators and targets (Transport for NSW, 2013):

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

In line with this sustainability commitment, and to recognise these targets in its infrastructure projects, Transport for NSW developed the *NSW Sustainable Design Guidelines* (Transport for NSW, 2014a). The guidelines are divided into seven sustainability themes (with several sub-themes) and include compulsory and discretionary initiatives in relation to:

- energy and greenhouse gases
- climate resilience
- materials and waste
- biodiversity and heritage
- water
- pollution control
- community benefit.

The guidelines encompass sustainability initiatives relevant to stations, transport interchanges, commuter car parks, maintenance facilities, civil infrastructure, tunnels and light rail.

Compulsory initiatives may relate to a corporate target or are considered to be fundamental to the delivery of sustainable assets. If an initiative is considered applicable, then it must be completed. A discretionary initiative may not be practical for a particular project or be the most appropriate initiative to meet a sustainability outcome. Written justification must be provided if a discretionary initiative has not been selected for implementation.

Projects can achieve a score of bronze, silver, gold, or platinum based on their selection of discretionary sustainable initiatives.

13.3 Assessment

13.3.1 Sustainability

The results of the sustainability assessment identify both compulsory and discretionary initiatives that can be adopted within each discipline across the project, and when these initiatives need to be considered in the design process. The results indicate that a silver rating is achievable for the proposal, and it may also be possible to achieve a gold rating by incorporating additional discretionary measures subject to further investigation (URS, 2014a). Consideration has also been given to the project stage and site selection. An additional initiative is consideration of the potential for earthquake impacts on structures.

The sustainability assessment would be updated as the proposal progresses.
The Sustainability Manager for the project would undertake review and consultation with the relevant members of the design team throughout the development process. This process would evaluate where initiatives are being implemented, in addition to promoting continuous improvement and innovation. If a sustainability initiative has not been incorporated, an explanation as to why it has not been incorporated into the project would be required to be documented as part of the design process.

As noted in section 5.2.2, Transport for NSW also intends to seek certification of the proposal from the Infrastructure Sustainability Council of Australia for an Infrastructure Sustainability rating.

13.3.2 Materials and waste

Waste generation during construction

Construction would have the potential to generate the following wastes:

- spoil from excavation
- surplus concrete, bricks and roofing materials
- electrical cabling from installation of wiring
- possible industrial waste such as lubricating oils, hydraulic fluids and cleaning agents
- vegetation
- wastewater
- general litter, including glass, plastic, metal and paper waste.

Potentially contaminated material and/or spoil such as oil-filled equipment or asbestos containing materials may also be encountered during construction (refer to section 14.4).

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

Waste generation during operation

Operation would have the potential to generate the following wastes:

- general litter including glass, plastic, metal and paper waste
- waste associated with maintenance activities (e.g. replacement of ballast, lubricating oils, cleaning agents).

Approach to management

The *NSW Sustainable Design Guidelines* (Transport for NSW, 2014a) includes materials and waste as a sustainability target, with the objective of meeting or exceeding prevailing waste management standards.

All waste materials produced by the proposal would be assessed, classified, managed and disposed of in accordance with the *Waste Classification Guidelines* (DECCW, 2009) and the waste management hierarchy (see Figure 13.1). Any waste material identified as being contaminated would be managed in accordance with the *Contaminated Land Management Act 1997* and other relevant legislation.

Separation of materials at the source of generation enables simpler, cheaper and more effective processing. Appropriate waste segregation systems would be implemented on site. A waste management plan would be developed identifying potential waste streams, quantities and destination of removal, consistent with the waste hierarchy and recycling and reuse targets.

Figure 13.1 The waste management hierarchy

13.3.3 Greenhouse gas emissions reduction

The proposal would result in greenhouse gas emissions during construction and operation as a result of the movement of plant and machinery, and operation of the transport facilities.

The consumption of fuel is a necessary requirement for vehicles and equipment used. However, a reduction in the quantity of fuel consumed may be achieved by optimising work activities and logistics. A small reduction in fuel consumption may also be achieved by the use of more efficient plant and vehicles. Newer vehicles and plant models are typically more fuel efficient than the older models. Avoiding prolonged idling of equipment when not in use would result in benefits including reducing fuel consumption and the potential for noise impacts.

The use of biodiesel in plant and equipment would assist in reducing the generation of greenhouse gases. Biodiesel blends (diesel that has a percentage of the fuel replaced with biodiesel) also has the potential to reduce greenhouse gas emissions in fuel consumption. However, this would be dependent on a number of factors including the origin of the biodiesel feedstock.

Overall, greenhouse gas emissions resulting from construction would be relatively low and produced over a short time period, and are therefore unlikely to contribute significantly to overall greenhouse gas emissions.

A greenhouse gas and carbon footprint assessment would be undertaken during the detailed design stage, in accordance with Transport for NSW's *Greenhouse Gas Inventory Guide for Construction Projects* and the *NSW Sustainable Design Guidelines*. This assessment would evaluate the sources of greenhouse gas emissions during the construction and operation phases, including:

- direct emissions from construction activities, such as the combustion of fuel in construction plant/vehicles and vegetation clearing
- indirect emissions from the use of electricity on-site and the disposal of waste
- embodied energy (and associated greenhouse gas emissions) in construction materials (the energy and resources that were consumed to produce a particular construction material)
- emissions produced from day-to-day operations.

The greenhouse gas assessment would identify a range of mitigation measures to reduce the volume of greenhouse gas emissions, which would be implemented during construction and operation.

13.3.4 Climate change

A climate change risk assessment would also be undertaken during the detailed design stage, in accordance with the *NSW Sustainable Design Guidelines*. The assessment would identify potential physical climate change impacts on the proposal, and associated impacts for the proposed infrastructure.

Extreme, high and medium risks and impacts would be identified, and mitigation measures would be implemented to reduce the impacts of climate change.

13.4 Implementation and mitigation measures

13.4.1 Construction

The following mitigation measures would be implemented during construction.

Sustainability

- Sustainable design and construction of the proposal would be in accordance with the *NSW Sustainable Design Guidelines*. Initiatives recommended by the sustainability assessment (URS, 2014a) to achieve a rating level of ‘silver’ would be implemented.
- The sustainability initiatives would be regularly reviewed, updated and implemented throughout the design development and construction phases.
- The detailed design of the proposal would aim to achieve an ‘excellent’ rating using the Infrastructure Sustainability Council of Australia’s infrastructure sustainability rating tool.

Waste management

- A waste management plan would be prepared as part of the CEMP and in accordance with the *Waste Classification Guidelines* (DECCW, 2009a). The plan would set targets for waste diversion, demonstrate how targets can be achieved, and outline how waste diversion would be tracked and reported. The plan would include the measures outlined below.
- Resource management hierarchy principles would be followed:
  - avoid unnecessary resource consumption as a priority
  - avoidance is followed by resource recovery (including reuse of materials, reprocessing, recycling and energy recovery)
  - disposal is undertaken as a last resort.
- Waste material would not to be left on site 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.
- Waste material, including soil and spoil that taken off site would be classified and managed in accordance with the *Waste Classification Guidelines* (DECCW, 2009) and would be disposed of in accordance with the *Protection of the Environment Operations Act 1997*. All waste documentation would to be collated in accordance with these guidelines and provided to Transport for NSW as requested.

- 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 useable 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.
- 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.*

Climate change and greenhouse gas emissions

- A carbon foot printing exercise, compliant with ISO 14064 Part 2 (Greenhouse gases – project level), would be undertaken in accordance with Transport for NSW’s *Greenhouse Gas Inventory Guide for Construction Projects* and the *NSW Sustainable Design Guidelines*. The carbon footprint would be used to inform decision-making in design and construction. Standard carbon coefficient values would be used for construction material and fuel usage.
- Opportunities to reduce operational greenhouse gas emissions would be investigated during detailed design. These would include the initiatives documented in the sustainability assessment (URS, 2014a).

13.4.2 Operation

The following mitigation measures would be implemented during operation.

Sustainability

- The sustainability initiatives would be regularly reviewed, updated and implemented throughout operation.

Waste management

- Waste would be managed in accordance with NSW Trains operating procedures and the *Waste Classification Guidelines* (DECCW, 2009).

14. Assessment of other environmental impacts

14.1 Overview

Sections 7 to 13 address what are considered to be the main potential environmental issues associated with the proposal. In addition to these potential impacts, a range of other issues have been considered to develop a comprehensive environmental management framework for the proposal. These issues include:

- water quality and groundwater, hydrology and flooding
- geology and soils
- contamination and hazardous materials
- Aboriginal heritage
- flora and fauna
- cumulative impacts
- infrastructure and services.

This section considers the nature of these issues and the management measures proposed to manage the potential impacts of the proposal.

Clause 228 of the Regulation lists, for the purposes of Part 5 of the EP&A Act, the factors to be taken into account when considering the likely impact of an activity on the environment. Appendix A considers the potential impacts of the proposal against these factors.

14.2 Hydrology, water quality and groundwater

14.2.1 Existing environment

Drainage and watercourses

The proposal site is located within the Throsby/Styx and Cottage Creek catchments. Throsby/Styx Creek has a catchment area of about 3,000 hectares and Cottage Creek has a catchment area of about 800 hectares. Both catchments are substantially developed and are drained by concrete pipe and open channel drainage systems. Both catchments drain into Newcastle Harbour.

Cottage Creek is located about 250 metres to the east of the eastern end of the proposal site. Styx Creek is located about 500 metres to the west of the proposal site. The confluence of Styx and Throsby Creeks is located about 600 metres to the north of the western end of the proposal site. The location of these creeks is shown in Figure 14.2.

Flood risk

The potential for flooding of the proposal site has been determined based on a review of the *Newcastle City-wide Floodplain Risk Management Study and Plan* (BMT WBM, 2012a), the *Lower Hunter Flood Study* (NSW Public Works, 1994), the *Hexham Relief Roads Flood Impact Assessment* (BMT WBM 2012b) and the *Newcastle Heavy Rail Truncation Definition Report* (URS, 2014c).

There are two main stormwater drainage pipes that run along the southern and northern boundaries of the railway corridor. These pipes receive surface water flows and direct them east towards Cottage Creek which outlets into Newcastle Harbour.

The proposal site is considered to be prone to flash flooding due its flat and relatively low-lying nature. During heavy rainfall, stormwater may pond in the proposal site area and cross-connections between floodwaters from the Throsby/Styx and Cottage Creek catchments are known to occur during major storm events.

As shown in Figure 14.1, flash flooding is most likely to be an issue at the eastern end of the proposal site, with the western end less impacted. Based on the flood modelling information reviewed for the project, the depth of water in the vicinity of Wickham Station is estimated to be about 600 millimetres during the 100 year average recurrence interval (ARI) event. It should be noted that, in this area, the proposed rail levels are similar to the existing rail levels.

For the 100 year ARI event, the proposal site is classified as high hazard by the *NSW Floodplain Development Manual* (DIPNR, 2005). This is a result of the potential depth of floodwaters and the limited warning time associated with flash flooding events. West of Railway Street, the proposal site is defined as low hazard.

Under the NSW Floodplain Development Manual, low hazard is defined as areas where 'should it be necessary a truck could evacuate people and their possessions; able bodied adults would have little difficulty in wading to safety'. High hazard is considered to be areas where there is 'possible danger to personal safety; evacuation by trucks difficult; able bodied adults would have difficulty in wading to safety; potential for significant structural damage to buildings'.

Flow paths

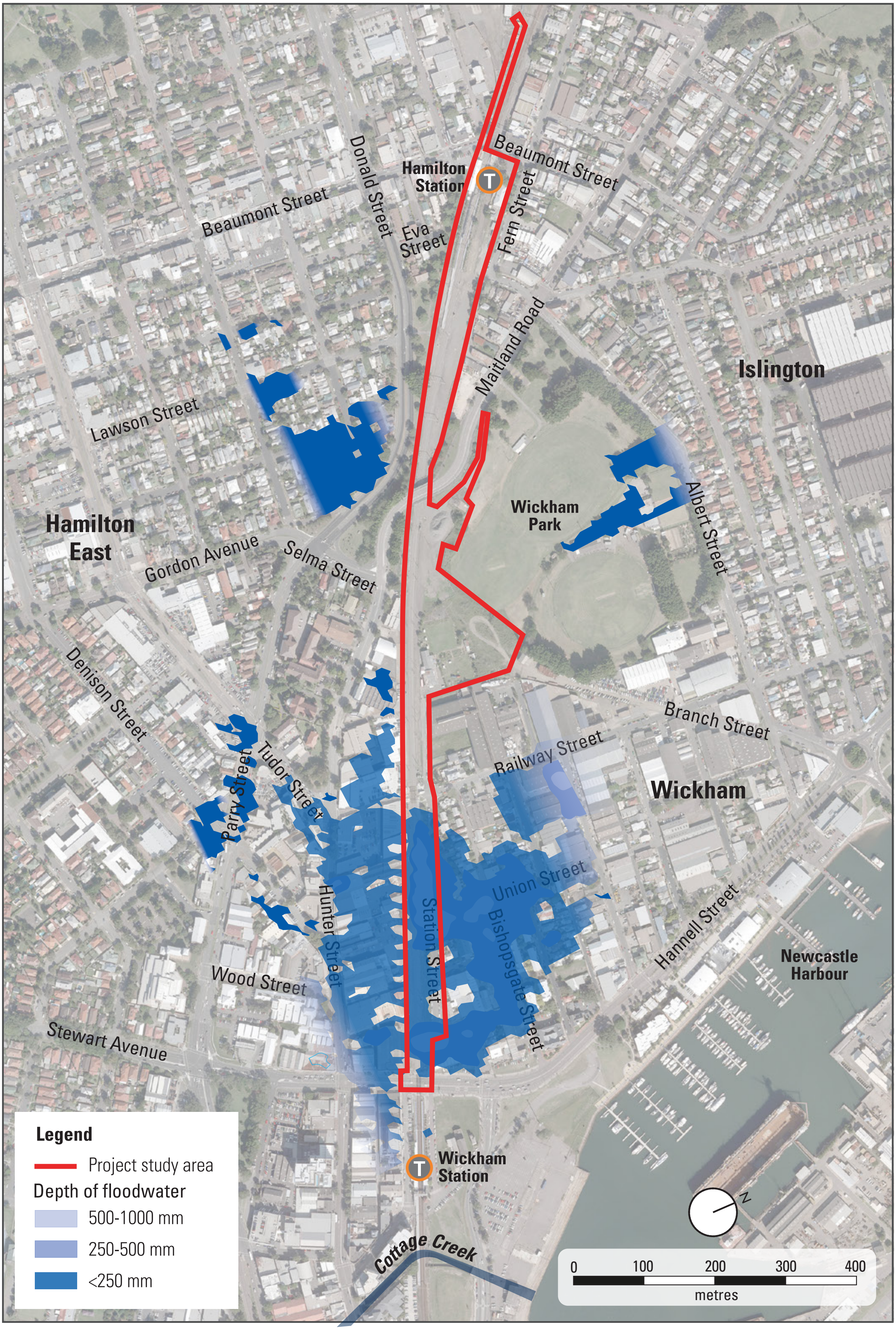
The reports reviewed indicate that the proposal site does not contain a floodway, and high velocity flow across the proposal site is unlikely. Flash flood water would pond in depressions and then drain slowly away. If the duration of the rainfall increased, inundation of the eastern end of the proposal site is likely, due to the inflow of water from the surrounding area. This would be most likely to occur near the Stewart Avenue level crossing.

Flooding events from the ocean would initially be caused by backwater from Newcastle Harbour flowing through existing pipes and channels in the study area. If the water level in the harbour exceeded the ground level, overland flow would reach the proposal site. This flow would be at low velocity.

Water quality

There is limited water quality data available for Throsby/Styx Creek and Cottage Creek. Council has water quality averages for the period between 1995 and 1997, however not enough data was collected to detect any trends and the time period is not recent.

Gross pollutants, nutrients, erosion and sedimentation, heavy metals, litter, and microbiological contamination are the major pollutants within Newcastle's waterways, which are typical of most urban waterways (City of Newcastle, 2004).



14.1 100-year ARI flooding extent

Groundwater

A search of the groundwater monitoring well register of NSW Water's Groundwater Atlas Database was undertaken by URS (URS, 2014a). Nine groundwater bores were identified, with two bores located within Dangar Street near the eastern end of the proposal site. The depth to groundwater was identified to be between 1.3 and two metres below ground level. Four bores were identified for domestic use (located between 60 and 810 metres from the proposal site); four were identified as monitoring bores (two on-site and two about 490 metres from the proposal site); and one was a test bore (located about 120 metres from the proposal site).

14.2.2 Impact assessment

Construction

Hydrology and drainage

Construction may result in temporary impacts to the behaviour of the local surface water systems. These impacts could include a temporary loss of floodplain storage and temporary redistribution of flood flows as a result of the presence of stockpiles and works within flow paths. These impacts would be short term and temporary, and would only be an issue if a flood event occurred during construction.

The measures provided in section 14.2.3 would be implemented to minimise the potential for impacts in the event of a flood event.

Water quality

Construction of the proposal would involve disturbance of the ground surface. This has the potential to impact on water quality. The main potential impacts relate to soil disturbance, which represents a risk to surface water quality, and runoff during construction. Pollutants such as sediment, soil nutrients and construction waste have the potential to mobilise and enter drainage lines, particularly during high rainfall events.

Potential impacts associated with increased sediment loading include increased turbidity and an increased potential for the transport of contaminants bound to sediment particles. The transportation of contaminated soil from construction sites (if present) could also affect waterways outside of the proposal site, if the contaminants escape containment measures.

Water quality impacts could also potentially occur during construction as a result of contamination by fuel or chemical spills from construction vehicles.

Although the proposal has the potential to temporarily increase impacts to water quality from pollutants and run-off, it would not be expected to cause significant impacts to the overall condition of surrounding waterways. As noted above, the existing water quality in Throsby/ Styx and Cottage Creeks is considered to be poor. Construction is unlikely to result in any long term hydrology or water quality impacts in the study area.

The risk of water quality impacts, and the significance of any impacts that may occur, would be minimised by implementing the mitigation measures provided in section 14.2.3.

Groundwater

Bored piling would be required to construct the new station at Wickham. Intercepted groundwater would either be left in place, to be displaced during placement of concrete, or (if required) would be dewatered and temporarily stored prior to disposal.

Any dewatering that may be required is likely to be superficial and associated with managing local and recent rainfall at the worksite.

The measures provided in section 14.2.3 would be implemented to minimise the potential impacts on groundwater.

Operation

Hydrology and drainage

The proposal would slightly reduce the available flood storage capacity of the study area as it would involve development of an additional area within the temporary flood storage area.

Minor changes to existing local flood flow patterns may result from construction of the station structure and modifications to the northern abutment of the Maitland Road overbridge. Additionally, there would be a slight increase in runoff as a result of an increase in the impervious surface. However these impacts are not likely to be significant, as the increase in impervious surfaces is likely to be minimal.

The proposal would change existing local drainage patterns and flows as a result of the need to make adjustments to cross and longitudinal track drainage. However, these changes are likely to be augmentations of existing drainage lines, and with the adoption of relevant design standards, no significant changes to flow quantities and velocities are likely.

Water quality

There is potential for stormwater run-off to be contaminated by oils, greases and gross pollutants from activities within the rail corridor, such as:

- chemical spills/leaks from rail maintenance vehicles/trains
- lubricating mechanisms for new turnouts (the intersection and mechanisms for the meeting of two rail tracks).

These impacts would already occur as a result of existing rail corridor operations and are unlikely to substantially increase as a result of the proposal.

Groundwater

There would be no impacts on groundwater during operation.

14.2.3 Mitigation measures

Detailed design

- The retaining walls and/or embankments would be designed to minimise the potential loss of flood storage.
- All track drainage would be designed to meet relevant Transport for NSW standards and the requirements of *Australian Rainfall and Runoff* (Engineers Australia, 1999).

Construction

Water quality management

- An erosion, sediment control and water quality management plan would be prepared as part of the CEMP. It would include the following measures:
  - Sediment and erosion control devices would be installed to minimise mobilisation and transport of sediment in accordance with *Managing Urban Stormwater, Soils & Construction* (Landcom, 2004).

- Maintenance and checking of the erosion and sedimentation controls would be undertaken on a regular basis and any subsequent records retained. Sediment would be cleared from behind barriers/sand bags on a regular basis as required and all controls would be managed to ensure they work effectively at all times.
- Exposed surfaces would be stabilised, and final landscaping implemented, as soon as practicable.
- Erosion control devices would be removed as part of final site clean-up. This would include removing any sediment in drainage lines which has been trapped by erosion control devices, and restoring disturbed areas.
- Upstream water flows would be diverted around the worksite in accordance with *Managing Urban Stormwater, Soils & Construction*.
- Spill kits would be maintained on-site at all times.
- Machinery would be checked daily to ensure that no oil, fuel or other liquids are leaking.
- Refuelling of plant and equipment would be undertaken within designated areas with appropriate controls.
- Visual monitoring of local water quality (i.e. turbidity, hydrocarbon spills/slicks) will be undertaken on a regular basis to identify any potential spills.
- Vehicle wash down and/or cement truck washout would occur in a designated bunded area or off-site.

Hydrology and flooding

- The existing drainage systems would remain operational during construction.
- A flood evacuation plan would be prepared and included in the CEMP.
- No stockpiles of materials or storage of fuels or chemicals would be located within high/medium flood risk areas or flow paths.
- Where practicable, site offices and facilities would be located above the 100 year ARI flood level.

Groundwater/dewatering

- If dewatering is required during construction, the water would tested (and treated if necessary) prior to re-use, discharge or disposal in accordance with the testing results.
- All water discharges would be undertaken in accordance with Transport for NSW's *Water Discharge and Re-use Guideline* (2012).

Operation

The proposal would be managed in accordance with NSW TrainLink's existing environmental management system.

14.3 Geology and soils

14.3.1 Existing environment

Topography/landform

The proposal site is generally flat to gently undulating. Slopes are generally less than two per cent and local relief is less than one metre, with elevations of about two metres near Stewart Avenue rising to about 10 metres west of Hamilton Station.

Geology and soils

Subsurface conditions comprise fill over alluvial soils deposited and reworked by the Hunter River over thousands of years. Alluvial soils overlie bedrock of Newcastle Coal Measures. The top of the bedrock, which comprises interbedded sandstone, siltstone and coal, is around 30 to 40 metres below the ground surface.

Mapping of soil landscapes in the study area (DLWC, 1995) indicates that the soil types present are the Hamilton residual soil landscape and its alluvial variant. Subsurface conditions are likely to comprise varying degrees of surface disturbance and filling over low lying Quaternary aged alluvial soils, characterised by thick layers of sand and silty sand, overlying estuarine silt and clay.

Acid sulphate soils

Acid sulphate soils are acidic soils resulting from the aeration of soil materials that are rich in iron sulphides. Acid sulphate soil risk mapping prepared by CSIRO indicates there is a low probability of encountering acid sulphate soils in the north-western portion of the proposal site (broadly to the west of Railway Lane – refer to Figure 14.2). If acid sulphate soils are present in this area, they are likely to be found at depths greater than three metres below the ground surface.

The mapping indicates that there is a high probability of acid sulphate soils being present over the south-eastern portion of the proposal site (refer to Figure 14.2). If acid sulphate soils are present in this area, they are likely to be found at between one to three metres below the ground surface. The remainder of the proposal site is indicated as a low risk of acid sulphate soils being present.

Further testing would need to be undertaken to confirm the actual presence of acid sulphate soils.

14.2 Acid sulfate soils

Abandoned coal mining and mine subsidence

Abandoned coal mine workings are known to exist beneath and adjacent to the proposal site. The mine workings are within the borehole seam of coal located at a depth of about 50 to 60 metres, associated with three historical collieries:

- Ferndale Colliery, which was located to the north of Maitland Road and the existing rail tracks in the Wickham Park area
- Wickham and Bullock Island Colliery, which was located to the east of Hannell Street, Wickham
- Hamilton No. 2 Colliery, which was located south of Maitland Road and Hunter Street.

The Ferndale Colliery workings resulted in three subsidence events in the Wickham Park area in August 1890.

A portion of the proposal site, broadly between the Maitland Road overbridge and Railway Street, is located within the Newcastle Mine Subsidence District (refer to Figure 14.3).

Mapping prepared by the NSW Mine Subsidence Board indicates that a small section of the proposal site north of the existing rail corridor, in the area of the former Morrow Park Bowling Club, is located in an area where the Mine Subsidence Board's 'category D' restrictions apply to surface construction. As noted in Table 3.1, Transport for NSW would consult the Mine Subsidence Board prior to the commencement of construction. The Board would advise the nature of the category D restrictions and their relevance to the proposal during this consultation. However, informal consultation with the Board indicates that the category D restrictions generally only apply to multi-storey developments, and would be unlikely to apply to the proposal.

14.3.2 Impact assessment

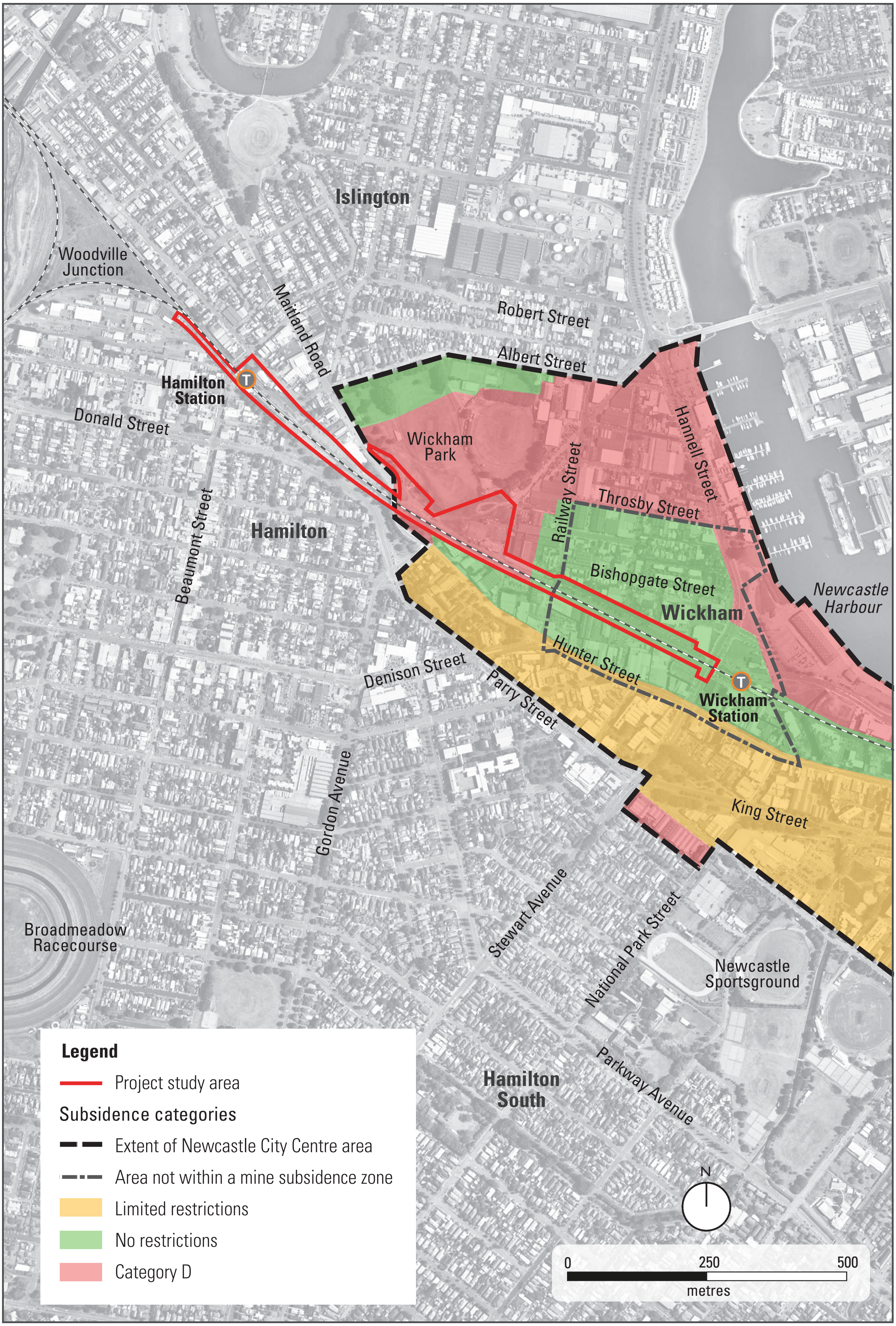
Construction of the proposal would involve disturbance to the ground surface and subsurface. Excavation associated with the proposal would be limited to excavations for structure footings, service trenches and pavements. No basement excavations or bulk excavation is proposed. The majority of excavations are expected to be less than 1.5 metres deep.

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.

These impacts are considered to be minimal, as exposure of soil and the stockpiling of spoil would be temporary and short-term in duration, and the potential for impacts would be managed by the implementation by the measures provided in section 14.3.1.

It is expected that the majority of spoil would be used as backfill. Excess spoil not required or able to be used as backfill would be stockpiled in a suitable location. It would either be reused elsewhere (if appropriate) or removed from the proposal site, and disposed of at an appropriately licensed facility.



14.3 Mine subsidence areas

Other potential impacts include:

- exposure of acid sulphate soils for shallow foundations, buried services and deep foundations
- excavation instability, particularly in excavations below the groundwater table, resulting in damage to adjacent features.

The exposure of potential acid sulphate soils to oxygen results in the oxidation of soils forming sulphuric acid, which can have detrimental impacts on water quality and lead to adverse environmental impacts. The mitigation measures provided in section 14.3.1 would be implemented to mitigate risks associated with acid sulphate soils.

Although the risk of future mine subsidence is a constraint in the proposal site, the proposal would not be expected to impact on the likelihood of future mine subsidence.

14.3.1 Mitigation measures

Detailed design

- Those aspects of the proposal located within the Newcastle Mine Subsidence District would be designed in accordance with any requirements provided by the Mine Subsidence Board.
- Further geotechnical assessment, including subsurface investigation, would be undertaken to provide geotechnical information and recommendations for design. Investigations would address:
  - groundwater levels and variations in response to rainfall
  - effect of groundwater extraction on settlement and groundwater quality where dewatering is proposed
  - ground vibration propagation and attenuation where vibrations are likely to be experienced in close proximity to sensitive features
  - the potential for acid sulphate soil conditions to be experienced
  - founding conditions for proposed structures, including retaining walls
  - excavation conditions, stability and shoring requirements
  - pavement and formation subgrade conditions
  - subsurface conditions as appropriate for design and construction of the proposal
  - constraints to development associated with abandoned coal mining and the risk of future mine subsidence.

Construction

The following measures would be incorporated in the erosion, sediment control and water quality management sub-plan to be prepared as part of the CEMP:

- Where acid sulphate soils are identified during the further geotechnical investigations, an acid sulphate soils management plan would be developed and implemented in accordance with the *Acid Sulfate Soil Planning Guidelines* (Department of Urban Affairs and Planning, 1998).
- Stockpiles would be managed by implementing sediment and erosion control devices in accordance with *Managing Urban Stormwater, Soils and Construction* (Landcom, 2004).
- The area of exposed surfaces would be minimised. Disturbed areas would be stabilised progressively to ensure that no areas remain unstable for any extended length of time.

- Soil and sediment that accumulates in erosion and sediment control structures would be reused where practicable during site restoration, unless it is contaminated or otherwise inappropriate for reuse.
- Work would cease during heavy rainfall events when there is a risk of sediment loss off site or ground disturbance due to waterlogged conditions.
- Equipment, plant and materials would be placed in designated lay-down areas where they are least likely to cause erosion.
- Following completion of work, land disturbed as a result of construction would be restored to its pre-existing conditions. A photographic survey would be undertaken prior to the work to provide a record of the baseline and ensure rehabilitation achieves the required outcome.

Operation

- For remedial or maintenance work where soils are exposed, sediment and erosion control devices would be installed to minimise transport of sediment in accordance with *Managing Urban Stormwater, Soils and Construction* (Landcom, 2004)

14.4 Contamination and hazardous materials

A preliminary environmental site assessment was undertaken by URS in May 2014 (URS, 2014d) to assess the potential for contamination within the proposal site. This section includes the relevant findings of the assessment.

14.4.1 Existing environment

The majority of the proposal site has been subject to use as an active rail corridor since 1875.

A search of the NSW EPA's contaminated land register undertaken by GHD on 20 May 2014 did not identify any registered contaminated sites within the proposal site. The following registered sites are located close to the proposal site:

- Shell Pipeline Easement (vacant land) at 24 Fern Street, Islington
- rail land at 50 Railway Street, Wickham
- 10 Dangar Street, Wickham
- Fuchs Lubricants at 2 Holland Street, Wickham
- rail land at 10 Maitland Road, Hamilton.

Anecdotal information provided by Transport for NSW indicated that stockpiles of material containing asbestos are located east of the Maitland Road overbridge adjacent to the rail lines. These stockpiles were sighted by GHD staff during a site inspection on 5 May 2014.

URS reviewed a number of previous environmental reports relevant to the proposal site and surrounds. Various contaminants were identified in these reports, including arsenic, lead, total petroleum hydrocarbons, polycyclic aromatic hydrocarbons (including benzo(a)pyrene), mercury, nickel, zinc, copper, chromium, and asbestos containing materials. An on-site management report was noted to have been prepared for the emplacement and capping of stockpiled soils contaminated with asbestos waste. This material was to be placed adjacent to Hamilton Station, however no further reports were available to confirm if these works were undertaken.

Site investigations were undertaken by URS at various locations within the proposal site in April 2014. These involved visual inspections and soil sampling. The results of the site investigations identified detectable concentrations of hydrocarbons, however the concentrations were below relevant criteria (the National Environmental Protection Measure 1999, as amended in May 2013, health screening investigation level for commercial/industrial applications).

Elevated concentrations of lead, zinc, copper and chromium were detected at one location. Based on the preliminary results, it is expected that elevated concentrations of these contaminants would also be detected at other locations.

The sampling results also indicated that asbestos contaminated materials are present at the former Morrow Park Bowling Club site.

URS concluded that (URS, 2014d):

- additional asbestos fragments and fibres in subsurface soils are likely to be present, particularly within the rail corridor and within fill located around the former Morrow Park Bowling Club site
- the sampling undertaken indicated that the concentrations of metals were below the site investigation levels, however previous environmental reports have identified elevated metals concentrations within the fill near the Morrow Park Bowling club, and within the ballast material and soils within the rail corridor.

Further investigation is required to adequately characterise areas of identified and potential impact. The areas recommended for further investigation include:

- stockpiled material in the rail corridor east of Hamilton Station and south of Wickham Park
- potential fill material about 60 metres north-west of Wickham Station
- fill material, and surface asbestos contaminated materials at the former Morrow Park Bowling Club site
- asbestos containing material within railway ballast and signal cables in the railway corridor and adjacent to Hamilton Station
- areas of potential dumping adjacent to the Beresford Street multi-storey car park and across the rail line to the north about 60 metres from the proposed station
- additional fill material identified during subsurface investigation
- potential hydrocarbon and heavy metals within the rail corridor
- fill material used within the railway corridor
- potential asbestos containing materials, lead paint, polychlorinated biphenyls, and synthetic mineral fibres within buildings
- areas within the railway corridor where herbicides and pesticides were used.

14.4.2 Impact assessment

Construction

Construction may disturb contaminated soils, particularly during the earthworks stage. If inadequately managed, the disturbance of any areas of contamination has the potential to impact on human health and water quality. Potential impacts would be minimised by the fact that the proposal would only disturb an area within the existing rail corridor where access is restricted. The measures provided in section 14.4.3 would be implemented to further minimise the potential for contamination related impacts.

Potentially hazardous materials (asbestos, lead paint, PCBs and synthetic mineral fibres) may be disturbed during construction. Asbestos containing materials may also be present within soils and stockpiles. This could present a risk to site workers.

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

The measures provided in section 14.4.3 would be implemented to manage these potential risks.

Operation

Operation and maintenance would make use of a variety of lubricants and compounds. These materials would have the potential to result in contamination. The proposal would be operated in accordance with NSW TrainLink's existing environmental management system to ensure that the conditions of the EPL continue to be met.

14.4.3 Mitigation measures

Detailed design

- Further contamination investigations would be undertaken as an input to the detailed design phase, in accordance with the findings of this REF and the recommendations of URS (2014d).

Construction

- An 'unexpected finds protocol' would be prepared and included in the CEMP to assist with the identification, reporting, assessment, management, health and safety implications, remediation and/or disposal (at an appropriately licensed facility) of any potentially contaminated soil and/or water. This would include specifying appropriate reporting requirements in accordance with the EPA's *Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997* (DECC, 2009b).
- In the event that indicators of contamination are encountered during construction (such as odours or visually contaminated materials), work in the affected area would cease immediately, and the procedures detailed in the unexpected finds protocol would be implemented.
- Construction hazard and risk issues associated with the use and storage of hazardous materials would be addressed through risk management measures developed as part of the CEMP, in accordance with relevant Department of Planning and Environment guidelines, Australian and ISO standards, and Transport for NSW's *Chemical Storage and Spill Response Guideline*. These measures would include:
  - the storage of hazardous materials, and refuelling/maintenance of construction plant and equipment would be undertaken in clearly marked designated areas that are designed to contain spills and leaks
  - spill kits, appropriate for the type and volume of hazardous materials stored or in use, would be readily available and accessible to construction workers.
  - all hazardous materials spills and leaks would be reported to site managers and actions would be immediately taken to remedy spills and leaks
  - training in the use of spill kits would be given to all personnel involved in the storage, distribution or use of hazardous materials

- machinery would be checked daily to ensure that no oil, fuel or other liquids are leaking.
- refuelling of plant and equipment would not be undertaken within the proposal site.

- Any hazardous materials that are to remain on site would be surveyed and recorded on a hazardous building material register. A risk assessment would be undertaken and a management plan implemented (including any remediation measures). The register and management plan would be maintained and updated in accordance with the relevant WorkCover codes of practice.

Operation

- Potential operational impacts would be managed in accordance with NSW TrainLink's existing environmental management system.

14.5 Flora and fauna

14.5.1 Existing environment

A desktop assessment was undertaken to determine the likelihood that any threatened flora and fauna species, populations and ecological communities would be present within or in the vicinity of the proposal site. This involved searches of relevant databases and a review of the ecology constraints assessment of the proposal site commissioned by URS (Biosis, 2014). A database search area radius of 10 kilometres was used.

The results of the desktop assessment were confirmed by a site inspection undertaken by a GHD ecologist on 5 May 2014. The purpose of this inspection was to identify whether any native vegetation or potential habitat (for threatened or migratory biota listed under the TSC and/or EPBC Acts) were present within or near the proposal site.

Database results

The results of the database searches indicated that 23 threatened ecological communities, 20 threatened flora species, 75 threatened fauna species and 39 migratory species (not including marine species) have been previously recorded or are predicted to occur within the search area.

A review of species profiles for threatened species indicated that there is suitable roosting habitat under the Maitland Road overbridge for a number of common and threatened microbats.

A review of previous vegetation mapping indicated that there are no native vegetation communities within the study area.

The following weeds are known to occur within the rail corridor:

- exotic perennial grasses, such as Rhodes Grass, Red Natal Grass and Kikuyu
- exotic vines, such as Asparagus Fern and Morning Glory
- noxious weeds including Lantana, Crofon Weed, Mexican Poppy, Mother of Millions and Mossman River Grass.

Field survey and Anabat results

The results of the field survey undertaken by GHD are consistent with the results of that undertaken by Biosis in May 2014.

The proposal site is a highly modified urban environment and is considered to be of low ecological significance. Vegetation in the proposal site is limited to exotic vegetation and planted street trees in various locations, including along Station Street and Maitland Road. With the exception of microbats, any fauna inhabiting the area would be common to urban environments and is unlikely to include threatened or migratory species. There are no aquatic habitats within or immediately adjoining the proposal site.

To determine the types of microbats that may be present under the Maitland Road overbridge, an Anabat detector was deployed for two nights on 13 and 14 May 2014. Evidence of the presence of the Little Bent-Wing Bat, a threatened species listed as vulnerable under the TSC Act, was recorded during the Anabat survey.

14.5.2 Impact assessment

Construction

Construction of the proposal would require the removal and/or trimming of street trees in Station Street and potentially along the western side of Wickham Park on Maitland Road (if required for access). The planted native trees immediately south of this area, on the other side of Maitland Road, may also need to be removed to allow for site access. None of these trees are hollow-bearing and they are unlikely to represent important fauna foraging habitat. No threatened flora or ecological communities would be removed. No potentially significant impacts to threatened flora and fauna have been identified.

Noise, vibration and artificial lighting associated with works in the vicinity of the Maitland Road overbridge may potentially disturb microbats. As a result, an assessment of the potential significance of impacts on the threatened Little Bent-Wing Bat was undertaken in accordance with section 5A of the TSC Act (refer to Appendix B). The assessment concluded that the proposal would not result in a significant impact on this community. This is due to the short-term and temporary nature of the works, and the fact that the population is already exposed to similar impacts as a result of the operation of the existing road and rail network.

Operation

There would not be any impacts associated with the operation of the proposal.

14.5.3 Mitigation measures

Construction

- The extent of vegetation clearing/trimming would be restricted to the proposal site as identified in Figure 2.2.
- Approval would be obtained in accordance with Transport for NSW's *Application for Removal or Trimming of Vegetation* for the trimming, cutting, pruning or removal of trees or vegetation where the impact has not been identified in this REF.
- All cleared vegetation would be replaced and/or offset in accordance with Transport for NSW *Biodiversity Offset Guidelines*.
- All vegetation planted on-site would consist of locally endemic native species, unless otherwise agreed with Transport for NSW, following consultation with Council where relevant.
- The vegetation proposed to be removed or trimmed and the proposed offset arrangements would be specified as part of the landscape plan which would be prepared as part of the detailed design process.

- Immediately prior to the commencement of clearing, a suitably qualified ecologist would check the area that would be cleared that day for any resident fauna, and if any is found, a suitably qualified wildlife handler or ecologist would relocate that fauna into suitable habitat nearby. If no habitat is present or there is concern over impacts of a day-time release of a nocturnal species, the animal would be released into the care of WIRES
- 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.*

14.6 Aboriginal heritage

14.6.1 Assessment approach and methodology

An Aboriginal heritage due diligence assessment of the proposal was undertaken by Artefact. The assessment was undertaken in accordance with the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (DECCW, 2010a). The assessment included searches of relevant heritage registers, including the Department of Planning and Environment's Aboriginal Heritage Information Management System database (AHIMS). Results of previous sub-surface archaeological investigations undertaken in the study area were also reviewed. A summary of the results of the assessment is provided in the following sections

14.6.2 Existing environment

The AHIMS database was searched on 19 May 2014 to identify registered (known) Aboriginal sites or declared Aboriginal places located within or adjacent to the proposal site. An area of about four kilometres (east-west) by three kilometres (north-south) was searched. The results of the search indicated that nine Aboriginal sites have been previously recorded within the search area. None of these sites are located within or close to the proposal site. The nearest site is located about 250 metres to the north of the proposal site.

Evidence of past Aboriginal activities in the study area is demonstrated by the results of several sub-surface archaeological investigations that have been undertaken in the surrounding area. These include archaeological investigations undertaken by Archaeological and Heritage Management Solutions (AHMS) at 684 Hunter Street, Newcastle (AHMS, 2011) and at 700 Hunter Street, Newcastle (AHMS , 2001), and documentation on the AHIMS site register of a potential archaeological deposit recorded on Beresford Street and associated with Cottage Creek (AHIMS sites 38-4-1222 and 38-4-1223).

The sub-surface investigations undertaken by AHMS demonstrated the potential for evidence of Aboriginal occupation to remain as in situ deposits beneath an upper layer of historical disturbance.

14.6.3 Impact assessment

Construction

The proposal would require minor shallow excavation. The due diligence assessment indicates that there is the potential for Aboriginal objects to occur beneath the surface layer of historical disturbance. Excavation may impact any Aboriginal objects located in sub-surface archaeological deposits. As a result, in accordance with the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales,* an archaeological survey report would need to be prepared as part of the detailed design process.

Operation

Operation of the proposal would not impact on Aboriginal heritage.

14.6.4 Mitigation measures

Detailed design

- An archaeological survey report would be prepared in accordance with the *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW, 2010b). The survey report would provide information and recommendations on areas which may require further investigation, such as archaeological test excavation to determine the nature and extent of areas of sub-surface archaeological potential.

Construction

- Should Aboriginal heritage items be uncovered all work in the vicinity will cease and the Project Manager and Transport for NSW staff will be notified immediately. The Department of Planning and Environment will be notified in accordance with the *National Parks and Wildlife Act 1974.* The Awabakal Local Aboriginal Land Council will be notified and an assessment by an archaeologist will be arranged to determine the significance of the objects and any other requirements before work resumes.

14.7 Cumulative impacts

14.7.1 Impact assessment

Cumulative impacts (positive and/or detrimental) may occur if the timing of construction coincides with the construction of other developments within the study area. Such developments could include road/footpath upgrades, infrastructure construction, public utility works or commercial/residential development.

Cumulative impacts may also occur as a result of the aggregation of the proposal's impacts with other local or regional initiatives. Such impacts could include the cumulative protection/loss of flora/fauna, an increase/reduction in noise levels, or an increase/reduction in traffic levels and the availability of parking. The nature and scale of any cumulative impacts would depend 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.

Developments that have been approved, or are proposed to be undertaken in the vicinity of the proposal, were identified through a desktop review of major projects listed on the Department of Planning and Environment's website, and a review of development applications listed on Council's online development application database (as at 15 May 2014).

Approved developments close to the proposal site include:

- a four storey, mixed use commercial and residential development at 220 Maitland Road, Islington, located about 2.9 kilometres north-west of Hamilton Station
- demolition of existing buildings, construction of mixed use development with ground floor retail, 17 level residential units and basement parking at 386 King Street and 509 Hunter Street, located about 850 metres to the north-west of the proposed new station at Wickham
- erection of three storey mixed use development comprising of a café, commercial units, 49 residential units and associated car-parking at 18 Throsby Street and 19-21 Dickson Street, Wickham, located about 300 metres north of the proposed new station at Wickham
- partial demolition, boundary adjustment, alterations and additions to existing buildings and adaptive reuse of heritage building for 47 serviced apartments and associated car parking at 6 and 12 Stewart Avenue and 777 and 787 Hunter Street, Newcastle West, located about 100 metres south of the proposed new station at Wickham

The proposal is also part of a larger program of urban renewal and transport infrastructure (the Newcastle Urban Renewal and Transport Program) being led by UrbanGrowth NSW (refer to section 4.1.2). The program consists of the following priority projects:

- developing a transport interchange at Wickham
- developing light rail between Wickham interchange and the Newcastle city centre
- relocating the University of Newcastle city campus, law and business faculties to Civic
- redeveloping landholdings around the Hunter Street Mall.

Together, these proposals aim to progress the revitalisation program proposed by the *Newcastle Urban Renewal Strategy* (Department of Planning and Infrastructure, 2012) and achieve the renewal of the Newcastle city centre. The medium and longer term cumulative benefits are expected to include:

- reduced traffic congestion as a result of the removal of a number of railway level crossings between Wickham and Newcastle Stations
- increased use of public transport as well as non-vehicular transport modes
- improved access to popular leisure and recreational areas at Honeysuckle and Nobby's Beach
- increased economic activity and output through the expansion of the CBD and new business and commercial opportunities
- improved urban amenity, including changes to the character of existing areas; reduced anti-social behaviour (including graffiti around the existing railway corridor); and improved levels of personal safety.

The cumulative impacts that might occur are expected to be temporary and, the majority would occur in the short to medium term. These would include:

- travel time increases for train passengers wishing to access the city centre, who would have to change transport modes and complete their journey to Civic or Newcastle by bus (in the short term) or light rail (in the long term).
- increased construction traffic
- changes to pedestrian, cyclist and vehicle routes that may require temporary or permanent closure to facilitate the works
- minor changes in local flood risk due to increases in impermeable areas
- changes to the visual character of railway areas
- potential impacts on heritage items
- increased levels of noise including some works during the evening and night-time periods.

In general, sensitive receivers that are most likely to be affected by cumulative impacts would be those that are in close proximity to the construction works and/or vehicle access routes. As potential impacts associated with construction of the proposal would be short term and impacts would be localised, the potential for significant cumulative impacts is considered to be limited. No long term cumulative impacts would occur as a result of the proposal.

In contrast, the cumulative benefits (as a result of the proposal combined with other Newcastle Urban Renewal and Transport Program projects) may take longer to achieve but would also be longer-lasting and would be experienced by a much wider group, including residents, workers and tourists.

14.7.2 Impact assessment

Detailed design

- 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 impacts.

Construction

- Works would be scheduled within the proposal site to minimise the potential for cumulative impacts with any other projects in the same area.

14.8 Land use and property

14.8.1 Existing environment

The study area is located in an inner urban area, and is highly urbanised. Land in the area is used for a variety of purposes. As noted in section 2.3, the proposal site and study area consist of a wide range of land uses, including:

- residential
- retail – including local shops
- other business/commercial uses
- recreation – including Wickham Park
- community and religious uses
- transport infrastructure.

Further information on land uses in the study area and surrounding the proposal site is provided in section 2.

14.8.2 Impact assessment

Construction

Direct impacts on land use would be limited to the short term presence of construction equipment, plant, vehicles and fenced work sites in the proposal site. During construction, the use of the land would change from an active rail corridor and vacant land (the area previously occupied by the Morrow Park Bowling Club), to a construction site.

Operation

The operation of the proposal would not result in any impacts on land use, as it would involve the continued use of rail land for transport infrastructure purposes. No acquisition of private property would be required. The proposal would be undertaken on public land.

14.8.3 Mitigation measures

No additional mitigation measures are required.

14.9 Infrastructure and services

14.9.1 Existing environment

A desktop utility investigation was undertaken by URS in 2014 (URS, 2014b). Key services identified by URS are summarised below.

A historical brick sewer with a diameter of about one metre is located in Station Street parallel to the rail corridor. This sewer, which was constructed in 1913, carries a significant proportion of Newcastle's sewerage flows. The sewer is owned by Hunter Water Corporation, who has advised that it is not likely to be impacted by the proposal.

A reinforced concrete box culvert stormwater drain is located within the rail corridor to the south of the rail line, adjacent to the proposed location of the new station at Wickham.

Sydney Trains has an 11 kilovolt high voltage electrical overhead and underground cabling located adjacent to the existing railway. Ausgrid also has high and low voltage overhead and underground conduits and cabling within the proposal site. These include underground track crossings and overhead cabling along Fern and Station streets. Some relocation of electricity infrastructure would be required during construction.

Initial discussions have been held with utility providers. Further investigation and consultation would be undertaken during the detailed design stage.

The infrastructure and services identified (URS, 2014b) that could be impacted by the proposal are summarised in Table 14.1.

Table 14.1 Infrastructure and services with the potential to be impacted by the proposal

Service type	Provider	Infrastructure
Electrical	Ausgrid	High and low voltage overhead cabling along Fern and Station streets and underground track crossings
	Sydney Trains	11 kV overhead and underground cabling adjacent to the existing tracks
Water and sewer	Hunter Water Corporation	Sewer main and concrete culvert
Communications	AAPT Telstra Ipera Kloster Newtgen Optus Soul	Cabling and conduits within the proposal site, particularly west of Beaumont Street near Railway Street
Gas	Jemena	Gas mains in the vicinity of Railway and Station streets
Roads	Roads and Maritime Services	Stewart Avenue, including signalling infrastructure
	Council	Various streets surrounding and within the proposal site.

14.9.2 Impact assessment

The study area includes a range of significant infrastructure and services, located both above and below ground. The proposal would have the potential to impact on this infrastructure as a result of the construction of structures and excavation. While there may be some short term disruptions while work is being undertaken, the design of the proposal is being developed to ensure that there is minimal physical impact on adjoining or adjacent infrastructure.

Impacts would be minimised by ensuring that investigations are undertaken by the contractor to locate all underground services in the vicinity of the proposal site, so that work methods take into account the presence of all infrastructure. Consultation with service providers would also be undertaken to minimise the potential for impacts.

Any service relocations would be designed and implemented in accordance with service providers.

14.9.3 Mitigation measures

Detailed design

- Detailed service searches and consultation with service providers would be undertaken to accurately locate services.
- The detailed design of the proposal would seek to minimise the need for service and utility relocations.
- The need for, and proposed location of any utility relocations would be determined in consultation with service providers.

Construction

- Measures to minimise impacts to services would be developed in consultation with service providers, including:
  - marking services on plans and on-site, and avoiding undertaking works in the vicinity of these services
  - service relocation
  - temporary connections.
- Construction planning would take into consideration the potential for impacts on all infrastructure and services. Construction methods would be developed in consultation with service providers, and works would be scheduled to minimise the potential for impacts to or on the use of infrastructure and services.
- Any impacts to infrastructure and services would be made good by the contractor at the completion of works.
- Work being undertaken on or around infrastructure would be clearly signposted and appropriately fenced.

Part D Conclusion

15. Environmental management and mitigation

15.1 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.

15.1.1 Construction

A 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 and transport management
- heritage management plan
- noise and vibration management
- air quality management
- erosion, sediment control and water quality management
- contamination, hazards and waste management
- site rehabilitation plan.

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.

15.1.2 Operation

For the operational phase, environmental issues and impacts would be managed under NSW TrainLink's existing operational EMS and through the mitigation measures summarised in Table 15.1. The proposal would also operate in accordance with the existing EPL (EPL No. 12208).

15.2 Summary of mitigation measures

The REF has identified a range of environmental impacts with the potential to occur as a result of the proposal. Table 15.1 provides a summary of the measures proposed to mitigate and manage the potential impacts of the proposal.

The measures listed in Table 15.1 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.

Environmental management measures to be implemented during the proposal are listed in Table 15.1. These measures have been consolidated from those included in sections 7 to 14 of the REF.

Table 15.1 Mitigation measures

Issue	ID number	Mitigation measure
General		
Environmental management	1	An environmental controls map (ECM) would be developed prior to commencement of construction in accordance with Transport for NSW's guide to preparing ECMs. The ECM would be implemented for the duration of construction.
	2	A Construction Environmental Management Plan (CEMP) would be prepared for the works. This would include a project risk assessment of environmental aspects and impacts. The CEMP must be prepared and approved by Transport for NSW prior to the commencement of construction.
	3	Regular inspections to monitor environmental compliance and performance would be undertaken by Transport for NSW and the Contractor during construction.
	4	Prior to the commencement of construction, all contractors would be inducted on the key project interfaces and associated environmental risks. The environmental induction would include reference to all items of environmental sensitivity, and the measures proposed to manage the impacts on these items
	5	The final location of any storage/stockpile site would be confirmed by the contractor during development of the detailed construction methodology. The site location would be subject to negotiations with the landowner (Council).
Detailed design		
Non-Aboriginal heritage	6	Potential impacts on the significance of Wickham, Civic and Newcastle stations as a result of ceasing rail operations at these stations would be addressed as part of the Residual Corridor Management Plan.
	7	Detailed design of the new station at Wickham, including materials selection would be sympathetic to the surrounding heritage items/elements and the significance of the Newcastle City Centre Heritage Conservation Area, while clearly marking the building as contemporary.
Noise from operation of the stabling yard	8	The acceptability of any operational limitations associated with the use of 'barrier' trains to shield noise from other trains within the stabling yard would be confirmed.
	9	Other feasible and reasonable operational measures to minimise noise emissions (such as the use of horns, powering down trains overnight) would be assessed.
	10	Detailed analysis of any potential noise barriers would be undertaken, including location, structural considerations, and a cost-benefit analysis.
	11	The effectiveness of architectural treatments on noise affected premises would be assessed.
	12	An assessment of the potential for sleep disturbance impacts would be undertaken in accordance with Sydney Trains' Environmental Management System
Noise from operation of the new station at Wickham	13	Public address systems would be designed to comply with the operational noise criteria. The use of measures such as speaker selection, orientation and placement would be considered.
	14	Mechanical plant would be designed to comply with the operational noise. Placement of plant, acoustic enclosures, silencers and acoustic barriers and treatments would be considered.
Socio-economic impacts	15	The design of the proposal would have regard to crime prevention through environmental design features, and the design features recommended by the socio-economic impact assessment report (Technical Paper 4).
	16	During detailed design, local businesses and the community would continue to be consulted regarding the potential impacts of the proposal. Where practicable, measures to address these impacts would be incorporated into the design.

Issue	ID number	Mitigation measure
Urban design and visual	17	An urban design and landscaping plan would be developed during the design phase to address the following: • Strategic use of materials that blend, enhance and/or complement existing surfaces and minimise additional visual clutter. • Materials, finishes, colour schemes and maintenance procedures including graffiti control for new walls, barriers and fences. • Directional lighting mounted to avoid unnecessary direct light spill into sensitive receivers such as residences. • Preservation of trees, landscape treatments and street tree planting to integrate with surrounding streetscape design detail that is sympathetic to the amenity and character of the local heritage items. • Strategic location of signage and lighting to avoid unnecessary impact on views. • Total water management principles to be integrated into the design where considered appropriate. • Barriers, railings, fences and walls would be design to complement the visual environment. • Heritage significance of the Newcastle City Centre Heritage Conservation Area. • Design measures included to meet the *NSW Sustainable Design Guidelines* (Transport for NSW, 2014a).
Hydrology, water quality and groundwater	18	The retaining walls and/or embankments would be designed to minimise the potential loss of flood storage.
	19	All track drainage would be designed to meet relevant Transport for NSW standards and the requirements of *Australian Rainfall and Runoff* (Engineers Australia, 1999).
Geology and soils	20	Those aspects of the proposal located within the Newcastle Mine Subsidence District would be designed in accordance with any requirements provided by the Mine Subsidence Board.
	21	Further geotechnical assessment, including subsurface investigation, would be undertaken to provide geotechnical information and recommendations for design. Investigations would address: • groundwater levels and variations in response to rainfall • effect of groundwater extraction on settlement and groundwater quality where dewatering is proposed • ground vibration propagation and attenuation where vibrations are likely to be experienced in close proximity to sensitive features • the potential for acid sulphate soil conditions to be experienced • founding conditions for proposed structures, including retaining walls • excavation conditions, stability and shoring requirements • pavement and formation subgrade conditions • subsurface conditions as appropriate for design and construction of the proposal • constraints to development associated with abandoned coal mining and the risk of future mine subsidence.
Contamination and hazardous materials	22	Further contamination investigations would be undertaken as an input to the detailed design in accordance with the findings of this REF and the recommendations of URS (2014d).
Aboriginal heritage	23	An archaeological survey report would be prepared in accordance with the *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (OEH, 2010). The survey report would provide information and recommendations on areas which may require further investigation, such as archaeological test excavation to determine the nature and extent of areas of sub-surface archaeological potential.
Cumulative impacts	24	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.

Issue	ID number	Mitigation measure
	25	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 impacts.
Construction		
Traffic and transport	26	Prior to the commencement of construction, a construction traffic management plan would be prepared in consultation with relevant stakeholders as part of the CEMP. It would address the following as a minimum: • Adequate road signage to inform motorists and pedestrians of the work and ensure that the risk of accidents and disruption to surrounding land uses is minimised. • A pedestrian management plan to maximise safety and access for pedestrians and cyclists, including details of alternative access arrangements. • Adequate sight lines to allow for safe entry and exit from the site. • Impacts and changes to on and off street parking and requirements for any temporary replacement provision. • Routes to be used by heavy construction-related vehicles to minimise impacts on sensitive land uses and businesses. • 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. • Measures to manage traffic flows around the area affected by the proposal, including required regulatory and directional signposting, line marking and variable message signs and all other traffic control devices necessary. • Traffic and access would be managed in accordance with *Traffic Control at Work Sites* (RTA, 2010) and in consultation with Roads and Maritime Services and Council. • Construction vehicles would park within the construction compound/rail corridor safe zone. • The timing of deliveries accessing the site would need to be considered to ensure there is sufficient space within the proposal site to accommodate deliveries. • The queuing and idling of construction vehicles in residential streets would be minimised.
	27	Road occupancy licences would be obtained from Council for any works within the road reserve of local roads.
	28	Access to all private properties adjacent to the proposal site would be maintained during construction, unless otherwise agreed by relevant property owners.
	28	Adequate signage would be provided at Broadmeadow and Hamilton stations to direct users to shuttle buses. Signage would also be provided at all stops along the bus routes to clearly show the location of stops and routes.
	30	Consultation with regional and interstate bus operators would be undertaken to determine their requirements, including any rerouting of services to either Broadmeadow and/or Hamilton stations.
Non-Aboriginal heritage	31	All heritage items in the immediate vicinity of the proposal site would be marked on site plans, fenced off where appropriate, and avoided.
	32	The construction noise and vibration management plan prepared as part of the CEMP 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.
	33	Vibration management measures provided in section 9.5 would be implemented to minimise the potential for structural vibration impacts to heritage items.
	34	Dilapidation surveys would be undertaken for heritage buildings/structures located on or within 25 metres of the proposal site.
	35	If previously unidentified heritage/archaeological items are uncovered during the works, all works would cease in the vicinity of the material/find and Transport for NSW would be contacted immediately. Works in the vicinity of the find would not re-commence until clearance has been received from Transport for NSW.

Issue	ID number	Mitigation measure
	36	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.
Noise and vibration	37	A noise and vibration management plan would be prepared as part of the CEMP in accordance with the *Construction Noise Strategy* (Transport for NSW, 2012). The noise and vibration mitigation measures detailed in Table 9.17 would be incorporated in the CEMP and implemented.
	38	Where the noise levels are predicted to exceed the criteria after implementation of the general work practices, the additional mitigation measures detailed in Table 9.18 would be implemented.
	39	The recommended safe working distances for vibration-intensive plant in the *Construction Noise Strategy* would be implemented.
	40	Temporary hoarding would be installed close to the stabling areas to minimise noise levels at residential receivers within noise catchment area 9.
	41	The use of train horns would be minimised during the night, or alternative warning systems would be used.
Air quality	42	An air quality management sub-plan would be prepared as part of the CEMP. It would include the following measures • All plant and machinery would be fitted with emission control devices complying with relevant Australian Standards. • Machinery would be turned off when not in use and not left to idle for prolonged periods. • Vehicle movements would be limited to designated entries and exits, haulage routes (to be determined during preparation of the traffic management plan, and in consultation with RMS and Council) and parking areas. • Dust generation would be monitored visually, and where required, dust control measures such as water spraying would be implemented to control the generation of dust. • Materials transported to and from the site would be covered to reduce dust generation in transit. • Access points would be inspected to determine whether sediment is being transferred to the surrounding road network. If required, sediment would be promptly removed from roads to minimise dust generation. • Shade cloth would be fastened to the perimeter fence on the proposal site to minimise dust transported from the site during construction. • Daily inspections and regular surveillance would be undertaken to identify any vehicle, plant or equipment that is causing visible emissions. If any defective vehicles, plant or equipment are identified, operation of this machinery would cease and service/maintenance would be undertaken.
		• Works (including the spraying of paint and other materials) would be suspended during strong winds or in weather conditions where high levels of dust or airborne particulates are likely. • Any exposed surfaces would be stabilised, and final landscaping implemented, as soon as practicable.
Socio-economic impacts	43	Community and stakeholder consultation would continue to be undertaken in accordance with the Community and Stakeholder Engagement Strategy.
	44	The shuttle bus routes would be finalised in consultation with key stakeholders.
	45	Further consultation with relevant stakeholders would be undertaken during development of the detailed construction methodology.
	46	Further consultation with the Transport for NSW Accessible Transport Advisory Committee would be undertaken during development of the detailed methodology.
	47	Potentially impacted stakeholders, and those with an interest in the proposal, would continue to be consulted in accordance with the community and stakeholder engagement strategy developed for the proposal. This would include notifications and advice regarding alternative arrangements to address accessibility.

Issue	ID number	Mitigation measure
	48	Contact details for a 24-hour project response line and email address would be provided for ongoing stakeholder contact throughout the proposal.
Visual impacts and urban design	49	The following measures would be incorporated into the CEMP and implemented during construction: • Work sites would be screened by fencing or placement of hoardings where practicable. Machinery, plant and equipment would be contained within these hoardings where practicable. • Work sites would be maintained in a clean and tidy condition at all times. • Work methods for excavation and other works with the potential to impact on trees would be developed to avoid street trees and their roots where practicable. • Any pruning or removal of trees would be undertaken by a qualified arborist. • Any trees requiring removal would require an approval through the Transport for NSW Application for Removal or Trimming of Vegetation. • In the event that trees are removed, they are to be replaced in accordance with Transport Project Division's vegetation offset guide and in consultation with Council as required. • Directional lighting would be mounted to avoid light spill into adjoining residences.
Sustainability	50	Sustainable design and construction of the proposal would be in accordance with the *NSW Sustainable Design Guidelines*. Initiatives recommended by the sustainability assessment (URS, 2014a) to achieve a rating level of 'silver' would be implemented.
	51	The sustainability initiatives would be regularly reviewed, updated and implemented throughout the design development and construction phases.
	52	The detailed design of the proposal would aim to achieve an 'excellent' rating using the Infrastructure Sustainability Council of Australia's infrastructure sustainability rating tool.
Waste management	53	A waste management plan would be prepared as part of the CEMP and in accordance with the Waste Classification Guidelines (DECCW, 2009a). The plan would set targets for waste diversion, demonstrate how targets can be achieved, and outline how waste diversion would be tracked and reported. The plan would include the measures outlined below.
	54	Resource management hierarchy principles would be followed: • avoid unnecessary resource consumption as a priority • avoidance is followed by resource recovery (including reuse of materials, reprocessing, recycling and energy recovery) • disposal is undertaken as a last resort.
	55	Waste material would not to be left on site once the works have been completed.
	56	Working areas would be maintained, kept free of rubbish and cleaned up at the end of each working day.
	57	Waste material, including soil and spoil that taken off site would be classified and managed in accordance with the Waste Classification Guidelines (DECCW, 2009a) and would be disposed of in accordance with the Protection of the Environment Operations Act 1997. All waste documentation would to be collated in accordance with these guidelines and provided to Transport for NSW as requested.
	58	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.
	59	100 per cent of useable spoil material would be beneficially reused in accordance with Transport for NSW's Sustainability Targets.
	60	Any waste material identified as being contaminated would be managed in accordance with the Contaminated Land Management Act 1997 and other relevant legislation.

Issue	ID number	Mitigation measure
	61	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.*
Climate change and greenhouse gases	62	A carbon footprinting exercise, compliant with ISO 14064 Part 2 (Greenhouse gases – project level), would be undertaken in accordance with Transport for NSW's Greenhouse Gas Inventory Guide for Construction Projects and the *NSW Sustainable Design Guidelines*. The carbon footprint would be used to inform decision-making in design and construction. Standard carbon coefficient values would be used for construction material and fuel usage.
	63	Opportunities to reduce operational greenhouse gas emissions would be investigated during detailed design. These would include the initiatives documented in the sustainability assessment (URS, 2014a).
Water quality	64	An erosion, sediment control and water quality management plan would be prepared as part of the CEMP. It would include the following measures: • Sediment and erosion control devices would be installed to minimise mobilisation and transport of sediment in accordance with *Managing Urban Stormwater, Soils and Construction* (Landcom, 2004). • Maintenance and checking of the erosion and sedimentation controls would be undertaken on a regular basis and any subsequent records retained. Sediment would be cleared from behind barriers/sand bags on a regular basis as required and all controls would be managed to ensure they work effectively at all times. • Any exposed surfaces would be stabilised, and final landscaping implemented, as soon as practicable. • Erosion control devices would be removed as part of final site clean-up. This would include removing any sediment in drainage lines which has been trapped by erosion control devices, and restoring disturbed areas. • Upstream water flows would be diverted around the worksite in accordance with Managing Urban Stormwater, Soils & Construction. • Spill kits would be maintained on-site at all times. • Machinery would be checked daily to ensure that no oil, fuel or other liquids are leaking.
		• Refuelling of plant and equipment would be undertaken within designated areas with appropriate controls. • Visual monitoring of local water quality (i.e. turbidity, hydrocarbon spills/slicks) will be undertaken on a regular basis to identify any potential spills. • Vehicle wash down and/or cement truck washout would occur in a designated bunded area or off-site.
Hydrology and flooding	65	The existing drainage systems would remain operational during construction.
	66	A flood evacuation plan would be prepared and included in the CEMP.
	67	No stockpiles of materials or storage of fuels or chemicals would be located within high/medium flood risk areas or flow paths.
	68	Where practicable, site offices and facilities would be located above the 100 year average recurrence interval flood level.
Groundwater/ dewatering	69	If dewatering is required during construction, the water would tested (and treated if necessary) prior to re-use, discharge or disposal in accordance with the testing results.
	70	All water discharges would be undertaken in accordance with Transport for NSW's Water Discharge and Re-use Guideline (2012).

Issue	ID number	Mitigation measure
Geology and soils	71	The following measures would be incorporated in the erosion, sediment control and water quality management sub-plan to be prepared as part of the CEMP: • Where acid sulphate soils are identified, an acid sulphate soils management plan would be developed and implemented in accordance with the Acid Sulfate Soil Planning Guidelines (Department of Urban Affairs and Planning, 1998). • Stockpiles would be managed by implementing sediment and erosion control devices in accordance with *Managing Urban Stormwater, Soils and Construction, Volume 1* (Landcom, 2004). • The area of exposed surfaces would be minimised. Disturbed areas would be stabilised progressively to ensure that no areas remain unstable for any extended length of time. • Soil and sediment that accumulates in erosion and sediment control structures would be reused where practicable during site restoration, unless it is contaminated or otherwise inappropriate for reuse. • Work would cease during heavy rainfall events when there is a risk of sediment loss off site or ground disturbance due to waterlogged conditions. • Equipment, plant and materials would be placed in designated lay-down areas where they are least likely to cause erosion. • Following completion of work, land disturbed as a result of construction would be restored to its pre-existing conditions. A photographic survey would be undertaken prior to the work to provide a record of the baseline and ensure rehabilitation achieves the required outcome.
Contamination and hazardous materials	72	An 'unexpected finds protocol' would be prepared and included in the CEMP to assist with the identification, reporting, assessment, management, health and safety implications, remediation and/or disposal (at an appropriately licensed facility) of any potentially contaminated soil and/or water. This would include specifying appropriate reporting requirements in accordance with the EPA's Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997 (DECC, 2009b).
	73	In the event that indicators of contamination are encountered during construction (such as odours or visually contaminated materials), work in the affected area would cease immediately, and the procedures detailed in the unexpected finds protocol would be implemented.
	74	Construction hazard and risk issues associated with the use and storage of hazardous materials would be addressed through risk management measures developed as part of the CEMP, in accordance with relevant Department of Planning and Environment guidelines, Australian and ISO standards, and Transport for NSW's Chemical Storage and Spill Response Guideline. These measures would include: • the storage of hazardous materials, and refuelling/maintenance of construction plant and equipment would be undertaken in clearly marked designated areas that are designed to contain spills and leaks • spill kits, appropriate for the type and volume of hazardous materials stored or in use, would be readily available and accessible to construction workers. • all hazardous materials spills and leaks would be reported to site managers and actions would be immediately taken to remedy spills and leaks • training in the use of spill kits would be given to all personnel involved in the storage, distribution or use of hazardous materials • machinery would be checked daily to ensure that no oil, fuel or other liquids are leaking. • refuelling of plant and equipment would not be undertaken within the proposal site.
	75	Any hazardous materials that are to remain on site would be surveyed and recorded on a hazardous building material register. A risk assessment would be undertaken and a management plan implemented (including any remediation measures). The register and management plan would be maintained and updated in accordance with the relevant WorkCover codes of practice.

Issue	ID number	Mitigation measure
Flora and fauna	76	The extent of vegetation clearing/trimming would be restricted to the proposal site as identified in Figure 2.2.
	77	Approval would be obtained in accordance with Transport for NSW's Application for Removal or Trimming of Vegetation for the trimming, cutting, pruning or removal of trees or vegetation where the impact has not been identified in this REF.
	78	All cleared vegetation would be replaced and/or offset in accordance with Transport for NSW Biodiversity Offset Guidelines.
	79	All vegetation planted on-site would consist of locally endemic native species, unless otherwise agreed with Transport for NSW, following consultation with Council where relevant.
	80	The vegetation proposed to be removed or trimmed and the proposed offset arrangements would be specified as part of the landscape plan which would be prepared as part of the detailed design process.
	81	Immediately prior to the commencement of clearing, a suitably qualified ecologist would check the area that would be cleared that day for any resident fauna, and if any is found, a suitably qualified wildlife handler or ecologist would relocate that fauna into suitable habitat nearby. If no habitat is present or there is concern over impacts of a day-time release of a nocturnal species, the animal would be released into the care of WIRES.
	82	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.
Aboriginal heritage	83	Should Aboriginal heritage items be uncovered all work in the vicinity will cease and the Project Manager and Transport for NSW staff will be notified immediately. The Department of Planning and Environment will be notified in accordance with the National Parks and Wildlife Act 1974. The Awabakal Local Aboriginal Land Council will be notified and an assessment by an archaeologist will be arranged to determine the significance of the objects and any other requirements before work resumes.
Infrastructure and services	84	Measures to minimise impacts to services would be developed in consultation with service providers, including: • marking services on plans and on-site, and avoiding undertaking works in the vicinity of these services • service relocation • temporary connections.
	85	Construction planning would take into consideration the potential for impacts on all infrastructure and services. Construction methods would be developed in consultation with service providers, and works would be scheduled to minimise the potential for impacts to or on the use of infrastructure and services.
	86	Any impacts to infrastructure and services would be made good by the contractor at the completion of works.
	87	Work being undertaken on or around infrastructure would be clearly signposted and appropriately fenced.
Operation		
Noise and vibration	88	Transport for NSW would liaise with NSW TrainLink to revise their horn testing procedure such that horns would be tested east of Maitland Road, west of Railway Street, remote from sensitive receivers.
	89	Additional options for managing the potential noise impacts of the stabling yard would be considered in accordance with Sydney Trains' *Environmental Management System Guide Noise and Vibration from Rail Facilities* (Sydney Trains, 2013), which provides best practice options for managing noise emissions from stabling facilities. Potential options include: • ensure that horns are used only to the extent required to meet safety and engineering procedures and criteria (i.e. no excessive use of horns)

Issue	ID number	Mitigation measure
		• educating employees to bear in mind neighbouring properties (keep voices down, stand away from receivers to talk) • the use of alternative horn test and warning procedures or removing the requirement to test the horn altogether • powering down trains whenever possible, rather than idling • the use of ‘barrier trains’ where shown to be feasible • scheduling noisy activities to less sensitive times, such as day or evening times
Air quality	90	All trains, particularly those that are diesel-powered, would be regularly maintained to ensure efficient operation.
	91	Diesel-powered trains that layover within the stabling yard would use siding 1, which is furthest away from the sensitive receivers.
	92	Where practicable, the layover duration of diesel-powered trains would be minimised.
Socio-economic impacts	93	The shuttle bus routes would be finalised in consultation with key stakeholders to maximise passenger transfer efficiencies and safety.
	94	The residual corridor management plan would be developed with consideration of the recommendations of the socio-economic assessment to enhance future access within the city centre.
Sustainability	95	The sustainability initiatives would be regularly reviewed, updated and implemented throughout operation.
Waste management	96	Waste would be managed in accordance with NSW Trains operating procedures and the *Waste Classification Guidelines* (DECCW, 2009a).
Hydrology, water quality and groundwater	97	The proposal would be managed in accordance with NSW TrainLink’s existing environmental management system
Geology and soils	98	For remedial or maintenance work where soils are exposed, sediment and erosion control devices would be installed to minimise transport of sediment in accordance with *Managing Urban Stormwater, Soils and Construction* (Landcom, 2004).
Contamination and hazardous materials	99	Potential operational impacts would be managed in accordance with NSW TrainLink’s existing environmental management system.

16. Conclusion

This section provides a conclusion to the REF, including a summary of the proposal justification and the key REF findings.

16.1 Justification of the proposal

A number of strategic planning strategies have considered the need to transform and revitalise Newcastle's city centre over the next 25 years, to respond to the projected growth and address the issues identified. The key issues and requirements for undertaking urban renewal in the city centre have been considered by a number of planning studies and reports, including the *Newcastle Urban Renewal Strategy.*

The proposal is needed to proceed with the revitalisation program proposed by the *Newcastle Urban Renewal Strategy* and the Newcastle Urban Renewal and Transport Program. It would also enable the key recommendations of the other relevant strategies and plans to be achieved. In summary, the proposal is needed to:

- remove the heavy rail line between Wickham and the city centre, which would provide the opportunity to implement the identified urban renewal objective of improving the connection between the city centre and the Newcastle Harbour waterfront
- provide a new transport interchange at Wickham, which is a key area for renewal and future urban growth and development under the renewal strategies
- provide the foundation for the future introduction of light rail to Newcastle.

16.2 Summary of REF findings

This REF considers the potential impacts of the proposal to construct and operate the Wickham Transport Interchange Project. It has been prepared by GHD on behalf of Transport for NSW to assist with determination of the proposal under Part 5 of the EP&A Act.

The REF has considered the potential impacts of the proposal. It has been prepared in accordance with Part 5 of the EP&A Act, and in particular, the requirements of section 111 of the EP&A Act and clause 228 of the Regulation. The REF has documented the potential environmental impacts of the proposal, and makes recommendations, management and mitigation measures to protect the environment.

16.2.1 Clause 228 considerations

Clause 228 of the Regulation specifies the matters 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 sections 7 to 14 of the REF. The clause 228 matters and how they relate to the proposal are considered in Appendix A.

16.2.2 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. Section 13 details how ecologically sustainable development considerations have informed the design of the proposal. Appendix A summarises how the principles of ecologically sustainable development adopted by the EP&A Act have been addressed by the REF process. A sustainability assessment of the proposal against the *NSW Sustainable Design Guidelines* (Transport for NSW, 2014a) was undertaken as outlined in section 13.

16.3 Conclusion

Environmental investigations were undertaken during preparation of the REF to assess the potential environmental impacts. There are considered to be no significant environmental issues associated with the proposal. The main potential impacts that would require further consideration during the detailed design process, and management during construction and operation are summarised below.

- **Transport and access** – The proposal would result in a change in the public transport environment for residents, workers and visitors travelling on the Newcastle Branch Line. Heavy rail services would not operate east of Wickham Station and existing train passengers wishing to travel to and from the Newcastle city centre would need to change transport modes (to bus and the future light rail system) at the new station at Wickham.
- **Noise and vibration** – Construction and operation of the stabling yard has the potential to impact nearby sensitive receivers. Feasible and reasonable mitigation measures would be considered during the detailed design process.
- **Heritage** – Construction planning would consider measures to protect listed heritage items located within and adjoining the proposal site.
- **Urban design and visual impacts** – The design of the new station and facilities provides an opportunity to reinforce the role of Wickham in the city centre urban renewal process. The design would continue to be refined during future design phases. The final design would continue to take into account all relevant considerations, including urban design and visual impacts.
- **Social and amenity impacts** – Amenity impacts during construction and operation, including traffic, noise and air quality impacts, would be managed through the implementation of the measures listed in section 15.

Potential impacts resulting from the proposal are considered manageable through the implementation of the proposed mitigation measures.

The detailed design for the proposal is being carefully developed with the objective of minimising potential impacts on the local environment, particularly impacts to traffic and transport; heritage items; other infrastructure in the vicinity of the proposal; and residents, businesses and visitors. The methodology would continue to be developed with this overriding objective in mind, taking into account the input of stakeholders.

In conclusion, the proposal is needed to enable the urban renewal of Newcastle's city centre. With the implementation of the proposed mitigation and management measures the potential environmental impacts of the proposal would be managed. Having regard to the provisions of section 111 of the EP&A Act, the likely impacts of the proposal (after mitigation) are not likely to be significant and an environmental impact statement is not required.

17. Reference list

AHMS, 2011, *Section 87/90 Aboriginal Heritage Impact Permit #1098622 Excavation Report*, Prepared for SBA Architects Pty Ltd

Archaeological & Heritage Management Solutions, 2001, *Ibis Hotel Site, 700 Hunter Street Newcastle, NSW: Interim Report on Archaeological Test and Salvage Excavations at the Site*, Prepared for ACCOR Asia Pacific

Australia International Council on Monuments and Sites (ICOMOS), 1999, *The Burra Charter* (The Australia ICOMOS Charter for Places of Cultural Significance), originally adopted in August 1979 and the revised version was adopted on 26 November 1999

Biosis Pty Ltd (Biosis), 2014, *Ecology Constraints Assessment - Newcastle Heavy Rail Truncation Project*, Draft Report, Prepared for URS, Australia Pty Ltd May 2014

BMT WBM Pty Ltd (BMT WBM), 2012a, *Newcastle City-wide Floodplain Risk Management Study and Plan,* Final Report, prepared for The City of Newcastle, June 2012

BMT WBM, 2012b, *Hexham Relief Roads Flood Impact Assessment*, Final Report, prepared for The City of Newcastle, May 2012

The City of Newcastle, 2004, *Stormwater Management Plan 2004*, updated June 2005

The City of Newcastle, 2010, *Revitalising Newcastle – Two Years On*, Report on Newcastle City Centre Plan, April 2010

Department of Environment and Climate Change (DECC), 2009a, *Interim Construction Noise Guideline*, July 2009

DECC, 2009b, *Contaminated sites - Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997,* June 2009

Department of Environment, Climate Change and Water (DECCW), 2009, *Waste Classification Guidelines, Part 1: Classifying Waste*, December 2009

DECCW, 2010a, *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales*, September 2010

DECCW, 2010b, *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales,* Part 6 National Parks and Wildlife Act 1974, September 2010

DECCW, 2011, *NSW Road Noise Policy*, March 2011

Department of Environment and Conservation (DEC), 2006, *Environmental Noise Management, Assessing Vibration: a technical guideline,* February 2006

Department of Infrastructure, Planning and Natural Resources (DIPNR), 2005, *Floodplain Development Manual – the management of flood liable land*, April 2005

Department of Land and Water Conservation (DLWC), 1995, 1:100,000 scale Soil Landscape Map Series Sheet 9232, Newcastle and the associated Soil Landscapes of Newcastle 1:100000 Sheet Report, L.E. Mathei

Department of Planning and Infrastructure, 2012, *Newcastle Urban Renewal Strategy 2012*

Department of Premier and Cabinet, 2011, *NSW 2021 A Plan to make NSW No 1*, September 2011

Department of Urban Affairs and Planning, 1998, *Acid Sulfate Soils Planning Guidelines*, a component of the Acid Sulfate Soils Manual, published by the Acid Sulfate Soil Management Advisory Committee

Ecologically Sustainable Development Steering Committee, 1992, *National Strategy for Ecologically Sustainable Development*, December 1992

Engineers Australia, 1999, *Australian Rainfall and Runoff*, 1987/1999

Environment Protection Authority (EPA), 2000, *NSW Industrial Noise Policy*, January 2010

EPA, 2013, *Rail Infrastructure Noise Guideline*, May 2013

Heritage Office, 2001, *Assessing Heritage Significance*, a NSW Heritage Manual Update

Heritage Office, 2002, *Statement of Heritage Impact*

Landcom, 2004, *Managing Urban Stormwater, Soils and Construction, Volume 1,* 4th Edition, March 2004

NSW Public Works, 1994, *Lower Hunter River Flood Study: Green Rocks to Newcastle,* prepared for Newcastle City Council and Port Stephens Council

Office of Environment and Heritage (OEH), 2012, *Lower Hunter Ambient Air Quality Review of Available Data,* April 2012

Roads and Traffic Authority (RTA), 2010, *Traffic control at work sites*, version 4.0, June 2010

Sydney Trains, 2013, *Environmental Management System Guide Noise and Vibration from Rail Facilities*

Transport for NSW, 2012a, *Construction Noise Strategy* 7TP-ST-157/2.0, Standard - Applicable to Transport Projects

Transport for NSW, 2012b, *NSW Long Term Transport Master Plan*, December 2012

Transport for NSW, 2014a, *NSW Sustainable Design Guidelines,* Version 3.0

Transport for NSW, 2014b, *Wickham Terminus Construction Period Service and Operational Plan*, March 2014

Transport for NSW, 2014c, *Hunter Regional Transport Plan*, March 2014

URS Australia Pty Ltd (URS), 2014a, *Preliminary Environmental Review, Newcastle Urban Renewal and Transport Program,* Prepared for Transport for NSW, April 2014

URS Australia Pty Ltd, 2014b, *Newcastle Urban Renewal and Transport Program, Heavy Rail Truncation Scoping Report,* Prepared for Transport for NSW, May 2014

URS Australia Pty Ltd, 2014c, *Newcastle Urban Renewal and Transport Program, Newcastle Heavy Rail Truncation Definition Report,* Prepared for Transport for NSW, July 2014

URS Australia Pty Ltd, 2014d, *Report Heavy Rail Truncation, Preliminary Environmental Site Assessment*, Prepared for Transport for NSW, May 2014

Appendices

Appendix A – Consideration of ESD and Clause 228 factors

Table A.1 Clause 228 considerations

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. The main potential for long-term environmental impacts on a community relate to noise associated with the operation of the stabling yard. These potential impacts would need to be mitigated during the detailed design phase.	Short-term – amenity impacts to be managed by the CEMP Long-term – noise to be mitigated by the design of the proposal
(b) Any transformation of a locality	The proposal would be located on rail infrastructure zoned land in an area in which rail infrastructure is already located. It would not result in the transformation of this locality.	None
(c) Any environmental impact on the ecosystems of the locality	The proposal would remove a small area of highly disturbed vegetation. No environmental impact on ecosystems has been predicted.	None
(d) Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality	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 is located within the proposal site. The main potential for impacts during construction would be as a result of vibration impacts, which would be managed through the implementation of appropriate measures in the CEMP. No long-term impacts on heritage are predicted.	Short-term – vibration impacts to be managed by the CEMP 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	Other than the introduction of new structures in the landscape, the proposal would not to have any long-term impacts on the environment. Potential noise impacts are considered under (a) above.	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. Potential noise impacts are considered under (a) above.	Short-term – minor negative Long-term – none
(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 would be managed by the contractor(s).	None

Clause 228 factor	Summary of results	Potential impact
(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 had 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 proposal environmental management plan. Operation of the proposal would not produce any 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 the works period 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	No significant cumulative impacts were identified as a result of the interaction of the proposal with other projects.	None
(p) Any impact on coastal processes and coastal hazards, including those under projected climate change conditions	The proposal would not impact on coastal processes and coastal hazards.	None

Table A.2 ESD factors

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 evolved to avoid environmental impact where possible and mitigation measures would be implemented to minimise 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 development of the rail corridor. 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 – Assessment of significance for threatened microchiropteran bats

Assessment of significance

One threatened microbat was recorded roosting under the Maitland Road overbridge within the proposal site. In addition there is potential for a further two microchiropteran bats to occur within the site based on the presence of suitable roosting habitat. These are:

- Little Bentwing-bat (*Miniopterus australis*) – Recorded
- Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*) – Predicted
- Southern Myotis (*Myotis macropus*) – Predicted

The proposal has the potential to impact roosting habitat for these species through indirect construction noise, vibration and lighting impacts. The proposal would not impact foraging or breeding habitat. Accordingly an assessment of significance has been completed for these species, as required under section 94 of the TSC Act. The assessment determines the significance of the proposal impact on these species and therefore the need for a species impact statement.

Introduction

The Little Bentwing-bat (*Miniopterus australis*) inhabits moist eucalypt forest, rainforest or dense coastal Banksia scrub. This species roosts in caves, tunnels, abandoned mines, culverts bridges and sometimes tree hollows. Breeding occurs during winter at maternal roost sites (OEH, 2014).

The Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*) is essentially a cave bat, but also utilises man-made habitats such as road culverts, bridges, storm-water tunnels and other man-made structures outside the breeding season. Breeding takes place from October to April in a number of maternity caves that host up to 100,000 females (Churchill, 2008). No maternity caves are present at the proposal site. However, potential foraging and roosting habitat is present and as a precautionary measure an assessment of significance has been undertaken to assess the potential impacts to this habitat.

The Southern Myotis (*Myotis macropus*) is mainly coastal but may occur inland along large river systems. This species is usually associated with permanent waterways at low elevations in flat/undulating country, usually in vegetated areas. It forages over streams and watercourses feeding on fish and insects from the water surface and roosts in a variety of habitats including caves, mine shafts, hollow-bearing trees, stormwater channels, buildings, under bridges and in dense foliage, typically in close proximity to water (Churchill, 2008). Although Southern Myotis (*Myotis macropus*) was not recorded at the site, potential roosting habitat is present and as a precautionary measure an assessment of significance has been undertaken to assess the potential impacts to this habitat.

Assessment of significance

a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The site contains one bridge structure which is known to provide diurnal roosting habitat for the Little Bentwing-bat (*Miniopterus australis*). The bridge may also provide roosting habitat for the Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*) and Southern Myotis (*Myotis macropus*).

The site contains small areas of planted native vegetation (*Eucalyptus sideroxylon, E. robusta, E. mannifera, Casuarina glauca, Corymbia maculata* and *Ficus rubiginosa*) adjacent to the rail corridor which may provide potential foraging habitat for these species.

The proposed works would not remove any foraging or roosting habitat for these species, however there may be some increased noise, vibration and artificial lighting within the vicinity of the Maitland Road overbridge during construction that could disturb bats utilising the bridge. These impacts would be temporary in nature and would be mitigated by the development of a noise and vibration management plan.

The site is currently exposed to noise and vibration from vehicle traffic over the bridge and trains passing underneath. The proposal would therefore not represent a new impact for any species utilising the area, and not result in any long term disturbances to potential habitat additional to those already present at the site.

The proposal is unlikely to have an adverse effect on the life cycle of the species as the habitat present is not suitable as a maternity roost. Furthermore there are extensive areas of alternative potential foraging and roosting habitat in the locality. Local populations are likely to persist in alternative habitat outside the site, within surrounding vegetation and in regenerating vegetation within the site.

b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

The proposal would not impact a listed endangered population.

c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

The proposal would not impact a listed endangered or critically endangered ecological community.

d) In relation to the habitat of a threatened species, population or ecological community:

(i) The extent to which habitat is likely to be removed or modified as a result of the action proposed, and ….

The proposal would directly not remove any foraging, roosting or breeding habitat for these threatened microbat species. The proposal may result in some temporary modification to diurnal roosting habitat due to an increase in noise, vibration and artificial lighting at the proposal site during construction.

(ii) Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and …

The proposal would not result in any foraging, roosting or breeding habitat for these threatened micobats becoming fragmented or isolated from other areas of habitat.

(iii) The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

The roosting habitat present within the proposal site is a small portion of the roosting habitat within the locality. The Little Bentwing Bat is known to travel long distances, with some populations travelling up to 300 kilometres every spring to their traditional nursery caves (Miller-Butterworth *et al*., 2003). There are numerous other areas within the locality that would provide roosting habitat for these species including other bridge structures, stormwater culverts, abandoned buildings, tunnels and patches of vegetation to the south and south-west of the site. Therefore, the potential indirect disturbance to this single roost site would be of minor importance to the long-term survival of these threatened microbat species.

e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

The proposal does not impact on critical habit currently listed under the Act.

f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

No recovery plans exist for these species, however the Department of Planning and Environment has management objectives set out under the Saving our Species program. The threatened microbats would be managed according to the following measures from the program:

- Little Bentwing Bat (*Miniopterus australis*) and Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*) – has been assigned to the site-managed species management stream which involves setting up key management sites where known populations occur with the aim of managing known habitat and conserving the species in the long term.
- Southern Myotis (*Myotis macropus*) – has been assigned to the landscape species management stream as there are no known breeding locations for this species. The Department of Planning and Environment is currently developing a targeted approach for managing this species. In the interim, management actions have been identified for this species surrounding maintenance of habitat, research, minimising threats, surveys and increasing knowledge.

The proposal would result in some temporary indirect disturbance to roosting habitat for these species on a small scale due to construction noise, vibration and lighting, however does not conflict with the management measures set out by the Department of Planning and Environment.

g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

A threatening process is defined under Part 1 of the TSC Act, as ‘a process that threatens, or may have the capability to threaten the survival or evolutionary development of species, populations or ecological communities’. Key threatening processes are listed under Schedule 3 of the Act.

The proposed works could increase the impact of the invasion, establishment and spread of *Lantana camara* threatened process, as this weed species is present at the site. The implementation of suitable weed controls, as set out in the CEMP, would prevent the proposed works exacerbating this threatening process. This includes hygiene procedures for equipment, footwear and clothing, and weed disposal protocols.

Conclusion

The seven part test completed above indicates that the proposal is not likely to result in significant impacts on local populations of the Little Bentwing-bat (*Miniopterus australis*), Southern Myotis (*Myotis macropus*) or, Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*) given that:

- The proposal would not remove any breeding, foraging or roosting habitat for these species.
- The roost site (Maitland Road overbridge) is already exposed to disturbance from noise, vibration and artificial light due to the existing road and rail traffic in the area.
- Noise, vibration and lighting disturbances associated with construction of the project would be temporary and minor in nature.
- There are large areas of alternative roosting habitat present within the locality.
- Operation of the proposal would not result in any impacts additional to those already present at the site (i.e noise and vibration caused by existing rail traffic).
- The proposal is highly unlikely to fragment an existing population as these are highly mobile species.
- The proposal would not form a barrier to movement of these highly mobile species.

Therefore, preparation of a species impact statement is not required.

References

Churchill, S, 2008, *Australian Bats* (2nd Edition), Allen and Unwin, Crows Nest, NSW

Miller-Butterworth, C.M., Jacobs, D.S & Harley, E. H. 2003, Strong populations substructure is correlated with morphology and ecology in a migratory bat. *Nature* 424, 187-191

Department of Planning and Environment, *NSW Threatened Species Profiles*, accessed 19 May 2014, http://www.environment.nsw.gov.au/threatenedspecies/

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Transport for New South Wales

Wickham Transport Interchange

Social Impact Assessment

July 2014

Executive summary

In 2012, the NSW Government announced the truncation of the heavy rail line at Wickham as part of the *Newcastle Urban Renewal and Transport Strategy*. Following consideration of options to cease railway operations, it was decided that a new station at Wickham would be constructed on land to the west of Stewart Avenue. The residual heavy rail corridor (comprising the existing Wickham Station and areas to the east) would be reviewed.

This social impact assessment has been prepared as a specialist report supporting the review of environmental factors (REF) for the proposal. This social impact assessment considers the likely social impacts and risks of the proposal and identifies mitigation measures to avoid or mitigate adverse impacts, and opportunities for improved social outcomes.

This impact assessment has identified social impacts during construction and operation of the proposal and proposes a range of mitigation measures to reduce identified impacts.

The key impact identified is the potential for increased travel time for commuters into and out of the Newcastle city centre as a result of the mode change requirement of the proposal. The assessment also identifies a number of risks and opportunities that would be further considered prior to commencement of construction and during detailed design.

The main impacts identified and mitigation measures proposed are as follows:

Access and connectivity

- increased travel time for commuters to and from Newcastle Station due to the cessation of train services. This impact may be more substantial for passengers who are elderly, disabled, or those travelling with young children
- permanent loss of vehicle and pedestrian access due to the closure of the Railway Street crossing with implications for nearby businesses and their customers
- permanent loss of parking for businesses in Station Street.

Proposed mitigation measure: Provision of timely, easily accessible shuttle bus service. Implement a communications strategy to provide for passenger community information, feedback/complaints and resolution.

Noise, vibration and amenity

- construction and operational noise impacts on residences in Station, Fern, Ivy, and Eva Streets and users of Wickham Park.

Proposed mitigation measure: Implement noise and visual impact mitigation measures consistent with Transport for NSW standard mitigation measures and the recommendations of the REF.

Business Impacts

- access for businesses in the vicinity of the Railway Street level crossing closure
- loss of parking for businesses in Station Street, and potential for increased competition for parking in the vicinity of Hamilton Station.

Proposed mitigation measure: Implement traffic and transport recommendations of the REF, and implement a stakeholder engagement strategy which engages with local business affected by the closure of Railway Street.

Community safety

- potential safety issues for passengers changing modes late at night
- potential community and patron safety issues along Station Street and in the vicinity of the Lass O'Gowrie Hotel at night.

Proposed mitigation measure: Design for the Transport Interchange will incorporate relevant Crime Prevention Though Environmental Design (CPTED) initiatives. Consider community safety issues in the vicinity of the Lass O'Gowrie Hotel in cooperation with Council, Newcastle Police and other key stakeholders

Vulnerable groups

- potential to impact the travel and sleeping patterns of homeless people and consequently their safety
- awareness of vulnerable groups (aged, elderly, disabled, non-English speaking background) to the changes in travel modes, places of boarding and alighting buses, ticketing and travel delays.

Proposed mitigation measure: Consult with homeless service providers in the area, Council and Newcastle Police to assess the risks to the homeless and manage appropriately. Ensure a project communications strategy considers the needs of vulnerable groups and is developed in consultation with relevant peak bodies and local service providers.

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1. Introduction

1.1 Background

In 2012, the NSW Government announced the truncation of the heavy rail line at Wickham as part of the *Newcastle Urban Renewal and Transport Strategy*. Following consideration of options to cease railway operations, it was decided that a new station at Wickham would be constructed on land to the west of Stewart Avenue and that the residual heavy rail corridor comprising the existing Wickham Station and areas to the east would be reviewed for suitability as part of the initial stage of the Newcastle Light Rail project.

1.2 The proposal

The proposal to truncate the heavy rail line at Wickham and deliver a new station and new transport interchange involves:

- removal of train services between Wickham and Newcastle stations
- constructing and operating a new train stabling facility to the north of Hamilton Station, within the existing rail corridor
- constructing and operating a new station interchange for pedestrians, cyclists, buses and heavy rail to the west of Stewart Avenue.

Shuttle bus services would be implemented during and following construction to enable train passengers to complete their journeys to Newcastle Station.

A number of modifications to the rail infrastructure and services between Wickham and Hamilton stations are required. This would involve:

- terminating services at Hamilton Station during construction of the new station and transport interchange at Wickham
- constructing and operating a new head shunt rail track, about 700 metres in length between the Maitland Road overpass and the new station at Wickham
- installing new crossovers and turnouts to facilitate the movement of trains between the three rail tracks
- ancillary infrastructure including traction power supply, signalling and overhead wiring.

Some road works would also be required, involving the removal of the railway crossing boom gates and signals at Stewart Avenue and the closure of Railway Street at the level crossing.

The design of the transport interchange makes allowance for the future provision of light rail. The Newcastle Light Rail project will be subject to a separate environmental impact assessment/planning approval process.

1.3 Approach

The social impact assessment has involved the following:

- site visits to review existing land uses and local conditions
- development and analysis of a community profile from information sourced through a desktop review of various publicly available sources including Australian Bureau of Statistics (ABS) Census 2011 data, NSW Bureau of Crime Statistics and Research (BOSCAR) and Bureau of Transport Statistics data and Newcastle City Council documents
- social research to identify and consider local issues and community values
- review of various technical data, including assessments of the proposal on local parking and traffic, visual amenity, noise and dust, contaminated lands and air quality
- analysis of the outcomes of previous community consultation undertaken by UrbanGrowth NSW (Elton Consulting) for the Newcastle Light Rail project
- consultation with City of Newcastle Council community and strategic planners
- Socio-economic impact assessment, identifying potential socio-economic impacts and benefits that would result from the truncation of the existing Wickham Station.

1.4 Study area

For the purpose of this study, the assessment will consider both local area and regional areas of impact. The local area is considered as two distinct precincts:

- western precinct, which includes distinct areas in the suburbs of Wickham, Islington and Hamilton
- eastern precinct, which includes the suburbs of Newcastle and Newcastle East and distinct areas of Wickham.

These areas reflect neighbourhoods in the immediate vicinity of the key project components and are likely to be directly affected. Broadmeadow (SA1 1122417 from ABS Census data) is also considered in this assessment as the operating pattern will result in a change in train and bus services to Broadmeadow.

More broadly, the project will indirectly affect people in the Greater Newcastle area (including Lake Macquarie and Maitland, defined as the Newcastle-Maitland Significant Urban Area by the ABS).

Figure 1.1 shows the boundaries of the study precincts and the section of railway line affected by the proposed rail line truncation at Wickham.

This social impact assessment also addresses the effects of the changes in transport services during construction and operation will have for users of those services. Accordingly, the affected persons include:

- local residents of Newcastle
- workers in Newcastle
- students in Newcastle
- visitors to Newcastle

1.5 Purpose and scope of this report

This social impact assessment has been prepared by GHD Pty Ltd (GHD) on behalf of Transport for NSW. The assessment considers the likely social impacts and risks of the proposal and identifies mitigation measures to avoid or mitigate adverse impacts, and opportunities for improved social outcomes.

The social impact assessment specifically relates to the Wickham Transport Interchange proposal which is independent of the future light rail development. As such, this report considers the interchange linking to a long term bus network. Considerations with regard to the management and potential future use of the truncated corridor will be addressed in a Residual Corridor Management Plan to be developed separately to the REF.

The social impact assessment does not address economic impacts. It considers direct socio-economic impacts related to the proposal, but does not undertake any economic assessment of direct or indirect impacts of the proposal.

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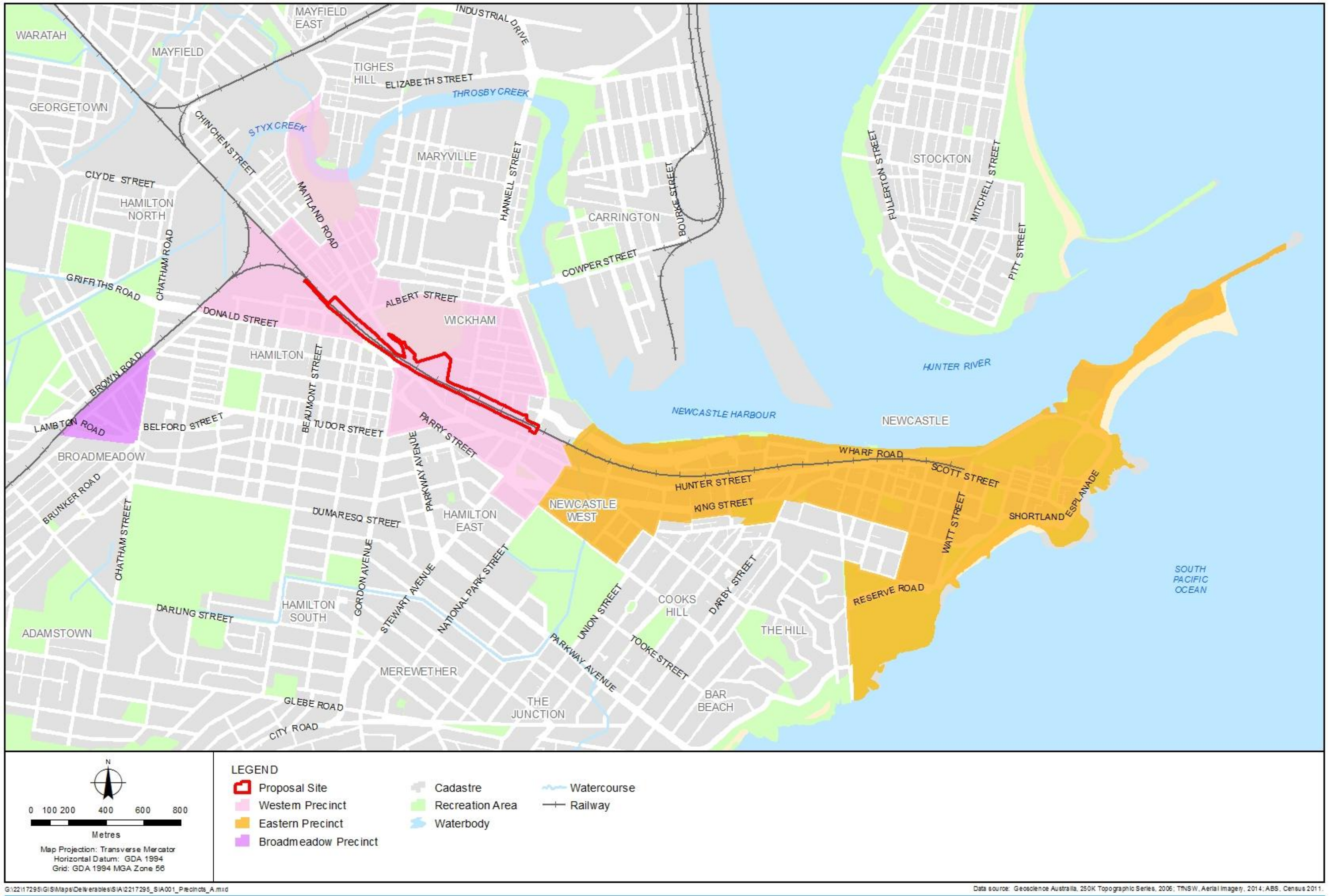

Figure 1.1 Social impact assessment study area

2. Community profile

This section presents an overview of:

- the two local precincts directly affected by the proposal (referred to as eastern and western)
- the local areas within the broader Lower Hunter region, which will potentially be indirectly affected by the proposal
- the working population and other passengers travelling to and from the Newcastle city centre.

2.1 Precinct descriptions

2.1.1 Eastern precinct

The eastern precinct encompasses Newcastle city centre, Newcastle East and distinct areas of Wickham, south of the existing Wickham Station. The eastern precinct is the heart of the city's business district. The city is currently undergoing a revitalisation with retail, dining and entertainment venues being established along Hunter Street and surrounds.

The precinct is located within walking distance to local beaches, cultural precincts (including the Newcastle Art Gallery), the foreshore and several public parks. The precinct has a population of 3,699 in an area which has experienced population growth of some 20 percent since 2006. There is a significant workforce of some 12,972 and visitor population of 879 (an additional 24 percent).

The precinct has the following characteristics:

- It is the **key employment centre** in Newcastle and regional hub for tourists and regional visitors delivering retail, hospitality, education, and commercial opportunities.
- **Low levels of disadvantage** – generally high incomes, low rates of unemployment, a labour force consisting of high levels of professionals and managers, and high levels of education, despite having a higher proportion of public housing than the local government area (LGA) average.
- **Small households** – primarily made up of couples without children, who are more likely to be renting or paying off a mortgage and living in apartments and semi-detached dwellings. Almost 40 percent of households are renting suggesting a high turnover of residents. Despite this, around 30 percent of households are either purchasing or own their home.
- **Older population** – The average age is 36 years with around 35 percent of the population aged 50 years and over. Low numbers of people requiring assistance.
- **Moderate levels of public transport use** – with comparatively high rates (compared with other areas of Newcastle) rates of bus and train use and active transport (walking). Given the relatively high rates of car ownership, this suggests people choose to leave the car at home and use public transport to journey to work.

2.1.2 Western precinct

The western precinct encompasses both residential and business districts in Wickham, Hamilton and Islington. Beaumont Street in Hamilton is known locally as an ‘eat street’ and is a popular shopping and dining precinct.

Hamilton Station is a key transport link for students attending Hamilton TAFE located nearby, and those changing trains on route to the University of Newcastle. The precinct accommodates 1,542 residents.

The suburbs of Wickham and Islington are rapidly gentrifying areas of Newcastle, with a growing retail and hospitality industry. Despite this change, there continues to be a strong industrial manufacturing and services trade in Wickham.

The western precinct has the following characteristics:

- **Younger population** – with over half the population aged between 18 and 49 years. It is likely this is due to the lower rental prices, close proximity to the city, public transport and education facilities (i.e. Newcastle University and Hamilton TAFE). Similar to the eastern precinct, around 40 percent of households are renting suggesting a high turnover of residents. Despite this, almost 30 percent of households are either purchasing or own their home.
- **High levels of disadvantage** – due to lower incomes, high rates of unemployment, a labour force consisting predominantly of community and personal services (16.1 percent) and technicians/trades (14.0 percent), and low levels of education. There is a higher proportion of single parent families and people requiring assistance, and an aged care residential facility is located in Hamilton. Around 6.5 percent of rental properties are public housing.
- **Moderate levels of public transport use** – comparatively high rates of bus, train and active travel (walking) to work (compared with other areas of Newcastle). Rates of car ownership are lower than the LGA average.

2.2 Profile of local area

This section provides an overview of residents living in the western, eastern and Broadmeadow precincts. The profile builds a picture of the community that would potentially be affected by the proposal and provides demographic indicators that can be used to predict different impacts and responses to impacts. Data on the Greater Newcastle area is also provided for comparison and to identify those in the wider area that may be indirectly affected by the proposal. Data reviewed to prepare the profile is provided in Appendix A.

2.2.1 Overall population

The total population of the Broadmeadow, western and eastern precincts in 2011 was 5,425 people. There are more than double the number of people living in the eastern precinct (3,679 people) compared to the western precinct (1,542 people) and Broadmeadow (204 people). Broadmeadow had a greater percentage of people aged 60 years and over (27.9 percent) compared to the eastern precinct (20 percent) and western precinct (13.3 percent).

The western precinct generally has a younger population, with over half the population aged between 18 and 49 years (61.3 percent). This compares to the eastern precinct (45.4 percent) and Broadmeadow (42.2 percent), which are similar to the Greater Newcastle area (42.4 percent).

Despite the generally younger population, there are more people in the western precinct requiring assistance (4.5 percent) compared to Broadmeadow and eastern precinct (3.9 percent and 2.7 percent respectively). However this is lower than for the Newcastle LGA (5.9 percent) and Greater Newcastle area (5.8 percent).

2.2.2 Cultural diversity

There is a significantly lower proportion of Indigenous people living in the eastern precinct (1.9 percent) and Broadmeadow (1.5 percent) compared to the western precinct (3.0 percent), which is similar to Greater Newcastle (3.1 percent). People from non-English speaking backgrounds represent around one in 20 residents in Newcastle (5.7 percent in the Newcastle LGA, 5.4 percent in the eastern precinct and western precincts and 4.1 percent in Greater Newcastle).

2.2.3 Households and families

The proportion of family households in the eastern and western precincts (46.9 percent and 46.7 percent respectively) is lower than Broadmeadow (50 percent) and significantly lower than the Newcastle LGA (63.8 percent) and Greater Newcastle (70.0 percent). This is reflected in the proportion of lone person and group households in the eastern precinct (40.5 percent and 12.5 percent) and western precinct (39.6 percent and 13.7 percent), which are both greater than Broadmeadow (39.6 percent and 10.4 percent) and Newcastle LGA (29.5 percent and 6.6 percent).

The most prevalent family type for the three precincts is couples without children. However the proportion is significantly higher in the eastern precinct (61.9 percent) than in Broadmeadow (46.3 percent) and the western precinct (39.7 percent). Despite this, the occupancy rate for the western precinct is 2.1 persons per dwelling, which is slightly higher than for the eastern precinct (1.9 persons) and Broadmeadow (1.8 persons).

There is significantly more one parent families in the western precinct (29.7 percent) and Broadmeadow (25.9 percent), compared to the eastern precinct (12.3 percent) and Greater Newcastle (18.0 percent).

2.2.4 Dwellings and tenure

The most common dwelling types in Broadmeadow and the western precinct are separate houses (50.9 percent and 45.1 percent respectively), followed by flats/units/apartments (35.1 percent and 27.8 percent respectively), which reflects the level of residential development in the precincts. In contrast, the eastern precinct has a significantly higher proportion of flats/units/apartments (64.5 percent) and significantly less separate houses (4.1 percent).

The rate of home ownership is lower in the three precincts compared to the Newcastle LGA (24.9 percent). Of the three precincts, Broadmeadow has the highest rate of outright home ownership (20.9 percent), followed by the eastern precinct (15.6 percent) then the western precinct (12.3 percent).

This is reflected in the higher proportion of renting in the three precincts compared to the LGA (27.3). The western precinct has the highest rate (40.3 percent) followed by the eastern precinct (38.8 percent) and Broadmeadow (33.8 percent).

2.2.5 Employment and education

Incomes in the eastern precinct are higher than the western precinct, Broadmeadow and Greater Newcastle. Average individual incomes in the eastern precinct are $847 per week compared to $547 per week for the western precinct and $558 per week for Broadmeadow. Average weekly individual incomes in Greater Newcastle ($544) are comparable to average incomes in the western precinct and Broadmeadow.

The rate of participation in the labour force in the eastern precinct (65.1 percent), western precinct (64.4 percent) and Broadmeadow (65.5 percent) is higher than the Newcastle LGA (61.5 percent) and Greater Newcastle (59.6 percent).

The unemployment rate for the eastern precinct (5.2 percent) is slightly lower than the LGA (5.7 percent) and Greater Newcastle (5.5 percent). The western precinct and Broadmeadow have a significantly higher unemployment rate, at 8.1 percent and 7.8 respectively.

The proportion of people working as manager and professionals in the eastern precinct (54.5 percent) is significantly higher than the western precinct (32.4 percent) and Broadmeadow (27.3 percent), the LGA (35.6 percent) and Greater Newcastle (30.8 percent).

At 29.9 percent of the population, there are less people in the eastern precinct without post-school qualifications compared to Broadmeadow (33.9 percent) and western precinct (36.2 percent). However these percentages are less than Greater Newcastle (44.9 percent) and NSW (42.8 percent). Likewise, there are significantly more people in the eastern precinct who have completed Year 12 (61.7 percent) compared to the western precinct (51.5 percent) and Broadmeadow (48.6 percent), and Greater Newcastle (37.6 percent).

2.2.6 Mobility

The proportion of households that do not own a car is higher in the western precinct (19.8 percent) and Broadmeadow (19.0 percent) than the eastern precinct (16.6 percent), LGA (11.9 percent) and Greater Newcastle (9.1 percent).

Over half of the workers who chose one mode of transport to work travelled by car. However the proportion for the eastern precinct (68.1 percent) and western precinct (65.2 percent) is slightly less than NSW (71.3 percent) and significantly less than Broadmeadow (81.5 percent) and the LGA (82.9 percent).

The proportion of people who travelled only by train or bus to work was higher in the western precinct (6.9 and 6.5 percent) compared to Broadmeadow (5.4 percent for each) and the eastern precinct (3.9 and 3.6 percent). All three precincts, however, have higher rates of train and bus use than the LGA (1.4 and 3.1 percent) and Greater Newcastle (1.4 and 2 percent). It is likely this is due to availability of train and bus services across the precincts.

The eastern and western precincts have a significantly higher proportion of people who walked to work (16.1 percent and 10.8 percent respectively) compared to the LGA (4.5 percent) and Broadmeadow where no one chose to walk. It is likely this higher proportion in the eastern precinct and western precinct is due to close proximity of these suburbs to the Newcastle city centre.

2.2.7 Socio-economic index

The index of relative socio-economic advantage and disadvantage is a continuum of advantage (high values) to disadvantage (low values), which is derived from census variables related to both advantage and disadvantage, such as households with low income and people with a tertiary education.

The index of relative socio-economic disadvantage is derived from census variables related to disadvantage, such as low income, low educational attainment, unemployment, and dwellings without motor vehicles (ABS, 2011). A higher score on the index indicates a lower level of disadvantage, while a lower score indicates a higher level of disadvantage.

The 2011 Index of Relative Socio-economic Disadvantage for suburbs in the study area is presented in Table 2.1.

Table 2.1 Index of relative socio-economic disadvantage for suburbs

Area	2011 index
Newcastle - Newcastle East - Newcastle West	1039.1
Australia	1002.0
New South Wales	995.8
Hamilton	994.8
City of Newcastle	993.9
Broadmeadow - Hamilton North	974.8
Islington	967.0
Mayfield East	960.4
Hamilton South - Hamilton East	942.5

Source: Australian Bureau of Statistics, Census of Population and Housing 2011. Compiled and presented in profile.id by .id, http://www.id.com.au

2.2.8 Crime and safety

Crime and safety is a significant issue in Newcastle, and success in reducing alcohol related violence in recent years is providing important lessons across Australia.

Other crime is also falling in Newcastle, with reductions in the number of incidents of assault (non-domestic violence), break and enter, vehicle theft and malicious damage of between 5 and 10 percent from 2009 to 2013.

Whilst theft from person figures have remained stable over the same period, overall figures indicate improved crime and safety conditions. Actions by Newcastle Council, NSW Government and the community to reduce the risks of such crime and safety lapses, including steps such as implementing the Newcastle/Hamilton Precinct Liquor Accord (NSW Government Communities, Office of the Director General), can be attributed to facilitating this decline.

Importantly though, the western and eastern precincts remain the hotspots for these activities, as indicated on the Bureau of Crime Statistics and Research (BOCSAR) hotspot maps in Appendix B to Appendix D. BOCSAR offence data are summarised in Table 2.2.

Table 2.2 Recorded incidents of selected offences in the Newcastle LGA

Offence	01/09 to 12/09	01/10 to 12/10	01/11 to 12/11	01/12 to 12/12	01/13 to 12/13	Trend	Percent Change
Assault - non-domestic violence related	1357	1443	1266	1246	1064	Down	-5.90%
Break and enter - dwelling	1428	1274	1349	1374	1136	Down	-5.60%
Break and enter - non-dwelling	775	561	596	574	489	Down	-10.90%
Motor vehicle theft	810	754	762	670	535	Down	-9.80%
Steal from person	285	293	281	295	244	Stable	
Malicious damage to property	3482	3186	3127	2657	2240	Down	-10.40%

Source: NSW Bureau of Crime Statistics and Research. 2014-488323-3

2.3 Social infrastructure

Social infrastructure is located across the study area. Wickham Park is adjacent to the proposal construction site. Community facilities, service providers and community organisations within the vicinity of proposal are illustrated in Figure 2.1, and listed in Appendix E.

Newcastle is one of the National Disability Insurance Scheme (NDIS) pilot locations, a result of which is a diversity of disability service organisations delivering services locally. Demand for affordable accommodation for these and other community services is a growing trend in Newcastle.

It is also of note that the public spaces around the Newcastle foreshore are the location of a number of large events within the city. Annual New Year's Eve celebrations and the 'Fat as Butter' music festival are the largest of these, though other events such as Anzac Day utilise these areas. The capacity of the transport system (bus and rail) is currently exceeded at many of these peak passenger events.

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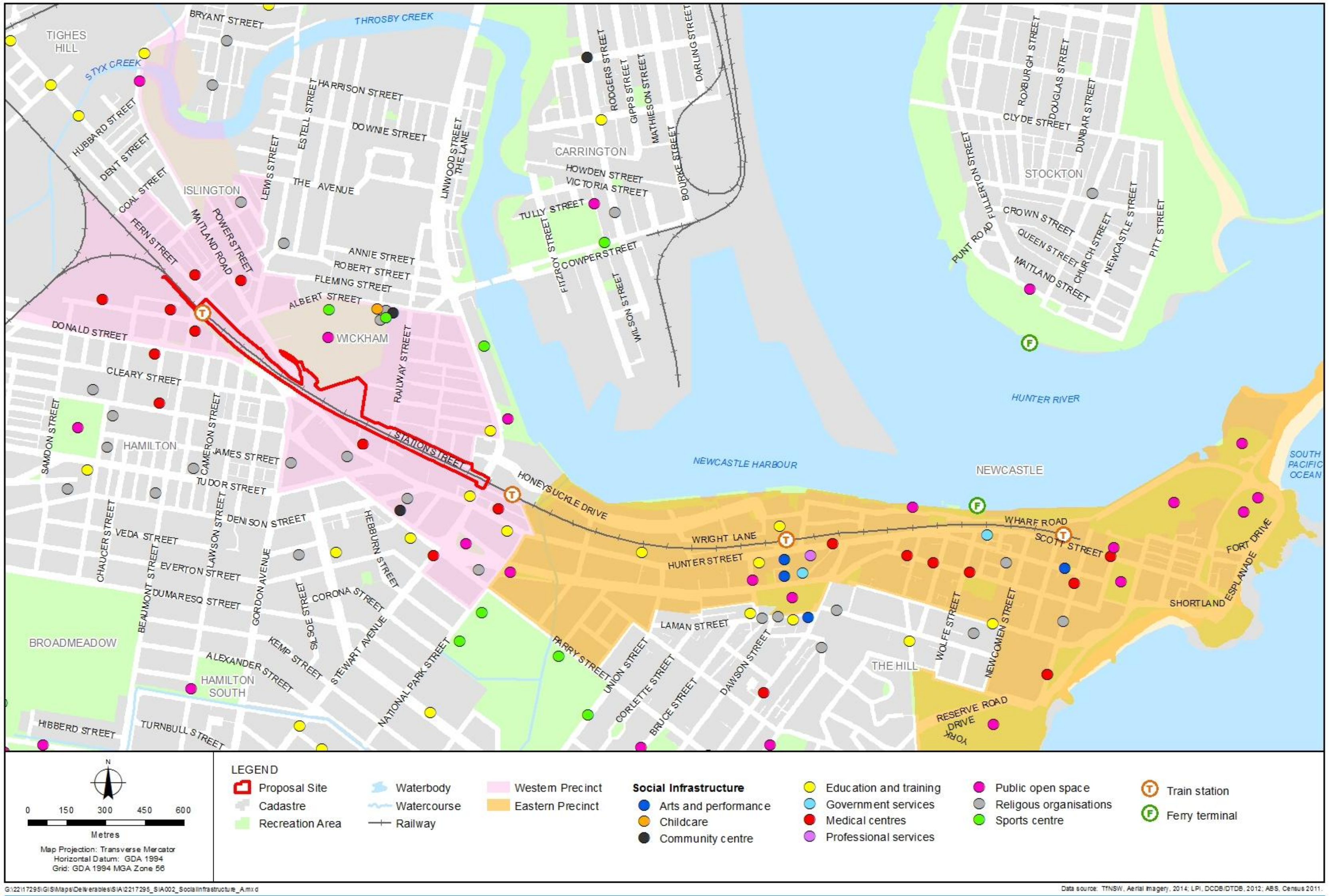


Figure 2.1 Social infrastructure in or adjacent to the study area

2.4 Train patronage

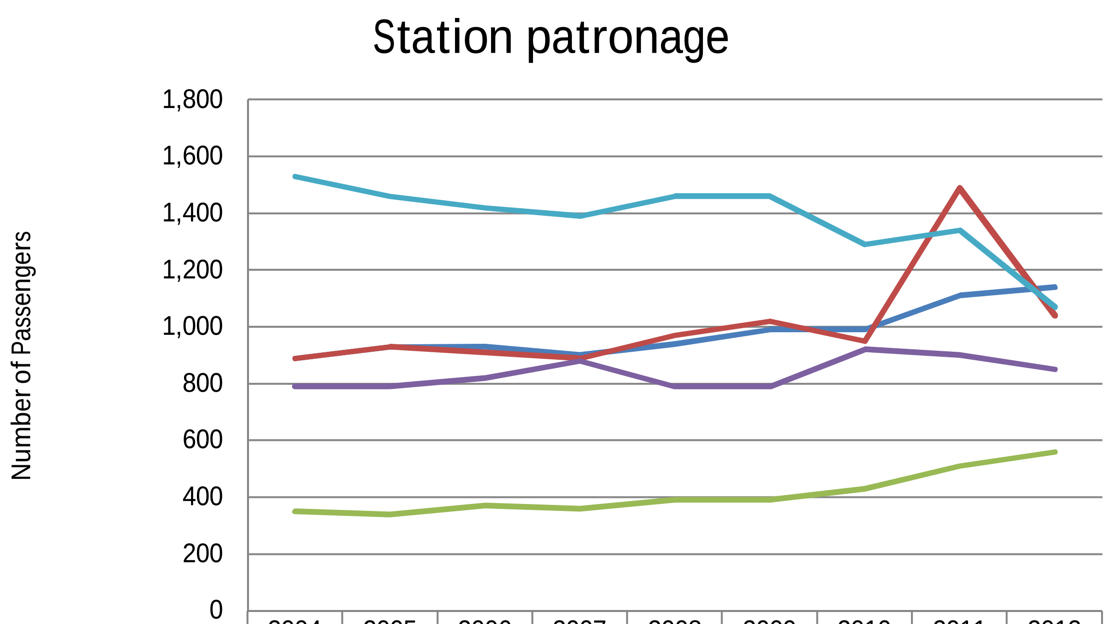
Passengers on the train services to Newcastle have various trip purposes, primarily for work, education and for accessing the facilities of the regional centre (such as retail, professional and government services, recreation and tourism).

Whilst the proposed truncation of the heavy rail would improve vehicle and pedestrian between the centre of Newcastle and the waterfront, this will come at the expense of direct single mode connection to the city centre. The following section draws on available data to describe transport use of relevance to the study area to inform the types of use and users which would be affected.

2.4.1 Overall train travel

In 2012, more than a thousand passenger movements were recorded both arriving and departing on an average weekday at Broadmeadow, Hamilton and Newcastle Stations, with significantly fewer (560) at Wickham than at Civic (850). Noteworthy is the decline by 30 percent in passenger numbers at Newcastle over the last eight years (refer Figure 2.2).

On the average weekday, in the order of 2,500 passengers (assuming that most journeys are return trips) would be required to make this change.



	2004	2005	2006	2007	2008	2009	2010	2011	2012
Broadmeadow	890	930	930	900	940	990	990	1,110	1,140
Hamilton	890	930	910	890	970	1,020	950	1,490	1,040
Wickham	350	340	370	360	390	390	430	510	560
Civic	790	790	820	880	790	790	920	900	850
Newcastle	1,530	1,460	1,420	1,390	1,460	1,460	1,290	1,340	1,070

Figure 2.2 Station patronage 2004-2012

Source :NSW Bureau of Transport Statistics, 2013 Electronic Publication No. E2013-36-Rail-BarrierCounts

Transport statistics also give an indication as to the purpose of journeys. Hamilton and Broadmeadow Stations activity reflects morning commuters departing the stations, whilst arrivals are more spread across the day, reflecting travel for more diverse purposes (see graphs in Appendix F).

Civic and Wickham demonstrate their primary function as commuter destination stations, with peaks in arrivals in the morning peak hours and departures in the evening peak period. Newcastle Station differs from the others with departures spread across the day yet arrival peaking during the middle of the day, consistent with the diverse passenger types expected in Newcastle. This would include regional passengers accessing the city for professional services, retail, recreation and tourist reasons.

2.4.2 Commuters

Journey to work data from the 2011 census indicates that approximately 17,186 people are employed in central Newcastle[1], however of these, six percent (883 people) use the train (see Figure 2.3). This represents about 35 percent of train passengers to the eastern precinct and is consistent with train use trends across the Sydney greater metropolitan area where 38 percent are work trips[2].

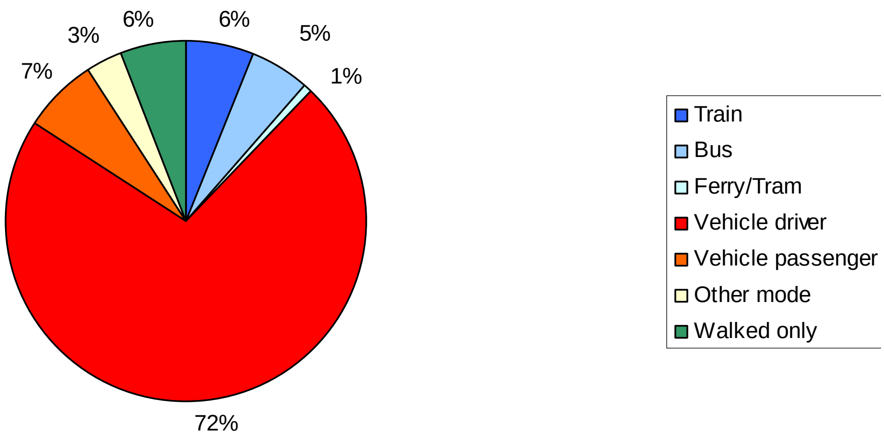


Figure 2.3 Mode of journey to work for central Newcastle workers

Source :NSW Bureau of Transport Statistics, 2013 Journey to Work Tables 12 and 13

Journey to work data indicates that approximately one in three work commuters to Newcastle are from Lake Macquarie and Maitland, and one in six is from Newcastle (see Figure 2.4).

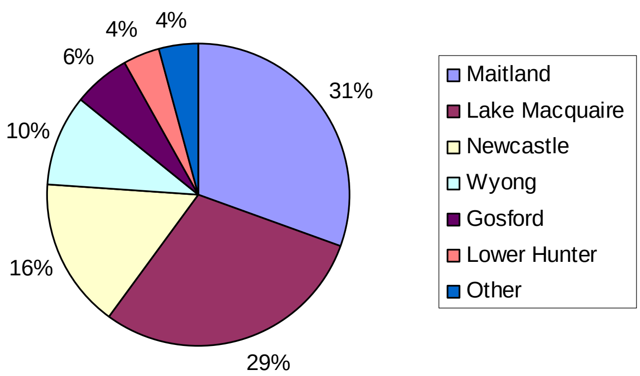


Figure 2.4 Origins of workers travelling to Newcastle by train

Source :NSW Bureau of Transport Statistics, 2013 Journey to Work Tables 12 and 13

[1] Central Newcastle –defined as east of Wickham Station, but a larger area than the project defined eastern precinct, incorporating BTS Travel Zones 6351, 6352, 6353 and 6355)
[2] Compendium of Sydney Rail Travel Statistics, 8th Edition v1.1. NSW Bureau of Transport Statistics 2012

2.4.3 Students

The data in the previous sections reflects those travelling for work. An additional 1,700 passengers per day travel for other purposes, with a significant yet unquantified proportion of these expected to be students. In the greater Sydney metropolitan network (which includes Newcastle), train trips for education represent 11.6 percent[3]).

Students are expected to utilise train services to the area to access campuses at Hamilton TAFE, Newcastle University city campus and Newcastle University Conservatorium of Music, as well as several smaller training institutes. With the development of the new Newcastle University Law School in the centre of Newcastle, increased student commuting is expected in the future. A far higher proportion of students are expected to use public transport, including trains, as they are less likely to own motor vehicles.

2.4.4 Visitors and local travellers

Although quantitative data is limited, the representative sample surveys undertaken in the census household travel survey (NSW Government Bureau of Transport Statistics, 2013) indicate the nature of travel undertaken for non-discretionary (commuting for work or study) and discretionary travel. The data indicates almost equal amounts of travel to Newcastle for both purposes. Discretionary travel to Newcastle could account for in the order of approximately 1,200 passengers per day.

Newcastle’s role as a regional recreation centre is facilitated by train services. Travellers from Lake Macquarie, the Central Coast and Maitland often visit the city to enjoy the night time economy, dining, the beach and other entertainment and to utilise professional and government services.

Travellers from Newcastle

Ticket sales data also indicates that travellers from Newcastle, Broadmeadow and Hamilton are more likely to be pensioners (see Figure 2.5). Importantly for the proposal, around a third of ticket sales at Newcastle Station are to pensioners. A greater proportion of concession passengers travel from Wickham and Civic (such as students). Adult tickets represent more than 50 percent of sales in all but Broadmeadow, representing over 55 percent of sales at Civic and Wickham.

2.4.5 Cyclists and pedestrians

Travel to work data for Newcastle LGA and for the study area indicate cycling and walking to work is relatively common. Compared to the state average of only 0.7 percent cycling, Newcastle LGA records 2.1 percent of workers cycling to work, and higher rates of 2.6 and 2.5 in the western and eastern precincts respectively.

Walking in the western and eastern precincts is also very high at more than one in 10 people for the western precinct and more than one in six residents of the eastern precinct walking to work.

[3] ibid

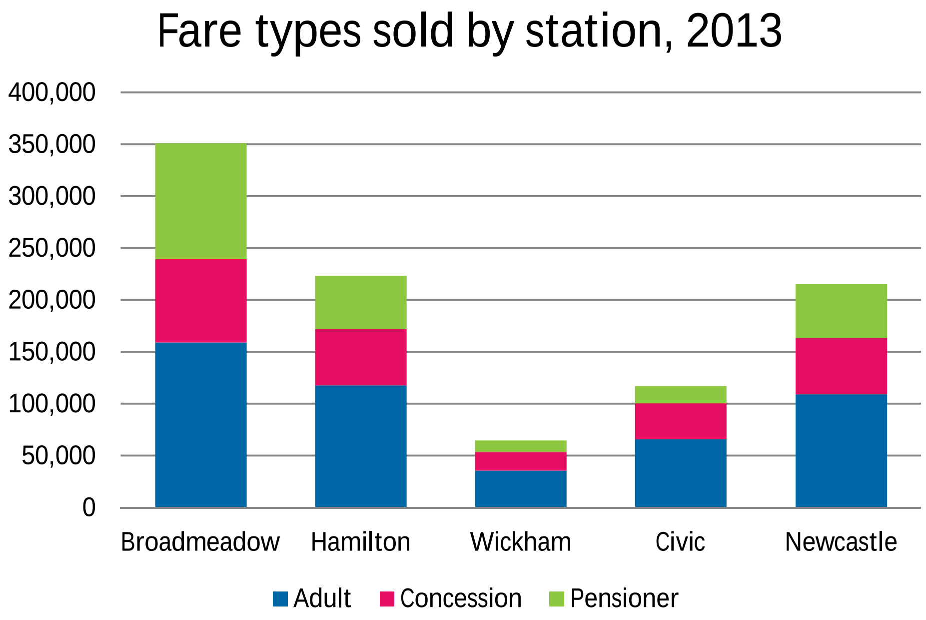


Figure 2.5 Fare types sold by station, 2013

Source :NSW Bureau of Transport Statistics, 2013 Rail Patronage Data, Electronic Publication No. E2014-02-Rail-Journeys

2.5 Summary of the community profile

The neighbourhoods surrounding the proposal site are largely mixed use commercial and residential adjoining, or in proximity to, the existing rail corridor. Social infrastructure serving both local and regional needs is located across both the eastern and western precincts, and serviced by both bus and train.

The western precinct has a higher proportion of disadvantaged residents, and with lower incomes, which may make some residents of the area less able to adapt to any changes resulting from the proposal. Whilst incidents of most crimes have declined in Newcastle in recent years, the proposal area (eastern and western precincts) is located in the local hot spots for offences.

Residents in both precincts show relatively high levels of cycling journeys to work, so could effectively take up opportunities for active travel that may be generated by the proposal.

Only six percent of workers in central Newcastle (883) use the train to travel to work. Of these, close to one third travels from Maitland, 45 percent from the central coast, and 15 percent from within Newcastle. Pensioners make up a significant component of train passengers especially at Newcastle, Broadmeadow and Hamilton. Students are also expected to represent a substantial number of train passengers in city centre Newcastle. These travel patterns are integral to understanding who may be most affected by proposed transport changes as a result of the proposal.

3. Businesses and residences

3.1 Eastern precinct

The eastern precinct is the business centre of Newcastle. There are several large professional service providers, such as legal and banking services, located near Newcastle Station. To support the business sector, there are a number of long and short term accommodation providers located within walking distance of the station.

There are several smaller professional service, and business education and training providers located near Civic Station, along Hunter Street. The Civic Theatre is located opposite Civic Station on Hunter Street with several small retail and dining businesses located in close proximity. Newcastle Museum is located north of Civic Station and is surrounded by a number of businesses including professional service providers, dining, some retail, and personal services (including a fitness centre) along the Newcastle Harbour foreshore. Refer to Figure 3.1 and Figure 3.2.

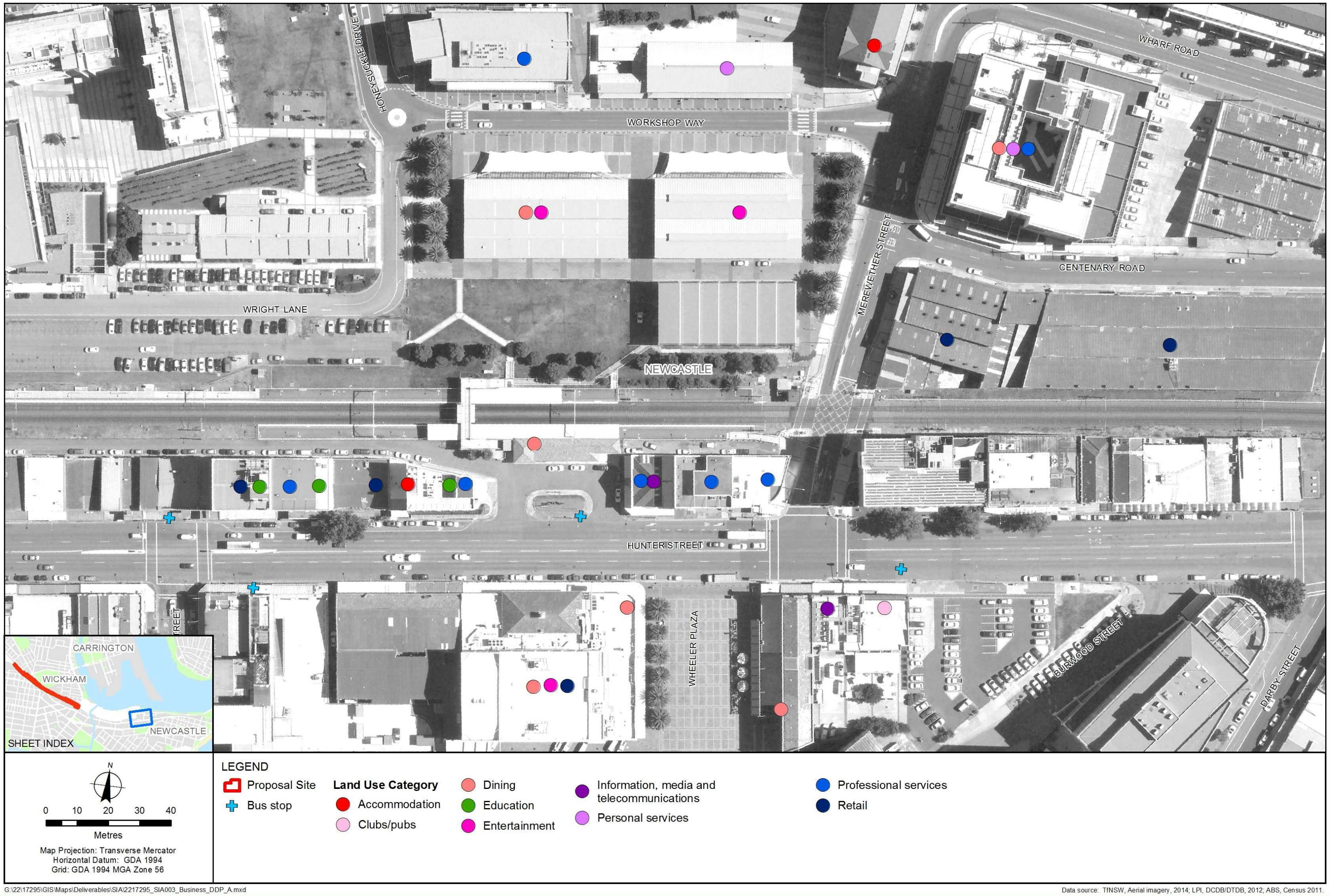


Figure 3.1 Eastern precinct (Civic Station)

G:\22\17295\GIS\Maps\Deliverables\SIA\2217295_SIA003_Business_DDP_A.mxd

Data source: TfNSW, Aerial imagery, 2014; LPI, DCDB/DTDB, 2012; ABS, Census 2011.

Figure 3.2 Eastern precinct (Newcastle Station)

3.2 Western precinct

3.2.1 Wickham

The western precinct is a mix of residential and businesses including light industrial, dining and retail. As shown in Figure 3.3, Figure 3.4 and Figure 3.5, the predominant business type in Wickham is light industrial goods and services, which includes automotive servicing and supply businesses as well as industrial storage and trades. Reflecting the level of gentrification of Wickham , there are also a number of professional services and personal service providers, including a gym and yoga studio.

A number of community service providers are located near the industrial precinct in Wickham. These providers are located on Albert Street adjacent to Wickham Park and to the east of the precinct, near Hannell Street.

These community services include:

- Wickham KU preschool (Albert Street)
- Awabakal Newcastle Aboriginal Co-Operative child care centre (Grey Street)
- The Mission to Seafarers (Hannell Street)
- Hunter Badminton courts (Albert Street)
- Canteen Australia and other youth services (Albert Street)
- Goodlife Church (Albert Street).

Figure 3.3 Western precinct (Wickham)

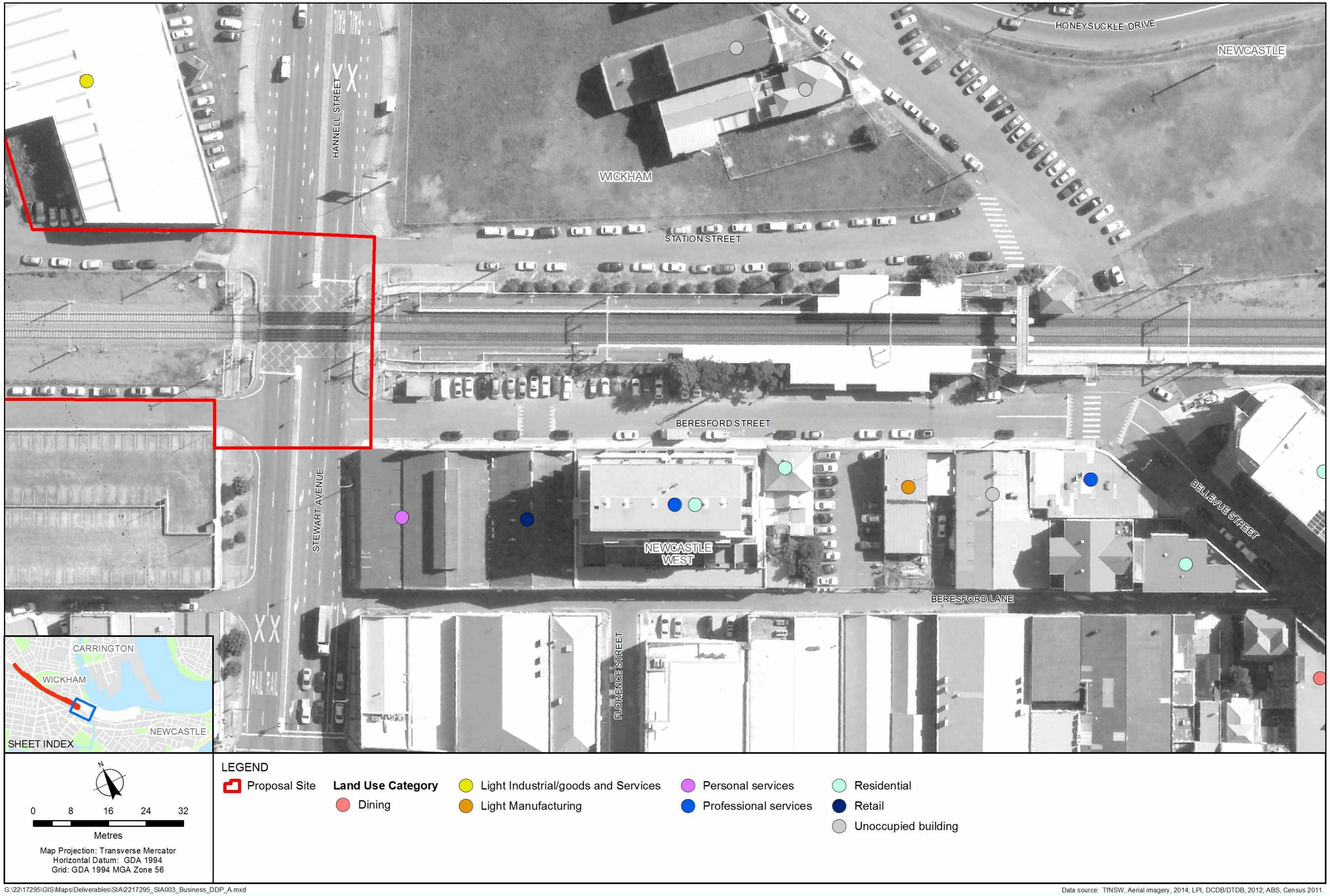


Figure 3.4 Western precinct (Newcastle west)

Figure 3.5 Western precinct (new Wickham)

3.2.2 Hamilton/Islington

The Hamilton and Islington portions of the western precinct have higher concentrations of dining, retail and professional services, than compared to Wickham. As shown in Figure 3.6, the types of businesses west of Hamilton Station include a mix of professional, community, health and allied services.

There are several health and allied service providers along this section of Beaumont Street, including:

- Awabakal Newcastle Aboriginal Co-operative medical centre (Hudson Street)
- Hudson Street Specialist Centre (Hudson Street)
- Vision Australia (Beaumont Street)
- Lifetime Care and Support Authority (Beaumont Street).

The north end of Beaumont Street is predominantly dining/hospitality and retail with some residential.

Conversely, businesses located east of Hamilton Station along Fern Street, Ivy Street and Maitland Road are more predominantly light manufacturing, light industrial goods and services and commercial retail (see Figure 3.7).

A Lifeline Centre is currently being constructed on Maitland Road (adjacent to the proposed stabling yard). This centre is proposed to provide counselling, suicide prevention, and training programs and associated services.

3.3 Broadmeadow precinct

Broadmeadow precinct is a residential neighbourhood with no business activity. As there are no physical works proposed at Broadmeadow as part of the proposal, it is not considered further in this social impact assessment.

Figure 3.6 Western precinct (Hamilton)

Figure 3.7 Western precinct (Islington)

4. Consultation outcomes and community values

As part of the planning for the proposed Newcastle Light Rail project, consultation was undertaken with the local community, including community organisations, businesses and focus groups in Newcastle and Maitland. This consultation also included consideration of the new transport interchange project.

Key feedback from the consultation reveals some community and stakeholder values and interests with regard to the project. During consultation, suggestions were made in relation to the proposed interchange, including that it deliver:

- ease of connectivity between modes, including single level platforms
- provision of long and short term parking
- bicycle access and secure storage
- universal access for people with limited mobility
- fast and frequent services with coordinated timetables and integrate ticketing
- amenities including shops and cafes, with security and lighting.

Concerns were also raised by the general public and the business community about:

- the capacity of Stewart Avenue to accommodate traffic associated with the interchange
- how well the light rail (or for the purposes of the proposal, buses) would accommodate large events in the city.

Community values with regard to the proposal are also reflected in local media, which indicates divided opinion and expectations for rail truncation and urban renewal. Some people are enthusiastic about the opportunity that an accessible and connected city centre could have for business, development, public space and urban vitality, and that more flexible transport networks in the city centre could better serve key areas. Others question the viability of buses or light rail as being suitable replacements for heavy rail and that such a change may discourage use of public transport and compromise the potential urban renewal objectives.

A community interest group, Save Our Rail NSW Inc., does not support the removal of heavy rail from the Newcastle city centre with concerns that proposed urban renewal will not be realised without heavy rail. The group argues heavy rail is required to maintain and develop the city as a regional centre, and are concerned more passengers will choose to drive due to the inconvenience of intermodal travel.

5. Social impact assessment

Potential impacts and their management will depend on their location and scheduling, and affect different people in different ways. In the first instance, impacts have been considered in terms of project scheduling as follows:

- following truncation of the railway and during construction of the new station at Wickham and interchange
- during operation of the new station at Wickham and interchange.

Impacts are considered by location, where appropriate, while also considering the different people and social uses that would be affected, both beneficially and adversely.

5.1 Truncation and construction impacts

The key elements of this stage of the project include:

- removal of the heavy rail line from Stewart Avenue, potential access to the truncated corridor, and cessation of the use of the existing Wickham, Civic and Newcastle stations
- closure of Railway Street level crossing, resulting in permanent loss of vehicle and pedestrian access across the railway at this location
- termination of all train services at Hamilton or Broadmeadow
- construction of the stabling yards (and associated infrastructure) at Hamilton and the new station at Wickham and interchange facilities.

5.1.1 Access and connectivity

Train passengers

The key issue during construction will be the additional travel time for some train passengers (approximately 2,500 per day) to and from Wickham, Civic and Newcastle due to the mode change between train and bus (or other modes as relevant). The mode changes at Broadmeadow and Hamilton will support disabled access and buses will be timed to meet arriving and departing trains wherever possible to facilitate ease of this transfer.

Impacts of the mode change will be disproportionately felt by those with limited mobility (aged and disabled), large items (such as bicycles, surfboards and luggage), or otherwise encumbered (including people travelling with young children). Taxi ranks will be located at Broadmeadow and Hamilton.

For Newcastle University students travelling by train, Hamilton Station is an important interchange stop for travel to Warabrook station. For those students who would be diverted to Broadmeadow as a result of the proposal, a shuttle bus directly from Broadmeadow station to the Callaghan campus is proposed.

In addition, a possible consequence is that passengers with access to a vehicle may change to private transport, which is more likely amongst workers. Over the longer term, this could potentially result in a reduction in healthy lifestyles through the loss of incidental physical activity which most public transport users undertake to and from their origins and destinations.

Traffic and transport

Removal of the boom gates and signals at Stewart Avenue is expected to improve traffic flow and accessibility and therefore improve traffic congestion in the vicinity of the proposal.

Closure of the Railway Street level crossing will primarily impact vehicular traffic for businesses to the north and south of the railway. Business impacts are discussed in section 5.1.6. Drivers and passengers using this route will need to travel a longer alternate route using either Stewart Avenue or Maitland Road to cross the railway.

A pedestrian access assessment study (URS 2014) identified that around 285 pedestrians use this crossing on weekdays and 151 persons on a Saturday. The key impacts of the closure will be for access to Hunter Street and Parry Street, for which walking distances are likely to increase from between 240 and 730 metres.

A Residual Corridor Management Plan is expected to include a plan to improve foreshore accessibility from Hunter Street at multiple points including Queens Wharf and Honeysuckle Drive. These will include improved accessibility for all population groups. These changes are expected to significantly improve access and travel for city residents, workers and visitors, and particularly those with limited mobility.

Mitigation measures

- communications strategy to provide for passenger community information, feedback/complaints and resolution.
- mitigation measures would be incorporated into construction work methods statements, as recommended in Technical Paper 1 – Traffic and transport assessment, prepared by GHD for the proposal
- a Residual Corridor Management Plan would be prepared prior to the cessation of train services at the existing Wickham Station in December 2014
- work with Council to address active travel plans for the project areas.

5.1.2 Noise and vibration

Noise and vibration impacts generated by construction works would be mitigated through the implementation of management and mitigation measures. Measures would include various techniques to reduce noise emissions and, where necessary attenuate noise generated by the construction works. Procedures and measures in the Transport for NSW Construction Noise Strategy (Transport for NSW, 2012) would be implemented.

Construction noise has the potential to impact on neighbouring businesses and residences in Fern, Ivy, Eva and Station Streets. This is particularly the case for out of hours works with the potential to generate sleep disturbance.

Peak hour construction traffic would also increase noise levels on streets adjoining construction access points including Fern Street, Maitland Road, Railway Lane and Station Street. Construction traffic would generally be expected to have limited impacts on the surrounding arterial road networks, although it is expected that construction traffic would be a new noise source on some smaller local streets (e.g. Fern Street, Railway Lane and Station Street). This would be most noticeable during peak hours (start and finish of shifts) and during any periods of particularly intense construction activity such as during rail closedowns and any out of hours works.

The noise and vibration assessment (Technical Paper 3 – Noise and vibration assessment, prepared by GHD) has concluded that vibration impacts are unlikely on the Hamilton Station precinct which is listed on the State Heritage Register. To ensure that this unlikely risk is managed, property condition inspections would be undertaken prior to and during construction to monitor any impacts.

Community information and notification will be undertaken to inform the potentially affected community of high noise impact activities and periods and therefore provide the opportunity for the community to make personal arrangements or for management measures to be implemented by Transport for NSW.

Mitigation measures

- mitigation measures for construction noise and vibration would be incorporated into construction work method statements, consistent with Transport for NSW standard mitigation measures
- implement proactive and comprehensive community information and engagement strategies with adjacent properties and businesses, particularly prior to out of hours works and rail closedowns.

5.1.3 Health

Western precinct

The implementation of standard Transport for NSW mitigation measures are expected to reduce the potential for health impacts resulting from dust, noise, air pollution or contaminated materials during construction, including mechanisms for community complaints.

In regard to contaminated materials, the proposal would only disturb areas within the existing rail corridor where access is already restricted, and provided appropriate mitigation measures are implemented, it is unlikely that the proposal would result in impacts to human health as a result of soil contamination. Potentially hazardous building materials (asbestos, lead paint, PCBs and synthetic mineral fibres) may be disturbed during construction works. The mitigation measures to be implemented would be expected to satisfactorily manage these potential issues without risk to community or worker health.

Dust impacts have the potential to affect the amenity of people occupying nearby properties or passing the proposal site (such as workers, nearby residents, visitors and pedestrians/cyclists). Due to the small amount of dust expected and the comparatively short duration of works, the potential for adverse effects is considered to be low. The operation of plant, machinery and trucks may also lead to increases in exhaust emissions in the study area, however these impacts would also be minor and short term. Implementation of the standard air quality management controls within the construction environmental management plan would avoid or reduce the potential for dust and air quality impacts during the construction phase.

Noise impacts have the potential to cause sleep disturbance, particularly during out of hours works and more generally reduced amenity, and discomfort associated with frequent, continuous and higher noise levels. These would be mitigated, as discussed above, through the implementation of a range of standard measures during construction as proposed in other sections of the REF.

Eastern precinct

Removal of diesel trains from Civic and Newcastle would result in a reduction of diesel train emissions. Overall urban renewal goals for the eastern precinct, facilitated by the heavy rail truncation involve making the city more walkable, encouraging more active travel and improving health outcomes for residents, workers and visitors to the area.

Mitigation measures

Included in the environmental management plan with no additional mitigation measures required.

5.1.4 Amenity

Eastern precinct

Truncation of the heavy rail will allow for:

- more and enhanced public spaces
- greater connection between key public spaces in the Newcastle City centre and the waterfront.

Reuse of the remaining heavy rail station buildings (Civic and Newcastle) presents an opportunity for adaptive reuse as community and urban resources, contributing to the amenity, enhancing the heritage and vibrancy of the city.

Western precinct

A visual assessment has found that adverse visual impacts would be experienced at some locations including Eva Street, Ivy Street, Fern Street and Railway Street. However these impacts would be short term, and can be mitigated by standard design and construction approaches, as the proposed infrastructure would be consistent with the existing rail corridor infrastructure and urban setting.

Increases in noise levels during construction would temporarily affect the amenity particularly of Fern, Ivy, Donald and Station Streets for the duration of works.

Dust and exhaust emissions from plant and construction equipment will occur during construction, however impacts are likely to be minor. The air quality assessment in the REF proposes measures to address air quality during construction.

Construction works may reduce the availability of on street parking, and vehicular and pedestrian access in the immediate vicinity of the work sites. It may also be necessary to temporarily close short sections of traffic lanes, streets and footpaths to undertake the works. Potential traffic and access impacts during proposal operation are also considered in the REF.

Mitigation measures

- noise mitigation as per Technical Paper 3 – Noise and vibration assessment, prepared by GHD, and considerations noted in section 5.1.2
- visual impact mitigation measures as per Technical Paper 5 – Visual and urban design assessment, prepared by GHD, adopted with consideration for community engagement in design and to contribute to public art/visual aesthetics
- the Residual Corridor Management Plan would explore opportunities for community use of decommissioned station buildings.

5.1.5 Property impacts

The proposal would not result in the acquisition of any private property.

Mitigation measures

No mitigation measures are required.

5.1.6 Business impacts

Eastern precinct

Truncation of the rail line at Wickham is not expected to have adverse impacts on businesses in the study area. The replacement of train services with buses will result in passengers' continued access to the city centre via Hunter Street.

The majority of businesses and service providers located in proximity to the remaining railway stations are professional services, education, entertainment, health, retail and dining. Of these, arrival by train or bus is unlikely to affect patronage, with the exception of the kiosk located in the Civic Station railway building. Patronage to this business will be affected by the cessation of train services.

Businesses adjacent to Newcastle Station may be affected by the loss of proximity to the terminus, however it is likely that their prominent locations with regard to the city centre, parkland and beaches will be a larger driver of their patronage than train passengers alone.

Businesses adjacent to the existing Wickham Station may be similarly affected by the rail truncation. This impact may be ameliorated by the likely increase in pedestrian activity with the introduction of replacement bus services (and additional stops) along Hunter Street, as well as the close proximity of the proposed replacement station on the western side of Stewart Avenue.

Western precinct

The proposal presents the potential for impacts on businesses in Wickham and Hamilton as a result of changes in vehicle and pedestrian traffic, parking and noise. Impacts are considered separately for each area below.

Wickham

Impacts in this area would include:

- construction traffic along Station Street
- loss of on-street parking
- construction noise
- disruption/loss of access for businesses currently using Railway Street.

Construction of the new transport interchange is likely to result in loss of car parking on the southern side of Station Street. Traffic will also increase on Station Street and Railway Lane as construction vehicles use these roads to move between the interchange construction site and the site compound.

Construction traffic would also likely increase on key streets including Railway Street, Throsby Street and Albert Street. The majority of businesses located on these streets are light industrial, goods and services which have associated heavy vehicle movements. Additional traffic may affect customers and business transport arrangements. Businesses may also be potentially impacted by increased noise from construction activities.

Closure of the Railway Street level crossing will result in slightly increased travel times for motorists and pedestrians. This is expected to be particularly the case for the Klosters Car Dealership and Spare Parts Division which has a number of premises on either side of the railway line at Wickham. The Lass O'Gowrie Hotel is also located close to the level crossing and is a popular pub and live music venue with a strong patronage.

Hamilton

Potential impacts for Hamilton businesses are both adverse and beneficial. Increased pedestrian and vehicular traffic due to higher volumes of passengers boarding and alighting bus and train services has the potential to generate an economic benefit for those businesses. The majority of businesses located adjacent the station are dining, community services, retail and professional services.

The businesses most likely to benefit from the increased pedestrian activity on Beaumont Street are clubs/pubs and restaurants/cafes located near the replacement bus stop on the southern side of the station. These include the Hamilton Station Hotel, Sydney Junction Hotel, Gallipoli Legion Club and Rolador café.

The provision of regular shuttle buses will also increase traffic on Beaumont Street, (the section from Hamilton Station to Donald Street) which currently only supports one bus route (Route 118 from Stockton to Union Street). However, this increase is unlikely to significantly impact on the amenity of the area (an average of four buses per hour). The frequency of railway movements at Beaumont Street level crossing will not increase as a result of the proposal.

However for businesses whose customers drive, increased competition for parking (i.e. commuters seeking parking in the Hamilton area and potential loss of on-street parking to facilitate additional bus areas) may be detrimental to their business. This will need to be managed through Council's parking strategy and local area traffic management plan.

A number of businesses in Fern and Beaumont Streets are also likely to experience noise impacts during construction.

Additional worker patronage is expected in the Hamilton area during stabling yard construction for at least six months.

Mitigation measures

- control construction traffic by restricting vehicles to higher volume roads (i.e. Railway, Station and Throsby Streets and avoiding Wickham, Union and Charles Streets) as per recommended traffic management measures
- noise mitigation measures to be implemented for affected businesses/organisations as per the recommended noise management measures
- stakeholder engagement strategy which engages with local businesses affected by the closure of Railway Street
- consultation with affected residences and businesses during development of local parking plan for the area in consultation with Council.

5.1.7 Social infrastructure

No existing social facilities or service providers would be directly impacted by the proposal.

The key issues for social infrastructure is how transport changes will affect accessibility to services and facilities. It is anticipated that social infrastructure in the western precinct will not be affected by the proposal. For passengers travelling to social infrastructure in the eastern precinct, a delay would be experienced due to the need to change mode of transport from train to bus to complete their journey. However commuters will still be able to access these locations and for some travellers, bus stops may be closer to their destination that the train stations.

A mobile homeless service is currently provided by Hunter Baptist Care to areas in the city centre. The changed train termination location has the potential result in a relocation of some homeless clients and therefore for the operation of this service (see section 5.1.9).

Mitigation measures

- ensure communications strategies and plans (advising of changed travel arrangements) target organisations delivering social services and operating social facilities and particularly homelessness services.
- communications strategy to provide for community feedback/complaints and resolution.

5.1.8 Community safety

Eastern precinct

Truncation of the heavy rail line presents a risk of unauthorised access to the residual rail corridor. The corridor generally has low casual surveillance which could result in community safety risks. Unauthorised access to the residual corridor could present physical safety risks. The Residual Corridor Management Plan would include measures to prohibit unauthorised access to the railway corridor following cessation of services.

Decommissioned station buildings, if left unused, present a risk of being the focus of antisocial activities.

Western precinct

Termination of train services at Hamilton will result in an increase in pedestrian activity in the vicinity of the railway station, both day and night. The current bus interchange area is setback from the busier Beaumont Street businesses and is adjoined by parkland with low levels of passive surveillance and little lighting. Beaumont Street currently experiences locally high levels of assault and robbery. Whilst the additional flow of passengers could increase passive surveillance, consideration should be given to other measures such as lighting to further reduce this risk.

On Railway Street, the Lass O'Gowrie Hotel is located close to the level crossing and is a popular pub and live music venue with a strong local and regional patronage. It is anticipated that many of the hotel's patrons currently use the level crossing to access Hunter Street buses and taxis when travelling to and from the venue. Closure of the crossing will mean patrons have reduced access to this transport and will need to walk along Station Street and Stewart Avenue to get to Hunter Street. This reduced pedestrian access (and consequently access to public buses on Hunter Street) for patrons of the Lass O'Gowrie Hotel creates the potential for decreased community safety in the vicinity of the hotel and walking routes. Community safety and transport at night are prominent issues in Newcastle (as highlighted by the introduction of initiatives such as the Walk Smart program), and changes in access for night venues need to be managed cooperatively to avoid creating safety risks.

Mitigation measures

- consider Crime Prevention Through Environmental Design (CPTED) issues for Hamilton bus interchange areas in cooperation with Newcastle Police
- provide appropriate exclusion fencing and sensor lighting for the construction compound site
- provide a graffiti removal program to maintain the amenity of the site and proposal infrastructure
- support public art in the vicinity/treatment of hoardings and other appropriate temporary site infrastructure to improve amenity, reduce vandalism and build community ownership of the proposal
- explore opportunities for activation of decommissioned station buildings. This could include to accommodate community service providers, or for interim “pop-up” uses.
- consider community safety issues in the vicinity of the Lass O’Gowrie Hotel in cooperation with Council, Newcastle Police and other key stakeholders.

5.1.9 Vulnerable groups

Homeless people

Council has identified that the proposal has the potential to alter the travel and sleeping patterns of homeless people and their consequent safety. Some homeless people travel and sleep on trains at night, currently arriving at Newcastle Station. Public areas of Newcastle and Civic Stations and surrounding parks and buildings are often used by homeless people to sleep.

With trains terminating at Hamilton, there is the likelihood that homeless people will alternatively use the adjoining parkland, rather than change mode to a further destination. This area has poor surveillance, little in the way of public buildings and spaces that can provide shelter, and adjoins residential properties (as discussed in section 2.2.8). Such a location presents a risk to homeless people and the community. It also represents a risk for the service providers who support them (i.e. the Hunter Baptist Care mobile service).

Other vulnerable groups

Effectively communicating the changes to travel modes, places of boarding and alighting buses, ticketing, and delays due to the mode transfer as a result of the proposal will be vitally important. Particular groups would need to be targeted in this communication, including the elderly and/or people with a disability and people from non-English speaking backgrounds.

Mitigation measures

- consult with homelessness service providers in the area, Newcastle Police and Council to better assess the risk and develop an appropriate management plan
- ensure the proposal communications strategy considers the needs of vulnerable groups and develops a strategy in consultation with relevant peak bodies or local service providers.

5.2 Operational impacts

5.2.1 Access and connectivity

Train passengers

The key social impacts during operation will be the need to change mode at the new transport interchange and the additional travel time involved. At current patronage rates, this would impact approximately 1,900 train passengers per day. During operation, all Newcastle bound trains will terminate at the new interchange and passengers will transfer to an onward shuttle bus from Stewart Avenue. The resultant additional travel time may be slightly less than that experienced during construction. The less mobile, people travelling with young children or with encumbrances (such as bicycles and luggage) would be most affected by this change.

Changes would be communicated effectively to all travellers to ease this transition through appropriate wayfinding and signage.

Traffic and transport

The opportunity provided by the proposal to provide additional vehicle crossing points along the former railway east of Stewart Avenue will greatly enhance access between the waterfront and the Newcastle city centre.

The changes to access discussed in section 5.1.1 for the western precinct, which include increased travel time and reduced pedestrian access in the vicinity of Railway Street, would continue during operation.

Mitigation measures

- provide passenger seating at bus stops where passengers will be boarding
- evaluate the effectiveness of the Railway Street pedestrian movement management strategies during construction to inform the development of long term management strategies
- design the interchange to incorporate and encourage active travel (bike parking and lockers)
- interchange design to be logically navigable, and incorporate real time displays for service timing and operation
- ensure the operational communications strategy considers the needs of vulnerable groups (less mobile, elderly) and develops a strategy in consultation with relevant peak bodies or local service providers
- management plans developed as part of future proposals would address universal access and active travel as key considerations.

5.2.2 Noise and vibration

Noise from operation of the Hamilton stabling yard is predicted to exceed regulatory criteria and may result in sleep disturbance impacts at residences in Fern and Ivy Streets and Eva Street, Hamilton. While a noise barrier would result in a noticeable reduction in noise levels at some premises, it is likely that a combination of controls would need to be implemented to bring noise levels to within acceptable criteria.

Further detailed analysis of design and operational measures to manage noise at the proposed stabling yard would be undertaken during the subsequent design stage.

Mitigation measures

- more detailed assessment of the effectiveness of feasible and reasonable design and operational measures during subsequent design phases.

5.2.3 Business impacts

No operational impacts on businesses are likely during proposal operation.

5.2.4 Health

The relocation of the existing station at Wickham to the western side of Stewart Avenue and introduction of stabling yards at Hamilton will move station-related diesel train emissions closer to some residential and business properties. However there are no likely impacts to sensitive receivers given separation distances. Further, the number of diesel trains would not increase, no diesel powered trains would be stabled in the Hamilton Stabling yards (only electric trains), and the speed limit would be reduced between Hamilton and Wickham.

The change to peoples' travel modes (i.e. if train passengers change to driving) could result in loss of incidental physical activity in their travel habits and consequent reduction in healthy lifestyles over the longer term.

5.2.5 Property impacts

More detailed studies of noise impacts and potential mitigation options during subsequent stages of design are necessary to determine if properties would be affected by operation of the proposal (refer to Technical Paper 3 – Noise and vibration assessment, prepared by GHD).

5.2.6 Community safety

Upon decommissioning of the construction compound, Transport for NSW will develop a long term strategy for use of the site.

Concerns in the vicinity of the new transport interchange regarding altered passenger movements would be addressed in a similar manner to ongoing management of safety for the changed travel patterns in central Newcastle. Continuing any construction phase management of community safety related to the Lass O'Gowrie hotel on Railway Street would be undertaken.

Consideration of some of the homeless population seeking safe areas to shelter after travelling on trains may be an issue to be considered during operation.

Mitigation measures

- undertake site planning and assessment for the new transport interchange in cooperation with Newcastle Police and an urban designer to address CPTED issues
- provide a graffiti removal program to maintain the amenity of the site and proposal infrastructure
- if required, consult with homelessness service providers in the area, Newcastle Police and Council to better assess the risks and develop an appropriate management plan for operation.

Table 5.1 Summary of social impact assessment

Potential impact /risk	Target group impacted	Timing	Nature of impact	Assessment	Mitigation measures proposed
Access and connectivity					
Increased travel times as a result of mode change	Train passengers to and from the eastern precinct – including commuters, students and visitors Limited mobility and encumbered passengers	Construction /operation	Moderate adverse (approximately 2,500 passengers)	Daily travellers to the eastern precinct would be impacted (if all travellers continued to use the train) with travel time increases expected	City shuttle buses be provided Buses are to be accessible Communication strategy to provide for passenger and community information feedback/complaints and resolution
		Operation	Moderate adverse (approximately 1,900 passengers)	Additional travel time for journeys to and from Newcastle	As for construction, and also: Buses will be timetabled to match train operations Opportunities for transponder technology, bus lanes and other bus priority measures will be explored to minimise shuttle bus journey times
Improved accessibility (pedestrian and vehicle) between the Harbour and city centre, including Queens Wharf and Honeysuckle Drive	Newcastle residents, workers and visitors generally Especially less mobile or encumbered people	Construction / operation	Major beneficial	Opportunities to allow for greater connectivity between the Newcastle city centre and the waterfront	This is a benefit of the proposal Transport for NSW and Urban Growth will be undertaking various projects to improve pedestrian, cyclist and vehicle permeability through the former rail corridor, which will be subject to separate planning approvals
Reduced pedestrian access due to closure of Railway Street level crossing	Workers and patrons of local businesses within Railway Street, Station Street and vicinity	Construction / operation	Minor adverse	Loss of direct access north and south of the rail corridor	See business impacts
Noise and vibration					
Noise, vibration and amenity impacts during construction works	Residences and businesses in Fern, Ivy, Eva and Station Streets and users of Wickham Park	Construction	Adverse	Potential noise impacts on businesses and residences	Early consultation with potentially affected property owners and users Mitigation measures for noise and vibration be incorporated into construction works methods , consistent with Transport for NSW standard mitigation measures

Potential impact /risk	Target group impacted	Timing	Nature of impact	Assessment	Mitigation measures proposed
Noise from the Hamilton stabling facility	Residential properties adjacent to the stabling facilities at Hamilton	Operation	Moderate adverse	Train idling and auxiliary system operation will increase noise levels, particularly during evening and nighttime	Adopt reasonable and feasible noise mitigation measures in accordance with the noise impact assessment
Health					
Passengers change mode of travel from train to car	Train passengers to or from the eastern precinct - mostly commuters and visitors	Construction / operation	Risk	Reduction in healthy lifestyles due to likelihood of reduced physical activity for passengers	Work with Council to address active travel plans for the project area
Amenity					
Cessation of use of railway buildings	Community	Permanent	Opportunity	Opportunity to reactivate them as vital community and urban resources, contributing to the amenity and vibrancy of the city	The future long term use of structures in the rail corridor will be explored with the NSW Heritage Division, Transport for NSW, Urban Growth, Newcastle Council and other key stakeholders
Increase in noise during construction, and reduced visual amenity	Residents and businesses in Fern, Ivy, Eva and Station Streets	Construction	Moderate adverse	Noise and visual impacts have the potential to reduce amenity	Noise mitigation as per the proposal noise assessment Visual impacts to be addressed as per the mitigation measures proposed in the visual impact assessment
Property impacts					
Reduced availability of on street parking, vehicular and pedestrian access in the immediate vicinity	Businesses and residences in nearby streets	Construction	Minor adverse	Reduce the availability of on street parking, vehicular and pedestrian access in the immediate vicinity, and temporary road and footpath closures	Community information and engagement strategies with properties in these key areas as a priority Develop mitigation and management measures in consultation with property owners and users
Businesses					
Reduced vehicle access due to closure of Railway Street level crossing	Businesses in the vicinity, particularly Klosters car yard on Hunter Street	Permanent	Minor adverse	Increased travel times to cross the railway	Notification of affected business and residences Consideration of road works at intersections with Stewart Avenue to allow for new movements, in consultation with Roads and Maritime Services

Potential impact /risk	Target group impacted	Timing	Nature of impact	Assessment	Mitigation measures proposed
Reduced pedestrian access due to closure of Railway Street level crossing	Workers and patrons of local businesses within Railway Street, Station Street and vicinity.	Permanent	Minor adverse	Increase walking distance to cross the railway	Notification of affected business and residences Implement a stakeholder engagement strategy which engages with local businesses affected by the closure of Railway Street
Reduced availability of parking	Businesses in Station Street	Permanent	Adverse	Loss of parking in Station Street resulting in loss of customer and employee parking	Develop a local parking management plan in consultation with Council
Impacts due to increased noise and traffic	Businesses in Wickham north of the railway line	Construction	Minor adverse	Construction traffic can cause additional noise and disrupt delivery access for businesses in the Wickham area north of the railway	Implement of construction traffic management plan and construction vehicle routes as per the traffic impact assessment (Technical Paper 1 – Traffic and transport assessment, prepared by GHD)
Stimulated economic activity	Businesses in Beaumont Street near Hamilton Station	Construction	Minor beneficial	Additional pedestrians may increase patronage of local retail, dining and other businesses in the area Construction workforce seeking local catering and services	Not required
Increased competition for parking	Businesses in Station Street	Permanent	Minor adverse	Parking will be lost on Station Street	Develop a local parking plan in consultation with Council
Community safety					
Safety of passengers at Hamilton Station transfer	Transferring passengers, homeless people, homeless service providers, local residents	Construction	Risk	The setback bus stop and adjacent park area at Hamilton Station may attract loitering, and being in a regionally active crime area, presents risks for community safety	Consider local safety issues for Hamilton bus interchange areas in cooperation with Newcastle Police Support public art in the vicinity/treatment of hoardings and other appropriate temporary site infrastructure to improve amenity, reduce vandalism and build community ownership of the proposal
Night time safety in the vicinity of the Lass O'Gowrie Hotel	Patrons and the local community in the vicinity and along routes to public transport	Permanent	Risk	Reduced options and efficiencies for transport at night increases risks of violence and misadventure for patrons and the community	Consider community safety issues in the vicinity of the Lass O'Gowrie Hotel in cooperation with Council, Newcastle Police and other key stakeholders

Potential impact /risk	Target group impacted	Timing	Nature of impact	Assessment	Mitigation measures proposed
Safety in the vicinity of the interchange	Passengers	Long term	Risk	Altered passenger movements will require revised management of safety and policing	Liaise with NSW Police and Newcastle City Council to address CPTED issues during detailed design
Vulnerable groups					
Community understanding of transport changes	Whole of community, but especially the elderly, disabled	Construction /operation	Risk	Vulnerable groups, if not communicated to effectively, will be the impacted by changed transport services and reduced access	Develop communication strategies that involve organisations delivering services at local levels

6. Conclusion

Truncation of the heavy rail line at Wickham and the construction of the new station and transport interchange will change the way people travel by public transport in Newcastle. The Newcastle community will realise substantial benefits from the wider program of works associated with the Newcastle Urban Renewal and Transport Program, of which the proposal is a necessary precursor.

This impact assessment has identified social impacts during construction and operation of the proposal and proposes a range of mitigation measures to reduce identified impacts.

The key impacts identified are the increased travel time for commuters into and out of the Newcastle city centre as a result of the mode change requirement of the proposal, and the associated disruption to passengers which will be sustained mostly by socially disadvantaged groups and other encumbered persons. The assessment also identifies a number of risks and opportunities that would be further considered prior to commencement of construction and during detailed design.

The main impacts identified and mitigation measures proposed are as follows:

Access and connectivity

- increased travel time for commuters to/from the former Newcastle Station due to the cessation of train services. This impact may be more substantial for passengers who are elderly, disabled, or those travelling with young children
- permanent loss of vehicle and pedestrian access due to the closure of the Railway Street crossing with implications for nearby businesses and their patrons
- permanent loss of parking in Station Street
- improved connectivity between the city centre and the foreshore.

Proposed mitigation measures: Provision of a timely, easily accessible shuttle bus service. Implement a communications strategy to provide for passenger community information, feedback/complaints and resolution.

Noise, vibration and amenity

- construction and operational noise impacts on residences in Station, Fern, Ivy, and Eva Streets and users of Wickham Park.

Proposed mitigation measures: Implement noise and visual impact mitigation measures consistent with Transport for NSW standard mitigation measures and the recommendations of the REF.

Business impacts

- access for businesses in the vicinity of the Railway Street level crossing closure
- loss of parking for businesses in Station Street and potential for increased competition for parking in the vicinity of Hamilton Station.

Proposed mitigation measures: Implement traffic and transport recommendations of the REF, and implement a stakeholder engagement strategy which engages with local business affected by the closure of Railway Street.

Community safety

- potential safety issues for passengers changing modes late at night
- potential community and patron safety issues along Station Street and in the vicinity of the Lass O'Gowrie Hotel at night.

Proposed mitigation measures: Design for the Transport Interchange will incorporate relevant Crime Prevention Though Environmental Design (CPTED) initiatives. Consider community safety issues in the vicinity of the Lass O'Gowrie Hotel in cooperation with Council, Newcastle Police and other key stakeholders

Vulnerable groups

- potential to impact the travel and sleeping patterns of homeless people and consequently their safety
- awareness of vulnerable groups (aged, elderly, disabled, non-English speaking background) to the changes in travel modes, places of boarding and alighting buses, ticketing and travel delays.

Proposed mitigation measures: Consult with homeless service providers in the area, Council and Newcastle Police to assess the risks to the homeless and manage appropriately. Ensure a project communications strategy considers the needs of vulnerable groups and is developed in consultation with relevant peak bodies and local service providers.

7. References

Australian Bureau of Statistics, *Census 2011*

NSW Bureau of Crime Statistics and Research (BOCSAR), *NSW Recorded Crime Statistics*, 2014-488323-3

NSW Government Communities, Office of the Director General, *Newcastle/Hamilton Precinct Liquor Accord*

NSW Government Bureau of Transport Statistics, *2013 Household Travel Survey* (HTS) Electronic Publication No. D2013-HTS-Table2-Linked

NSW Government, Bureau of Transport Statistics, *Compendium of Sydney Rail Travel Statistics*, 8th Edition v1.1 November 2012

Transport for NSW, *NSW Sustainability Design Guidelines* – Rail, 2012

Transport for NSW, 2014, *Wickham Terminus Construction Period*, Service and Operational Plan

URS, 2014, *Newcastle Urban Renewal and Transport Program - Pedestrian Footbridge Requirement Study*

Appendices

Appendix A - Demographic indicators

Source: ABS Census 2011

	Western precinct		Eastern precinct		Newcastle LGA		Greater Newcastle	
Population								
Total Persons	1,542		3,679		148,535		398,770	
Age groups:								
0 to 4 years	91	5.9%	112	3.0%	9,006	6.1%	25,413	6.4%
5 to 11 years	92	6.0%	100	2.7%	11,583	7.8%	34,296	8.6%
12 to 17 years	51	3.3%	128	3.5%	9,620	6.5%	30,542	7.7%
18 to 24 years	233	15.1%	577	15.7%	17,091	11.5%	38,655	9.7%
25 to 34 years	378	24.5%	876	23.8%	22,059	14.9%	50,257	12.6%
35 to 49 years	334	21.7%	622	16.9%	29,829	20.1%	80,106	20.1%
50 to 59 years	160	10.4%	528	14.4%	18,600	12.5%	52,300	13.1%
60 to 69 years	127	8.2%	425	11.6%	13,919	9.4%	41,724	10.5%
70 to 84 years	66	4.3%	260	7.1%	12,964	8.7%	36,231	9.1%
85 and over years	12	0.8%	49	1.3%	3,864	2.6%	9,246	2.3%
Under 18 years	234	15.2%	340	9.2%	30,209	20.3%	90,251	22.6%
15 years and over	1,338	86.8%	3,407	92.6%	123,229	83.0%	324,070	81.3%
Median Age	32		35		37		38	
Cultural Diversity:								
Indigenous persons	46	3.0%	71	1.9%	3,926	2.6%	12,178	3.1%
Non English Speaking Background	57	3.6%	225	6.1	8,550	5.7%	16,432	4.1%
Household Characteristics								
Family households	313	46.7%	797	46.9%	37,309	63.8%	106,067	70.3%
Lone person household	265	39.6%	688	40.5%	17,266	29.5%	38,887	25.8%
Group household	92	13.7%	213	12.5%	3,875	6.6%	6,024	4.0%
Average household size	2.1		1.9		2.4		2.5	
Family Characteristics								
Total families	317		795		37,907		108,184	
Couple family with children	75	23.7%	185	23.3%	15,368	40.5%	45,577	42.1%

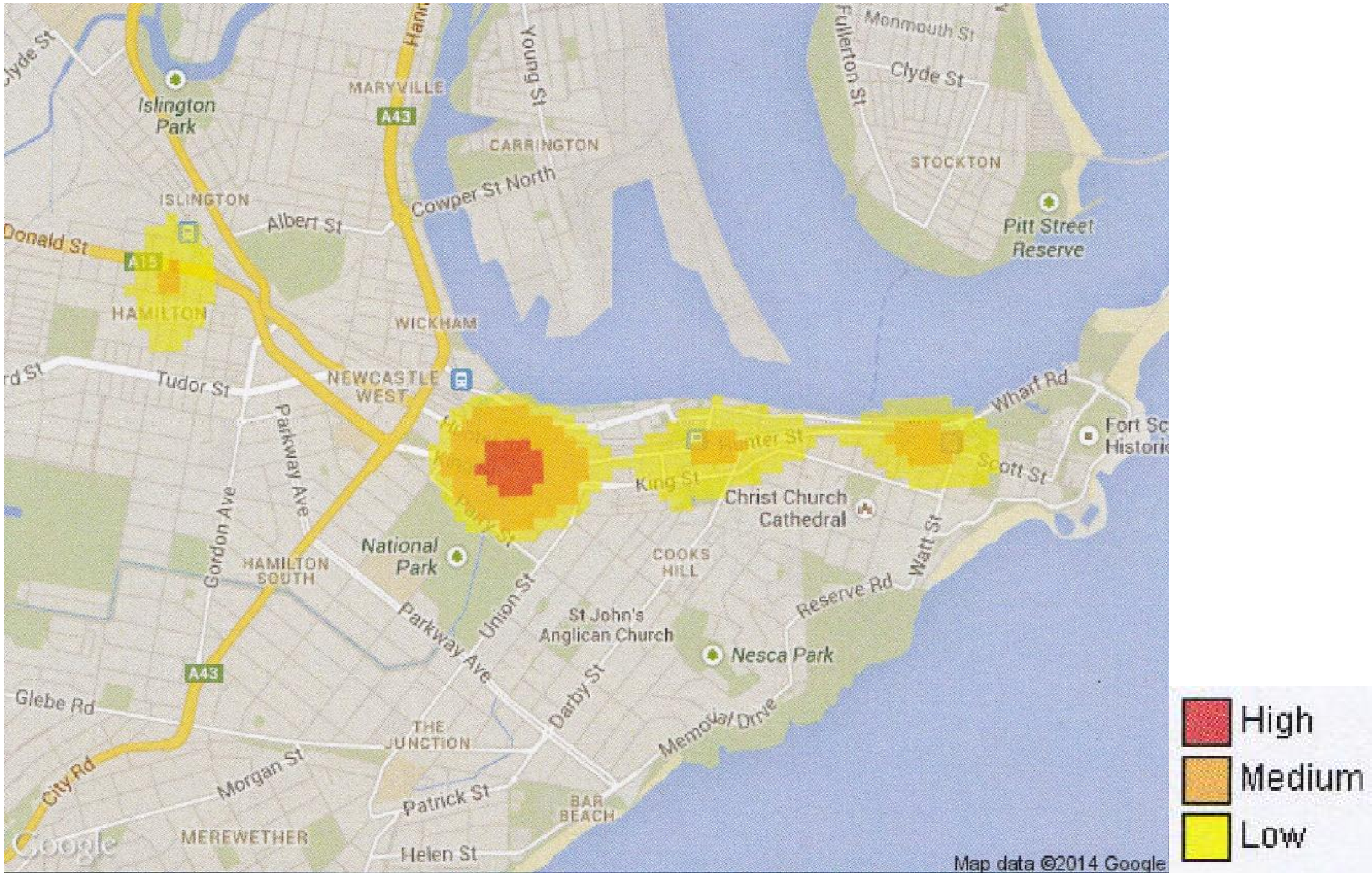
	Western precinct		Eastern precinct		Newcastle LGA		Greater Newcastle	
Couple family without children	126	39.7%	492	61.9%	14,704	38.8%	41,466	38.3%
One parent family	94	29.7%	98	12.3%	7,022	18.5%	19,440	18.0%
Other family	22	6.9%	20	2.5%	813	2.1%	1,701	1.6%
Other characteristics								
Need for assistance	70	4.5%	99	2.7%	8,730	5.9%	23,036	5.8%
Dwellings								
Separate House	344	45.1%	88	4.1%	42,986	67.9%	122,964	75.4%
Semi-detached, terrace house, townhouse	94	12.3%	200	9.3%	7,057	11.1%	13,838	8.5%
Flat, unit or apartment	212	27.8%	1,382	64.5%	8,124	12.8%	12,992	8.0%
Other dwellings	18	2.4%	27	1.3%	200	0.3%	1,066	0.7%
Not stated	-	0.0%	-	0.0%	84	0.1%	118	0.1%
Unoccupied private dwellings	94	12.3%	445	20.8%	4,890	7.7%	12,111	7.4%
Tenure Type:								
Fully owned	114	12.3%	381	15.6%	18,056	24.9%	51,221	28.1%
Being purchased	163	17.6%	325	13.3%	18,590	25.6%	52,212	28.7%
Rented (Total):	372	40.3%	948	38.8%	19,812	27.3%	42,714	23.5%
Real estate agent	228	24.7%	586	24.0%	10,606	14.6%	22,104	12.1%
State Housing Authority	31	3.4%	159	6.5%	3,511	4.8%	8,957	4.9%
Other Tenure Type	3	0.3%	15	0.6%	401	0.6%	1,036	0.6%
Not stated	13	1.4%	29	1.2%	1,592	2.2%	3,794	2.1%
Income								
Median Individual Income ($/weekly)	574		847		563		544	
Median Household income ($/weekly)	1,028		1,543		1,165		1,165	
Labour Force								
Labour force participation	862	64.4%	2,218	65.1%	74,542	60.5%	193,130	59.6%
Unemployed persons	70	8.1%	116	5.2%	4,283	5.7%	10,585	5.5%
Occupation								
Managers	67	8.4%	305	14.5%	6,937	9.9%	17,861	9.8%
Professionals	192	24.0%	840	40.0%	18,065	25.7%	38,260	21.0%
Technicians and trades	112	14.0%	185	8.8%	9,647	13.7%	28,858	15.8%
Community and personal service	129	16.1%	186	8.8%	7,379	10.5%	18,363	10.1%
Clerical and administrative	102	12.8%	251	11.9%	9,916	14.1%	26,666	14.6%

	Western precinct		Eastern precinct		Newcastle LGA		Greater Newcastle	
Sales	81	10.1%	167	7.9%	6,908	9.8%	18,763	10.3%
Machinery operators and drivers	46	5.8%	51	2.4%	4,090	5.8%	13,472	7.4%
Labourers	63	7.9%	93	4.4%	6,313	9.0%	17,628	9.7%
Not Stated	7	0.9%	24	1.1%	1,002	1.4%	2,670	1.5%
Key Industry								
Agriculture, forestry & fishing	10	1.3%	3	0.1%	189	0.3%	710	0.4%
Mining	10	1.3%	40	1.9%	1,129	1.6%	5,215	2.9%
Manufacturing	61	7.6%	151	7.2%	6,460	9.2%	18,521	10.1%
Electricity, gas, water & waste services	3	0.4%	28	1.3%	1,145	1.6%	3,150	1.7%
Construction	51	6.4%	114	5.4%	4,635	6.6%	14,372	7.9%
Wholesale trade	20	2.5%	38	1.8%	2,000	2.8%	5,556	3.0%
Retail trade	70	8.8%	179	8.5%	7,338	10.4%	20,591	11.3%
Accommodation & food services	100	12.5%	179	8.5%	5,444	7.7%	12,847	7.0%
Transport, postal & warehousing	34	4.3%	56	2.7%	2,852	4.1%	7,807	4.3%
Information media & telecommunications	18	2.3%	39	1.9%	872	1.2%	1,898	1.0%
Financial & insurance services	24	3.0%	78	3.7%	2,361	3.4%	5,767	3.2%
Rental, hiring & real estate services	17	2.1%	58	2.8%	1,071	1.5%	2,696	1.5%
Professional, scientific & technical services	56	7.0%	58	12.3%	5,222	7.4%	11,206	6.1%
Administrative & support services	29	3.6%	40	1.9%	2,083	3.0%	5,502	3.0%
Public administration & safety	61	7.6%	163	7.8%	4,811	6.8%	11,576	6.3%
Education & training	69	8.6%	27	10.8%	6,639	9.4%	15,538	8.5%
Health care & social assistance	114	14.3%	29	15.7%	11,204	15.9%	26,324	14.4%
Arts & recreation services	14	1.8%	50	2.4%	969	1.4%	2,190	1.2%
Other services	25	3.1%	51	2.4%	2,565	3.7%	7,598	4.2%
Not Stated	13	1.6%	21	1.0%	1,268	1.8%	3,477	1.9%
Educational attainment								
Completion of Year 12 (or equivalent)	689	51.5%	2,101	61.7%	55,126	44.7%	121,849	37.6%
Without post-school qualifications	485	36.2%	1,018	29.9%	52,575	42.7%	145,532	44.9%
Mobility								
Lived at same address 5 years ago	503	32.6%	1,011	27.5%	76,049	51.2%	220,306	55.2%
Transport								
Households without a motor vehicle	128	19.8%	272	16.6%	6,686	11.9%	13,373	9.1%

	Western precinct		Eastern precinct		Newcastle LGA		Greater Newcastle	
One motor vehicle	298	46.1%	826	50.5%	22,555	40.0%	54,265	37.1%
Two motor vehicles	171	26.5%	445	27.2%	20,026	35.5%	55,103	37.7%
Three motor vehicles	36	5.6%	69	4.2%	5,079	9.0%	16,112	11.0%
Four or more motor vehicles	13	2.0%	24	1.5%	2,040	3.6%	7,308	5.0%
Journey to work								
Train	48	6.9%	74	3.9%	850	1.4%	2,166	1.4%
Bus	45	6.5%	68	3.6%	1,867	3.1%	3,178	2.0%
Ferry	3	0.4%	3	0.2%	119	0.2%	149	0.1%
Tram (includes light rail)	-	0.0%	-	0.0%	-	0.0%	8	0.0%
Taxi	14	2.0%	-	0.0%	159	0.3%	265	0.2%
Car, as driver	409	58.9%	1,181	62.4%	46,119	76.2%	125,832	79.9%
Car, as passenger	44	6.3%	107	5.7%	4,058	6.7%	10,521	6.7%
Truck	3	0.4%	-	0.0%	507	0.8%	1,819	1.2%
Motorbike/scooter	6	0.9%	21	1.1%	623	1.0%	1,317	0.8%
Bicycle	18	2.6%	47	2.5%	1,279	2.1%	1,743	1.1%
Other	3	0.4%	10	0.5%	268	0.4%	633	0.4%
Walked only	75	10.8%	304	16.1%	2,715	4.5%	4,521	2.9%
Worked at home	26	3.7%	78	4.1%	1,998	3.3%	5,383	3.4%

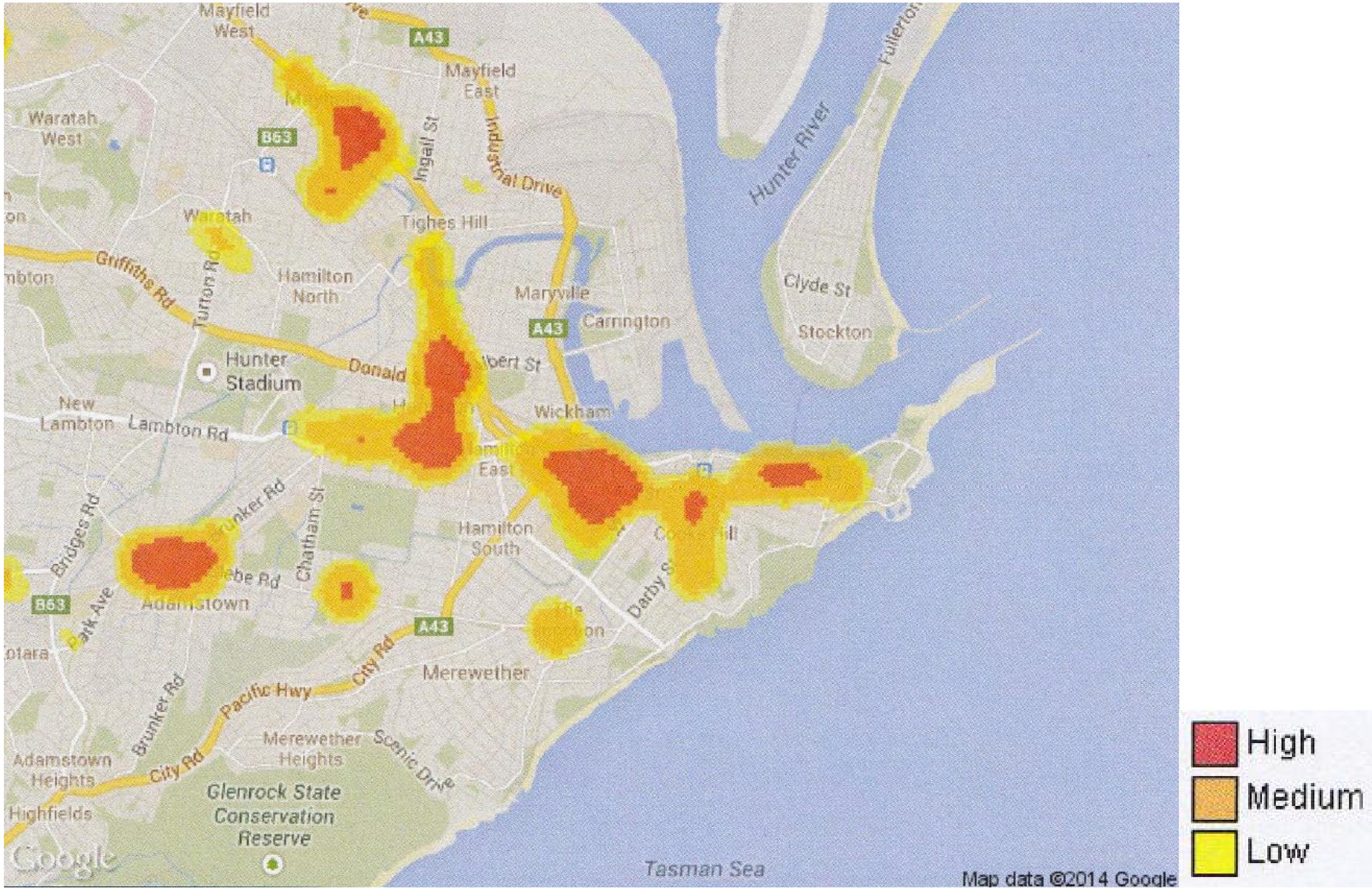
Appendix B - Incidents of theft (steal from person) from July 2012 to June 2013

Source: NSW Bureau of Crime Statistics and Research, NSW Recorded Crime Statistics, 2014-488323-3



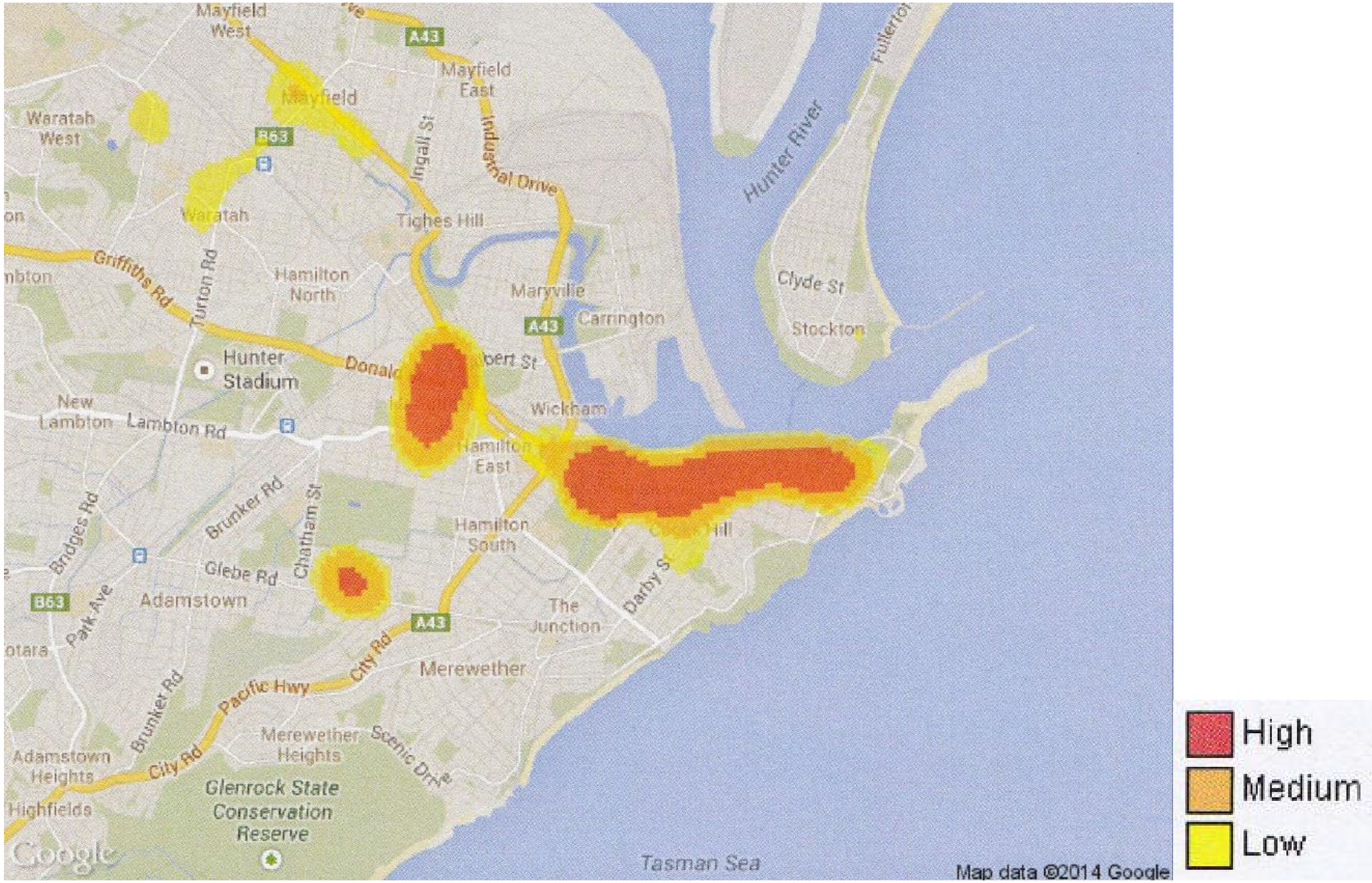
Appendix C - Incidents of robbery from July 2012 – June 2013

Source: NSW Bureau of Crime Statistics and Research, NSW Recorded Crime Statistics, 2014-488323-3



Appendix D - Incidents of assault (non-domestic assault) from July 2012 – June 2013

Source: NSW Bureau of Crime Statistics and Research, NSW Recorded Crime Statistics, 2014-488323-3



Appendix E - List of social infrastructure located on or adjacent to the study area

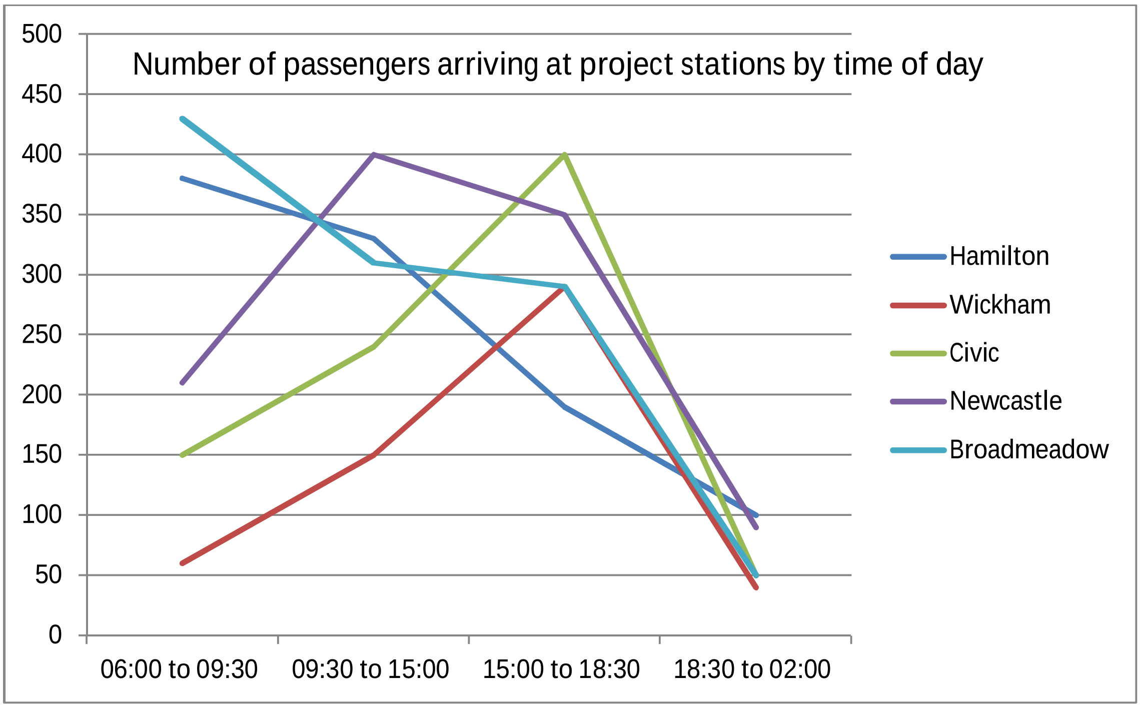
Type of social facility	Name	Location	Services
Government services	Newcastle City Council	282 King Street, Newcastle	City administration centre and offices
	NSW Civic and Administrative Tribunal	1/175 Scott Street, Newcastle	Provides tribunal services
Professional services	Newcastle Law Precinct	Hunter Street, Newcastle	Provides legal and tribunal services
Arts and performance	Newcastle City Hall	290 King Street, Newcastle	Function and performance centre
	Newcastle Art Gallery	1 Laman Street, Cooks Hill	Art gallery
	Civic Theatre	375 Hunter Street, Newcastle	Hosts a range of music, performances and other events
Education and training	Newcastle Museum	6 Workshop Way, Newcastle	Regional museum
	Newcastle University	Hunter Street, Newcastle	Law campus (TBC)
	University of Newcastle Conservatorium	Cnr Laman Street & Auckland Street, Newcastle	Music education and performance
	Newcastle Library	Laman Street, Newcastle	Regional library providing access to information and research materials
	Hunter TAFE-Hamilton Campus	91 Parry Street, Hamilton	Delivers a range of accredited courses in hospitality, community, health and education
	Yarnteen Aboriginal and Torres Strait Islanders Corporation	840 Hunter Street, Newcastle West	Delivers a range of employment, accredited and non-accredited training programs
	Gracegrove College	1/723 Hunter Street, Newcastle West	Massage therapy school
Childcare	KU Wickham Preschool	18A Albert Street, Wickham	Day care for ages 2-6 years
	Awabakal Newcastle Aboriginal Co-operative Childcare Centre	5 Grey Street, Wickham	Indigenous child care centre

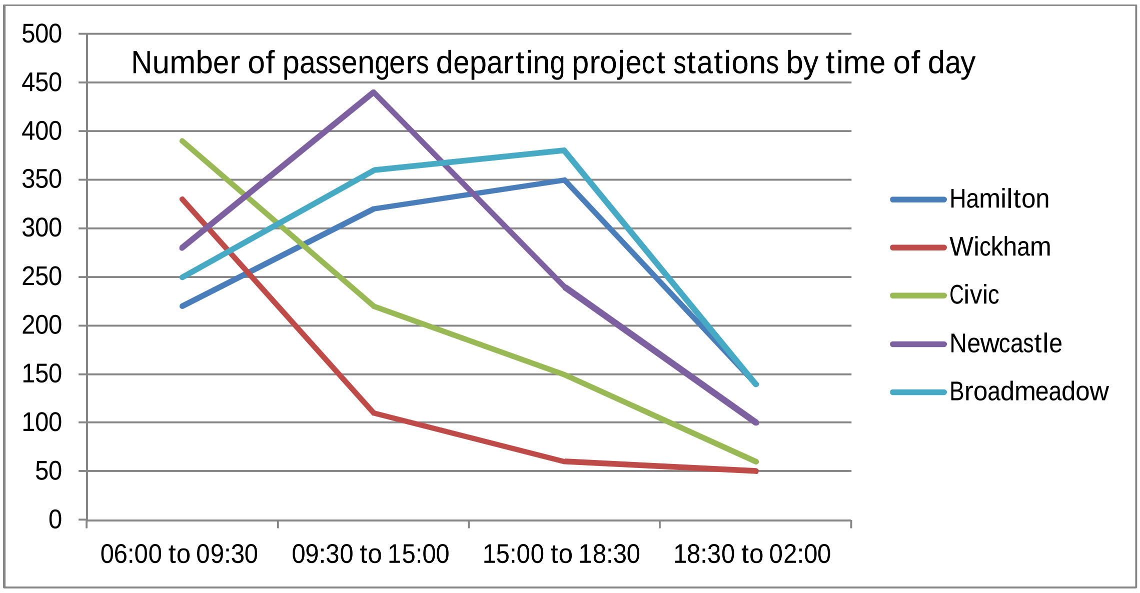
Type of social facility	Name	Location	Services
Medical centres	Hudson Street Specialist Centre	48 Hudson Street, Hamilton	Provides psychologist and psychiatrist services
	Hunter Street Medical Centre	802 Hunter Street, Newcastle	Comprehensive general practice service
	Awabakal Newcastle Aboriginal Co-operative medical centre	10 Hudson Street, Hamilton	Delivers a broad range of health care, disability and children's services and community programs
	Leapfrog Ability	37 Fern Street Islington	Provides a range of disability support services
	Vision Australia	7-9 Beaumont Street, Hamilton	Provides blindness and low vision services
	Lifetime Care and Support Authority	Beaumont Street, Hamilton	Provides treatment, rehabilitation and attendant care services to people severely injured in motor accidents in NSW
	Dental on Beaumont	20 Beaumont Street, Hamilton	Dental practice
Public open space	Wickham Park	Albert Street, Wickham	Large park with playground and several sports fields
	Tree of Knowledge Park	Hannell Street, Wickham	Historic park contains a tribute to Henry Lawson and historic fig trees
	Birdwood Park	King Street, Newcastle West	Small park with playground
	Civic Park	Cnr Darby Street and King Street, Newcastle	Small park provides access to the Newcastle City Library and Art Gallery. Art and craft markets held at the park.
	Central Promenade	Wharf Road, Newcastle East	Small park with walking path
	Enterprise Park	Scott Street, Newcastle East	Small park with picnic facilities
	Foreshore Park	Wharf Road, Newcastle East	Large park with playground, picnic and BBQ facilities, formal walking path, and disabled access toilets
	Nobbys Beach Reserve	Nobby's Road, Newcastle East	Large park reserve with picnic facilities
	Flagstaff Hill	Newcastle East	Historic park where Fort Scratchley is located
	Pacific Park	Pacific Street, Newcastle	Small park with toilet facilities. A market is held on the park grounds once a month.
	Fort Scratchley Historic Site	Flagstaff Hill, Newcastle East	Guided tours of the site available. Function centre is available for private bookings.

Type of social facility	Name	Location	Services
Religious organisations	Catholic Diocese Church	Church Street, Hamilton	Religious services
	Christian Science Church	Gordon Avenue, Hamilton	Religious services
	Sacred Heart Cathedral	841 Hunter Street, Hamilton	Religious services
	Christ Church Cathedral	46 Newcomen Street, Newcastle	Religious services
	Goodlife Church – Christian Outreach Orthodox Church	18 Albert Street, Wickham	Religious services and community outreach programs
Community centre	Apex Australia		
	Cooks Hill City Scout Group	Albert Street, Wickham	Scout group for children from 6 years of age
Sports centre	Newcastle Badminton Centre	18 Albert Street, Wickham	Purpose built centre consisting of four surfaced courts. The centre hosts weekly social sessions, junior training (5-18 years old) and regular competitions.

Source: Collated by project team

Appendix F - Passenger movement at study area stations by time of day





Source: NSW Bureau of Transport Statistics, 2013 Electronic Publication No. E2013-36-Rail-BarrierCounts

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0	J. Klein A Mithieux	H Nesbitt	*H Nesbitt*	G Marshall	*G Marshall*	22/07/2014
1	J. Klein A Mithieux	H Nesbitt	H Nesbitt	G Marshall	G Marshall	28/07/2014

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Heritage Impact Statement

Wickham Transport Interchange

July 2014

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Executive Summary

In 2012, the NSW Government announced the truncation of the heavy rail line at Wickham as part of the Newcastle Urban Renewal and Transport Strategy. Following consideration of options to cease railway operations, it was decided that a new station at Wickham would be constructed on land to the west of Stewart Avenue, and that the residual heavy rail corridor comprising the existing Wickham Station and areas to the east would be reviewed for suitability as part of the initial stage of the Newcastle Light Rail project.

The following heritage items (listed under the *Heritage Act 1977* and the *Newcastle Local Environmental Plan 2012*) are located within the proposal site:

- Hamilton Railway Station Group and Signal Box (I113) (state listing, s170)
- Newcastle City Centre Heritage Conservation Area (C4) (local listing)

The following heritage items, listed under the *Newcastle Local Environmental Plan 2012*, are located within 50 metres of the proposal site:

- Hamilton Business Centre Heritage Conservation Area (C2) (local listing)
- Hamilton Station Hotel (I197) (local listing)
- Residence at number 22 Maitland Road, Islington (I200) (local listing)
- Former Newcastle Cooperative Store (I504) (local listing)
- Wickham Station (I683) (local listing and S170)
- Hawkins Oval and Memorial at Wickham Park (I675 and I676) (local listing)
- Lass O'Gowrie Hotel (I691) (local listing)
- Residences at number 15 Charles Street, Wickham (I681) (local listing)
- Dairy Farmers Building (I505) (local listing)
- Sydney Junction Hotel (I114) (local listing)
- Hamilton Railway Depot and Triangle (S170)

This Heritage Impact Statement has found that there is the potential for direct impacts during construction on the Hamilton Station Buildings and Signal Box, and the timber relic located near the station. The measures provided in Section 6.1 would reduce the likelihood and consequence of the potential impact.

Works located within the State Heritage Register curtilage of Hamilton Station would require approval under the NSW *Heritage Act 1977*. As the works are minor in nature, an exemption application would be required under section 57(2) of the Act.

Indirect impacts during construction are possible for the former Newcastle Cooperative Store, the Sydney Junction Hotel and Hamilton Railway Depot and Triangle, which directly adjoin the proposal site. Mitigation measures provided in Section 6.1 would prevent or minimise the potential for these impacts.

The following measures would be implemented during the design phase:

- Potential for impacts on the significance of Wickham, Civic and Newcastle stations as a result of ceasing rail operations at these stations would be assessed as part of the Residual Corridor Management Plan.
- Design of Wickham station, including materials selected, would be sympathetic to the surrounding heritage items/elements and the significance of the Newcastle City Centre Heritage Conservation Area, while clearly marking the building as contemporary.

The following measures would be implemented during construction.

- All heritage items in the immediate vicinity of the proposal site would be marked on site plans, fenced off where appropriate, and avoided.
- Vibration management measures would be implemented to minimise the potential for structural vibration impacts to heritage items.
- Dilapidation surveys would be undertaken for heritage buildings/structures located on or within 25 metres of the proposal site.

- A heritage induction would be provided to all workers before construction begins informing them of the location of heritage items within and adjoining the proposal site, and guidelines to follow if unanticipated heritage items or deposits are located during construction.
- If previously unidentified heritage/archaeological items are uncovered during the works, all works would cease in the vicinity of the material/find and Transport for NSW would be contacted immediately. Works in the vicinity of the find would not re-commence until clearance has been received from Transport for NSW.
- 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.

1 Introduction

1.1 BACKGROUND

Urbis has been engaged by GHD on behalf of Transport for New South Wales (NSW) to prepare the following Heritage Impact Statement. The proposal comprises construction of a new station at Wickham, head shunt track from Wickham to Hamilton and a stabling yard at Hamilton Station. This Heritage Impact Statement is required as the proposal site is located within a historically significant area of Newcastle. Items within 50 metres of the site are described below and shown in Figure 1.

The following heritage items (listed under the *Heritage Act 1977* (RailCorp's Section 170 Heritage Register or the State Heritage Register) and *Newcastle Local Environmental Plan 2012* (LEP)), are located within the proposal site:

- Hamilton Railway Station Group and Signal Box (I113) (state listing, S170) – number 6, Figure 1
- Newcastle City Centre Heritage Conservation Area (C4) (local listing) – number 12, Figure 1

The following items are located within 50 metres of the proposal site:

- Hamilton Business Centre Heritage Conservation Area (C2) (local listing) – number 1, Figure 1
- Hamilton Station Hotel (I197) (local listing) – number 2, Figure 1
- Residence at 22 Maitland Road, Islington (I200) (local listing) – number 3, Figure 1
- Former Newcastle Cooperative Store (I504) (local listing) – number 4, Figure 1
- Wickham Station (I683) (local listing and S170) – number 5, Figure 1
- Hawkins Oval and Memorial at Wickham Park (I675 and I676) (local listing) – number 7, Figure 1
- Lass O'Gowrie Hotel (I691) (local listing) – number 8, Figure 1
- Residence at number 15 Charles Street, Wickham (I681) (local listing) – number 9, Figure 1
- Dairy Farmers Building (I505) (local listing) – number 10, Figure 1
- Sydney Junction Hotel (I114) (local listing) – number 11, Figure 1
- Hamilton Railway Depot and Triangle (S170) – number 13, Figure 1

1.2 SITE LOCATION

The subject site is located within the rail corridor between Hamilton and Wickham Stations (Figure 1), in the City of Newcastle.

1.3 METHODOLOGY

This Heritage Impact Statement has been prepared in accordance with the *NSW Heritage Manual* (1996), *Statements of Heritage Significance* (2002) and *Assessing Heritage Significance* (2001) guidelines. The philosophy and process adopted is guided by the *Australia ICOMOS Burra Charter* (1999).

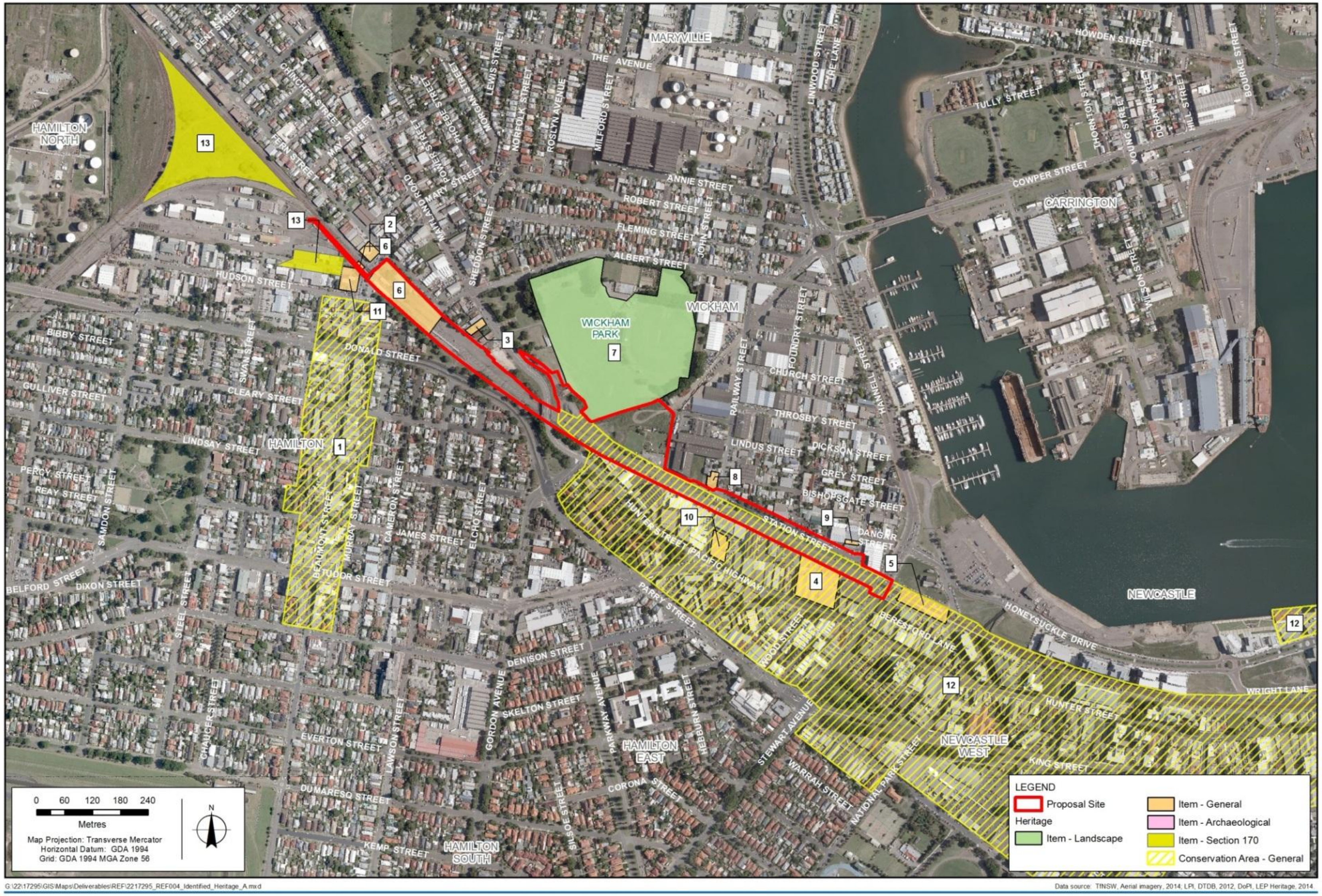
1.4 AUTHOR IDENTIFICATION

This report has been prepared by Joseph Heng (Consultant) and Kate Paterson (Associate Director). Stephen Davies (Director) has reviewed and endorsed its content. Unless otherwise stated, all drawings, illustrations and photographs are the work of Urbis.

JOSEPH HENG	KATE PATERSON	STEPHEN DAVIES

Editorial review has been undertaken by GHD.

FIGURE 1 – PROPOSAL SITE OUTLINED IN RED, HERITAGE ITEMS IN THE VICINITY SHOWN IN YELLOW AND GREEN



[SOURCE: GHD]

1.5 THE PROPOSAL

In 2012, the NSW Government announced the truncation of the heavy rail line at Wickham as part of the Newcastle Urban Renewal and Transport Strategy. Following consideration of options to cease railway operations, it was decided that a new station at Wickham would be constructed on land to the west of Stewart Avenue, and that the residual heavy rail corridor comprising the existing Wickham Station and areas to the east would be reviewed for suitability as part of the initial stage of the Newcastle Light Rail project.

The proposal to truncate the heavy rail line at Wickham and deliver the new station and transport interchange at Wickham involves:

- cessation of rail services between Wickham Station and the Newcastle city centre
- constructing and operating a new train stabling facility to the north of Hamilton Station, within the existing rail corridor
- constructing and operating a new station and interchange for pedestrians, cyclists, buses and heavy rail to the west of Stewart Avenue.

Rail replacement bus services during and following construction would enable rail passengers to complete their journeys to the former Newcastle Station.

To continue operating the rail network to the west of the new station at Wickham, a number of modifications to the rail infrastructure and services between Wickham and Hamilton stations are required. This would involve:

- terminating services at Hamilton or Broadmeadow Stations during construction of the new station at Wickham and transport interchange
- constructing and operating a new head shunt rail track, about 700 metres in length between the Maitland Road overpass and Wickham Station
- installing new crossovers and turnouts to facilitate the movement of trains between the three rail tracks
- ancillary infrastructure including traction power supply, signalling and overhead wiring.

Some roadworks would also be required, including the removal of the boom gates and signals at Stewart Avenue and the closure of Railway Street level crossing.

The design of the transport interchange makes allowance for the future provision of light rail. The Newcastle Light Rail project will be subject to a separate environmental impact assessment/planning approval process.

This report was written with reference to the following drawings from the URS Australia Pty Ltd:

Appendix A: Reference Drawings:

- NHRT-43168046-TR-1021 Horizontal Alignment Sheet 1 of 4 11/04/2014
- NHRT-43168046-TR-1022 Horizontal Alignment Sheet 2 of 4 11/04/2014
- NHRT-43168046-TR-1023 Horizontal Alignment Sheet 3 of 4 11/04/2014
- NHRT-43168046-TR-1024 Horizontal Alignment Sheet 4 of 4 11/04/2014

Appendix C – Wickham Station Architectural Images:

- A.02B Option A.02 Future Precinct Plan 14/05/2014
- A.02B_1 Option A.02 Precinct Plan 13/05/2014
- A.02B_1/200 Concourse GF 14/05/2014
- A.02B_1/201 Station Concourse Level 2 14/05/2014
- Image 1: Wickham Station – High Level View from the East
- Image 2: Wickham Station – Viewed from the East
- Image 3: Wickham Station – Viewed from the Southwest
- Image 4: Wickham Station – Viewed from the North West
- Image 6: Wickham Station – High Level view Level View from the Southwest
- Image 7: Wickham Station – High Level View from the Northwest
- Image 8: Wickham Station – High Level View from the Northeast
- Image 9: Wickham Station – High Level View from the East

2 Historical overview

2.1 WICKHAM STATION HISTORY

The following historical information is quoted from the State Heritage Inventory Database (Number. 4801045):

> *The Main Northern line between Sydney and Newcastle was constructed in two distinct stages and in the earliest years, was worked as two separate railway systems. The line between Sydney (actually the junction at Strathfield) and the Hawkesbury River was opened on 5 April 1887, with the terminus being on the southern bank of the Hawkesbury River. The line between Newcastle and the northern bank of the Hawkesbury River (near present day Wondabyne) was opened in August 1887. The line was completed through (sic) between Sydney and Newcastle with the opening of the massive bridge over the Hawkesbury River in 1889.*
>
> *In 1857, the railway was opened in the Newcastle area when a line was opened from Honeysuckle Point (near present-day Civic Station) to East Maitland. Unfortunately, neither of these locations were near sea ports, one of the main reasons for the establishment of rail transport in the Newcastle area. At the time, the terminus was known as 'Newcastle' and was established where Civic station is located today.*
>
> *By 1858, the Newcastle-end had been extended to the sea port and the East Maitland-end had been extended into the town of Maitland. By the 1870s, the Great Northern Railway (GNR) had been extended further up the Hunter Valley and into Murrurundi. Initially, single lines were laid in the area, but by the 1860s, most lines had been duplicated.*
>
> *The 'new' Newcastle Railway Station was opened on 9 March 1858. One of the original stations in Newcastle (Honeysuckle) was closed in 1872. By the 1930s, two new stations were opened in the same vicinity - Civic and Wickham (with Wickham opening on 9 February 1936).*
>
> *Wickham Railway Station comprises two side platforms, one each for Up and Down traffic. A brick station building with awnings was built on each platform.*
>
> *A brick / timber / fibro signal box (two storey, tile roof) was built at the Newcastle-end of the down platform in 1965, replacing the original 1928-built signal box. This signal box was, at one time, a very important and busy installation, controlling the nearby level crossing gates, arrival and departures from the platforms and a series of industrial sidings.*
>
> *Railway activities, train operations, supervision and staff were extensive in the northern areas and Newcastle was at the hub of all these activities. Signalling and safe control for the passage of these trains was also extensive in the Newcastle area and Wickham Signal Box was part of that operation.*
>
> *The original Wickham Signal Box had been in use at one of the busiest junctions in the state for 37 years with its 1965 replacement remaining in use for the past 35 years.*
>
> *The signal box has been described as 'Australia's First Television Equipped Level Crossing'. This closed circuit television link between the level crossing and the signal box was bought into use 19/05/1966. A set of modern electric half-boom barriers and flashing lights also replaced the original mechanical boom barriers.*

FIGURE 2 – 1970S PHOTOGRAPH OF HAMILTON STATION

[Source: Heritage Division]

2.2 HAMILTON STATION HISTORY

The following historical information (and photograph) is quoted from the State Heritage Inventory Database (Number. 5012049):

> *By 1858, the Newcastle-end had been extended to the sea port and the East Maitland-end had been extended into the town of Maitland. By the 1870s, the Great Northern Railway (GNR) had been extended further up the Hunter Valley and into Murrurundi. Initially, single lines were laid in the area, but by the 1860s, most lines had been duplicated.*
>
> *Hamilton Railway Station was opened in 1872, between Newcastle and Waratah.*
>
> *In January 1888, a line had been constructed from Hamilton, south to the Hawkesbury River. The railway junction between the GNR and the new main line toward the Hawkesbury River was named Hamilton Junction. A signal box was built at Hamilton Junction in 1888, later being replaced by a new elevated brick, standard style signal box in 1898.*
>
> *In 1892, a locomotive depot was built in the triangular area of land formed by the line from Newcastle toward Maitland, the line from Hamilton toward the Hawkesbury River and the line between Waratah and Broadmeadow, which in effect joined the GNR to the line to Sydney. The locomotive depot replaced the first depot in the Newcastle area - Honeysuckle Point. Hamilton locomotive depot was itself replaced by the much larger Broadmeadow locomotive depot in 1924.*
>
> *At Hamilton, two side platforms were built, one for the Up main line and one for the Down main line. A goods yard was laid in behind the Up main (northern side) platforms. A number of station buildings (in brick) were constructed on each platform.*
>
> *At the Sydney-end of the platforms, Beaumont Street crossed the main lines and part of the goods yard, and a footbridge (parallel to Beaumont Street) spanned the main lines allowing access to the platforms. Pedestrians normally crossed the railway tracks using the Beaumont Street level crossing, but when a train was due in either direction, and the level crossing gates were closed, the same pedestrians could use the station footbridge to cross the tracks.*

Hamilton Junction signal box (also at the Sydney-end of the platforms and adjacent to the level crossing) controlled the main lines, the level crossing gates and access to the nearby Substation / Electrical and Mechanical depot sidings. Up until 1924, Hamilton Junction signal box also controlled the entry and departure (by locomotives) to Hamilton locomotive depot, situated in the triangle.

Between c.1890 and the 1970s railway gardens proliferated, with competitions and prizes for the best ones. A Railway Nursery was set up at Homebush station in Sydney in 1923 and another smaller one at Hamilton Station although most plants were sourced from staff's home gardens or donations by residents (Longworth, 2012, 4).

Electrification of the main line between Gosford and Newcastle was opened in May 1984, an extension of the Sydney-Gosford electrification which had been completed in 1960. The new electrification project involved new or rebuilt platforms, station buildings, footbridges, overbridges and under bridges, line side buildings, sidings and myriad structures in that section in order to permit the operation of the wider electric passenger rolling stock and electric locomotives.

Accordingly, some upgrading was undertaken at Hamilton, and that included total replacement of the original footbridge. Some station buildings on each platform have been upgraded, but the original brick main station buildings on each platform are extant, albeit with some modern features. The goods sidings behind the down main line platform have been removed. The existing Hamilton Junction signal box retains control of the main lines and Beaumont Street level crossing.

FIGURE 3 – C1900 PHOTOGRAPH OF HAMILTON STATION

[Source: Heritage Division]

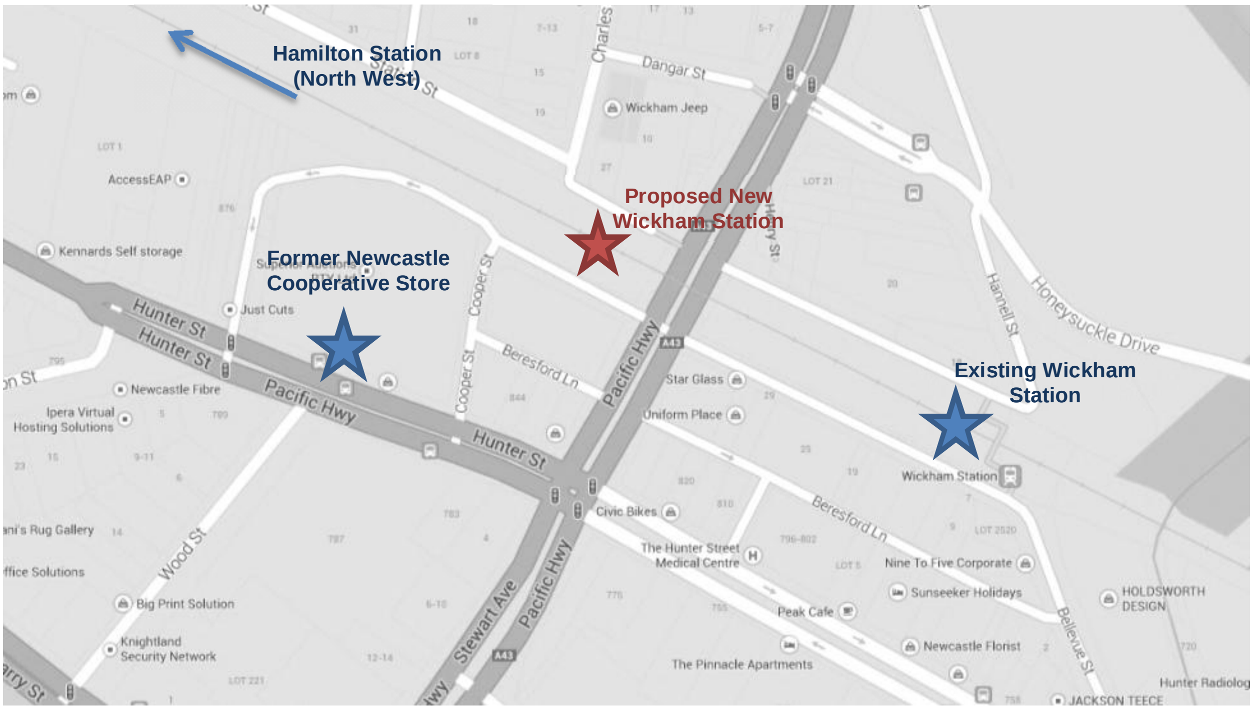
3 Site description

3.1 PROPOSED NEW STATION AT WICKHAM

The proposed new station at Wickham is situated between Beresford Street to the south and Station Street to the north. The existing streetscape of Station Street is predominantly comprised of industrial buildings.

The proposal site includes the state heritage listed Hamilton Station which includes numerous buildings and the signal box. This complex is located a substantial distance from the proposed new station. The proposed new station is located within close proximity to two locally listed items, the former Newcastle Cooperative Store to the southwest on Hunter Street and the existing Wickham Station located east of Stewart Avenue but not adjoining the subject site (Figure 4).

FIGURE 4 – SITE FOR PROPOSED NEW STATION SHOWING HERITAGE ITEMS IN THE IMMEDIATE VICINITY



3.2 HAMILTON STATION

Hamilton Station has a two sided platform configuration. The platforms have modern precast concrete side wall faces and asphalt pavement. The eastern ends of the platforms feature well maintained garden beds with a small shrubbery. All furniture, lights and bins are standard late twentieth century State Rail Authority specification.

The train station also contains a level crossing on Beaumont Street, which is considered to be a key feature of the station. It features an early twentieth century boom gate, imported from the United States. The crossing is operated by the adjacent signal box.

Views of the Hamilton Station are provided in Figure 5.

FIGURE 5 – HAMILTON STATION BUILDING DETAIL

PICTURE 1 – VIEW OF STATION PLATFORMS

PICTURE 2 – VIEW OF PLATFORMS FROM FOOTBRIDGE

The station building on Platform 1 is a single storey face brickwork building with gabled corrugated iron roof. The building is thought to be the original c.1875 third-class station building, which was modified in 1898 to its current configuration (Figure 6).

The awning is supported on curved cast iron brackets and has been extended to the east where it forms a large sheltered seating area adjacent to the ticket office. The roof form of this enclosed seating area follows the form of the station building. Three brick chimney stacks with corbelled string courses are located at the northern end of the station building. Both ends of the station have retained their original timber scrolled bargeboards and finials, which adds greatly to the otherwise utilitarian structure. The easternmost wall of the station building (seating area) features a corrugated iron wall.

The building is typical of the suburban and regional railway stations constructed during the last decades of the nineteenth century. Consistent with these architectural styles, all windows are timber framed double hung sash windows. Doors are four panelled generally with glazing in the upper panels.

A small brick toilet block exists at the eastern end of Platform 1. The building has a tiled floor and corrugated iron gabled roof, and is likely to be the most recent building to have been constructed on the platforms at Hamilton Station. A small store room is located at the Newcastle (eastern) end of the Platform 1 building. The building is square in plan and is of brick construction with a corrugated iron hipped roof. Access is by a door in the eastern wall, while the northern wall features a small window. A storage box for a wheelchair ramp is attached to the northern wall.

Internally the station building on Platform 1 still retains its original joinery. The walls comprise painted plaster, and its floor finishes are generally modern. The ceilings are modern plasterboard with cornices, although some of its original board ceilings remain. The Station Master's office features a timber mantelpiece and a blocked fireplace.

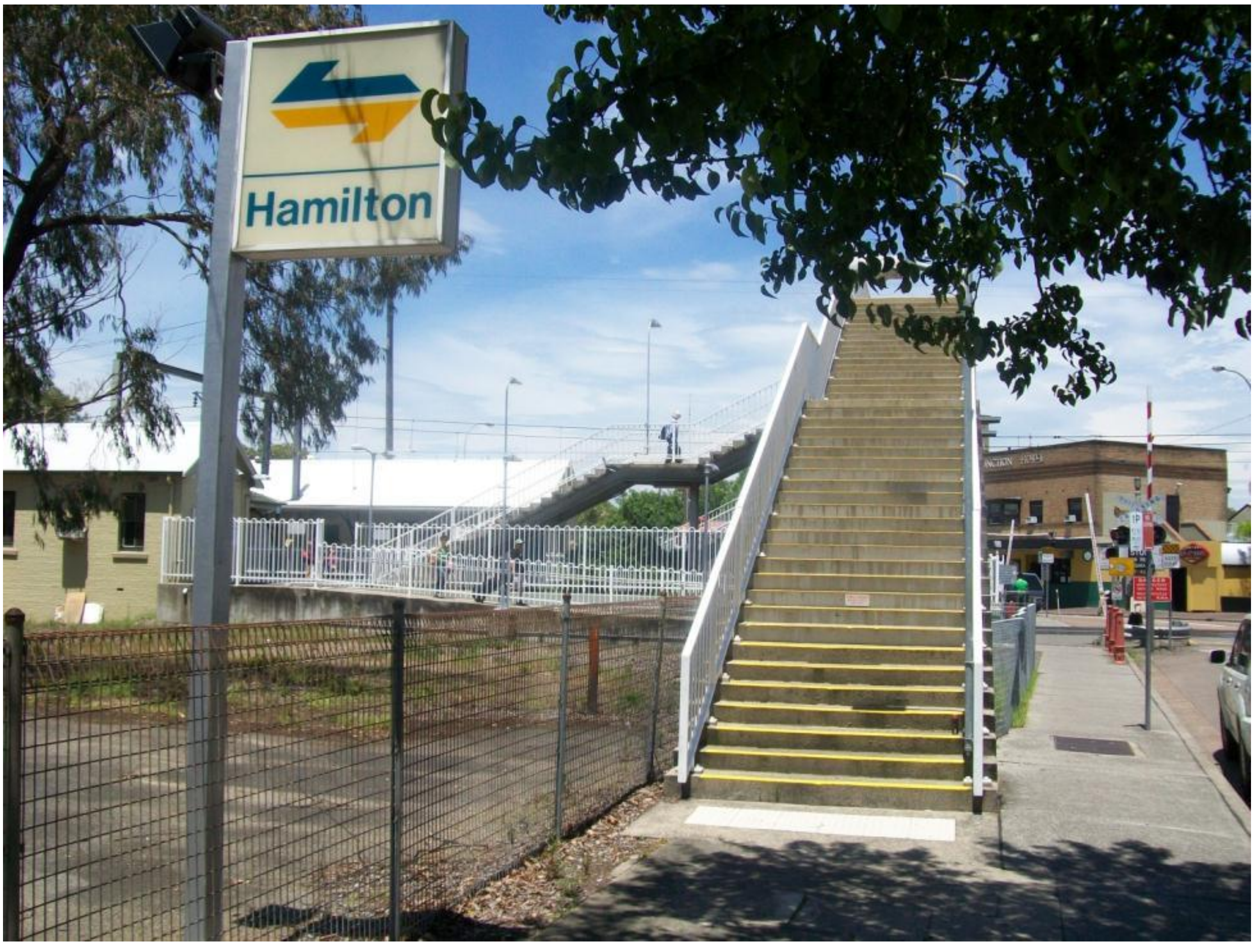
The station building on Platform 2 is very similar to the building on Platform 1, being of brick construction with a corrugated iron gabled roof (Figure 7). This building replaces an earlier building on Platform 2. The roof features bargeboards (not scrolled) and timber finials. There is a central double breasted chimney stack with corbelled brick string course. A small awning (not the whole length of the building) is supported on arching cast iron brackets and features timber valances. All external original joinery is still extant, including double hung sash windows. The eastern end of the building features an attached brick toilet block with gabled roof (slightly lower than the station building), also with bargeboards and finial. The toilet block wall presents three recessed lower bays and six sets of air vents to the platform side, and is entered by an arched brick opening.

FIGURE 6 – SOUTHERN STATION ENTRANCE - PLATFORM 1

FIGURE 7 – VIEW OF PLATFORM 2 FROM THE PEDESTRIAN FOOTBRIDGE

The original steel framed footbridge was replaced in 1976 by a steel beam structure over the main line at the level crossing. The footbridge spans over the land formerly occupied by sidings on the northern side of the Platform 2 building (Figure 8).

FIGURE 8 – HAMILTON RAILWAY STATION SIGNAGE AND FOOTBRIDGE, LOOKING SOUTH FROM BEAUMONT STREET



Hamilton Junction Signal Box is located adjacent to the main Sydney to Newcastle rail line and Beaumont Street at the Sydney-end of Hamilton Station. The signal box is a two-storey Type E2 structure. The ground floor is of brick construction and features four six pane arched windows on the northern (railway line) elevation. The southern (The Esplanade) elevation is of brick construction to roof height with two timber framed sash windows, while the northern wall is brick to sill height, above which sliding timber-framed six pane glazed windows extend around the perimeter. The gabled roof is corrugated fibre cement sheeting with gables of tongue-and-groove timber horizontal boarding. Original timber bargeboards and finials have been removed, as has the original stair and balcony on the eastern (Beaumont Street) elevation which has been replaced with a utilitarian steel structure. A corbelled brick chimney has been removed from the centre of the rear elevation. The building has been painted cream in colour (Figure 9).

Internally, the signal box's ground floor contains interlocking levers and rodding, a separate relay room and signal control wiring. The upper floor (operating level) contains a large mechanical lever frame with 56 large-type signal/point levers, track/signal diagrams, telephones and other equipment necessary for the functioning of an important signal box. Control equipment for the adjacent level crossing gates and warning lights are located at the Newcastle-end of the signal box. Sliding, timber-framed six pane glass windows are located in the front (northern) wall and both end walls to assist with natural lighting, although the windows at the north-east corner have been replaced with aluminium framed single panes. A fireplace has been filled in the centre of the southern wall. The upper floor has a timber floor and timber tongue-and-groove panelling on the walls. The ceiling (originally tongue-and-groove but since covered over) is of plasterboard.

FIGURE 9 – HAMILTON JUNCTION SIGNAL BOX

In addition to the landscaping on the platforms, a large number of mature trees are located on the southern side of the eastern end of Platform 1, extending through to Donald Street. The trees include Camphor Laurels, palms and eucalypts, and form a picturesque background to the curving station platforms. Most of this landscaping is not contained within the rail corridor but provides an attractive setting for the station.

The Newcastle Field Depot for Sydney Trains Communications and Control Systems is located at 4 Fern Street, on the northern side of Hamilton Station (excluded from the listing). This large, hip-roofed, brick building is of modern construction and stands on the site formerly occupied by sidings. The area surrounding 4 Fern Street was a former goods yard and siding. Some tracks remain, but mostly this area is unused. There are a number of mature trees in this area.

3.3 THE TIMBER RELIC

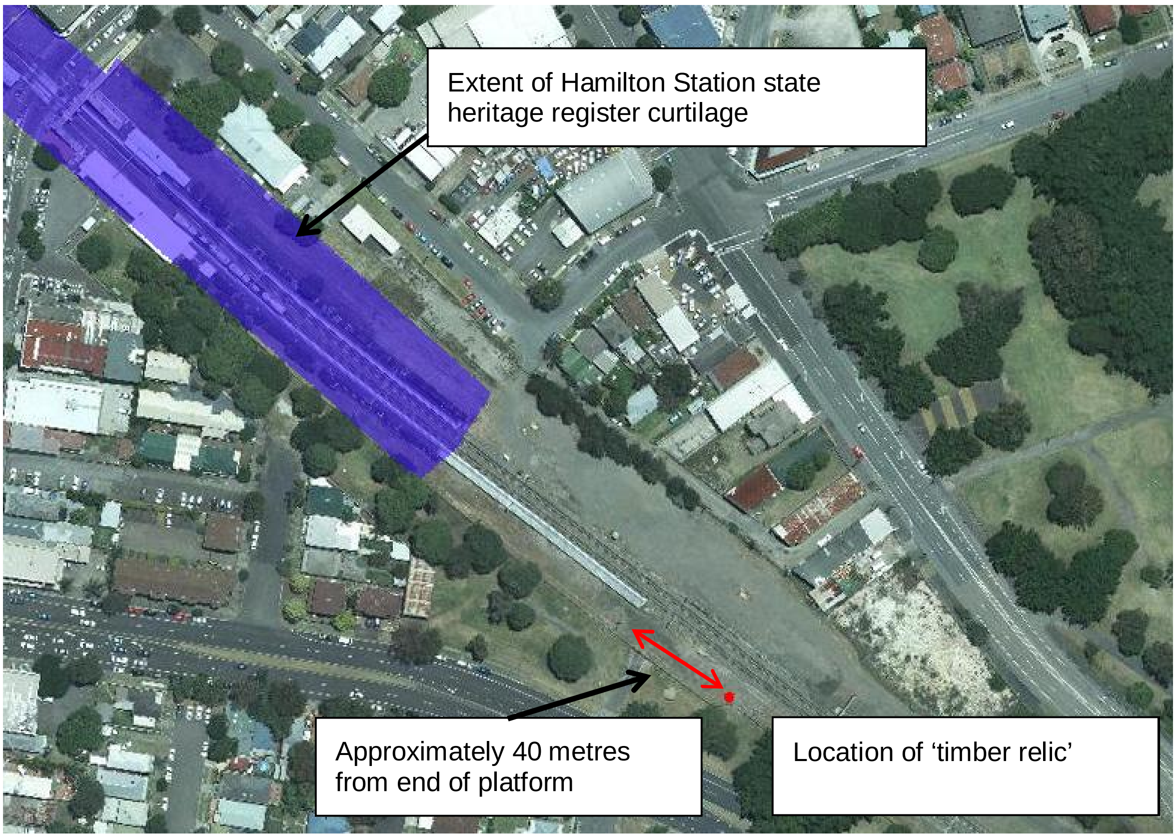
Transport for NSW advises there is a timber relic in close proximity to Hamilton Station outside of the state heritage listing curtilage (Figure 10). The item is located approximately 40 meters south east of Platform 1, adjacent to the chain wire fence (Figure 11). It is possible that this is a relic is from the early rail system. However, the historical origin of this timber relic is uncertain.

FIGURE 10 – TIMBER RELIC

PICTURE 3 – VIEW OF TIMBER RELIC IN RELATION TO ITS SURROUNDING CONTEXT

PICTURE 4 – CLOSE DETAIL OF TIMBER RELIC

FIGURE 11 – RELIC LOCATION



3.4 THE FORMER NEWCASTLE COOPERATIVE STORE

The former Newcastle Cooperative Store is a two to four storey rendered facade brick building. The store is located on the northern side of Hunter Street and is bounded by Cooper Street. The significant facade is on Hunter Street (southern elevation), whereas the later additions are to the rear. The former Newcastle Cooperative Store is located southwest of the new station at Wickham. The area surrounding the former Newcastle Cooperative Store is shown in Figure 12 and Figure 13.

FIGURE 12 – VIEW OF FORMER NEWCASTLE COOPERATIVE STORE FAÇADE ON HUNTER STREET

[Source: Outimage Media Portal, 2014]

FIGURE 13 – NEW STATION SITE AND REAR OF THE FORMER NEWCASTLE COOPERATIVE STORE BUILDING

FIGURE 14 –INDUSTRIAL USES NORTH OF THE PROPOSED NEW STATION

FIGURE 15 – VIEW SOUTHEAST OF STEWART AVENUE AND EXISTING WICKHAM STATION

[Source: Google Maps 2014]

3.5 EXISTING WICKHAM STATION

The existing Wickham Station is located to the east of the Stewart Avenue (Figure 16). Wickham Station is a two sided platform that can only accommodate four carriages. The building on Platform 1 is a roadside platform building with an extensive awning supported by cantilevered curved cast iron brackets. The station building is of dark face brickwork and is relatively austere in detail with simple timber framed window and doors. The gabled roof is of corrugated iron and features timber valances to the awning. The eastern elevation of the building is comprised of a brick wall with a single opening and attached awning. The Beresford Street elevation has been extended at the end using slightly lighter brickwork and the extension of the existing roof pitch (Figure 17).

FIGURE 16 – VIEW OF WICKHAM STATION, PLATFORMS 1 AND 2, LOOKING TOWARD STEWART AVENUE

FIGURE 17 – SOUTHERN ELEVATION OF STATION AS VIEWED FROM BERESFORD STREET

Internally the building retains its original layout and some original fabric. The former ticket office retains its original ticket window with copper coin tray and original counter and draws. Its walls are painted, rendered masonry with painted joinery. The room at the eastern end of the building has a concrete floor. The ceiling of this room is angled on the southern side as a result of the room being enlarged. The western section of the building contains toilets.

Platform 2 contains two detached gable roofed dark brick buildings of similar detail to the Platform 1 building (Figure 18). The platform is linked by a large cantilevered awing supported by curved cast iron brackets. At the eastern section of the building structure, the awning is extended to become a gabled structure with timber valance and acts as the station entry point. The eastern most building contains a single room, while the western building contains two rooms and features a brick wall that has been extended to the west along which the awning extends.

FIGURE 18 – STATION BUILDING DETAIL

PICTURE 5 – VIEW OF STATION PLATFORM

PICTURE 6 – VIEW OF PLATFORM 2 FROM FOOTBRIDGE

A signal box is located at the eastern end of the platform near the Stewart Avenue level crossing (Figure 19). The Wickham Signal Box is an example of a Type O design and was built in stages around the former Type EO signal box that was on the site, with building works being completed around 1965. The signal box is a small two storey face brick building with a terracotta tiled hipped roof and aluminium framed windows. The upper level is accessed by an external metal stair and has a band of windows facing the track. The lower level internally contains a relay room, signal wiring and control equipment for the former level crossing, while the upper level has a main area with large control console and staff facilities.

The platforms feature brick faces and have an asphalt surface. The dark bricks are of the same type as the station buildings. In 2007 Platform 1 was extended at its eastern end to allow the Stewart Avenue level crossing to remain open while the trains are stopped at the station (Figure 19). The platform was resurfaced with the same materials in 2010. A reinforced concrete footbridge is located at the eastern end of the station.

FIGURE 19 – VIEW SOUTHEAST SHOWING EXTENDED PLATFORM

3.6 HERITAGE ITEMS WITHIN THE GREATER VICINITY

Other heritage items located within the vicinity of the proposal site are listed below and are shown in Figure 1 (map reference numbers are provided in brackets).

- Hamilton Business Centre Heritage Conservation Area (C2) (no.1)
- Hamilton Station Hotel (I197) (no.2)
- Residence at 22 Maitland Road, Islington (I200) (no.3)
- Hawkins Oval and Memorial (I675 and I676) (no.7)
- Lass O'Gowrie Hotel (I691) (no. 8)
- Residence at 15 Charles Street, Wickham (I681) (no.9)
- Dairy Farmers Building (I505) (no.10)
- Sydney Junction Hotel (I114) (no.11)
- Hamilton Railway Depot and Triangle (no.13)

4 Heritage context

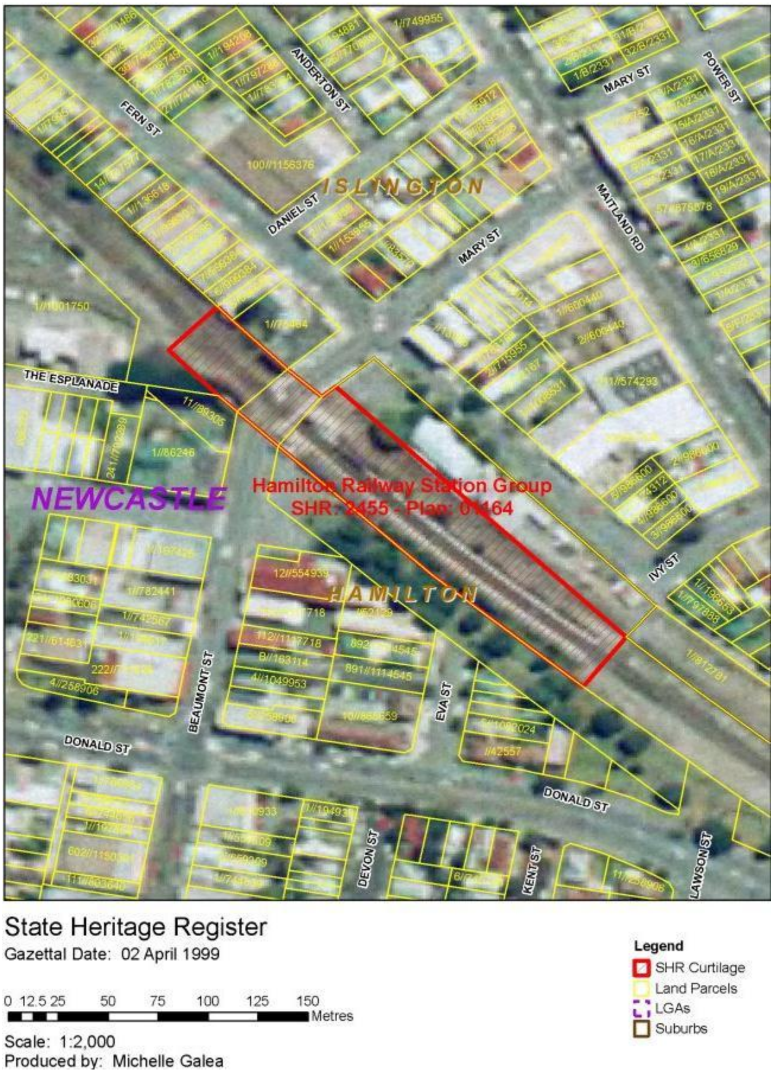
4.1 HERITAGE LISTINGS

The proposal site contains local and state listed heritage item – the Hamilton Station and its group buildings (I113) (Figure 20 and Figure 21). A number of other heritage items, including the current Wickham Station (I683) and the former Newcastle Cooperative Store (I504), are located within 50 metres of the proposal site (Figure 22). The corridor is also partially within a Heritage Conservation Area as identified under the Newcastle LEP 2012. All listed heritage items and areas within 50 metres of the proposal site are shown in Figure 1.

FIGURE 20 – NEWCASTLE LOCAL HERITAGE ITEM: HAMILTON RAILWAY STATION HERITAGE MAP (I113)

[Source: Newcastle LEP 2012]

FIGURE 21 – STATE HERITAGE REGISTER CURTILAGE OF THE HAMILTON RAILWAY STATION GROUP



[Source: Heritage Division - 5012049, 2014]

FIGURE 22 – HERITAGE MAP SHOWING AREA OF PROPOSED NEW STATION AT WICKHAM IN BLUE

[Source: Newcastle LEP 2012]

4.2 EXISTING ENVIRONMENT

The proposal site is located within a historically significant area of Newcastle as a result of its inner urban location. Items within the proposal site and those items that are located within 50 metres of the site are shown in Figure 1 and described in the following sections.

4.2.1 STATE HERITAGE REGISTER

4.2.1.1 HAMILTON RAILWAY STATION GROUP

The Hamilton Railway Station Group and Signal Box (I113) is listed on the State Heritage Register (under the *Heritage Act 1977*) and is located within the proposal site (Figure 21). The following items form part of the listing's curtilage/site (note not all items listed below are of significance). Hamilton Railway Station Group is also listed on the Section 170 Heritage Register and the heritage schedule of the Newcastle LEP 2012 (discussed further in section 4.2.2 and 4.2.3 respectively).

- Station Building, Platform 1 - type 4 (c.1875, altered 1898)
- Station Building and Toilet Block, Platform 2 - type 11(1898)
- Toilet Block
- Store Room (c.1898)
- Signal Box (1898)
- Platforms (c.1984)
- Level Crossing
- Footbridge (1976)
- 4 Fern Street and Former Sidings and Goods Yard
- Landscaping

Statement of Significance – Hamilton Railway Station Group

The following statement of significance for the Hamilton Railway Station Group has been taken from the Heritage Division:

> *Hamilton Railway Station Group has significance at a state level as part of the wider Hamilton and Woodville Junction railway precinct, formerly one of the most important railway junctions in the State. It was established in 1873 before the construction of the Short North and as such has direct associations with operation of the Great Northern Railway, which was one of the first railway lines in Australia. While there was some limited settlement in the area prior to this date, the construction of the railway encouraged the rapid subdivision and development of the township. Hamilton Railway Station is significant as the junction station between the Great Northern Railway and the Short North, and for its association with the former Hamilton locomotive depot between 1892 and 1924. The platform buildings are good examples of highly intact Victorian railway buildings in their original setting which form part of an excellent example of a late 19th century suburban railway junction, with a range of items still intact including signal box, level crossing, sidings, depot and surrounding hotels and shops. The signal box is considered to be historically rare as an excellent example of a historic signalling installation and retains much original fabric, including the signal lever frame, and has been in constant use for over 110 years.*

4.2.2 SECTION 170 HERITAGE REGISTER

Section 170 of the *Heritage Act 1977* requires NSW Government agencies to maintain a register of items of heritage significance within their estate. The following items are listed on the RailCorp Heritage Register:

- Hamilton Railway Station Group, described in section 4.2.1
- Wickham Railway Station Group, described in section 4.2.3
- Hamilton Rail Depot and Triangle, located to the north-west of the site along the rail corridor.

The description of the Hamilton Rail Depot and Triangle below has been sourced from the NSW Heritage Register.

> *This listing has two curtilages. The Triangle: North East: the Down edge of the Newcastle to Maitland Railway Line; South: the Down edge of the Sydney to Newcastle Railway Line; West: the Up edge of the Sydney to Maitland railway line. The Depot: North: a line 5m from the northern edge of the former goods shed, the northern wall of the former perway store and the northern wall of the substation compound; South: the property boundary; East: a line 5m from the eastern wall of the former power station; West: a line 5m from the western end of the former perway store and then 5m from the western end of the former goods shed; These curtilages exclude all modern buildings and most of the open spaces within the depot site.*

The statement of significance below has been sourced from the citation in the NSW Heritage Inventory for the Hamilton Railway Depot.

> *The Hamilton Railway Depot has historical significance at a local level for its long association with the provision of tramway and railway services for over 100 years. This significance is demonstrated in the through goods shed (1890s) and the substation (1923). The through goods shed is the last remaining such shed dating from the nineteenth century on the former Great Northern Line. As a purpose-designed shed, the through goods shed has technical significance as an increasingly rare example of such railway structures in NSW, which demonstrates through its construction the design parameters and use patterns for the handling of goods at the end of the 19th century. The shed represents the end of a particular technical design for such sheds, which was phased out at the end of the 19th century.*
>
> *The former substation has historical significance at a local level as a near intact and rare example of a tramway substation in NSW. The building has significance for continuing the link with railway operation in the Hamilton Goods yard, which came into operation in 1890. The former substation has aesthetic significance as an example of a substation designed to be viewed 'in-the-round' and therefore great care has been taken in its Egyptian inspired Art Deco design. The former substation retains a high degree of integrity externally and marks a change in design approach for such structures, which through their design proclaimed a 'new era' for the 20th century in Newcastle and the introduction of tram services to the city.*
>
> *The triangle site has archaeological research as the site of the former 10-road brick through shed, chargemen's office, store, fitting shop, turntables and tracks which may provide information not available from other sources about the operation of this significant servicing hub in the northern rail network.*

4.2.3 LOCAL HERITAGE

The Newcastle City Centre and Hamilton Business Centre Heritage Conservation Areas (C2 and C4) (no. 1 and 12 in Figure 1) are mapped under the Newcastle LEP 2012. Development seeking consent, which is not required for the proposal, must take into account the requirements of clause 5.10 of the LEP, which aims to:

(a) to conserve the environmental heritage of the City of Newcastle,

(b) to conserve the heritage significance of heritage items and heritage conservation areas, including associated fabric, settings and views,

(c) to conserve archaeological sites,

(d) to conserve Aboriginal objects and Aboriginal places of heritage significance.

Also listed under Schedule 5 of the LEP are the following items within 50 metres of the proposal site (refer Figure 1):

- Hamilton Station Hotel (I197) (no.2)
- Residence at 22 Maitland Road (I200) (no.3)
- Former Newcastle Cooperative Store (I504) (no.4)

- Wickham Station (I683) (no.5)
- Hawkins Oval and Memorial (I675 and I676) (no.7)
- Lass O'Gowrie Hotel (I691) (no.8)
- Residence at 15 Charles Street (I681) (no.9)
- Dairy Farmers Building (I505) (no.10)
- Sydney Junction Hotel (I114) (no.11)

Though the proposal does not require consent and therefore the LEP and DCP are not triggered, an assessment of the local heritage significance of the items described above is provided in the following sections.

4.2.3.1 CONSERVATION AREAS

The proposal site is located within the Newcastle City Centre Heritage Conservation Area (C4) and in the vicinity of the Hamilton Business Centre Heritage Conservation Area (C2) (see Figure 1).

Hamilton Business Centre Heritage Conservation Area

The following statement of significance for the Hamilton Business Centre Heritage Conservation Area has been taken from the Heritage Division:

> *Hamilton (Beaumont Street) Heritage Conservation Area is of heritage significance for its role in the economic and social life of the local Hamilton community. It contains many examples of two storey shops and commercial premises that serve to reflect the various periods of economic growth and social history. The area is representative of the waves of immigration during the 20th century and the eastern European immigrants who came to Newcastle established businesses in the street. Newcastle's earliest examples of Italian and Greek eateries opened on Beaumont Street during the 1950s.*
>
> *The Newcastle Earthquake of December 28 1989 dramatically changed Beaumont Street. There was widespread damage and loss of life and major social dislocation. However, in terms of the buildings that survived, they were revitalised and many of the two storey shopfronts were saved by judicious planning and urban design. Beaumont Street is now a thriving urban centre with a cosmopolitan character. Many of the buildings have been compromised by unsympathetic signage and later shopfronts however the two storey scale is important in defining the character of the street.*

Newcastle City Centre Heritage Conservation Area

The following statement of significance for the Newcastle City Centre Heritage Conservation Area has been taken from the Heritage Division:

> *The Newcastle City Centre Heritage Conservation Area is significant on many levels. The assemblage of commercial and civic buildings is a powerful reminder of the city's rich history and its many phases of development. The number of historic buildings surviving is quite remarkable for a city of this size, with a number of pre-1840s buildings surviving (Rose Cottage, c1830, Newcomen Club, 1830, Parts of James Fletcher Hospital). All of these are associated with the city's penal heritage. It is also known to be a city with a rich archaeological record of national significance, for its potential to yield information about the early convict settlement and early industrial activities.*
>
> *The city area is known to have been a place of contact between colonists and the indigenous population, who owned the land on the southern shores of the Hunter river. This evidence is available in historical accounts and in the archaeological record surviving beneath the modern city. The high numbers of commercial and civic buildings of the 19th and 20th centuries gives the city a historic character which is notable and allows an understanding of the importance of the city as a place of commerce, governance and city building. The historical foundation of the city was the discovery and exploitation of coal with good shipping access via a safe and navigable harbour. The town's layout by Surveyor General Henry Dangar in 1828 is still visible in the city's streets, and is an element of historical value.*

4.2.3.2 HERITAGE ITEMS

Wickham Railway Station

The following statement of significance for the Wickham Railway Station Group has been taken from the Heritage Division:

> *The Wickham Railway Station Group has local heritage significance. Having been constructed much later than most of the neighbouring stations, Wickham Railway Station demonstrates increasing urban development in Newcastle during the first few decades of the 20th century. The site has aesthetic significance associated with the station buildings, being examples of small railway station buildings dating from the 1930s, with simple and traditional materials and details. While many railway stations constructed during this period were designed in a contemporary interwar architectural style, Wickham Railway Station is unusual in that it was designed with a stripped Federation character.*

Other Items

Other items listed under Schedule 5 of the Newcastle LEP 2012 are described in Table 1.

TABLE 1 – LOCAL HERITAGE ITEMS STATEMENT OF SIGNIFICANCE

ITEM	STATEMENT OF SIGNIFICANCE
Hamilton Station Hotel	*Interesting example of an inter-war period hotel in an art deco style.*
Residence at 22 Maitland Road, Islington	*Associated with prominent local citizen. Demonstrating the development of social class and economic growth of the region. An important element within streetscape.*
Former Newcastle Cooperative Store	*Important and dominant townscape element. Represents a significant phenomenon in the socio economic development of the Hunter Valley, the co-operative movement. The interiors are of significance.* *It is also noted that the rear of the building has a four storey later addition.*
Hawkins Oval	*An important open space area within the townscape.*
Hawkins Oval Memorial	*Located in prominent parkland. An unusual monument recording a tragic event of historical and social significance*
Lass O'Gowrie Hotel	*Reflects social life of local community. Illustrates form and style of hotel development in the late 19th century and early 20th century.*
Residence at 15 Charles Street, Wickham	*The cottage at 15 Charles Street appears to be one of the oldest surviving cottages in the Wickham area, and is a rare example of a building from the mid to late 19th century retaining most of its decorative features largely intact. It is a conspicuous feature of the streetscape, being a rare remaining house surrounded by industrial/commercial buildings.*
Dairy Farmers Building	*Forms an important visual termination of Tudor Street and is a landmark. The interiors are of significance.*
Sydney Junction Hotel	*Illustrates form and style of hotel development in the early 20th century. Reflects social life of local community. Internal fabric of note.* *Two storey face brick work building with flat-top clock tower emphasizing the hotels corner position. Curved flat awning over footpath. Stylized horizontal brick stringcourse and lettering to upper level of building.*

Note: The statements of significance above have been taken from the Heritage Division inventory sheets

4.3 ARCHAEOLOGICAL POTENTIAL

The archaeological potential of the land on which the proposal site is located is considered to be moderate. Early tracks and relics may be located under the current modern track work on the site. Archaeological assessment and monitoring by a suitably qualified archaeologist is recommended prior to commencement of works.

5 Impact assessment

5.1 STATUTORY CONTROLS

This proposal does not require consent under part 4 of the *Environmental and Planning Assessment Act 1979*. Therefore, as previously stated, assessment against the provisions of the LEP and DCP is not required.

5.2 HERITAGE DIVISION GUIDELINES

The proposal is addressed in Table 2 in relation to relevant questions posed in the Heritage Division's *Statements of Heritage Impact* guidelines (Heritage Office 2002).

TABLE 2 – HERITAGE DIVISION CONSIDERATIONS

QUESTION	DISCUSSION
The following aspects of the proposal respect or enhance the heritage significance of the item or conservation area for the following reasons:	The design scheme for the proposed new station at Wickham is contemporary, and will add a new element to the conservation area. The design is sympathetic and does not detract from the surrounding streetscape, the nearby heritage item and overall character of the conservation area (the site it is located on the northern boundary). The proposed new station at Wickham is located close to a locally listed heritage item – the former Newcastle Cooperative Store (I504). The store's significant elements lie towards its southern elevation. Due to the location of the new station at the rear, the significant elements of the heritage item will not be impacted, as the proposed station cannot be seen in the same view lines as the principle facade on Hunter Street. Due to the distance from the new station at Wickham, the current Wickham Station Group (I683) will not be affected by this proposal. It is considered that the design of the new station at Wickham will have no impact on the heritage significance of the station. The proposed track realignment at Hamilton Station will have no effect on the heritage significance of the Hamilton Railway Station and Station Group (I113) as no building works are proposed to alter the extant buildings and platforms. The realignment will consist of adjusting existing railway tracks to accommodate train stabling.
The following aspects of the proposal could detrimentally impact on heritage significance. The reasons are explained as well as the measures to be taken to minimise impacts:	Refer above.
The following sympathetic solutions have been considered and discounted for the following reasons:	Not applicable.
New development adjacent to a heritage item How does the new development affect views to, and from, the heritage item? What has been done to minimise negative effects?	Refer above.

QUESTION	DISCUSSION
How is the impact of the new development on the heritage significance of the item or area to be minimised? Why is the new development required to be adjacent to a heritage item? How does the curtilage allowed around the heritage item contribute to the retention of its heritage significance? Is the development sited on any known, or potentially significant archaeological deposits? If so, have alternative sites been considered? Why were they rejected? Is the new development sympathetic to the heritage item? In what way (e.g. form, siting, proportions, design)? Will the additions visually dominate the heritage item? How has this been minimised? Will the public, and users of the item, still be able to view and appreciate its significance?	

5.3 CONSTRUCTION IMPACTS

5.3.1 POTENTIAL FOR DIRECT IMPACTS ON LOCALLY LISTED ITEMS

Locally listed heritage items that are located outside the proposal site would have no or minimal potential for direct construction impacts. The Wickham Railway Station (heritage item) is located outside the proposal site and would not be directly impacted by the proposal.

5.3.2 POTENTIAL FOR INDIRECT IMPACTS ON LOCALLY LISTED ITEMS

Locally listed heritage items that are located outside the proposal site would have no or minimal potential for indirect construction impacts. Additional vehicular construction traffic would not significantly impact on any of the items or areas. However, there is the potential for vibration impacts to items within close proximity of the new station at Wickham site. Measures to avoid or mitigate this impact are provided in Section 6.

5.3.3 POTENTIAL FOR IMPACTS ON THE HAMILTON RAILWAY STATION GROUP

The state and locally listed Hamilton Railway Station Group is located within the proposal site and could be directly impacted during construction. Construction works would be located in close proximity to the significant buildings. Appropriate management measures are provided in Section 6.

An assessment of potential construction impacts on the heritage items and areas addressed in this report is summarised in Table 3.

TABLE 3 – POTENTIAL INDIRECT AND DIRECT IMPACTS DURING CONSTRUCTION

MAP REF. (FIGURE 1)	ITEM NAME AND ADDRESS	HERITAGE LISTING	LOCATION IN RELATION TO THE PROPOSAL SITE	SUMMARY OF POTENTIAL CONSTRUCTION IMPACTS
1	Hamilton Business Centre Heritage Conservation Area	Local	Approximately 30 metres south-west of Hamilton Station	No impact. The conservation area is located a sufficient distance from proposal construction activities.
2	Hamilton Station Hotel	Local	Approximately 20 metres north-west of Hamilton Station	No impact. The item is located a sufficient distance from proposal construction activities.
3	Residence at 22 Maitland Road, Islington	Local	Approximately 20 metres north-east	No impact. The item is located a sufficient distance from proposal construction activities.
4	Former Newcastle Cooperative Store	Local	Directly adjoining the proposal site	Potential minor indirect impact. The proposal site's rear boundary is adjacent to the item. The significance of the building is related primarily to its front section on Hunter Street. The rear later section is considered to be of less significance and has potentially been significantly altered. Refer to Section 6 for mitigation measures.
5	Wickham Railway Station	Local	Approximately 25 metres east	No impact. The item is located a sufficient distance from proposal construction activities.
6	Hamilton Station Buildings and Signal Box	State	Within the proposal site	Potential direct impact. There is potential for impact as track work is proposed in and around the station buildings of significance. Refer to Section 6 for mitigation measures.
	Hamilton Station timber relic/stump	Not listed	Within the proposal site	Potential direct impact. There is potential for contact impact from site activities including vehicles. Refer to Section 6 for mitigation measures.
7	Hawkins Oval and Memorial (Wickham Park)	Local	Directly adjoining the proposal site	No impact. Whist the site is located in close proximity, this site is greenfield with no built items. Built items are located a substantial distance away from proposal construction activities.

MAP REF. (FIGURE 1)	ITEM NAME AND ADDRESS	HERITAGE LISTING	LOCATION IN RELATION TO THE PROPOSAL SITE	SUMMARY OF POTENTIAL CONSTRUCTION IMPACTS
8	Lass O'Gowrie Hotel	Local	Approximately 10 metres north	No impact. Whist the site is located in close proximity there is a road separating the site of the proposal construction activities and the listed item. Although some additional passing construction traffic will occur on the public road, there would be no potential construction impact.
9	Residence at 15 Charles Street, Wickham	Local	Approximately 10 metres north	No impact. The item is located a sufficient distance from the site to mitigate impact. The item is separated from proposal construction activities by another building and there would be no potential construction impact.
10	Dairy Farmers Building	Local	Approximately 50 metres south	No impact. The item is located sufficient distance from proposal construction activities.
11	Sydney Junction Hotel	Local	Directly adjoining the proposal site	Potential minor indirect impact. The heritage item's rear boundary is adjacent to the proposal site. Refer to Section 6 for mitigation measures.
12	Newcastle City Centre Heritage Conservation Area	Local	A small section of the conservation area falls within the eastern section of the proposal site	No impact. The proposal will involve the generation of construction traffic for the duration of works. Although this traffic may impact temporarily on amenity it is not considered that it will have an impact on the heritage fabric of the conservation area. The area of the proposal site that is in the conservation area forms part of the rail corridor. This section of the conservation area has no built heritage items and there would be no potential construction impact.
13	Hamilton Railway Depot and Triangle	RailCorp s170	Depot adjacent to the site, Triangle approximately 50 metres to the north-west	Potential minor indirect impact. The heritage item's rear boundary is adjacent to the proposal site. Refer to Section 6 for mitigation measures.

5.4 OPERATION IMPACTS

5.4.1 POTENTIAL FOR IMPACTS ON LOCALLY LISTED ITEMS

Impacts on heritage items and areas during operation of the proposal is unlikely. However there could be negative impacts for Wickham Station once it no longer supports regular rail services and visitation.

5.4.2 POTENTIAL FOR IMPACTS ON STATE LISTED ITEMS

The proposed works facilitate the continuing use of the existing Hamilton Station, with the addition of a stabling yard. There would be carriages present within visual sight lines of the heritage item, but, as this is in keeping with existing and ongoing historical rail use, there would be no operational impact.

An assessment of potential operation impacts on the heritage items and areas addressed in this report is summarised in Table 4.

TABLE 4 – POTENTIAL IMPACTS DURING OPERATION

MAP REF. (FIGURE 1)	ITEM NAME AND ADDRESS	HERITAGE LISTING	LOCATION IN RELATION TO THE PROPOSAL SITE	SUMMARY OF POTENTIAL CONSTRUCTION IMPACTS
1	Hamilton Business Centre Heritage Conservation Area	Local	Approximately 30 metres south-west of Hamilton Station	No impact. The item does not directly adjoin the proposal site, and the historical and ongoing use of the site for rail is continuing. Additionally the operation of the stabling yard will not impinge on the heritage significance of the conservation area.
2	Hamilton Station Hotel	Local	Approximately 20 metres north-west of Hamilton Station	No impact. The item does not directly adjoin the site, and the historical and ongoing use of the site for rail is continuing. Additionally the operation of the stabling yard will not impinge on the heritage significance of the item.
3	Residence at 22 Maitland Road, Islington	Local	Approximately 20 metres north-east	No impact. The item does not directly adjoin the site, and the historical and ongoing use of the site for rail is continuing. Additionally the operation of the stabling yard will not impinge on the heritage significance of the item.

MAP REF. (FIGURE 1)	ITEM NAME AND ADDRESS	HERITAGE LISTING	LOCATION IN RELATION TO THE PROPOSAL SITE	SUMMARY OF POTENTIAL CONSTRUCTION IMPACTS
4	Former Newcastle Cooperative Store	Local	Directly adjoining the proposal site	No impact. The rear boundary of the item is adjacent to the existing rail corridor. The significance of the former Newcastle Cooperative Store relates principally to its façade and original interiors. The rear section is of lesser significance. The new station at Wickham will have little impact on the significant fabric of the building.
5	Wickham Railway Station	Local	Approximately 25 metres east	Potential impact. The cessation of rail services to Wickham Station may affect the significance of the existing station if maintenance is not undertaken. Refer Section 6 for mitigation measures.
6	Hamilton Station Buildings and Signal Box	State	Within the proposal site	No impact. The new station at Wickham and changes to rail infrastructure will not affect the significance of the existing station.
	Hamilton Station timber relic/stump	Not listed	Within the proposal site	No impact. The operation of the proposal will not impact on the timber relic.
7	Hawkins Oval and Memorial	Local	Directly adjoining the proposal site	No impact. Operation of the proposal continues historical use of the rail corridor. Operational impacts are not considered likely.
8	Lass O'Gowrie Hotel	Local	Approximately 10 metres north	No impact. The item does not directly adjoin the site (it is separated from the site of the proposal by Station Street). The operation of the station will not impinge on the heritage significance of the item.

MAP REF. (FIGURE 1)	ITEM NAME AND ADDRESS	HERITAGE LISTING	LOCATION IN RELATION TO THE PROPOSAL SITE	SUMMARY OF POTENTIAL CONSTRUCTION IMPACTS
9	Residence at 15 Charles Street, Wickham	Local	Approximately 10 metres north	No impact. The item does not directly adjoin the site, and the historical and ongoing use of the site for rail is continuing. The operation of the station will not impinge on the heritage significance of the item.
10	Dairy Farmers Building	Local	Approximately 50 metres south	No impact. The item does not directly adjoin the site, and the historical and ongoing use of the site for rail is continuing. The operation of the station will not impinge on the heritage significance of the item.
11	Sydney Junction Hotel	Local	Directly adjoining the proposal site	No impact. The rear boundary of the item is adjacent the subject site. The item does not directly adjoin the site, and the historical and ongoing use of the site for rail is continuing. The operation of the station will not impinge on the heritage significance of the item.
12	Newcastle City Centre Heritage Conservation Area	Local	A small section of the conservation area falls within the eastern section of the proposal site	No Impact. The historical and ongoing use of the site for rail is continuing therefore there would be no potential operational impact. It is noted that the new station would be located in close proximity to the existing Wickham station and therefore, the operational use will have no impact on the conservation area.
13	Hamilton Railway Depot and Triangle	RailCorp S170	Depot adjacent to the site, Triangle approximately 50 metres to the north-west	No impact. The item adjoins the proposal site. However proposal operation would include continuation of existing rail activities. There would be no potential operational impact.

6 Mitigation measures

6.1 DESIGN

The following measures would be implemented during the design phase:

- The potential for impacts on the significance of Wickham, Civic and Newcastle stations as a result of ceasing rail operations at these stations would be assessed as part of the Residual Corridor Management Plan.
- The design of Wickham station, including materials selected, would be sympathetic to the surrounding heritage items/elements and the significance of the Newcastle City Centre Heritage Conservation Area, while clearly marking the building as contemporary.

6.2 CONSTRUCTION

The following measures would be implemented during construction.

- All heritage items in the immediate vicinity of the proposal site would be marked on site plans, fenced off where appropriate, and avoided.
- Vibration management measures would be implemented to minimise the potential for structural vibration impacts to heritage items.
- Dilapidation surveys would be undertaken for heritage buildings/structures located on or within 25 metres of the proposal site.
- A heritage induction would be provided to all workers before construction begins informing them of the location of heritage items within and adjoining the proposal site, and guidelines to follow if unanticipated heritage items or deposits are located during construction.
- If previously unidentified heritage/archaeological items are uncovered during the works, all works would cease in the vicinity of the material/find and Transport for NSW would be contacted immediately. Works in the vicinity of the find would not re-commence until clearance has been received from Transport for NSW.
- 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.

7 Conclusion and recommendations

This Heritage Impact Statement has found that there is the potential for direct impacts during construction on the Hamilton Station Buildings and Signal Box and the timber relic located near the station. The measures provided in Section 6.1 would reduce the likelihood and consequence of the potential impact. These measures include consideration of the potential heritage impacts on stations no longer associated with an operating heavy rail line.

Works located within the State Heritage Register curtilage of Hamilton Station would require approval under the *Heritage Act 1977*. As the works are minor in nature, an exemption application would be required under section 57(2) of the Act.

Indirect impacts during construction are possible for the former Newcastle Cooperative Store, the Sydney Junction Hotel and Hamilton Railway Depot and Triangle, which directly adjoin the proposal site. Mitigation measures provided in Section 6.1 would prevent or minimise the potential for these impacts.

Mitigation measures to avoid and minimise heritage impacts would form part of the construction environmental management plan for proposal works.

Impacts on the heritage items or areas within 50 metres of the site are considered unlikely during proposal operation. However a Residual Corridor Management Plan is recommended to ensure the Wickham Station is appropriately maintained and utilised into the future after rail services cease.

8 References

Apperly, R., Irving, R. and Reynolds, P. (eds) 2002, *A Pictorial Guide to Identifying Australian Architecture: Styles and Terms from 1788 to the Present*, Angus and Robertson, Pymble.

Australia ICOMOS 1999, *The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance*, Australia ICOMOS, Burwood.

Heritage Office and Department of Urban Affairs & Planning 1996, *NSW Heritage Manual*, Heritage Office and Department of Urban Affairs & Planning (NSW), Sydney.

Heritage Office 2001, *Assessing Heritage Significance*, Heritage Office, Parramatta.

Heritage Office 2002, *Statements of Heritage Impact*, Heritage Office, Parramatta.

Newcastle Local Environmental Plan 2012

Newcastle Development Control Plan 2012

Heritage Division, Inventory Sheets, Hamilton Station (I113), Wickham Station (I683), Former Newcastle Cooperative Store (I504), Hamilton Railway Depot and Triangle.

[Note: Some government departments have changed their names over time and the above publications state the name at the time of publication.]

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Transport for NSW

Wickham Transport Interchange

Traffic Impact Assessment

July 2014

Executive summary

Background

In 2012, the NSW Government announced the truncation of the heavy rail line at Wickham, as part of the *Newcastle Urban Renewal and Transport Strategy*. Following consideration of options to cease railway operations, it was decided that a new Wickham Station would be constructed on land to the west of Stewart Avenue and that the residual heavy rail corridor comprising the existing Wickham Station and areas to the east would be reviewed for suitability as part of the initial stage of the Newcastle Light Rail project.

The proposal to truncate the Newcastle Branch Line at Wickham and deliver the new station and transport interchange at Wickham would result in a change of transport mode for trips to and from Newcastle. Rail replacement bus services would be implemented from Broadmeadow and Hamilton to the Newcastle Station during construction of the new station and transport interchange and following the opening of the new interchange.

Modifications to the road network are also proposed, including the removal of the railway crossing boom gates and signals at Stewart Avenue and the closure of Railway Street at the level crossing.

Purpose of report

This report has been prepared to support the review of environmental factors (REF) for the proposal. It provides information about the potential impacts of the project as an input to the determination process. The purpose of the traffic assessment is to:

- describe the existing traffic and transport context
- assess the potential traffic and transport impacts
- provide recommendations for measures to mitigate the potential impacts.

The impacts considered in this report are of a strategic nature, and further work will be undertaken to detail the impacts and formulate traffic management plans at a localised level. The findings of this assessment should be considered during development of the comprehensive traffic and transport management plans.

Existing road network

The existing road network in the suburbs surrounding the proposed new interchange is shown in Figure 2.1 with the key arterial roads in the vicinity of the proposed interchange, as well as the local roads within the immediate neighbourhood.

Roads and Maritime Services (RMS) has authority over classified roads under the *Roads Act 1993*. Classified roads within the study comprise:

- HW10 Pacific Highway – Stewart Avenue south of Hunter Street, Hunter Street west and Maitland Road
- MR316 Hannell Street and Industrial Drive
- MR 82 Parry Street and Donald Street

Each of these classified roads, as well as other arterial and key local roads (including the various intersections and level crossings), are identified where changes are proposed.

The daily flows on these major arterial roads into Newcastle are generally between 20,000 and 30,000 vehicles per day. Because of the volume of existing traffic and the relative scale of the interchange proposal, these flows are unlikely to change markedly as a result of the proposal.

However, peak hour volumes and turning movement changes at key intersections will be the main determinant of traffic patterns and behaviour on the road network around the interchange.

Daily traffic volumes on the minor roads in Wickham were calculated from peak hour volume counts at key intersections in the area. The on-street parking capacity and utilisation survey identifies that approximately 700 vehicles enter and depart the Wickham area on a typical weekday.

The key intersecting points of this network, as relevant to this study, are shown in Table E.1.

Table E.1 Traffic intersections in the study area

Intersection location	Type
Honeysuckle Drive/Hannell Street	3 way signals (T intersection)
Hunter Street/Stewart Avenue	4 way signals
King Street/Parry Street/Stewart Avenue	4 way signals
Hunter Street/Tudor Street/Railway Street	4 way signals
Maitland Road/Albert Street/Sheddon Street/Ivy Street	4 way signals
Hannell Street/Throsby Street	3 way signals
Hannell Street/Cowper Street	Roundabout
Hunter Street/Steel Street	4 way signals

There are four level crossings along the railway line between Hamilton and Newcastle – Beaumont Street, Railway Street, Stewart Avenue and Merewether Street. These railway controlled crossings create significant delays for traffic at the crossing point and adjacent intersections. There are also safety risks to the high number of vehicle and pedestrian traffic movements across the railway line.

The major level crossing is on the Stewart Avenue/Hannell Street route across the railway. This will be removed with the rail truncation but may ultimately be replaced with traffic signals for the future light rail. The railway level crossing at Stewart Avenue in Wickham creates significant delays for the north-south vehicular traffic, especially during the peak periods.

Proposed interchange development

The changes to the road network as a result of the proposal are initially limited to:

- The removal of the Stewart Avenue level crossing.
- The permanent closure of the Railway Street level crossing.

This will result in short term adjustments to traffic flows in and around the Wickham area, primarily as a result of redistribution of traffic from the existing Railway Street level crossing.

The proposed interchange would be provided with temporary access facilities north of the new station concourse, broadly bounded by Station Street, Railway Street and Hannell Street in Wickham.

Short term parking facilities would be located in Station Street north of the station. Existing local buses would continue to pick up/drop off in Hunter Street continue to use the existing bus interchange at Newcastle east during development of the new interchange. Changes to parking, street widths, traffic directions and intersections would be undertaken within the area to facilitate increased circulation of traffic after the removal of the Railway Street level crossing.

Access to Station Street is proposed by way of Bishopsgate Street and Charles Street. Alterations to Station Street to accommodate the third station platform, together with short term parking and taxi bays would also be provided. Station access to these facilities would be located in Station Street, to the north of the station interchange.

Other road network changes

During the construction of the interchange, it is expected that there would be other road network adjustments with new crossings of the rail corridor opened to traffic or modified as follows:

- Opening of Steel Street to all road users for north-south access between Honeysuckle Drive and Hunter Street.
- Removal of the boomgates and related rail infrastructure at Merewether Street level crossing.

The impacts of these road network changes are not part of the Wickham Transport Interchange proposal but will have an influence on the performance of intersections in the vicinity of the proposal site. A detailed regional traffic model is currently being developed to account for changes resulting from the proposal, as well as these other changes, to identify the overall effect on traffic conditions. These results will be provided subsequent to public display.

Intersection performance

The three key intersections in and around the proposed interchange which will be most affected by revised traffic flows and turning movements are:

- Honeysuckle Drive/Hannell Street
- Hunter Street/Stewart Avenue
- Hunter Street/Tudor Street/Railway Street.
- Hannell Street/Throsby Street

Current and future intersection performance parameters have been derived from traffic modelling of each intersection for the following scenarios:

- 2014 Base network with existing traffic flows
- December 2014 with Stewart Avenue level crossing removed and Railway Street level crossing permanently closed

The removal of the level crossing on Stewart Avenue would remove the current delay to traffic flows in Stewart Avenue and through the intersections at Honeysuckle Drive and Hunter Street (especially during the peak hours) associated with rail movements. Based on a survey conducted over three consecutive weekdays in May 2014, the boom gate closures resulted in the interruption of traffic movements for approximately 22 per cent and 19 per cent of the AM and PM peak hours respectively.

The current daily traffic volume on Railway Street is about 3,500 vehicles per day while the volume of traffic carried by Stewart Avenue is about 17,500 vehicles per day. The removal of the level crossing in Railway Street, while resulting in a diversion of traffic to other crossing locations, is unlikely to result in a marked deterioration in traffic conditions as a result of the benefit to traffic flows overall when the boom gates are removed. Further detailed regional traffic modelling is currently being undertaken to confirm these concepts.

In summary, the proposal is likely to result in the following key impacts:

- The intersection of Honeysuckle Drive/Hannell Street is likely to have an acceptable level of service for all current and future scenarios.
- The intersection of Hunter Street/Stewart Avenue currently operates with a poor level of service, and will continue to operate to a poor level of service into the future as additional vehicles will use the intersection.
- The intersection of Hunter Street/Tudor Street/Railway Street is expected to result in an improvement in level of service with the permanent closure of the rail crossing. It is projected that the intersection will continue to operate to an acceptable level of service in 2021.

Bus movements

During the operation phase of the interchange, Newcastle Buses will continue to operate on current routes along Hunter Street. Transport for NSW proposes that until the light rail project is operational, a rail replacement shuttle bus service will carry passengers from the new interchange to the existing Newcastle railway station.

The regional and interstate bus services will continue to terminate at the existing Newcastle Bus Interchange in Watt Street at Newcastle Station.

Car parking

The proposed interchange includes the removal of up to 75 on-street parking spaces in Station Street for the provision of the third track, station platform, kiss and ride, and taxi facilities. Overall, given the number of parking spaces available in the Wickham area, while this loss may increase local competition for parking, there is sufficient supply in the local area to accommodate demand.

Pedestrian and cyclists

A URS Pedestrian Footbridge Requirement Study conducted in May 2014 included an assessment of the permanent closure of the Railway Street level crossing. This study concluded that:

- There would be a minimal impact on pedestrian movements in the Railway Street Precinct.
- The most affected group will be those wishing to access surrounding residential properties on a daily basis and patrons of a hotel located 50 metres north of the current level crossing. The permanent closure of the crossing will add an additional 750 metre walk for these residents and patrons.
- There is a minimal impact on public transport access, largely due to the presence of alternative bus stops north of the rail line.

As there are no recognised cycle routes north of the rail line in the Wickham area, the proposed transport interchange is unlikely to have an impact on cyclists.

Contents

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1. Introduction

1.1 Background

In 2012, the NSW Government announced the truncation of the heavy rail line at Wickham as part of the *Newcastle Urban Renewal Strategy*. Following consideration of options to cease railway operations, it was decided that a new station at Wickham would be constructed on land to the west of Stewart Avenue and that the residual heavy rail corridor comprising the existing Wickham Station and areas to the east would be reviewed for suitability as part of the initial stage of the Newcastle Light Rail project.

1.2 Overview of the proposal

The proposal to truncate the heavy rail line at Wickham and deliver the new transport interchange involves:

- removal of rail services between Wickham Station and Newcastle Station
- constructing and operating a new train stabling facility to the north of Hamilton Station, within the existing rail corridor
- constructing and operating a new station and transport interchange at Wickham for pedestrians, cyclists, buses and heavy rail to the west of Stewart Avenue.

Rail replacement bus services would be implemented during and following construction to enable train passengers to complete their journeys into and out of Newcastle.

To continue operating the rail network to the west of the new Wickham Station, a number of modifications to the rail infrastructure and services between Wickham and Hamilton stations are required. This would involve:

- terminating services along the Newcastle Branch Line at Hamilton Station during construction of the new station and transport interchange
- installing new crossovers and turnouts to facilitate the movement of trains between the three rail tracks
- constructing and operating a new head shunt rail track, about 700 metres in length between the Maitland Road overpass and new station at Wickham
- ancillary infrastructure including traction power supply, signalling and overhead wiring.

Some road works would also be required, involving the removal of the railway crossing boom gates and signals at Stewart Avenue, and the closure of Railway Street at the level crossing.

The design of the transport interchange makes allowance for the future provision of light rail. The Newcastle Light Rail project will be subject to a separate environmental impact assessment/planning approval process.

1.3 Purpose and scope of this report

This report has been prepared to support the review of environmental factors (REF) for the Wickham Transport Interchange project. It provides information about the potential impacts of the project as an input to the determination process. The purpose of the traffic assessment is to:

- describe the existing traffic and transport context of project
- assess the potential traffic and transport impacts of the project
- provide recommendations for measures to mitigate the potential impacts.

The impacts considered in this report are of a strategic nature, and further work will be undertaken to identify impacts and formulate traffic management plans at a localised level. The findings of this assessment should be considered during development of the comprehensive traffic and transport management plans.

1.4 Report structure

This report consists of the following sections:

- **Section 1 – Introduction:** provides an overview of the project and the scope of the traffic impact assessment
- **Section 2 – Description of existing environment:** describes the road network and traffic conditions in the vicinity of the project area
- **Section 3 – Proposed development:** summarises the changes that the project will place on the transport network and traffic conditions
- **Section 4 – Impact Assessment:** discusses the likely impacts and implications of the changes to the transport network and traffic conditions
- **Section 5 – Recommendations:** proposes mitigation measures to address the defined impacts
- **Section 6 – Conclusion:** presents a summary of the study findings.

2. Existing transport network

2.1 Existing road network and traffic conditions

The existing road network including key arterial roads and local roads in the suburbs surrounding the proposal site is shown in Figure 2.1.

2.1.1 Classified roads

Roads and Maritime Services (RMS) has authority over roads classified under the *Roads Act 1993*. Classified roads within the study are:

- HW10 Pacific Highway – Stewart Avenue south of Hunter Street, Hunter Street west and Maitland Road
- MR316 Hannell Street and Industrial Drive
- MR 82 Parry Street and Donald Street.

Each of these classified roads, arterial roads and key local roads (including the various intersections and level crossings) are described in the following sections where changes are proposed. These are split between the areas around the existing railway stations at Wickham and Hamilton.

2.1.2 Newcastle West and Wickham

Hunter Street

Hunter Street is a two-way four lane undivided road that runs for approximately 3.2 kilometres generally east-west between Newcastle East and Newcastle West, eventually becoming Maitland Road. Considered as Newcastle's main street, it is mixed use residential/commercial on its western end and a local shopping and café precinct in the eastern mall area. There are several signalised intersections along Hunter Street with particular relevance to the proposal at Steel Street, Stewart Avenue and Tudor Street/Railway Street.

The existing railway line runs parallel to Hunter Street on its northern side.

King Street and Parry Street

King Street is a major arterial road that runs parallel to Hunter Street, one block to the south. It is a four lane divided road on the section from Union Street to Stewart Avenue. The adjacent land is generally commercial but also has a number of hotels and residential apartment blocks along its length. The western leg of the intersection with Stewart Avenue is Parry Street, also a four lane divided road, which connects with Donald Street, Hamilton and ultimately becomes Newcastle Road to the western suburbs and the M1 Motorway.

Honeysuckle Drive

Honeysuckle Drive runs generally east-west on the northern side of the existing rail line. It is bounded by Hannell Street to the west and Merewether Street to the east. Honeysuckle Drive services the emerging commercial office space, residential and restaurant/bar precinct that is adjacent to Newcastle Harbour. The intersection of Honeysuckle Drive and Hannell Street is the only access to the Honeysuckle Precinct from the northern, western and southern suburbs of the city. It is adversely impacted by level crossing closures in peak periods, with traffic signal delays and queues exacerbated by unsynchronised rail closures.

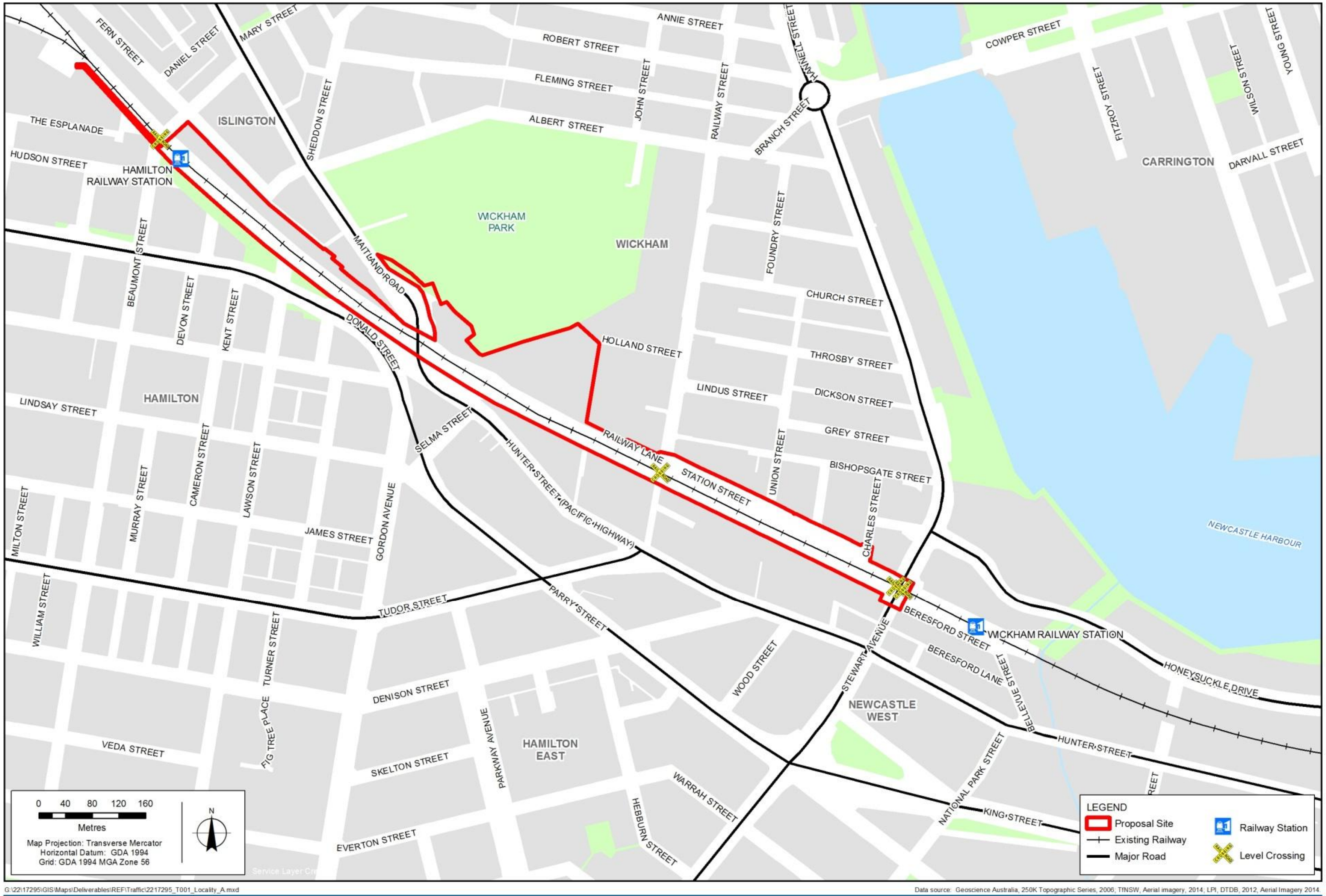

Figure 2.1 Existing road network

Stewart Avenue/Hannell Street

Stewart Avenue and Hannell Street form a major arterial road that runs generally north-south through the study area. These roads are currently divided by the railway crossing between Hunter Street and Honeysuckle Drive. This crossing causes significant delays during peak periods. These roads are both dual carriageway with two lanes in each direction. These roads carry traffic from the southern and northern suburbs to Newcastle West.

Railway Street

Railway Street is a local road that runs north-south in the project area approximately 350 metres west of Stewart Avenue, effectively parallel to Hannell Street, from Hunter Street through to Annie Street, Wickham. This street carries local traffic accessing residents and businesses in Wickham, as well as providing an alternative route between Hannell Street and Maitland Road. Railway Street is generally busy in peak times, with delays caused by the railway level crossing and the adjacent signalised intersection with Hunter Street. The road is two-way, single lane in each direction.

The northern end of Railway Street is used to unload cars (from delivery trucks) bound for dealerships on the southern end of the existing level crossing.

Albert Street

Albert Street is the main sub-arterial road through Wickham, connecting Maitland Road (the western extension of Hunter Street) and Hannell Street. It also provides another access to Railway Street. In recent years, Albert Street has experienced increased traffic as a result of the development of the Honeysuckle Precinct.

Station Street

Station Street runs east-west immediately north of and parallel to the railway line, east from Railway Street. It is closed at the eastern end, with no direct access from Hannell Street, however it can be accessed from Bishopsgate Street. The primary use of Station Street at present is all day parking by employees of the Honeysuckle Precinct and other nearby businesses. Opposite Station Street is Railway Lane for access to properties west of Railway Street.

Other local streets

There are numerous local streets in the Wickham area which provide access between Hannell Street and Railway Street. The most prominent of these streets are Throsby Street, Union Street and Bishopsgate Street. These streets service a wide range of residential, light industrial and commercial businesses in Wickham. Also of note is Dangar Street which is a short cul-de-sac at Hannell Street, opposite Honeysuckle Drive.

The Wickham area is currently undergoing urban renewal with new residential development reversing trends of 40-50 years ago when light industry replaced the previous residential uses.

2.1.3 Hamilton and Islington

Tudor Street

Tudor Street is a major arterial route through Hamilton, connecting Broadmeadow to Newcastle West. It is the primary route for Newcastle Buses with multiple routes using this street for access to Hunter Street. Land use along the street is primarily commercial with numerous car dealerships at the eastern end.

Donald Street

Donald Street is a major arterial road that connects Newcastle West to the western suburbs. It provides the most direct route to the M1 Motorway and the new Hunter Expressway. In the Hamilton area, it is a four lane divided road. The adjacent land use includes residential and retail.

Maitland Road

Maitland Road is the western extension of Hunter Street, crossing the railway line at the Islington overbridge. From that point, it continues in a north-westerly direction through the shopping strip at Islington, and on to Tighes Hill and Mayfield. Key intersections on Maitland Road in the vicinity of the proposal site are at Albert Street and Beaumont Street.

Beaumont Street

Beaumont Street is a busy restaurant, local shopping and café precinct running generally north-south. There is significant pedestrian activity with three pedestrian crossings between Tudor Street and Maitland Road. There are three signalised intersections within the same area. Parking is generally on-street and is time-regulated. Hamilton Station is located towards the northern end of Beaumont Street between Donald Street and Maitland Road. Beaumont Street is a two way, single lane road.

Other local streets

There are other local streets of note on the Islington side of the railway line. Ivy Street and Fern Street provide an alternative access to Beaumont Street, from Maitland Road and Albert Street. These streets are immediately north of the railway line.

2.1.4 Key intersections

The various roads described above form the western precincts of the Newcastle inner city road network. The key intersecting points of this network (as relevant to this study) are shown in Figure 2.2 and described in Table 2.1.

Table 2.1 Key intersections in vicinity of interchange

Intersection location	Type	Description and context
Honeysuckle Drive/ Hannell Street	3 way signals (T intersection)	Major signalised intersection and western access to Honeysuckle Precinct. Close to the existing railway level crossing
Hunter Street/ Stewart Avenue	4 way signals	Intersection of two major arterial routes, east-west to/from Newcastle and north-south along western edge of Newcastle West
King Street/ Parry Street/ Stewart Avenue	4 way signals	Intersection of two major arterial routes, east–west to/from Newcastle and north-south along western edge of Newcastle West
Hunter Street/ Tudor Street/ Railway Street	4 way signals	Tudor Street meets Hunter Street at an acute angle, Railway Street is opposite Tudor Street, accessing the Wickham area across the railway level crossing about 150 metres north of the intersection

Intersection location	Type	Description and context
Maitland Road/ Albert Street/ Sheddon Street/ Ivy Street	4 way signals	This intersection has five-legs (Ivy Street is one way in only). It is on the northern side of the railway line, situated west of the Maitland Road overbridge. Traffic to/from the Honeysuckle Precinct uses Albert Street to connect with Honeysuckle Drive, by way of Hannell Street.
Hannell Street/ Throsby Street	3 way signals (T intersection)	This intersection provides the only opportunity for southbound access to Hannell Street south of the Cowper Street roundabout
Hannell Street/ Cowper Street	Roundabout	Major roundabout facilitating turning movements from Hannell Street to/from Carrington and Wickham
Hunter Street/ Steel Street	4 way signals	Hunter Street and Steel Street meet at a standard four way signalised intersection. Steel Street currently provides access to King Street to the south. Hunter New England Health and fast food outlets are located to the north, where it is currently terminated by the railway corridor.

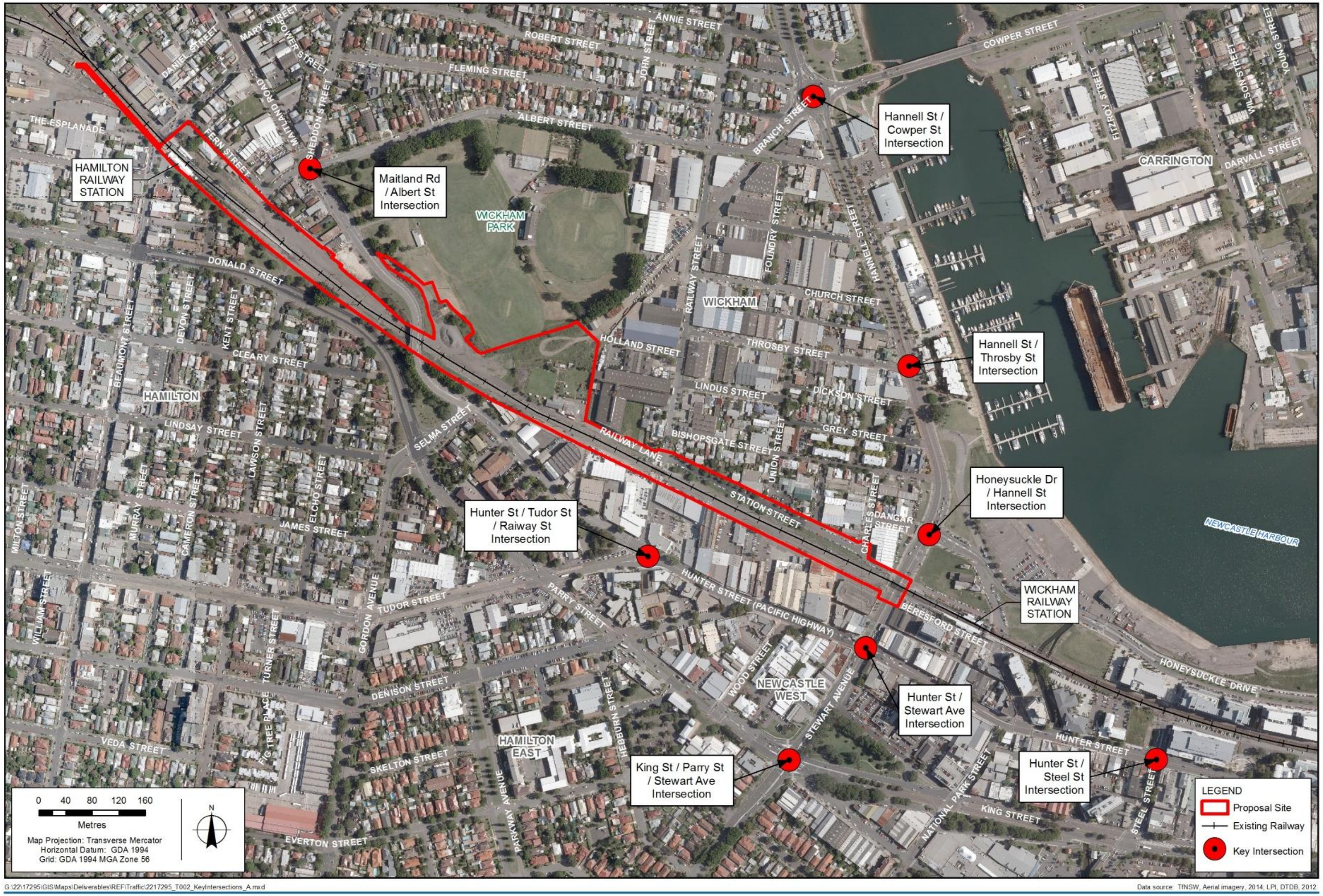

Figure 2.2 Key road intersections in the study area

2.1.5 Existing railway level crossings

There are four level crossings along the railway line between Hamilton and Newcastle – Beaumont Street, Railway Street, Stewart Avenue and Merewether Street. These controlled railway crossings create significant delays for traffic at the crossing point and adjacent intersections. There are also safety risks to the high number of vehicle and pedestrian traffic movements across the railway line. A description of each of these level crossings is outlined in Table 2.2.

Table 2.2 Existing railway level crossings

Level crossing	Current usage
Beaumont Street	Primarily local traffic usage between Maitland Road and the commercial area of Hamilton
Railway Street	Mixed use between local traffic accessing residential and commercial areas in Wickham and through traffic to Hannell Street or Maitland Road
Hannell Street/ Stewart Avenue	Commuters from northern and southern suburbs and through traffic on major north-south arterial route
Merewether Street	Access for motorists and pedestrians to/from the Honeysuckle Precinct to/from Hunter Street

The major level crossing is on the Stewart Avenue/Hannell Street route across the railway. This will be removed with the rail truncation but may ultimately be replaced with traffic signals for the future light rail. The railway level crossing at Stewart Avenue in Wickham creates significant delays for the north-south vehicular traffic, especially during the peak periods.

A survey undertaken in May 2014 measured the level crossing closure times over a 12 hour period for three consecutive days. The survey results showed that over these three survey days, the average crossing closure times for morning (AM) and afternoon (PM) peak periods were as follows:

- Between 8am and 9am the gates were closed for 13 minutes (22% of the AM peak hour).
- Between 5pm and 6pm the gates were closed for 11 minutes (19% of the PM peak hour).

The longest delays are incurred when two trains arrive within a few minutes of each other, requiring the boom gates to stay down for a longer period.

2.1.6 On-street parking in Wickham

The streets in the Wickham area are used for parking by residents, businesses, visitors and local employees. The area offers generally unrestricted (free) parking within a 15 minute walk to major employment and leisure precincts in the city. Accordingly Wickham is an area of high parking demand.

A parking survey of the on-street parking utilisation and capacity in the Wickham area during a typical weekday was conducted in May 2014 to determine the total available number of on-street parking spaces, the parking demand and duration of occupancy. The scope of the area surveyed is shown in Figure 2.3.

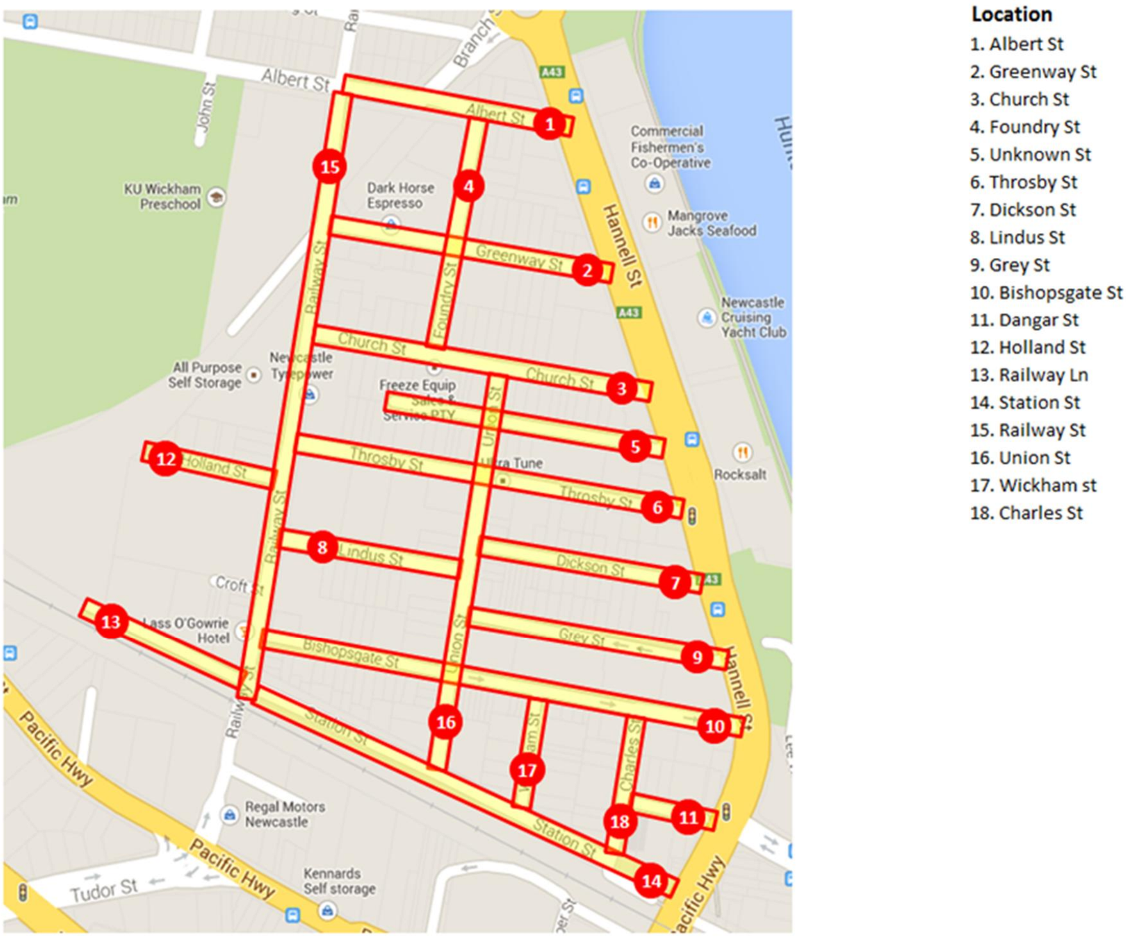

Figure 2.3 Wickham on-street parking survey area

The findings of the survey are presented in Table 2.3. It was found that the Wickham area has a total of 771 on-street parking spaces with the vast majority being unrestricted. Parking restrictions exist on the following streets:

- Throsby Street: 2 spaces 5P
- Grey Street: 8 spaces 2P
- Bishopsgate Street: 15 spaces 2P
- Dangar Street: 7 spaces 2P
- Union Street: 6 spaces 2P
- Wickham Street: 5 spaces 2P

All other parking spaces in Wickham (west of Hannell Street) are unrestricted, with the exception of a loading zone located on Dickson Street. To the east of Hannell Street, closer to Honeysuckle Drive, parking spaces are metered.

Table 2.3 Summary of parking survey at Wickham north of the railway

Street	Existing spaces	Peak demand (per cent)	Average stay (h:min)
Station Street	93	99	8:34
Railway Street	89	90	6:34
Dangar Street	11	91	8:15
Charles Street	22	100	7:05
Wickham Street	20	90	6:37
Union Street	64	78	6:06
Bishopsgate Street	52	75	6:23
Grey Street	60	82	6:52
Lindus Street	35	91	6:45
Dickson Street	25	76	7:42
Throsby Street	58	64	5:01
Unknown Lane	25	32	5:54
Church Street	61	80	5:33
Foundry Street	45	67	6:21
Greenway Street	48	65	5:25
Albert Street (east of Railway Street)	26	81	4:47
Sub-total restricted	**43**	**-**	**-**
Sub-total unrestricted	**728**	**-**	**-**
TOTAL	**771**	**75**	**6:07**

2.1 Daily traffic volumes

The daily traffic volumes on the major arterial and minor roads in the study area have either been directly provided by Roads and Maritime or generated from intersection counts provided by same. The conduct of a comprehensive traffic survey was outside the scope for this REF, although multiple intersection and midblock counts have been conducted by others in recent years. Daily volume counts from Roads and Maritime sources are shown in Table 2.4.

These volumes represent typical daily flows on the key four-lane arterial roads into Newcastle. Because of the volume of existing traffic and the relative scale of the proposal, these flows are unlikely to change markedly as a result of the proposal. Peak hour volumes and turning movement changes at key intersections are discussed in detail in latter sections of this report.

Daily traffic volumes on the minor roads in Wickham have been calculated from peak hour volume counts at key intersections in the area. The on-street parking capacity and utilisation identified in Section 2.1.5 identifies that approximately 700 vehicles come into and depart the Wickham area on a typical weekday. This statistic and other peak to daily volume calculations provide a confident approximation (volumes rounded) of traffic volumes on these minor roads as shown in Table 2.5.

Table 2.4 Published AADT data for classified roads

Station	Road	Location	AADT			
			2008	2010	2012	2013
05.593	Stewart Avenue	North of Parry Street	17,512	18,589	Not available	Not available
05.209	Hannell Street	North of Greenway Street	22,442	Not available	28,746	28,994
05.323	Donald Street	Railway overbridge	28,662	Not available	30,920	30,591
05.276	Tudor Street	North of Parry Street	8,669	Not available	Not available	Not available
05.279	Maitland Road	North of Mary Street	21,026	Not available	Not available	Not available

Table 2.5 Estimated traffic volumes on local roads in Wickham

Street	Daily traffic (VPD)	Source data / road function
Railway Street	3,500	From traffic count at Hunter Street intersection; entry to Wickham from south, some through traffic.
Station Street	500	Parking study, minimal through traffic, mostly residential, commercial and parking.
Throsby Street	1,000	Secondary exit and entry point to the Wickham area through the traffic lights on Hannell Street.
Albert Street, east of Railway Street	4,000	From traffic count of Hannell Street roundabout supplied by RMS; entry to Wickham from the north.
Albert Street, west of Railway Street	2,500	From traffic count at Maitland Road intersection supplied by RMS; entry to Wickham from west.

2.2 Intersection traffic volumes

The existing intersections identified in Section 2.1.3 operate at various degrees of capacity (or saturation) during peak periods. Some delays are apparent due to high traffic volumes for certain movements and railway level crossing closures often exacerbate these delays.

Total volumes passing through the respective intersections are shown for both the morning (AM) and afternoon (PM) peak periods in Table 2.6. These volumes are intersection counts that were obtained from RMS. The table shows that the intersections on the key Hannell Street/Stewart Avenue north-south route are most utilised with between 3,000 and 5,000 vehicles per hour passing through the Honeysuckle Drive, Hunter Street and King Street/ Parry Street signalised intersections.

Table 2.6 Total traffic volumes for key intersections during peak periods

Intersection location	Type	Total AM peak hour traffic volume	Total PM peak hour traffic volume
Honeysuckle Drive/ Hannell Street	3 way signals (T intersection)	3,014	2,752
Hunter Street/ Stewart Avenue	4 way signals	3,441	4,338
King Street/Parry Street/ Stewart Avenue	4 way signals	4,097	4,615
Hunter Street/ Tudor Street/ Railway Street	4 way signals	1,923	2,102
Maitland Road/ Albert Street	4 way signals	1,646	1,697
Hannell Street/ Cowper Street	Roundabout	2,877	3,463
Hunter Street/ Steel Street	4 way signals	1,476	1,452

Source: various RMS traffic counts

2.3 Existing intersection performance

The performance of the road network is largely dependent on the operating performance of intersections which form critical capacity control points on the road network.

The Level of Service provided to motorists is a measure of intersection performance, factoring in traffic volumes, intersection geometry, turning facilities and traffic signal phasing. It is derived from the overall delay to vehicles averaged over the whole intersection and allocated on an alphabetical scale as defined in Table 2.7. The Level of Service calculations and definition are also able to be applied on any given leg of the intersection or any movement (through or turning) on individual approaches.

Table 2.7 Level of service criteria for intersections

Level of service	Average delay per vehicle (seconds/vehicle)	Intersection performance
A	< 14	Good operation
B	15 to 28	Good with acceptable delays and spare capacity
C	29 to 42	Satisfactory
D	43 to 56	Operating near capacity
E	57 to 70	At capacity, incidents will cause excessive delays.

The intersection performance can be derived from traffic modelling of the geometry and traffic volumes in a number of software packages. For this investigation, the outputs from a city centre Paramics model developed for the Newcastle Light Rail project (GHD, 2014) have been made available.

This provides base year (2014) intersection performance of the existing road network for five of the key intersections in and around Wickham. The results of modelling, which are summarised in Table 2.8, indicate that:

- during the morning peak, the intersection of Hunter, Tudor and Railway streets operates with a level of service F
- during the afternoon peak, the intersection of Honeysuckle Drive and Hannell Street operates with a level of service F
- all other intersections operate with an acceptable level of service of D or better.

Table 2.8 Existing intersection performance

Intersection	AM peak		PM peak	
	Level of service	Average delay (secs)	Level of service	Average delay (secs)
Honeysuckle Drive/Hannell Street (three way traffic signals)	C	29	F	103
Hunter Street/Stewart Avenue (four way traffic signals)	E	58	D	50
King Street/Parry Street/Stewart Avenue (four way traffic signals)	D	47	D	52
Hunter Street/Tudor Street/Railway Street (four way traffic signals)	F	71	C	30
Hunter Street/Steel Street (four way traffic signals)	A	11	A	12

Source: Newcastle Light Rail Paramics model (GHD, 2014)

One of the contributing factors to traffic congestion in Newcastle and the results shown in the above table, is the operation of railway level crossings, which causes significant delays for pedestrians and motorists. The level crossing delay surveys, quoted in Section 2.1.5, confirm that the Stewart Avenue level crossing is closed for approximately 20 percent of the AM and PM peak periods. These closures and resultant queues/traffic signal interactions contribute to delays and poor Levels of Service.

It should be noted that revisions are currently being made to the Newcastle Light Rail traffic model to better reflect existing (2014) base conditions. The updated modelling results are expected to be different from those in Table 2.8 above.

2.4 Other transport modes

2.4.1 Bus network

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

Newcastle Buses

Newcastle Buses is operated by the State Transit Authority (NSW Government) and runs bus services throughout Newcastle and Lake Macquarie. There are over 7000 regular services each week and 1,400 school bus services.

Thirty bus routes currently use Hunter Street to terminate at the Newcastle Bus Interchange which is located adjacent to Newcastle Railway Station. Newcastle Buses has a total of ten bus stops in each direction along Hunter Street.

Regional buses and interstate coaches

The regional buses in Newcastle provide a valuable transport link to communities in the greater Hunter, Port Stephens and Mid-North Coast regions. The interstate coaches run by Greyhound Australia use Newcastle as a stop on their Sydney to Brisbane routes. At present, these services operate out of the Newcastle bus interchange near the existing Newcastle Railway station. A summary of the number of weekday services operated by each company through the Newcastle Bus Interchange is shown in Table 2.9, with the peak hour volumes as shown between 7.30am and 8.30am.

Table 2.9 Weekday regional bus and interstate coach services

Operator	AM peak in	AM peak out	24 hour in	24 hour out
Port Stephens Coaches	3	3	18	18
Hunter Valley Buses	3	3	27	27
Rover Coaches	1	1	4	4
Busways	1	1	4	4
Greyhound Australia	0	0	5	5
Premier Motor Coaches	0	0	1	1
Total	**8**	**8**	**61**	**61**

Cyclists

There are no dedicated cyclist paths in the study area, the closest being in Honeysuckle Drive to the east. A narrow, non-separated cyclist lane (about 0.5 metres wide) is provided on Stewart Avenue/Hannell Street near the proposed interchange. However due to its narrow nature and the large traffic volumes on this road, it is not highly utilised.

A safer option for cyclists is to use the Railway Street level crossing for north–south movements in the area as it has much lower traffic volumes, and develops into a wide street north of the rail line. No cyclist counts exist for the area.

Pedestrians

Pedestrian traffic in and around the proposed Wickham Transport Interchange consists of three main groups:

- city workers walking to and from their parked cars
- residents
- customers and patrons of a number of commercial and entertainment venues.
- Bus and train passengers walking to and from Broadmeadow, Hamilton and Wickham stations.

Many of these pedestrians currently use the Railway Street level crossing. A count conducted by URS (URS, 2014) showed that 285 pedestrians used the crossing between 7am and 10pm on a typical weekday. Earlier pedestrian studies also found a significant number of patrons from a hotel in Railway Street used the crossing on a weekend night. No other pedestrian counts exist for the area.

3. Proposed development

3.1 Operations phase

The proposed new Wickham Transport Interchange would be provided with access facilities north of the new station concourse in Station Street. This would include facilities for short term parking for kiss and ride drop offs and taxi bays as shown in Figure 3.1.

Existing local buses would continue to pick up/drop off in Hunter Street, and continue to use the existing bus interchange at Newcastle East during development of the new interchange.

Access to Station Street is proposed by way of Bishopsgate Street and Charles Street. Alterations to Charles and Station Streets to maintain safe conditions for road users and accommodate the third track and station platform would also be required.

3.1.1 Changes to the Wickham road network

Railway Street

Railway Street at the level crossing would be permanently closed in each direction preventing travel across the rail corridor in this location. The southern side of the street would be converted to a hammerhead-style cul-de-sac, allowing vehicles to complete a U-turn. The northern side of the crossing would have kerb and gutter extended across Railway Street from Station Street to Railway Lane. This loss of the direct north-south access to the Hunter Street/Tudor Street intersection would result in the increased use of other streets in the road network to compensate.

Stewart Avenue/Hannell Street

The manually controlled boom gates on Stewart Avenue would be removed. This will significantly improve travel times for motorists, pedestrians and cyclists that currently use Stewart Avenue due to the extra road storage space provided and avoided disruption to traffic movements.

On the western side of Stewart Avenue, footpath, and kerb and gutter modifications would be provided for shuttle bus pick-up areas. A dedicated kerbside lane and a right turn bus priority signal would be provided at the Honeysuckle Drive intersection. The bus priority signal would provide safe and efficient bus movements from Stewart Avenue into Honeysuckle Drive.

A pedestrian fence would be installed along the median of Stewart Avenue between Hunter Street and Honeysuckle Drive to encourage pedestrians to cross safely at traffic signals.

Hannell Street/Honeysuckle Drive intersection

The existing signalised intersection would remain largely unchanged with the interchange development. There will be a modification to the intersection signal phasing to incorporate the proposed right turn bus priority signal (this is discussed further in Section 3.1.2).

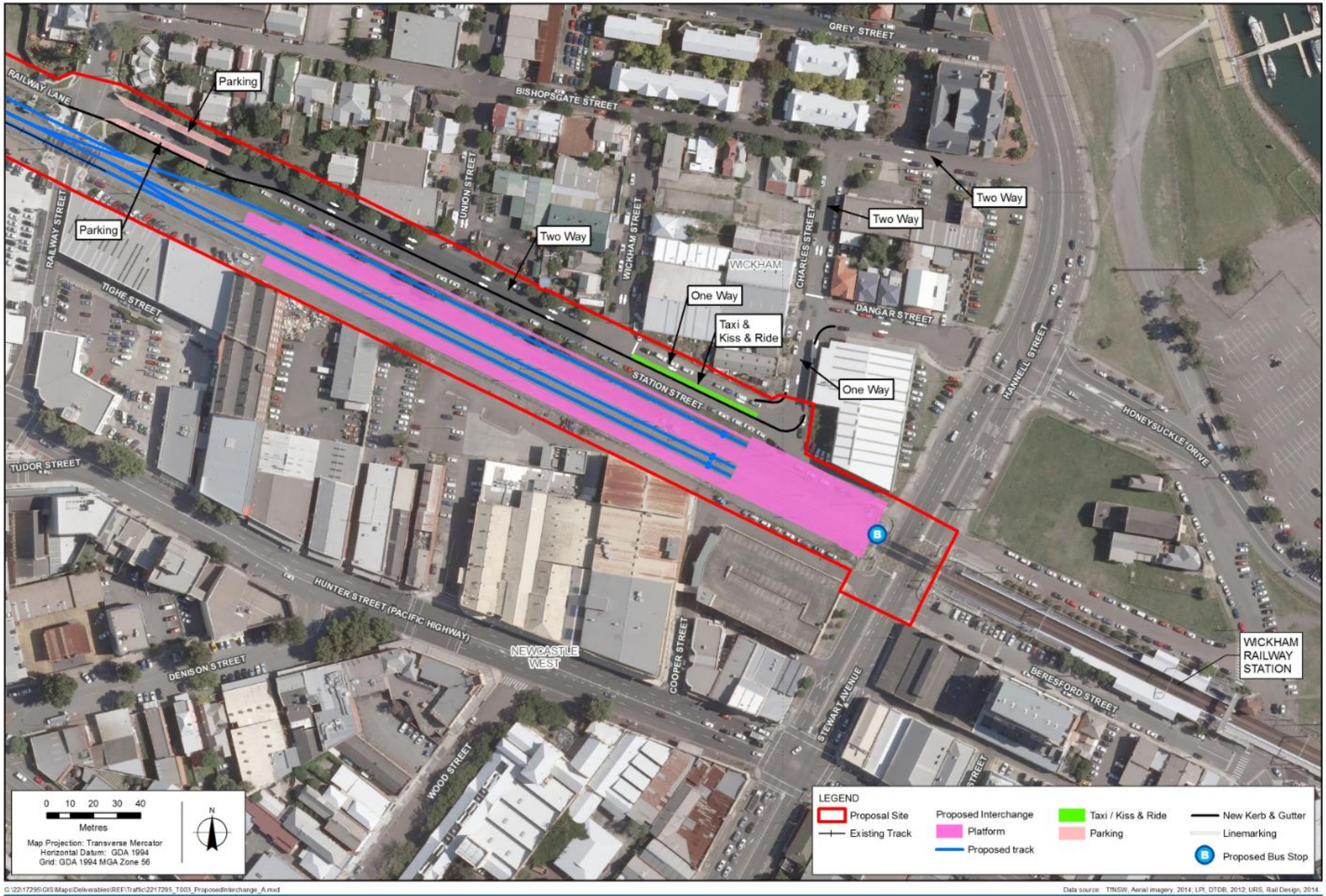

Figure 3.1 Proposed interchange facilities

Dangar Street/Bishopsgate Street

Dangar Street will remain closed with no direct access to Hannell Street. Approximately 50 metres north of Dangar Street is Bishopsgate Street which allows for left turn movements for light vehicles to access Station Street by way of Charles Street.

This will act as a new access point to Wickham and will partially compensate for the permanent closure of the Railway Street level crossing. Altered traffic flows will result at the intersection of Bishopsgate Street and Hannell Street, as vehicle flows change across the network.

Charles Street

Charles Street will be one way in the southbound direction from Dangar Street to Station Street. The section of Charles Street that is north of Dangar Street will remain bi-directional to retain property access.

Realigned kerb and gutter and a footpath would be provided on the eastern side Charles Street (south of Dangar Street). As a result, it is estimated that 4 existing on-street parking spaces would be removed.

Station Street

Station Street will undergo substantial changes to traffic conditions as a result of the rail corridor widening and the provision of the proposed interchange facilities. These include:

- Narrowing of Station Street between Union Street and Charles Street to accommodate the third rail track, train platforms, kiss and ride, and taxi set down areas.
- Reduced road reserve widths arising from these changes will require new footpath and realigned kerb and gutter on the southern side of Station Street.
- Station Street between Charles Street and Wickham Street would become one-way westbound.
- Station Street will be kept bi-directional between Wickham Street and Railway Street to allow vehicles travelling southbound on Railway Street to exit the area along Union Street.
- To achieve these changes, it is estimated that up to 71 of the 93 existing on street car parking spaces would need to be removed on both sides of Station Street.

3.1.2 Rail replacement bus service

Following completion of the new station and interchange in 2016, and prior to the commencement of Newcastle Light Rail services, a rail replacement bus service will be provided to allow passengers to complete their journey to the former Civic or Newcastle Stations.

Frequency

Train passengers would board the rail replacement bus from a proposed new bus stop on the western side of Stewart Avenue at the eastern end of the station concourse. It would be scheduled to meet the trains at the new station wherever possible. Additional services during peak periods or for special events in Newcastle would be scheduled as required. Drop-offs occur only in the eastbound direction at Civic and Newcastle stations with two additional stops in-between to replicate, as closely as possible, the future light rail stop locations. In the westbound direction, the bus would be for boarding passengers only that are travelling to the new station to transfer to a train service.

Route

The proposed rail replacement bus route would be designed to mirror the proposed light rail stops as closely as possible along Hunter Street. The eastern terminus will be at the existing Newcastle Bus Interchange. The western terminus will be at Wickham Station.

Arrangement

An indented bus bay would be created immediately east of the station concourse on the western side of Stewart Avenue. This arrangement would avoid commuters walking to the existing bus stops on Hunter Street.

There is also an existing bus stop approximately 50 metres north of the proposed station which is not used for regular bus services. It is proposed to merge the proposed bus bay with the existing bus bay to form a short bus lane.

At the intersection with Honeysuckle Drive, it is proposed to provide a bus lane and priority signal, allowing shuttle buses a priority right turn into Honeysuckle Drive. A similar bus priority signal that already exists in Newcastle is shown in Figure 3.3.

Kerb and pavement works, traffic signal modifications, line-marking, signage, lighting and a shelter will be provided for this bus stand. Relevant approvals would be sought from key stakeholders to implement this solution.

Patronage

A train patronage survey was undertaken in 2013 for railway stations from Broadmeadow to Newcastle. The passenger counts are summarised in Table 3.1 and Figure 3.2. The table and figure show that the total number of journeys to and from Wickham, Civic and Newcastle stations is about 4,720 during the construction period. This is approximately 2,350 people, assuming return trips.

The total number of journeys on a weekday to Civic and Newcastle stations only is 3,600 or about 1,800 people per day. Therefore it is estimated that about 77 percent of the total daily train passengers might be potential customers for the post-construction shuttle bus or the future light rail.

Table 3.1 Newcastle Branch Line Weekday Passenger Counts

Direction	From Sydney to Newcastle		From Newcastle to Sydney		From Hunter Line to Newcastle		From Newcastle to Hunter Line		Totals		
Station	Passenger Ons	Passenger Offs	Passenger Ons	Passenger Offs	Passenger Ons	Passenger Offs	Passenger Ons	Passenger Off	On	Off	Total
Broadmeadow	84	812	871	96	0	0	0	0	955	908	**1,863**
Hamilton	67	657	685	68	72	633	615	56	1,439	1,414	**2,853**
Wickham	7	257	247	7	10	291	265	12	529	567	**1,096**
Civic	3	403	390	6	4	405	362	7	759	821	**1,580**
Newcastle	0	636	603	0	0	406	399	0	1,002	1,042	**2,044**
All Stations	**161**	**2,765**	**2,796**	**177**	**86**	**1,735**	**1,641**	**75**	**4,684**	**4,752**	**9,436**

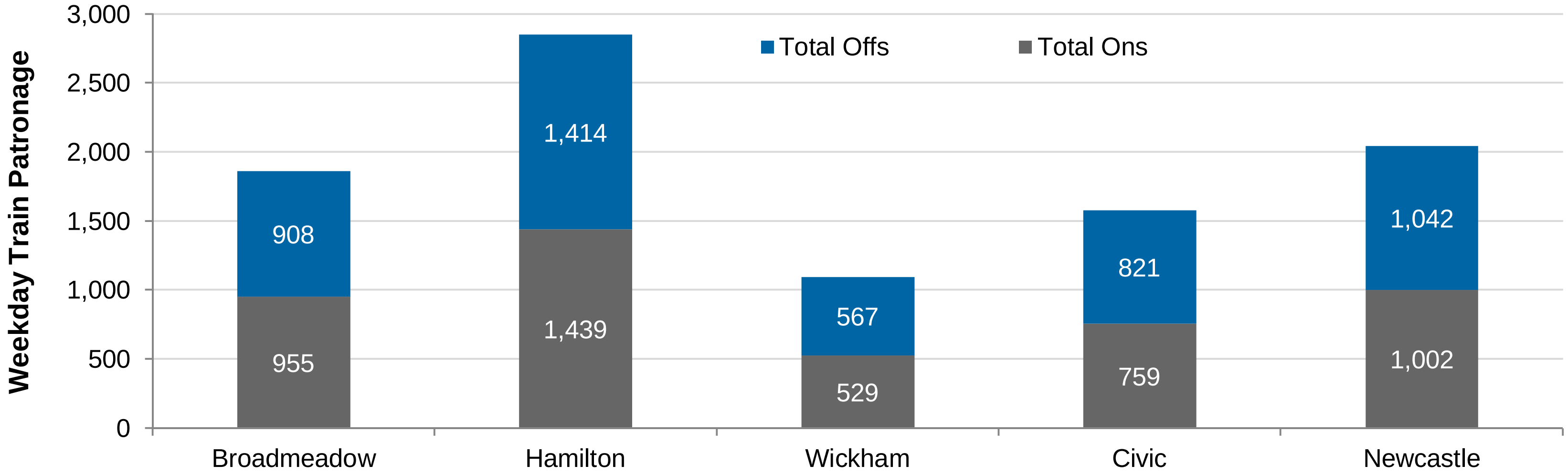

Figure 3.2 Newcastle Branch Line weekday passenger patronage

Figure 3.3 Bus priority signal, University Drive, Callaghan

3.2 Construction phase

Construction of the proposal is currently forecast to commence in December 2014. The proposal is anticipated to take approximately 24 months to complete and is expected to be commissioned in December 2016. Construction activities would overlap between the key stages outlined as follows:

- Stage 1: Establish site compound at the location of the former Morrow Park Bowling Club south of Wickham Park and undertake early works.
- Stage 2: Cease rail services east of Hamilton Station, which will operate temporarily as the easternmost station of the Newcastle Branch Line.
- Stage 3: Construct stabling yard north of Hamilton Station.
- Stage 4: Construct new station and interchange at Wickham.

It is anticipated that up to 100 construction staff (typical working day) and approximately 150 construction staff (during rail closedown periods) would typically be required on-site during the construction period.

3.2.1 Site compound locations

The proposed location for the construction compound (including stockpile sites and laydown areas) is south of Wickham Park and north of the railway corridor (and includes the former Morrow Park Bowling Club site). The site extends from the eastern side of the Maitland Road overbridge to Railway Lane and adjoins the railway corridor as shown on Figure 3.4. Subject to confirmation, entry to the site from Maitland Road would be left-in only and exits would be enabled at Railway Lane.

Once a construction contractor has been selected, the location of the construction compound(s) would be reviewed. Should the preferred location differ from the location considered by the REF, consultation would be undertaken with Transport for NSW to confirm the suitability of the location and whether any additional environmental impact assessment is required.

3.2.2 Site access

Site access is proposed at multiple locations along the railway corridor between Beaumont Street and Stewart Avenue. Figure 3.4 shows the proposed site compound and access points. The site would be accessed from six locations with five being on the northern side of the corridor.

Fern Street

- Fern Street site entry is by an existing gate. This allows all movements except for right out as there is no access to Maitland Road from Ivy Street.
- The exit at Fern Street requires construction traffic to use the Beaumont Street intersection. This intersection is busy but allows all traffic movements. This potentially poses a safety risk for straight or right turning movements.

Maitland Road

- Entry is by an existing driveway on the southern side of Wickham Park, immediately west of the railway overpass. The entry and exit to Maitland Road would be a left in, left out arrangement due to an existing raised concrete median.
- Due to the tight turning circle required, it is recommended that only light vehicles be allowed to exit the construction site using the access point. Entry for heavy vehicles will be possible with some driveway modifications and widening required.

Old railway formation onto Railway Street

- Access is by an unsealed drive running generally northeast from the former Morrow Park Bowling Club to where it joins Railway Street approximately 400 metres north of the existing railway level crossing. This would allow right in left out turning movements.

Railway Lane

- Railway Lane leads directly to the former Morrow Park Bowling Club where the main site compound is proposed to be located. Entry and exit movements from Railway Lane will be right in, left out.

Station Street

- The exact location of this access point will be confirmed during detailed design, prior to commencement of construction. There is no existing access to the rail corridor from Station Street. However, it is assumed that the access point will be towards the eastern end of the street for both separation from the Railway Lane access and for convenience for construction of the new interchange.

Donald Street

- An existing gate to the railway corridor is available off Donald Street in Hamilton, opposite the Lawson Street intersection. This is expected to be used infrequently for access as only minor works are proposed on the southern side of the railway corridor.

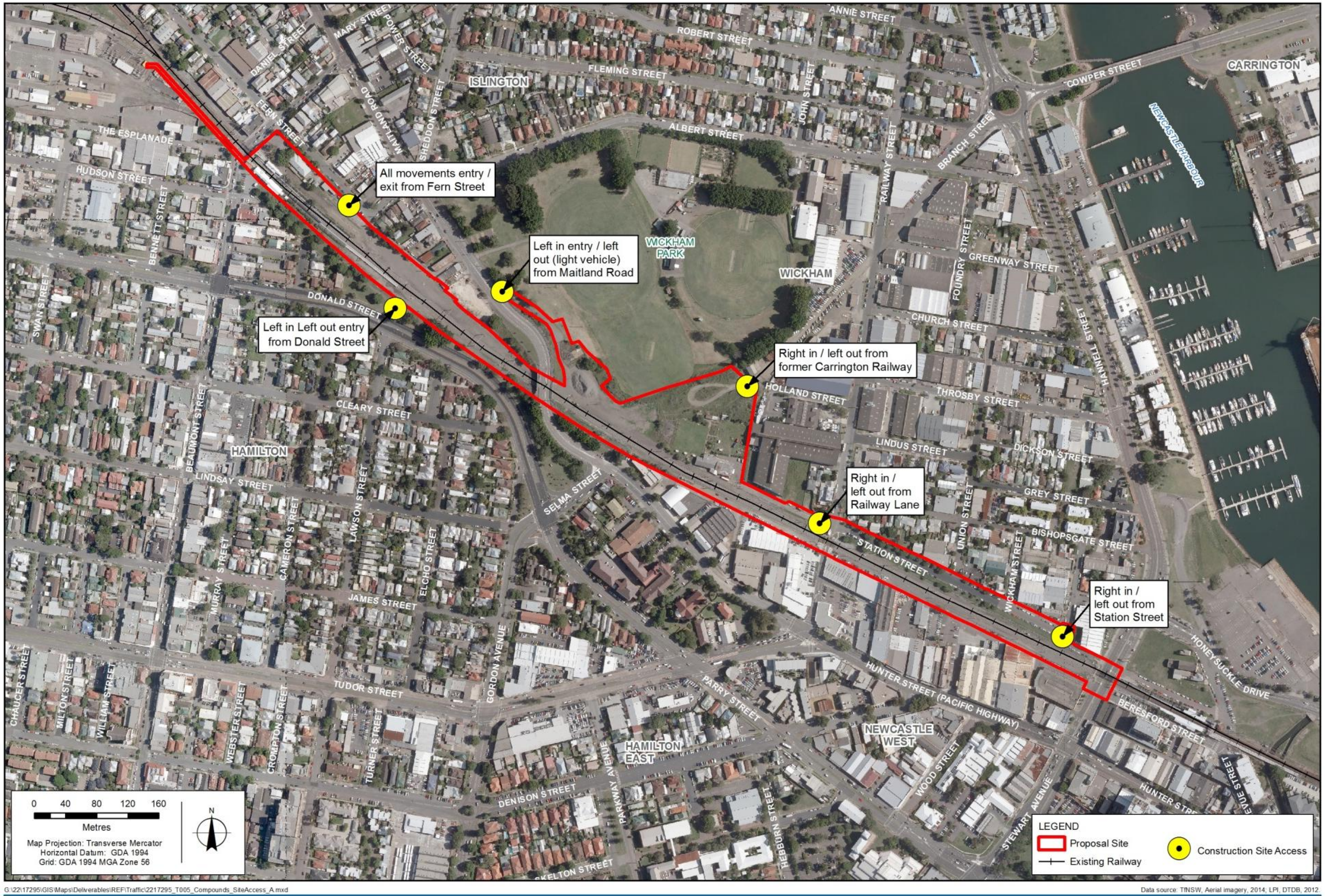

Figure 3.4 Site access points and construction compound

3.3 Interim arrangements

3.3.1 Description

During construction of the new interchange and stabling facilities, trains will terminate at either Hamilton Station or Broadmeadow Station. These stations will be used temporarily as a bus transfer point to shuttle passengers into Newcastle. Section 3.3.4 provides more details of the proposed shuttle bus services.

3.3.2 Changes to the road network

There will be no physical changes to the road network in Hamilton to accommodate the temporary terminus. The level crossing at Beaumont Street will be retained. No changes to the lane configuration or traffic capacity will occur.

Minor changes to Beaumont Street, including the potential removal of a street tree, the provision of seating/shelter and signage, may be provided for the temporary bus shuttle service. This would be subject to separate planning approvals following further design definition.

There are no changes to the road network or transport facilities proposed at Broadmeadow Station as part of the new interchange proposal. There are improvements proposed to bus facilities at Graham Road, but these would be subject to separate planning approvals following further design definition.

3.3.3 Temporary access arrangements

Vehicular access

Vehicular access arrangements are not required to change at Hamilton Station or Broadmeadow Station during this interim operating scenario.

Bus access

No changes to existing local bus services in either timetabling or routes would be required.

3.3.4 Shuttle bus service

During the period when trains are terminating at either Broadmeadow or Hamilton Stations, shuttle buses would enable train passengers to travel into and out of Newcastle. The bus services would be timetabled to meet trains in both directions wherever possible. A detailed timetable would be provided prior to the start of construction.

There is no current plan to change existing public bus routes during construction.

Pedestrians and cyclists

Pedestrian and cyclist access arrangements during the interim operating scenario are expected to remain as they are at both Hamilton and Broadmeadow stations.

4. Impact assessment

4.1 Operation

4.1.1 General traffic impacts

The changes to the road network (as discussed in detail in 3.3.2) as a result of the Wickham Transport Interchange are initially limited to:

- Removal of the Stewart Avenue and Merewether Street boom gates and the permanent opening of these roads to vehicular traffic.
- Permanent closure of the Railway Street level crossing.

This will result in adjustments to traffic flows in and around the Wickham area, primarily as a result of redistribution of traffic from the existing Railway Street level crossing.

During the construction of the interchange, other road network changes (further described in Section 3.2) are expected to provide improvements to north-south access across the former rail corridor. These additional improvements to the road network are not part of this proposal but will have an impact on the performance of intersections in the vicinity of the interchange.

Removal of the Stewart Avenue level crossing

The removal of this level crossing is expected to result in substantially improved performance of three key intersections on the north-south Stewart Avenue/Hannell Street route as follows:

- Honeysuckle Drive/Hannell Street
- Hunter Street/Stewart Avenue
- Parry Street/Stewart Avenue

These intersections all experience adverse effects due to the operation of the level crossing, as discussed in Section 2.1.5. The removal of the Stewart Avenue level crossing would result in a benefit to traffic flows along Stewart Avenue to Hannell Street during peak traffic periods, with a 20 percent increase in capacity across the railway corridor arising from the removal of level crossing closures.

The substantially improved north-south traffic flow and the elimination of extensive level crossing queues will also provide more intersection capacity and reduced delays for turning movements to and from this route at the key Honeysuckle Drive and Hunter Street intersections.

These preliminary findings are expected to be confirmed by more detailed and expanded regional traffic modelling currently being undertaken.

Railway Street level crossing permanent closure

The permanent closure of Railway Street at the level crossing will cause traffic to be diverted to other parts of the road network. Access to/from the Wickham area is sought as either a through route between other arterial roads such as Tudor Street, Donald Street, Hannell Street and Maitland Road or as a destination (residential, work or parking) in its own right.

For through traffic, drivers will quickly become aware of the street closure and adjust driving patterns to find their respective optimal path through the network, either diverting to the Stewart Avenue/Hunter Street intersection or the Maitland Road/Albert Street intersection, by the Islington overbridge. There may also be minor increases in travel across other level crossings further west at Beaumont Street or Clyde Street.

The net result is that daily and peak hour volumes currently using the Railway Street level crossing will be dissipated across the road network and absorbed with an expected no net increase in congestion because of the capacity benefits provided by the removal of boom gates and signals at Stewart Avenue.

For traffic passing through the greater Wickham area, the closure will result in a minor trip change, with little or no expected impact or travel time increase.

For drivers with Wickham as a destination (estimated at up to 1,000 vehicles per day) the level crossing closure will result in some difficulties gaining access to/from the immediate Wickham area. The nature and scale of the street layouts means that alternative access/egress options are not ideal, with expected increases in incoming traffic from Hannell Street by Bishopsgate Street and Throsby Street, as well Maitland Road by Albert Street.

The departure journeys are potentially more problematic with an expected increase in right turn movements from Throsby Street to Hannell Street.

Hannell Street/Honeysuckle Drive intersection modifications

The western kerb line on Hannell Street would be realigned to provide for bus pickup areas associated with the proposed bus shuttle service. This will include a bus priority signal for right turns into Honeysuckle Drive. Changes to phasing to accommodate this movement are expected to have minor increased delays for vehicles turning right into Honeysuckle Drive.

Bishopsgate Street, Charles Street and Station Street

The proposed arrangement is for light vehicles to access Station Street by Bishopsgate Street and Charles Street. Most of these vehicles will exit Wickham using Railway Street to travel to either Throsby Street or Albert Street. These streets will most likely not observe a significant increase or decrease in total traffic volumes compared to their current levels.

Throsby Street

Throsby Street will become a key exit point from Wickham for traffic wishing to proceed south along Hannell Street and traffic flows will increase over existing levels. Any increase in green time for the Throsby Street leg of the intersection to accommodate this increase has the potential to increase delays for north-south traffic on Hannell Street.

4.1.2 Assessment of operational traffic

Operational traffic generation

The new interchange facilities on Station Street will attract additional traffic to Wickham. Taxis and private vehicles will use these facilities, accessing Station Street from Hannell Street by Dangar Street and Charles Street.

Assumptions in relation to peak hour traffic generation have been made as follows:

- 50 private vehicles
- 10 taxis

This peak hour traffic generation equates to estimated daily flows as outlined in Table 4.1, distributed across the Wickham road network for travel north, south and west as shown.

Table 4.1 Operational traffic generation

Street	Operational traffic generation (vehicles per day)	
	Taxis	Private vehicles
Station Street	100	500
Railway Street, south of Throsby Street	100	500
Railway Street, north of Throsby Street	50	250
Throsby Street	50	250
Albert Street, east of Railway Street	30	150
Albert Street, west of Railway Street	20	100

4.1.3 Parking impacts

Changes to existing conditions

The proposed Wickham Transport Interchange includes the removal of on-street parking (expected to be 71 spaces) on Station Street as a result of the interchange construction and provision of kiss and ride and taxi facilities. There would also need to be some parking changes on Charles Street with four spaces removed.

It is expected that there will be a shift of parking into streets further north as the spaces are removed and interchange becomes operational, which will have impacts on residents and businesses in the affected streets.

Future demand

There will be an increase in the demand for parking during the operational phase of the new interchange. This demand will result from city workers, and those who wish to park their cars near the station to use the transport networks that will operate through the interchange. It is currently not known what this demand will be, and it is recommended that this be investigated further. This further investigation is however beyond the scope of this traffic study.

Future development in Newcastle West as part of urban renewal plans by UrbanGrowth and additional office developments in the Honeysuckle area will increase demand for parking in the Wickham area.

4.1.4 Access arrangements

Bus access

Transport for NSW proposes that Newcastle Buses will continue to operate on current routes along Hunter Street. It is understood that until the light rail project is operational, a shuttle bus service will carry passengers from the new interchange to the former Newcastle Station.

Pedestrians and cyclists

URS undertook a Pedestrian Footbridge Requirement Study in May 2014. This study included a pedestrian impact assessment of the permanent closure of Railway Street level crossing. The assessment concluded this would have a minimal impact on pedestrian movements in the Railway Street precinct.

The assessment indicated that the most affected group will be those wishing to access surrounding residential properties on a daily basis and patrons of a hotel on Railway Street (Lass O'Gowrie), which is located 50 metres north of the current level crossing. The closing of this crossing will:

- add an additional 750 metres walk for these residents and hotel patrons
- add an average of 20 metres additional walking distance to Hunter Street bus stops.

Since there are no recognised cycle routes north of the railway line in the Wickham area, the proposed transport interchange is unlikely to have a noticeable impact on cyclists. Cyclists that currently proceed north over the rail line using Railway Street will however be required to utilise the busier roads of Stewart Avenue/Hannell Street or Maitland Road.

4.1.5 Rail passenger journey times

During operation of the new interchange, there will be changes to rail passenger journeys involving transfer to a shuttle bus service which will result in increased journey times compared to completion of the journey by heavy rail. This will also be the case during the preceding construction phase.

Trip times are predicted to increase. This could lead to a decrease in rail patronage and a subsequent increase in private car usage.

4.2 Construction

The construction of the new interchange is expected to take 24 months with a commissioning date in December 2016. During this period, there will be significant construction activity that will have an impact on the general road network in and around the Hamilton and Wickham areas. These impacts are discussed further below.

4.2.1 Construction worker parking

Designated worker parking areas will be provided either within the site compound or adjacent to the rail corridor to minimise inconvenience to railway users, residents and local businesses during the construction period. Where parking is allocated next to the rail corridor assets, effective means of maintaining safety of workers from moving components would be provided.

4.2.2 Construction vehicle movements

The construction of the proposal would involve a significant number of vehicles movements in and around the construction site and compound areas. Construction vehicle movements would comprise:

- heavy vehicles: a third of the daily total of the heavy vehicles would occur in the peak periods with the majority of deliveries occurring in the early morning.
- light vehicles: light vehicles are expected to arrive during peak periods only.

The estimated numbers of heavy and light construction vehicles in peak hour are provided in Table 4.2.

Table 4.2 Estimated peak hourly construction vehicle movements

Peak hour traffic volumes (two way)						
Type	Ivy Street	Wickham Park	Railway Lane	Railway Street	Station Street	Total
Heavy vehicles	12	8	28	2	32	**82**
Light Vehicles	15	15	90	15	15	**150**

The delivery of some infrastructure components, such as roofing panels and beams, may be considered oversized deliveries. These deliveries would be undertaken in accordance with the requirements of relevant authorities, so as not to cause undue interruption or compromise the safety of the road network.

4.2.3 Access roads

The roads leading to the access points discussed in Section 3.2.2 will experience increased heavy vehicle traffic during the construction phase of the proposal. The number of additional heavy vehicles on surrounding streets is estimated in Table 4.3.

Table 4.3 Additional heavy construction vehicles on surrounding streets

Street	Additional heavy vehicles (peak hour)	Additional heavy vehicles (daily)
Railway / Albert Streets	62	186
Station Street	32	96
Maitland Road	20	60

It is concluded from these traffic volumes that:

- Railway Street and Albert Street will observe a significant increase in heavy vehicle traffic. Measures would be undertaken to reduce or eliminate heavy vehicle queues of idling trucks along Railway Street. This additional traffic will be offset by the closure of the Railway Street level crossing and the absence of traffic which would have otherwise used these same streets which will eliminate through traffic along Railway and Albert Streets.
- Station Street would experience an increase in heavy vehicle traffic, although it will be to a lesser extent than that experienced by Railway and Albert Streets. Measures would be taken to reduce idling queues along the street.
- Maitland Road would experience a small increase in heavy vehicles, however as it is currently a busy arterial road with limited residential properties, the impact would be less noticeable.

4.2.4 Access intersections

The intersections in and around the site will experience an increase in construction vehicle movements during the construction period. The impacts of these increases will be especially noticeable at the local road intersections due to the current low traffic volumes.

The impacts to local roads surrounding Broadmeadow Station and Hamilton Station potentially impacted by commuter shuttle buses during construction will be addressed in a separate study.

4.2.5 Rail passenger journey times

Similar to the operational phase, rail passenger journeys are expected to lengthen as a result of the need to transfer to a bus to complete the trip into Newcastle.

5. Mitigation measures

The proposed mitigation measures are:

- Traffic management plans would be prepared and provided to the relevant roads authority as required.
- Heavy vehicles would be restricted to specified routes, with the aim of avoiding local streets, high pedestrian areas and school zones. Where feasible, route markers would be installed for heavy vehicles along designated routes.
- Limit off-site construction vehicle parking in designated areas. Areas of temporary on-street parking during peak construction events would be identified in the traffic management plans to minimise the impact on surrounding facilities, properties and businesses particularly railway patrons.
- The queuing and idling of construction vehicles in residential streets would be minimised.
- An emergency response plan would be developed for construction traffic incidents.
- Where required, public communications would be conducted to warn the community and local residents of vehicle movements and anticipated effects on the local road network relating to site works in accordance with the CEMP.
- Access to all private properties adjacent to the works would be maintained during construction, unless otherwise agreed by relevant property owners.
- During project inductions, all heavy vehicle drivers would be provided with the emergency response plan for construction traffic incidents.
- Completion of more detailed, regional traffic modelling to confirm the preliminary findings of this report. This modelling will consider the impact of traffic diverted following the closure of the Railway Street level crossing and the effect of the proposal on key intersections in the study area.

6. References

Bitzios, 2009. *Newcastle City Centre Traffic and Transport Study - Traffic and Transport Options Modelling Report*, Newcastle City Council

GHD, 2014. *Newcastle Light Rail – Options Identification and Initial Feasibility Assessment Study*, Transport for NSW

GHD, 2014 *Newcastle Light Rail – City Centre Traffic Modelling Services – Light Rail Alignment Options Assessment*, Transport for NSW

GHD, 2014 *Newcastle Light Rail – City Centre Traffic Modelling Services – Microsimulation Model Calibration and Validation Report*, Transport for NSW

Transport for NSW, 2014 – *Wickham Terminus Construction Period Services and Operational Plan*

URS, 2014 *Pedestrian Footbridge Requirement Study*, Transport for NSW

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Transport for NSW

Wickham Transport Interchange

Urban Landscape and Visual Impact Assessment

July 2014

Executive summary

In 2012, the NSW Government announced the truncation of the heavy rail in the Wickham area, construction of a new transport interchange west of Stewart Avenue and light rail to the east.

This Urban Landscape and Visual Impact Assessment (ULVIA) report discusses the existing townscape character and visual amenity of the study area between Hamilton Station and Stewart Avenue. It identifies publically accessible view points within the study area and discusses potential visual impacts that may occur as a result of the proposal.

The assessment was carried out using a desktop study, site visit and photographic inventory. There is a discussion of urban character areas and potential visual impacts. A photomontage and architectural rendering illustrate the potential impacts of the proposal on the visual landscape. Key urban design objectives and strategies for protection of visual amenity are identified through reference to existing Transport for NSW and City of Newcastle guidelines.

The visual impacts of the proposal would generally be contained to areas within close proximity to the existing rail corridor. In particular, residents in Fern Street, Hamilton adjacent to the proposed stabling yard and Station Street, Wickham opposite the proposed new station, would experience the greatest change in visual amenity. However these changes would be viewed within the context of an existing rail corridor and associated infrastructure.

A number of mitigation measures are outlined that would reduce potential impacts and improve integration into the existing urban environment. Urban design guidelines have been outlined in the Urban Design Report as part of the Definition Design Report (URS, June 2014). These would be incorporated into subsequent design processes to facilitate outcomes that would be sympathetic to the local context and ensure appropriate integration with the existing landscape.

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Definitions

Term	Definition
Landscape feature	A component, part or feature of the landscape that is prominent or eye-catching, e.g. hills, buildings, vegetation
Landscape quality	Largely subjective judgement based on particular characteristics that influence the way in which the environment is experienced, including special interests such as cultural associations or heritage interests, the presence and/or type of elements and condition
Landscape sensitivity	The extent to which landscape can accept a change of a particular type and scale without unacceptable adverse impacts on its character
Landscape value	Areas of formally designated landscape that through national or local consensus, reflect the value placed by society on particular environments and/or their features
Mitigation	Measures, including any process, activity or design to avoid, reduce, remedy or compensate for adverse urban landscape and visual impacts of a development project
Sensitive visual receiver	Person and/or viewer group that will experience an impact
Visual amenity	The value of a particular area or view in terms of what is seen
Visual impact	Changes in the appearance of the landscape or in the composition of available views as a result of development, to people's responses to these changes, and to the overall impacts in regard to visual amenity. This can be positive (i.e. beneficial or an improvement) or negative (i.e. adverse or a detraction)
Visual catchment	Extent of potential visibility to or from a specific area, feature or proposal
UDVIA	Urban Design and Visual Impact Assessment

1. Introduction

1.1 Background

In 2012, the NSW Government announced the truncation of the heavy rail line in the Wickham area west of Stewart Avenue as part of the *Newcastle Urban Renewal Strategy (NURS)*. Following consideration of options to cease railway operations, it was decided that a new station at Wickham would be constructed on land to the west of Stewart Avenue and that the residual heavy rail corridor, comprising the existing Wickham Station and areas to the east, would be reviewed for suitability as part of the initial stage of the Newcastle Light Rail project.

1.2 Overview of the proposal

The proposal to truncate the heavy rail line at Wickham and deliver the proposed interchange involves:

- constructing and operating a new train stabling facility to the north of Hamilton Station, within the existing rail corridor
- constructing and operating the new station at Wickham and transport interchange for pedestrians, cyclists, buses and heavy rail to the west of Stewart Avenue.

Shuttle bus services would be implemented during and following construction to enable train passengers to complete their journeys into the Newcastle city centre.

To continue operating the rail network to the west of the new station at Wickham, a number of modifications to the rail infrastructure and services between Wickham and Hamilton stations are required. This would involve:

- terminating train services on the Newcastle Branch Line at Hamilton Station for about two years during construction of the new station at Wickham and transport interchange
- constructing and operating a new head shunt (third) rail track, about 700 metres in length between the Maitland Road overpass and new station at Wickham
- installing new crossovers and turnouts to facilitate the movement of trains between the three rail tracks
- ancillary infrastructure including traction power supply, signalling and overhead wiring.

Some road works would also be required, involving the removal of the railway crossing boom gates and signals at Stewart Avenue and the closure of Railway Street at the level crossing.

The design of the transport interchange makes allowance for the future provision of light rail. The Newcastle Light Rail project will be subject to a separate environmental impact assessment process.

1.3 Purpose and scope of this report

An assessment of the urban design and visual impacts of the proposal was undertaken by GHD. The assessment involved a desktop study, site visit, photographic inventory, identification of urban character areas, and potential visual impacts. One photomontage and an architectural rendering have been prepared to illustrate the potential impacts of the proposal on the visual landscape.

1.4 Assumptions and limitations

The ULVIA process aims to be objective and describe any changes factually; however, the importance of these changes requires qualitative (subjective) judgements to be made. The conclusions of this assessment therefore combine objective measurement and subjective professional interpretation. This assessment has attempted to be objective, however it is recognised that visual assessment can be highly subjective and individuals are likely to associate different visual experiences to the study area.

For the purposes of this assessment, the impact ratings have been based on the implementation of the landscape and urban design strategies developed as part of URS Urban Design Report (URS, June 2014). The assessment was based on the successful establishment of vegetation. The operation phase assessment was based on the impacts approximately five years after the completion of construction.

2. Methodology

2.1 Introduction

The methodology for this study, including impacts and proposed mitigation measures, has been derived from the *Guidelines for Landscape and Visual Impact Assessment, Third Edition*, published by the Landscape Institute and Institute of Environmental Management and Assessment (UK) (2013), *Visual Landscape Planning in Western Australia* document produced by the Western Australian Planning Commission (2007), and the Forest Practice Board of Tasmania's, *A Manual for Forest Landscape Management (2006)*.

2.2 Urban landscape and visual impact assessment scope

This ULVIA addresses the potential urban landscape and visual impacts associated with the proposal, including:

- review of existing information relevant to the visual environment, including existing landform, vegetation, and land use
- a description of the proposal and its visual components
- an evaluation of the existing urban landscape and visual environment
- discussion of visual receiver sensitivity within the study area through the use of representative viewing locations
- assessment of the rating of importance of impacts on visual landscape character and amenity at the sensitive receiver viewing locations as a direct result of the proposal
- proposed mitigation strategies and review of the urban design guidelines.

A worst case indicative visual catchment, within which the proposal may be seen, has been defined based on the proposal site. This has been determined through a desktop study examining aerial photographs and topographic maps where landform and land cover (screening) were considered in tandem. Also taken into consideration was the potential maximum visibility for this type of development. For ULVIA, the visual catchment becomes the study area which, for this assessment, has been set at 1 kilometre with the majority of impacts predicted to be within 500 metres of the proposal, based upon previous studies of a similar nature. This preliminary visual catchment is then used to identify sensitive receivers with potential views of the proposal.

2.3 Existing environmental values

The methodology for the identification of the existing environmental values of the area surrounding the site and the identification of the viewpoints included:

- identification via aerial photography review of potentially affected receivers and viewing locations which are accessible to the public or are a place of residence
- site verification of publicly accessible and representative viewpoints with photographic recording to provide a representation of typical views possible from that locality to the proposal
- review of existing design information and collation of relevant background information including planning and land use.

2.4 Assessment of impacts

A qualitative assessment of urban landscape and visual impacts forms the second component of the assessment. The rating of importance of impacts has been evaluated using a combination of landscape impacts and visual impacts, as defined below.

2.4.1 Landscape impact

Landscape impacts refer to the relative capacity of the landscape to accommodate changes to the physical landscape of the type and scale proposed that would occur as a direct result of the proposal. Impacts have been assessed from identified viewing locations and consider (through professional judgement) the scale of change including:

- the extent to which the change of features alters the existing landscape character
- the extent of area from which the effect is evident
- the duration of the effect (short, medium, long term, or permanent)
- the physical state (or condition) of the landscape and its intactness from visual, functional, and ecological perspective. This includes consideration of the condition of landscape elements such as landscaping or features such as a distinctive building, or significant mature trees and their contribution to landscape character
- the effectiveness of any proposed mitigation measures.

Definitions used to describe this assessment are detailed in Table 2.1

Table 2.1 Visual modification definitions/magnitude of landscape impacts

Landscape Impact	Definition
Large	A substantial/obvious change to the landscape due to total loss of, or change to, elements, features or characteristics of the landscape. Would cause a landscape to be permanently changed and its quality diminished.
Moderate	Discernible changes in the landscape due to partial loss of, or change to the elements, features or characteristics of the landscape. May be partly mitigated. The change would be out of scale with the landscape, and at odds with the local pattern and landform and would leave an adverse impact on the landscape.
Small	Minor loss or alteration to one or more key landscape elements, features, or characteristics, or the introduction of elements that may be visible but may not be uncharacteristic within the existing landscape.
Negligible	Almost imperceptible or no change in the view as there is little or no loss of/or change to the elements, features or characteristics of the landscape.

2.4.2 Visual impact

Visual impacts arise from changes in available views of the landscape that occur as a result of the proposal. Visual impact is determined through the subjective assessment of sensitivity of the visual receivers and the magnitude (scale) of the change in view. Sensitivity is dependent upon receivers' location, the importance of their view, their activity, expectations, available view, and the extent of screening of this view.

Factors that have been considered in assessing the response to changes in the visual amenity include:

- interest in the visual environment and their distance/angle of view to the source of the impact

- the extent of screening/filtering of the view
- magnitude of change in the view (i.e. loss/addition of features that change the view's composition)
- integration of changes within the existing view (form, mass, height, colour and texture)
- duration of the effect (temporary/permanent, intermittent/continuous)
- effectiveness of the proposed mitigation.

Receiver sensitivity definitions used to describe this assessment have been outlined in Table 2.2 below.

Table 2.2 Assessment of receiver sensitivity

Sensitivity	Definition
High	Occupiers of residential properties with long viewing periods, within close proximity to the proposed development. Communities that place value upon the landscape and enjoyment of views of their setting.
Medium	Outdoor workers who have a key focus on their work who may also have intermittent views of the proposal site. Viewers at schools, or similar, when outdoor play and recreation areas are located within close proximity but viewing periods are limited. Occupiers of residential properties with long viewing periods, at a distance from or screened from the proposal site.
Low	Road users in motor vehicles, trains or on transport routes that are passing through or adjacent to the study area and therefore have short term views. Viewers indoor at their place of work, schools or similar.
Negligible	Viewers from locations where there is screening by vegetation or structures where only occasional screened views are available and viewing times are short. Road users in motor vehicles, trains or on transport routes that are passing through/adjacent to the proposal site and have partially screened views and short viewing times.

2.4.3 Duration of impact

Duration of impacts has been defined for the purposes of this assessment as outlined in Table 2.3.

Table 2.3 Duration of impacts

Duration	Definition
Temporary	Impacts lasting one year or less
Short Term	Impacts lasting one to seven years
Medium Term	Impacts lasting seven to fifteen years
Long Term	Impacts lasting fifteen to sixty years
Permanent	Impacts lasting over sixty years

2.5 Rating of importance of impact

For the purposes of this assessment, predicted impacts as a direct result of the proposal have been described according to their importance, which is a function of the magnitude of the impact and the sensitivity of the receiver as detailed in Table 2.4 below. Only impacts that are considered to be of major or high rating are considered as important for the purposes of this assessment.

Table 2.4 Significance of Impact

		Landscape Impact			
		Large	**Moderate**	**Small**	**Negligible**
Visual Sensitivity	**High**	Major Significance	High Significance	Moderate Significance	Minor Significance
	Medium	High Significance	Moderate Significance	Minor Significance	Not Significant
	Low	Moderate Significance	Minor Significance	Not Significant	Not Significant
	Negligible	Minor Significance	Not Significant	Not Significant	Not Significant

3. Existing visual character

This section provide an overview of the existing landform, land uses and vegetation in the vicinity of the proposal site. These features all contribute to the urban landscape and visual character of the area.

3.1 Existing visual environment

The existing visual environment is characterised by its highly developed urban nature and existing rail operations. The study area is dominated by road and rail infrastructure with a mix of surrounding residential, commercial, light industrial and recreational uses. Key viewing locations include view corridors (mainly along roads and through open areas) and from elevated structures on Maitland Road (road overbridge) and Beaumont Street (pedestrian overbridge).

The key features of the existing visual environment relevant to the assessment include:

- narrow roads to the north of Station Street with a mix of residential, commercial and light industrial properties. Buildings in this area are generally single-storey in height and include a recently refurbished car dealership to the north of the proposed new station at Wickham on Dangar and Charles Streets. Some light industrial uses occur along Station Street and Railway Street.
- Wickham Street and Charles Street visually connect some residential properties on Bishopsgate Street to the proposal site.
- a multi-storey car park (three storeys in height) to the south of the proposed new station at Wickham, adjacent to the former Newcastle Cooperative Store (three storeys in height) which is listed on the Newcastle Local Environment Plan (LEP) heritage register.
- Stewart Avenue to the east is a wide major arterial road, which currently has a level crossing across the railway.
- Cooper Street, a narrow laneway which visually connects Hunter Street to the proposal site.
- Beaumont Street, a retail strip to the west.
- the existing Hamilton Station (State heritage register listed) precinct.
- Wickham Park to the north, on Maitland Road, which is also listed on the Newcastle LEP heritage register.

The vegetation in the study area varies from cleared ovals with ornamental trees (Wickham Park), planted ornamental street trees, mown exotic grasses, hedges and some landscaping along streets and adjacent residential and commercial areas. Generally, vegetation within the rail corridor varies from scattered trees to small stands of trees with mown exotic grasses. These provide some screening to adjacent properties. The proposal site has a limited scattering of mature trees.

3.2 Existing urban fabric

3.2.1 Wickham

The area immediately surrounding the proposal site at Wickham Station is mixed commercial, light industrial and residential. To the north of the railway corridor, there is a mix of detached single-storey housing and commercial. The buildings vary in condition. To the south, the built form provides locally distinctive variation but is dominated by large, multi-storey buildings. These buildings also vary in condition.

There are two heritage buildings in the vicinity of the proposed station. These include the existing Wickham Station, former Newcastle Cooperative Store to the south-west and a small unit on Charles Street to the north of station. The former Newcastle Cooperative Store currently functions as a shopping centre. There are otherwise few townscape features of merit and generally, the built form is not uniform and there are gaps in the urban fabric.

The rail corridor is straight in this section and relatively wide between building frontages, opening out when viewed to the west towards Wickham Park and towards the mixed land use to the north-west of the site.

There are some landscape elements in this area that contribute positively to the urban fabric, including street trees in Stewart Avenue and Station Street. Mostly, the public realm is dominated by traffic, parking and rail infrastructure requirements. There is minimal dedicated footway space for pedestrians, other than on Stewart Avenue. Cycle lanes are provided on Stewart Avenue. Pedestrian guardrails extend along the Stewart Avenue level crossing and mesh fencing to both sides of the rail corridor reinforcing the unrelated character of the two sides of the corridor. Footpath finishes are generally average to poor. There are few pedestrian facilities within the local area and pedestrian activity is limited. Generally, the scale, busy transport focus and controlled pedestrian crossing facilities of the area are inhospitable.

The character of the local Wickham area is primarily determined by the built form described above. Long vistas are generally defined by the wide, straight, rail corridor and building heights of up to three storeys to the south. The visual amenity of the area is influenced by wide pavements in generally poor condition, extensive road and rail infrastructure, guard rails and fencing, side roads lined with parked cars and intermittent street trees within the pavement. Views are dominated by traffic requirements, signage and some pedestrian activity along Stewart Avenue. Views to the north/north-west are generally more open than to the south/south-east.

Given the generally open urban setting, poor amenity of the public realm, few pedestrian linkages at the street level, a partial sense of place, limited landscape elements, two heritage-listed buildings, the listed station, and limited civic elements that contribute to townscape character, it is anticipated that the townscape in this location is *moderately sensitive to change*.

3.2.2 Hamilton Station

The character of Hamilton surrounding the station is influenced by the footbridge, level crossing, car parking, built form of the state-listed Hamilton Station and generally retail and commercial and residential land uses. Historically, the area located in the rail corridor immediately north of Hamilton Station, between Beaumont Street and Maitland Road overbridge, was used as a stabling yard before the former sidings were removed. Generally, two storey buildings line Beaumont Street with some areas of uniform frontages. The Sydney Junction Hotel and Hamilton Junction Hotel are notable contributors to townscape. There is an active street front of ‘al-fresco’/cafe dining in places. Despite the influences of heavy through traffic, car parking, a rail corridor and station, it manages to retain a visually distinctive ‘village’ character, pedestrian scale and local sense of place.

The rail corridor is narrow at Hamilton Station between platforms and station buildings, but widens west towards the Maitland Road overbridge. There are long distance views eastwards towards Wickham Park and Maitland Road overbridge from the pedestrian footbridge and station on Beaumont Street.

Street trees and mature trees within private land and public open space play a part in influencing the character of the area. The vegetation serves to break up the visual mass of the road and rail infrastructure and screens views to the rail corridor.

The main road, railway station and associated infrastructure dominate views within the area and tends to sever visual and physical connectivity throughout. The public realm is mostly limited to footpaths either side of the road, a footbridge at Hamilton Station and parkland to the south of the station, but lacks facilities and connectivity and is influenced by vehicles accessing the surrounding use. Footpath finishes are variable and the quality of the public realm is disconnected. Some areas are in good condition with distinct character, with other areas in poor condition and disconnected. There is moderate pedestrian activity throughout.

Given the valued urban setting with mixed public realm amenity, quality and connectivity, scattered landscape and built elements that contribute to townscape character and sense of place, it is anticipated that the townscape in this location is *moderately sensitive to change.*

3.3 Sensitive receivers viewing locations

In order to undertake an assessment of visual impacts, a series of key sensitive receiver viewing locations have been selected to represent the points from which the proposal is likely to be viewed by the greatest number of visual receivers and/or from where the most sensitive visual receivers are likely to perceive the project. The viewing locations are areas where full or screened views of the proposal are available, or in residential, business, educational or recreational areas. Sensitive receiver viewing locations would also include areas where views are transient such as vehicles using a road or views from trains.

Publically accessible sensitive receiver viewing locations have been identified through the desktop study and site survey to represent receiver’s’ visual context. Viewing locations are shown Figure 3.1 and the visual context for each location is described in the following sections.

The representative sensitive receiver viewing locations that have been identified and assessed in this report are:

View location 1 – Beaumont Street, Hamilton

View location 2 – Eva Street, Hamilton

View location 3 – Ivy Street, Hamilton

View location 4 – Maitland Road Overbridge

View location 5 – Wickham Park

View location 6 – Station Street, Wickham

View location 7 – Stewart Avenue, Wickham

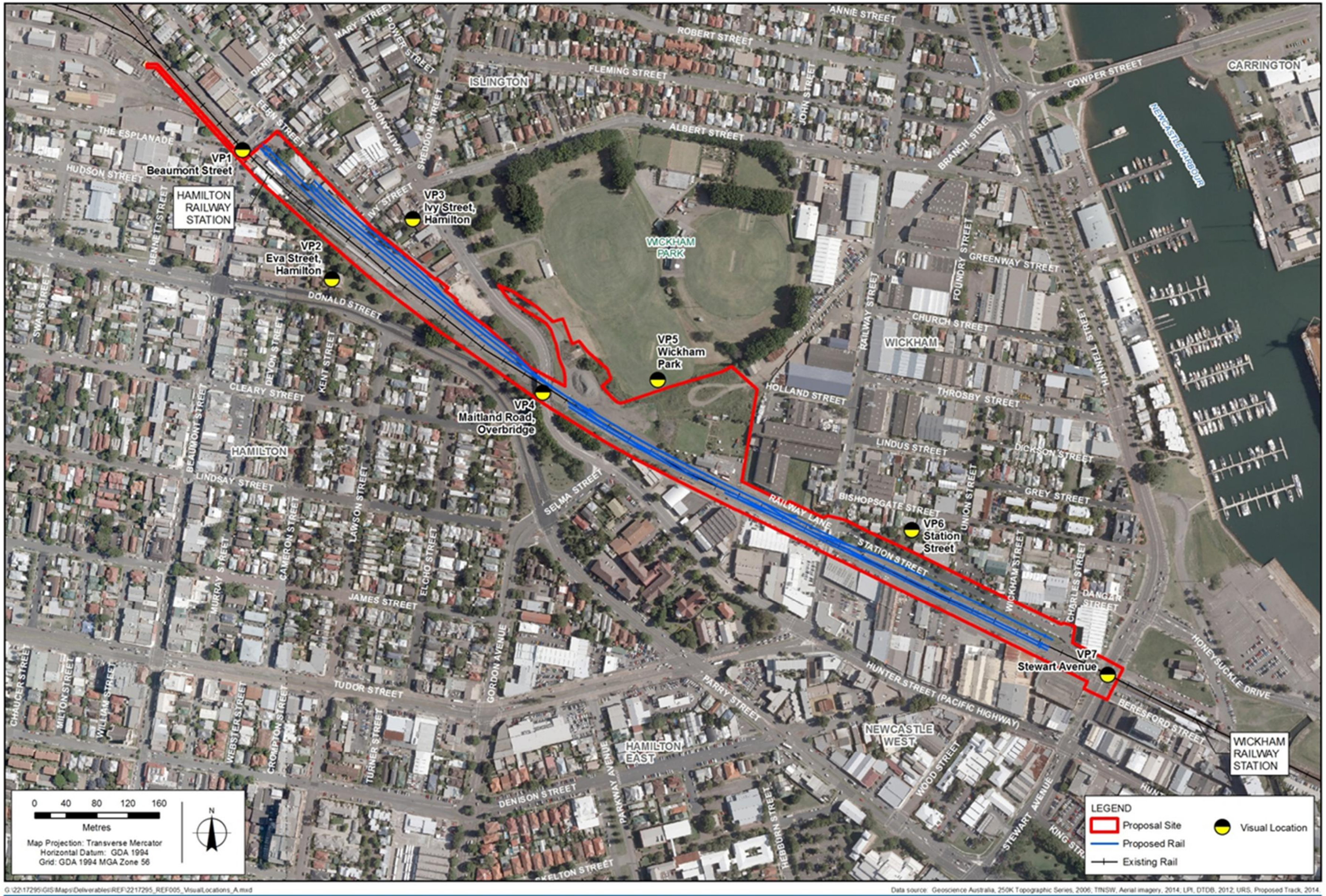

Figure 3.1 Sensitive receiver viewing locations

3.3.1 View location 1 – Beaumont Street, Hamilton

Beaumont Street borders the western edge of the proposal site, crosses over the rail corridor and passes through the Hamilton commercial and residential areas.

The existing visual context of this area is described in Table 3.1.

Table 3.1 Beaumont Street, Hamilton - existing visual context

Photo 1 View to the west from Beaumont Street at the level crossing.

Photo 2 View to the south-west along Beaumont Street to Hamilton Station.

Landform	The railway corridor is at grade with the surrounding landform.
Vegetation	Limited, but significant, individual street tree plantings to the back of footpath kerb to both sides of Beaumont Avenue, both north and south of the level crossing.
Land Use	Transport and retail
Visual Context	Beaumont Street borders the western edge of the proposal site, crosses over the rail corridor and passes through the Hamilton retail and residential areas. Two-storey retail buildings generally enclose views to give Hamilton a pedestrian scale. Railway infrastructure (level crossing, pedestrian overbridge, railway station, materials storage car park, vacant land) and streetscape infrastructure (level crossing, signage, vehicle traffic and on-street parking) dominate the view. Buildings screen most views of the rail corridor from Beaumont Street on approach to the railway corridor. Views south-east and north-west along the rail corridor are open when passing through the Beaumont Street level crossing, particularly where there is vacant railway land north of the station which currently stores railway infrastructure (concrete sleepers, gravel etc.). A mix of transparent mesh wire and palisade fences defines the rail corridor boundary. The level crossing (boom gates, street signage and fencing) and railway infrastructure are prevalent in the view. Individual street tree plantings occur on both sides of Beaumont Avenue, both north and south of the level crossing. Views from this location are experienced by pedestrians and vehicles passing through the area.

3.3.1 View location 2 – Eva Street, Hamilton

Eva Street is located in to the south of Hamilton Station. The existing visual context of this section of Eva Street is described in Table 3.2.

Table 3.2 Eva Street, Hamilton - existing visual context

Photo 3 **VP2 *Eva* Street, Hamilton – view north-east from residential properties on Eva Street towards Hamilton Station.**

Landform	The residential properties along Eva Street are at-grade with the railway corridor.
Vegetation	Private gardens, street tree planting and lawns within the street verge provide screening between the rail corridor and the residential properties. Tree planting and hedging within recreational open space directly adjacent to (south side) of Eva Street.
Land Use	Predominantly low density single storey residential
Visual Context	Residential properties located on Eva Street are in close proximity, and at-grade with the rail corridor. Their views vary depending on the building height and design, vegetation, fencing and distance from the rail corridor. Properties are separated from the rail corridor by a linear park with mature trees, lawns and a hedge along the railway corridor boundary, partially screening views. Railway infrastructure, Hamilton Station and platforms, passing trains, and the materials storage area to the north of the rail corridor (Fern Street) are visible. Residential properties on Donald Street have views north over the rail corridor, Hamilton Station concourse and associated railway infrastructure. The four lane dual carriageway Donald Street (with central median), street trees (on both sides), parkland and private landscaping provide visual separation and/or screening of the rail corridor. Maitland Road overbridge is visible.

	Views from this location are experienced by: • residents of Eva Street with prolonged viewing opportunities towards the rail corridor, Hamilton Station and its associated infrastructure in the foreground, and railway storage area in the background. Existing fencing and mature vegetation provides partial screening of views • residents of Donald Street have views of the railway corridor, but are separated by road infrastructure and street trees partially screening views • visitors to the residential properties described above • road users and pedestrians passing through the area • users of the recreation open space directly south of Hamilton Station • views of the local parkland /landscape setting may be valued by the community.

3.3.2 View location 3 – Ivy Street, Hamilton

Some of the residential properties located to the northern edge of Fern Street, and on the corner of Fern and Ivy Streets have close views to the rail corridor. The views vary depending on the building height and design, vegetation, fencing and distance from the rail corridor. The existing visual context from this viewing location is described in Table 3.3.

Table 3.3 Ivy Street, Hamilton - existing visual context

Photo 4 **VP3 *Ivy* Street, Hamilton – view from residential properties from the southern end of Ivy Street.**

Landform	The residential properties along Fern and Ivy Streets are at-grade with the railway corridor.
Vegetation	Private gardens, dense street tree provide screening between the rail corridor and the residential properties.
Land Use	Residential dominated by low density housing, predominantly single storey.
Visual Context	Residential properties located on Ivy Street are generally one storey in height, with some having views to the rail corridor. The views vary depending on the building height and design, vegetation, fencing and distance from the rail corridor. Houses are at-grade with the rail corridor and private landscape areas and dense street trees providing visual screening. Views south over the rail corridor comprise Hamilton Station concourse and associated railway infrastructure. Views from this location are experienced by passing pedestrian and vehicle traffic, and residents with long viewing periods and close proximity to the proposal.

3.3.1 View location 4 – Maitland Road overbridge

Maitland Road overbridge is located approximately in the middle of the proposal site, adjacent to Wickham Park. The existing visual context of this area is described in Table 3.4.

Table 3.4 Ivy Street, Hamilton - existing visual context

Photo 5 VP4 Maitland Road overbridge - view to the north-west along the rail corridor from Maitland Road overbridge towards Beaumont Street.

Photo 6 VP4 Maitland Road overbridge - view to the south-east along the rail corridor from Maitland Road overbridge towards Stewart Avenue.

Landform	The railway corridor is generally at-grade with Wickham Park to the north. To the south, there is a gently sloping embankment up to Maitland Road that falls to the east until it is at-grade with the railway corridor.
Vegetation	A row of trees to the south of the rail corridor exists in the foreground. Grassed landscaping and scattered trees occur along the length of the corridor.
Land Use	Rail surrounded by bulky commercial buildings to the south east, residential in the distance with roads including on-street parking to the north east. Rail materials storage immediately to the north, recreational with open space beyond.
Visual Context	Vehicles and pedestrians travelling along Maitland Road at elevation have views of the rail corridor. Retail and commercial buildings are visible to the south-east, residential development is also visible in the distance to the east. A railway materials storage area is immediately to the north of the rail tracks, with the parkland of Wickham Park beyond. Overhead wiring crosses the rail corridor from north to south. Views from this location are experienced by road users passing through the area and pedestrians walking/riding through the area with short term views.

3.3.1 View location 5 – Wickham Park

Wickham Park is directly adjacent to the rail corridor, on the north side. The existing visual context of Wickham Park is described in Table 3.5

Table 3.5 Wickham Park - existing visual context

Photo 7 View south-east from Wickham Park towards the railway corridor.

Photo 8 View *south*-west from Wickham Park to the Maitland Road overpass.

Landform	Wickham Park is at-grade with the railway corridor.
Vegetation	The southern areas of Wickham Park are predominantly lawns, with occasional stands of trees. Isolated trees occur within the railway corridor.
Land Use	The park consists predominantly of sporting fields and passive recreation areas.
Visual Context	Wickham Park is listed on the Newcastle LEP heritage register and is directly adjacent to the northern side of the rail corridor. The view south-east, from the southern edge of Wickham Park looks over the railway corridor with multi-storey commercial buildings in the background. The interface between Wickham Park and the rail corridor has a slight vegetated mound but views are otherwise open. The existing rail line, overhead wiring and associated rail infrastructure and passing trains are clearly visible. The Maitland Road overbridge is also dominant within this view. Views experienced by park users are short term.

3.3.1 View location 6 – Station Street, Wickham

Many of the residential properties located in Station Street, between Union Street and Railway Street, have views south over the rail corridor. Properties are at-grade with the rail corridor. The views vary depending on the building height and design, vegetation and fencing. The existing visual context of this viewing location is described in Table 3.6.

Table 3.6 Station Street, Wickham – existing visual context

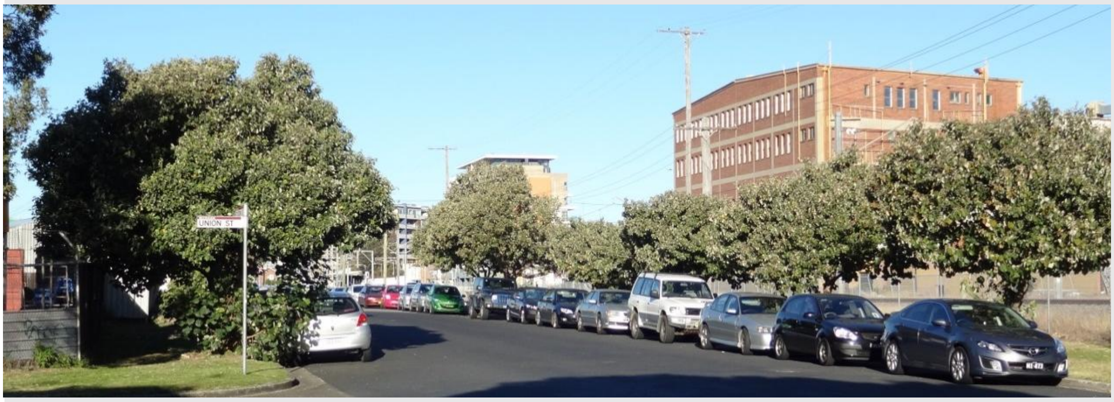

Photo 9 **VP6 Station Street, Wickham - View south-east from residential properties located on the northern side of Station Street.**

Landform	The residential properties along Station Street are at-grade with the railway corridor.
Vegetation	Existing street trees (on both sides of the street), private landscaping and the Station Street roadway provides visual separation from the rail corridor.
Land Use	Residential dominated by low density housing. Transport – Station Street road reserve and roadside parking.
Visual Context	Properties are generally single storey, with some two storey buildings. Views from this location are experienced by passing road users, commercial buildings and residents and their visitors on the north side of Station Street. There are also some views from residential properties on Bishopsgate Street south along Wickham Street and Charles Street. Residents have prolonged viewing opportunities towards the rail corridor and its associated infrastructure in the foreground, and multi-storey commercial buildings in the background. Existing fencing and vegetation provides partial screening of views.

3.3.1 View location 7 – Stewart Avenue, Wickham

Stewart Avenue forms the eastern boundary of the proposal site and is at-grade with the rail corridor. The existing visual context of this section of Stewart Avenue is described in Table 3.7.

Table 3.7 Stewart Avenue, Wickham – existing visual context

Photo 10 VP7 View north-west from Wickham Station across Stewart Avenue with Co-Op building visible on left.

Photo 11 VP7 View south from Stewart Avenue to the Wickham station and residential apartment block.

Landform	The railway corridor is at-grade with the surrounding landform.
Vegetation	A few scattered trees are located on the western side of Stewart Avenue, both north and south of the level crossing.
Land Use	Transport, surrounded by commercial, car parking associated with the commercial activity and on street parking.
Visual Context	The bulky, impermeable building facades and scale of the commercial buildings to the east and west of Stewart Avenue dominate this view. Buildings largely screen the views of the rail corridor from surrounding areas. Views south-east and north-west along the rail corridor are open when passing over the Stewart Avenue level crossing. Chainwire fencing runs along the majority of the boundary between the adjacent area and the rail corridor. The level crossing (e.g. boom gates, street signage and fencing) and railway infrastructure are prevalent in the view. A six-storey residential apartment building, located on Beresford Street and oriented in a north-easterly direction, is located directly south of Wickham Station. Residents with balconies on the north-west corner will have oblique views to the proposal. The focus of views, however, is north-east towards Throsby Creek and Newcastle Harbour. Views from this location are experienced by customers of commercial premises, obliquely from balconies of the multi-storey building on Beresford Street, and road vehicles and pedestrians passing through the area.

4. Urban landscape and visual impact assessment

4.1 Introduction

The potential urban landscape and visual impacts are considered in the context of the sensitivity of the surrounding visual environment and the potential for viewing of the areas that have had changes to their visual outlook due to the proposal. The assessment of potential urban landscape and visual impacts of the proposal focuses on the visibility of both the construction and operation phases of the proposal.

4.2 Proposal description and visual elements

The proposal is located generally between Wickham Station and Hamilton Station. The visible project elements both during construction and operation have been outlined in the description provided in Section 4.2.

4.3 Potential impacts

Potential landscape and visual impacts of the proposal are summarised below, with reference to the representative viewing locations identified in Figure 3.1. An assessment of the potential visual impacts during construction and operation is provided for each viewing location. A summary of overall visual and landscape impacts is provided in Table 6.1.

The current concept design has been developed to identify key functional requirements and achieve a primary understanding of the likely bulk and scale of the proposed infrastructure. This has enabled identification of key visual impacts at a conceptual level. The key impacts are:

- Construction compound (temporary).
- Vegetation removal.
- Increased duration of train views.
- Local road and car parking changes.
- New fencing and streetscape.
- New head shunt (third) track.
- Overhead services structures and railway infrastructure.
- Additional train stabling tracks.
- New station buildings and concourse.

These elements would be further developed during detailed design (as described in Section 5) in accordance with the proposal urban design and landscape principles. The urban design and landscape plan, which will be a recommendation of this study. will provide further analysis of impacts and identification of appropriate mitigation measures.

4.4 Assessment of urban landscape and visual impacts

The urban landscape and visual impacts of the proposal on the representative sensitive receiver viewing locations have been assessed for both the construction and operational phases of the proposal. These impacts, along with the rating of importance of the impact on the urban landscape and visual impact are addressed in Table 4.1.

4.5 Short term impacts

The proposal would generate temporary visual impacts during the construction period for residents, visitors and workers in the study area. Impacts would be experienced in the vicinity of work sites. During works, visible elements would include work sites, machinery and equipment, waste materials and the station and stabling yards being constructed.

The change in the visual environment would generally be experienced by viewers from a relatively short distance. The proposal would be viewed within the context of a highly developed and dynamic urban environment, where construction and associated works are frequent occurrences. This feature, together with the transient and temporary nature of the majority of works, would reduce the potential significance of the visual impacts during the construction period.

There may also be potential for some light spill impacts associated with lighting required to carry out night works. However, sections of the rail corridor at Hamilton Station are already generally well lit during the night and additional lighting would not result in a significant increase in light spill events. Any additional lighting would be directionally-mounted so as to avoid any unnecessary direct light spill into sensitive receivers such as residences.

Tree removal would be avoided where possible. In the event that removal is required, the contractor would obtain approval from Transport for NSW by submitting an ‘Application for Removal or Trimming Vegetation’. Any trees subject to removal would be replaced in accordance with Transport for NSW’s ‘Vegetation Offset Guide’ (2011).

Mitigation measures provided in Section 5 would assist in reducing the potential significance of these short term impacts.

Table 4.1 Assessment of urban landscape and visual impacts

Viewing location	Visible project elements	Urban landscape and visual impact – construction and operation	Importance of impact
VP1 Beaumont Street, Hamilton	***Construction*** Machinery and construction works occurring within the rail corridor. ***Operation*** Overhead services structures and railway infrastructure. Train stabling tracks. Increased duration of train views.	There would be limited views of both the construction and operation components of the proposal from this viewing location. Adverse landscape impacts would be confined to the construction phase and would be within the rail corridor. The proposal would be viewed as, and would be characteristic of, the existing rail infrastructure, urban context and visual landscape. The proposal would have a *small adverse landscape impact* from this viewing location during construction and operation. The visual environment would be impacted during construction and operation stages. However, as the views are only experienced by vehicles and pedestrians travelling along Beaumont Street, they are transient and *short-term* in nature, reducing the visual sensitivity. The nature of this viewing location and the focus of drivers travelling along the road draws attention away from the proposal. This viewing location has *low visual sensitivity*.	***Construction*** Not important ***Operation*** Not important
VP2 Eva Street, Hamilton	***Construction*** Machinery and construction works occurring within the rail corridor. Construction compound (from some residences). ***Operation*** Overhead structures. Additional stabling yard tracks. Increased duration of train views.	Due to the proximity of the proposal to residences, there would be extensive views of the construction and operation components available from this viewing location. Landscape impacts would be viewed within the context of, and would be characteristic of, the existing rail infrastructure and rail corridor. The proposal would have a *moderate adverse landscape* impact during construction and a *small adverse landscape impact* during operation from this viewing location. The visual environment would be impacted during construction and operation. The change in view would be experienced by residents with prolonged viewing opportunities, and visitors to Eva Street. This viewing location has a *high visual sensitivity*.	***Construction*** High importance ***Operation*** Moderate importance

Viewing location	Visible project elements	Urban landscape and visual impact – construction and operation	Importance of impact
VP3 Ivy Street, Hamilton	***Construction*** Machinery and construction works occurring within the rail corridor. Construction compound (from some residences). Vegetation removal. ***Operation*** Overhead structures and railway infrastructure. Additional train stabling tracks. Vegetation removal Increased duration of train views. New fencing and streetscape.	Due to the proximity of the proposal to residences, and removal of screening vegetation, there would be extensive views of the construction and operation components available from this viewing location. Landscape impacts would be viewed within the context of, and would be characteristic of, the existing rail infrastructure and rail corridor. The proposal would have a *moderate adverse landscape* impact during construction and a *small adverse landscape impact* during operation from this viewing location. The visual environment would be impacted during construction and operation. The change in view would be experienced by residents with prolonged viewing opportunities, and visitors to Ivy and Fern Streets. This viewing location has a *high visual sensitivity*.	***Construction*** High importance ***Operation*** Moderate importance
VP4 Maitland Road Overbridge	***Construction*** Machinery and construction works occurring within the rail corridor. Construction compound. Vegetation removal. ***Operation*** A new head shunt (third) track. Overhead structures. New station at Wickham	There would be extensive but short term views, from a distance, of both the construction and operation components of the proposal from this viewing location. Despite the views, there would be *minimal adverse landscape impact* as the proposal is characteristic of the existing rail infrastructure and visual landscape. The proposal would have a *negligible adverse landscape impact* from this viewing location during construction and operation. The visual environment would be impacted during construction and operation stages. However, as the views of the proposal are only experienced by vehicles and pedestrians travelling over the bridge, they are transient and *short-term* in nature, reducing the visual sensitivity. The nature of this viewing location and the focus of drivers travelling across the bridge draws attention away from the proposal. This viewing location has *low visual sensitivity.*	***Construction*** Not important ***Operation*** Not important

Viewing location	Visible project elements	Urban landscape and visual impact – construction and operation	Importance of impact
VP5 Wickham Park	***Construction*** Machinery and construction works occurring within the rail corridor. Construction compound. Vegetation removal ***Operation*** New head shunt (third) track. New station. Overhead structures. Increased duration of train views.	Due to the proximity to the proposal, there would be open views, from a distance, of construction and operation components available from this viewing location. Despite the views, there would be *minimal adverse landscape impact* as the proposal would be characteristic of the existing rail infrastructure and visual landscape. The proposal would have a *moderate adverse landscape impact* during construction and a *small adverse landscape impact* during operation from this viewing location. The intensity of the impact would reduce with distance from the proposal site. The visual environment from this viewing location would be impacted both during construction and operation stages. The change in view would be experienced by recreational users of the park. It is assessed that this viewing location has a *medium visual sensitivity*.	***Construction*** Moderate importance ***Operation*** Minor importance
VP6 Station Street, Wickham	***Construction*** Machinery and construction works occurring within the rail corridor. Vegetation removal ***Operation*** Overhead structures. New station buildings, concourse. Local road changes. A new head shunt (third) track. Increased duration of train views.	Due to the proximity to the proposal, there would be extensive views of the construction and operation components available from this viewing location. Landscape impacts would be viewed within the context of, and would be characteristic of, the existing rail infrastructure. The proposal would have a *moderate adverse landscape* impact during construction and a *small adverse landscape impact* during operation from this viewing location. The visual environment would be impacted during construction and operation. The change in view would be experienced by residents with prolonged viewing opportunities, and visitors to Station Street. This viewing location has a *high visual sensitivity.*	***Construction*** High importance ***Operation*** Moderate importance

Viewing location	Visible project elements	Urban landscape and visual impact – construction and operation	Importance of impact
VP7 Stewart Avenue, Wickham	***Construction*** Machinery and construction works occurring within the rail corridor. ***Operation*** Overhead structures. New station buildings and concourse. Local road changes. A new head shunt (third) track. Increased duration of train views.	There would be open views of both the construction and operation components of the proposal from this viewing location. Despite the views, there would be minimal adverse landscape impact as the proposal is characteristic of the existing rail infrastructure, urban context and visual landscape. The proposal would have a *small adverse landscape impact* from this viewing location during construction and operation. The visual environment would be impacted during construction and operation stages. However, as the views are only experienced by vehicles and pedestrians travelling along Stewart Avenue, they are transient and short-term in nature, reducing the visual sensitivity. The nature of this viewing location and the focus of drivers travelling along the road draws attention away from the proposal. This viewing location has *low visual sensitivity*.	***Construction*** Not important ***Operation*** Not important

4.6 Long term impacts

The proposal has the potential to affect the urban fabric, landscape resources and visual amenity. The following potential impacts may result during operation:

- alteration to townscape/streetscape elements (new road infrastructure, removal of existing parking, implementation of consistent streetscape language) as a result of road works to the north of the proposed new station at Wickham.
- permanent loss of vegetation including a small loss within the rail corridor itself, some loss to Station Street north of the proposed new station and to the north of the stabling yard in Fern Street. This would be offset by new street tree planting and landscaping as part of the proposed public realm and fencing improvements to the north of the stabling yard on Fern Street.
- implementation of visually-cohesive and legible form, and streetscape/public realm themes around the new station at Wickham. This may include provision for new and better quality open spaces of a 'people scale' with pedestrian priority and linkages
- re-introduction of a stabling yard at Hamilton with prolonged viewing opportunities of trains in the stabling yard.
- increased light levels in areas not currently illuminated.
- decreased light levels in terms of shading and reduction of available light within buildings and overhead structures.
- loss of privacy due to the proximity of vehicles and pedestrians to dwellings.
- the obstruction of locally important views by structures or vehicles.
- potential for reduced privacy at some residential properties immediately adjacent to the rail corridor. The main issues would arise due to the positioning of the new third track approximately 10 metres closer to existing property boundaries.

The proposal would be confined within a predominantly urban environment and the new scheme may give rise to impacts which would be positive or negative, according to the value, quality and sensitivity of the existing environment. Impacts on visual amenity would impact viewers depending on their identity and sensitivity, and may be temporary or long term. The impacts sustained would also be subject to the subsequent stages of the design, nature and form of the proposed works, particularly at Wickham.

Conceptual architectural renderings of the proposed new Station structure are provided in Figure 4.1, Figure 4.3 and Figure 4.3. A photomontage depicting the before and after construction view of the stabling yard from Ivy Street, Hamilton is also provided in Figure 4.4.

These provide an indication of how the landscape would appear, and likely visual impacts, once the station and the stabling yard are operational. These drawings are subject to detailed design.

In general, given the key project elements have been developed to recognise and be consistent with the existing urban fabric and the scale of building, and the infrastructure proposed is similar in form and function to its surroundings, the proposal is considered likely to result in a low visual impact from most viewing locations.

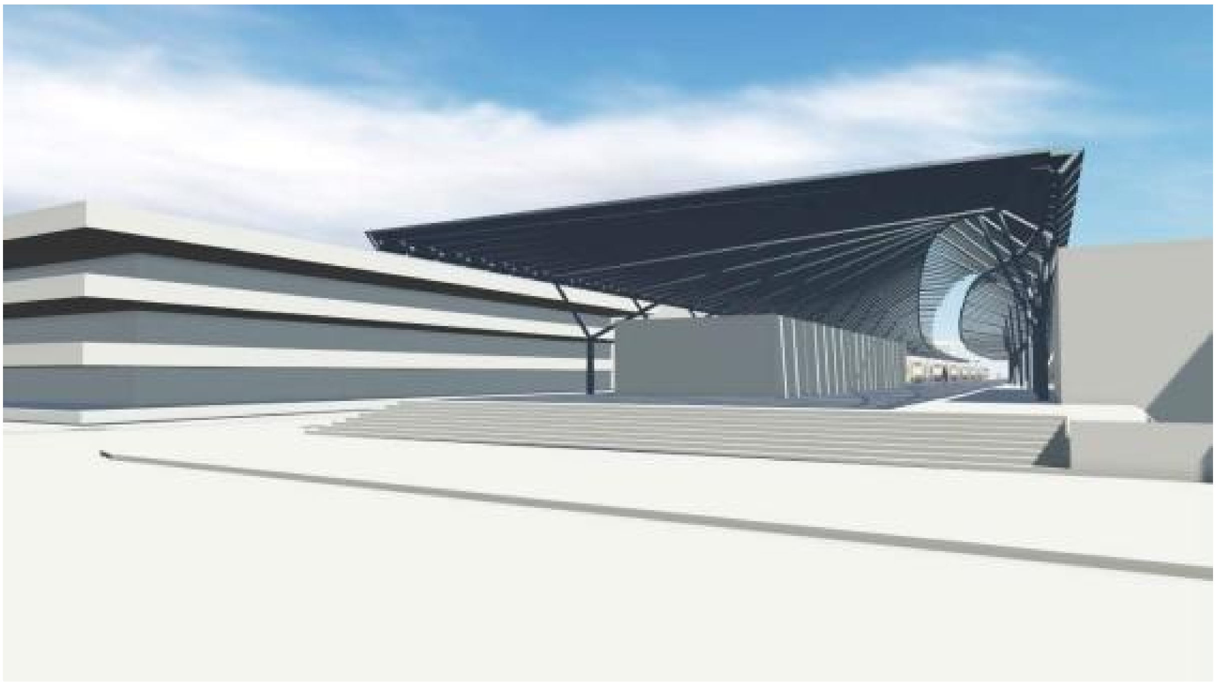

Figure 4.1 Conceptual architectural rendering of the new station from Stewart Avenue, Wickham

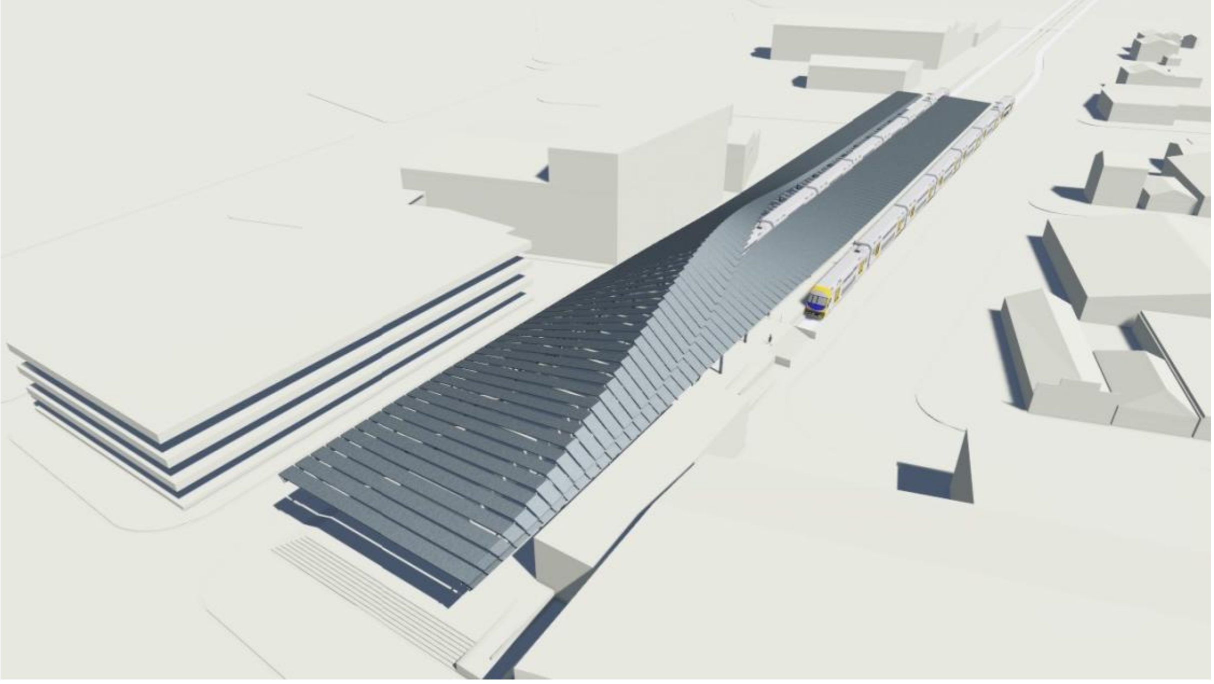

Figure 4.2 Conceptual architectural rendering of the new station (oblique)

Figure 4.3 Conceptual cross section of the new station at Wickham

Figure 4.4 Photomontage of the likely pre- and post- construction view of the stabling yard from Ivy Street, Hamilton

5. Mitigation measures

The following measures would be implemented to minimise the potential adverse impacts of the proposal, and enhance the potential benefits.

5.1 Construction

The following measures would minimise visual impacts during construction of the proposal:

- avoid unnecessary loss or damage to vegetation within the rail corridor and adjacent road reserves by protecting trees prior to construction and/or trimming vegetation to avoid total removal
- sensitive placement and specification of lighting to minimise light spill from the rail corridor
- temporary hoardings, barriers, traffic management and signage would be removed when no longer required
- site compounds would be screened, with shade cloth or similar material to minimise visual impacts
- provision of visual screening/retention of existing vegetation for visually sensitive areas

5.2 Operation

The detailed design would include an urban design and landscaping plan (UDLP), which would address the following matters:

- strategic use of materials that blend, enhance and/or complement existing surfaces and minimise visual clutter
- materials, finishes, colour schemes and maintenance procedures including graffiti control for new walls, barriers and fences
- directional lighting which would be mounted so as to minimise light spill
- preservation of landscape treatments and street tree planting to integrate with surrounding streetscape design detail that is sympathetic to the amenity and character of the local heritage items
- opportunities for public art created by local artists
- strategic location of signage and lighting to maintain sensitive sight lines and avoid unnecessary intrusion into receivers' views
- barriers (railings, fences or walls) required for safety to complement the existing visual environment.
- design measures included to meet the *NSW Sustainable Design Guidelines* (Transport for NSW, 2013).

The UDLP would be prepared in consultation with Council and other relevant stakeholders.

6. Conclusion

The overall urban landscape and visual impacts of the proposal are assessed as being of varying importance throughout the study area ranging from negligible to high importance. Due to the nature of the proposal, there will be a permanent impact on the visual landscape and amenity for some viewing locations within the study area. The focus of mitigation measures should be on those viewing locations where the rating of importance of impact is ranked as moderate or high.

The urban landscape and visual impacts of the proposal will occur both during the construction and operation phases of the proposal and measures to minimise these impact need to be undertaken for both stages. While there will be impacts during the construction phase, these will be short term.

Table 6.1 Summary of impact importance rating during construction and operation phases

View location	Importance of impact (construction)	Importance of impact (operation)
VL 1 – Beaumont Street, Hamilton	Not important	Not important
VL 2 – Eva Street, Hamilton	High importance	Moderate importance
VL 3 – Ivy Street, Hamilton	High importance	Moderate importance
VL 4 – Maitland Road Overbridge	Not important	Not important
VL 5 – Wickham Park	Moderate importance	Minor importance
VL 6 – Station Street, Wickham	High importance	Moderate importance
VL 7 – Stewart Avenue, Wickham	Not important	Not important

7. References

GHD (2014) *Newcastle Light Rail Product Definition Report*, report prepared for Transport for NSW

Newcastle City Council (2012), *Newcastle Development Control Plan, 7.02 Landscape, Open Space and Visual Amenity*, Newcastle City Council

Department of Planning and Infrastructure (2012), *Newcastle Urban Renewal Strategy*, DoPI, Sydney

Transport for NSW (2013), *NSW Sustainable Design Guidelines for Rail (2013)*, Transport for NSW, Sydney

Transport for NSW (2011), *NSW Sustainable Design Guidelines for Rail*, version 2.0: *Draft Vegetation Offset Guide,* Transport for NSW

Forest Practice Board Tasmania (2006) *A Manual for Forest Landscape Management*

Landscape Institute and Institute for Environmental Management and Assessment (2013) *Guidance for Landscape and Visual Impact Assessment*. Spon Press 3rd Edition

Scottish Natural Heritage,(2006), Commissioned supplementary report to the above mentioned report: *Visual Representation of Windfarms Good Practice Guidance*

United States Forest Service (1974) *National Forest Landscape Management Agriculture Handbook Number 462, Chapter 1 – The Visual Management System.* United States Department of Agriculture

University of Newcastle (2002), *Visual Assessment of Windfarms Best Practice*. Scottish Natural Heritage Commissioned Report, Edinburgh, Scotland

Western Australian Planning Commission (2007) *Visual Landscape Planning in Western Australia – a manual for evaluation, assessment, siting and design*. State of Western Australia, Perth, WA.

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Transport for NSW

Wickham Transport Interchange

Noise and Vibration Assessment

July 2014

Executive summary

This noise and vibration impact assessment has been undertaken for Transport for NSW for the proposed Wickham Transport Interchange Project (the proposal) and forms part of the Review of Environmental Factors (REF) for the proposal. This report is subject to, and must be read in conjunction with, the limitations set out and the assumptions and qualifications contained throughout the report.

The proposal involves ceasing train services on the Newcastle Branch Line east of Stewart Avenue, Islington and constructing a new station and transport interchange at Wickham west of Stewart Avenue.

Background monitoring

Sensitive receivers and land uses potentially impacted from noise and vibration impacts associated with the proposal have been identified. Noise monitoring was undertaken at six locations along the proposal to determine existing background noise levels. Noise and vibration criteria were established at the surrounding sensitive receivers and land uses. Noise monitoring was undertaken at one location to determine the existing rail emission noise levels between Wickham and Hamilton stations.

Construction noise

Construction works during standard construction hours have the potential to exceed the construction noise management levels at the surrounding residential receivers. Standard noise mitigation measures have been recommended for implementation where feasible and reasonable. Mitigation measures will minimise impacts at the surrounding residential receivers. However, it is unlikely that implementation of all feasible and reasonable noise mitigation measures would reduce noise levels to below the construction noise criteria under all circumstances.

Out of hours works have a high potential to cause exceedances at nearby sensitive receivers. It is recommended that out of house work be considered and assessed in more detail when more information is available about the specific activities that are required to be undertaken outside of standard working hours.

Construction traffic noise

Estimates indicate that construction traffic should generally have minimal impacts to the surrounding road networks, in particular to busy roads such as Maitland Road, Hannell Street/Stewart Avenue and Albert Street.

Peak hour construction traffic accessing the site via Station Street has the potential to increase existing traffic noise by more than 2dB. Accordingly it is recommended that construction traffic movements along Station Street are scheduled during the standard daytime hours where practicable.

To manage construction traffic on local roads, prior to commence of construction a traffic management plan would be prepared detailing specific routes that construction traffic would follow throughout the construction phase. The traffic management plan would also identify temporary traffic changes required for local traffic during the construction phase.

Construction vibration

Based on safe working distances, when high vibration generating activities occur within 100 metres of adjacent residences it is recommended that potentially impacted residents be informed of the nature of the works, duration and contact details.

Having regard to cosmetic building damage, the expected magnitude of ground vibrations should not be sufficient to cause damage if the equipment operates at distances greater than 25 metres from structures. There is the potential for vibration generating construction activities within 35 metres of heritage structures (Hamilton Station) to exceed the cosmetic criteria. Mitigation options are discussed in Section 4.5.

Operational rail noise

Operational rail noise levels have been predicted and potential impacts assessed against the rail assessment trigger noise levels outlined in the Rail Infrastructure Noise Guideline at sensitive noise receivers. Operational rail noise levels are not predicted to exceed the trigger levels, and accordingly no mitigation measures are required.

Groundborne noise

Groundborne noise is generally only considered a potential issue where levels are higher than the airborne noise levels such as for underground railways. As there are no underground sections of rail associated with the proposal, ground borne noise due to operational rail is not assessed further in this report.

Stabling facility impacts

While trains are idling within the stabling facility, with auxiliary systems operating, there is potential for the industrial noise criteria to be exceeded at the most affected residential receivers, particularly during the night-time period.

Operation of train horns and brake air release systems also have the potential to generate sleep disturbance impacts at the most affected residential receivers.

Management and mitigation options are discussed in Section 6.1.7 for stabling facility operational noise impacts.

Interim operational noise impacts during construction

Interim stabling operations during construction of the proposal have been considered. Similar to the predicted impacts for operation of the stabling facility, noise impacts have been predicted at the nearest sensitive receivers during construction. Noise impacts during this interim stabling scenario will be temporary.

Operations of train horns and brake air release systems also have the potential to generate sleep disturbance impacts at the most affected residential receivers during this temporary stabling period.

A number of management and mitigation options are discussed in Section 6.1.7.

Operational vibration

Operational rail vibration impacts have been predicted and assessed against the vibration criteria outlined in the Assessing Vibration: A Technical Guideline. Vibration estimates indicate that the vibration criteria will be achieved at 5 metres from the railway. All receivers and buildings are further than 5 metres from the railway. Accordingly cosmetic damage or human comfort impacts are not anticipated at any sensitive receivers for the proposal.

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Definitions

Term	Definition
AVTG	Assessing Vibration: A Technical Guideline
CNS (Rail Projects)	Construction Noise Strategy (Rail Projects)
CoRTN	Calculation of Road Traffic Noise
dB	Decibel, which is 10 times the logarithm (base 10) of the ratio of a given sound pressure to a reference pressure; used as a unit of sound.
dB(A)	Unit used to measure 'A-weighted' sound pressure levels.
Down and Up Track	Specific to the Newcastle Branch Line, the Up track carries trains to the Newcastle terminus (eastbound trains) and Down track refers to the track carrying trains away from the Newcastle terminus (westbound trains).
EPA	Environment Protection Authority
Feasible and reasonable (RING definition relating to mitigation measures)	A feasible mitigation measure is a noise mitigation measure that can be engineered and is practical to build, given project constraints such as safety, maintenance and reliability requirements. It may also include options such as amending operational practices (e.g. changing timetable schedules to achieve noise reduction). Selecting reasonable measures from those that are feasible involves judging whether the overall noise benefits outweigh the overall adverse social, economic and environmental effects, including the cost of a mitigation measure. To make such a judgement the following should be considered: • noise impacts • noise mitigation benefits • cost effectiveness of mitigation • community views.
Groundborne vibration	Groundborne vibration is transmitted from source to receiver through the ground.
Groundborne rail noise	Internal noise radiated by the building structure due to ground-borne vibration produced by rail vehicle movements.
Heavy rail	Heavy rail is considered to be rail infrastructure and its associated rolling stock which may be electrified or hauled by diesel locomotives that operates in dedicated rail corridors for either passenger and/or freight transportation. Heavy rail generally operates at higher speeds, has a higher carrying capacity than light rail and travels over longer distances. Passenger train services currently provided by Sydney Trains and NSW TrainLink and freight operations are heavy rail.
ICNG	Interim Construction Noise Guideline
INP	Industrial Noise Policy
$L_{A90(period)}$	The A-weighted sound pressure level that is exceeded for 90% 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.
$L_{Aeq(15hr)}$	The L_{Aeq} noise level for the period 7:00 to 22:00 hours.
$L_{Aeq(9hr)}$	The L_{Aeq} noise level for the period 22:00 to 7:00 hours.
$L_{A(max)}$ (RING definition)	The maximum noise not exceeded for 95% of rail pass-by events and is measured using the 'fast' response setting on a sound level meter.

Term	Definition
$L_{A(max)}$	The maximum sound level recorded during the measurement period.
$L_{Aeq(1hr)}$ (RING definition)	For sensitive land uses, $L_{Aeq(1h)}$ means the highest 10th-percentile hourly A-weighted L_{Aeq} during the period when the particular class of receiver building/place is in use. Alternatively, the highest measured $L_{Aeq(1h)}$ value can be used where insufficient measurements have been made to provide a valid 10th-percentile level and it can be demonstrated that the measured values are representative.
Level crossing	A road/pedestrian crossing provided at grade across the rail corridor.
Light rail	Light rail refers to a passenger transport system that generally operates at a lower capacity and on a localised, shorter network compared to heavy rail, does not use locomotives to haul the carriages and may operate on shared roadways with other road vehicles.
Mitigation	Reduction in severity
NCA	Noise catchment area
NMT	Nordic Prediction Method for Train Noise (TemaNord 1996:524).
NVRF	Sydney Trains Environmental Management System Guide for Noise and Vibration from Rail Facilities
Overbridge/overpass	A road or pedestrian footway over the railway line.
Rating background level (RBL)	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.
Receiver	A noise modelling term used to describe a map reference point where noise is predicted. A sensitive receiver would be a home, work place, church, school or other place where people spend time.
RING	Rail Infrastructure Noise Guideline
RNP	Road Noise Policy
SEL	Sound Exposure Level (SEL) parameter closely related to L_{Aeq} for assessment of events (rail pass-bys) that have similar characteristics but are of different duration. The value of acoustic energy over a 'normalised' 1-second period as the actual noise event under consideration.
Short-term Vibration	Vibration that occurs so infrequently that it does not cause structural fatigue nor does it produce resonance in the structure.
TIA	Traffic Impact Assessment
Tonality	Noise containing a prominent frequency or frequencies characterised by a definite pitch.
VDV	Vibration Dose Value (VDV) - As defined in BS6472 – 1992, VDV is given by the fourth root of the integral of the fourth power of the frequency weighted acceleration.
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).
Vrms	The vibration velocity presented as a root mean square value.
PPV	Peak Particle Velocity

1. Introduction

1.1 Background

In 2012, the NSW Government announced the truncation of the heavy rail line at Wickham as part of the *Newcastle Urban Renewal and Transport Strategy*. Following consideration of options to cease railway operations, it was decided that a new station at Wickham would be constructed on land to the west of Stewart Avenue and that the residual heavy rail corridor comprising the existing Wickham Station and areas to the east would be reviewed for suitability as part of the initial stage of the Newcastle Light Rail project.

1.2 Overview of the proposal

The proposal to truncate the heavy rail line at Wickham and deliver the Wickham Transport Interchange involves:

- cessation of train services between Wickham Station and Newcastle Station
- constructing and operating a new train stabling facility to the north of Hamilton Station, within the existing rail corridor
- constructing and operating a new station and transport interchange at Wickham for pedestrians, cyclists, buses and heavy rail to the west of Stewart Avenue.

Shuttle bus services would be implemented during and following construction to enable train passengers to complete their journeys into the Newcastle city centre.

To continue operating the rail network to the west of the new station, a number of modifications to the rail infrastructure and services between Wickham and Hamilton stations are required. This would involve:

- terminating services at Hamilton Station during construction of the new station and transport interchange
- constructing and operating a new head shunt rail track, about 700 metres in length between the Maitland Road overpass and Wickham Station
- installing new crossovers and turnouts to facilitate the movement of trains between the three rail tracks
- ancillary infrastructure including traction power supply, signalling and overhead wiring.

Some road works would also be required, involving the removal of the railway crossing boom gates and signals at Stewart Avenue and the closure of Railway Street at the level crossing.

The design of the transport interchange makes allowance for the future provision of light rail. The Newcastle Light Rail project will be subject to a separate environmental impact assessment/planning approval process.

1.3 Purpose and scope of this report

This noise and vibration impact assessment has been prepared by GHD Pty Ltd to assess the potential noise and vibration impacts of the proposal based on the current status of design and construction information available. Specifically, this report has been prepared with consideration of the following documents:

- Interim Construction Noise Guideline (ICNG),Department of Environment and Climate Change, 2009
- Assessing Vibration: A Technical Guideline (AVTG), Department of Environment and Conservation, 2006
- Road Noise Policy (RNP), Department of Environment, Climate Change and Water, 2011
- Rail Infrastructure Noise Guideline (RING), Environment Protection Authority (EPA), 2013
- Industrial Noise Policy (INP), EPA, 2000
- Construction Noise Strategy (CNS), Transport for NSW, 2012
- Environmental Management System Guide: Noise and Vibration from Rail facilities (NVRF), Sydney Trains, 2013.

2. Existing environment

2.1 Sensitive receivers locations

Noise and vibration sensitive receivers are defined based on the type of occupancy and the activities performed in the land use. Sensitive noise and vibration receivers could include both existing and proposed:

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

GHD are not aware of any proposed residential developments around the proposal site. However, if future developments were to occur, the onus would be on local councils and developers to comply with the *State Environmental Planning Policy (Infrastructure) 2007.*

The key existing sensitive receivers and land uses in close proximity to the proposal are detailed in Table 2.1 and shown in Figure 2.1.

Table 2.1 Sensitive receivers and land uses

Noise catchment area (NCA)	Identified residential receivers	Land use type	Noise monitoring logger location no.	Distance to proposal site boundary	Non-residential land uses
NCA 1	R1-R4	Mixed residential and commercial	L1	20 metres	Businesses on Fern Street and Beaumont Street
NCA 2	R5-R7	Mixed residential and commercial	L2	8 metres	Businesses on Ivy Street and Maitland Road
NCA 3	None	Mixed residential and commercial	L1	95 metres	Dental surgery and other businesses on Maitland Road
NCA 4	None	Mainly residential, some commercial	L4	140 metres	KU Wickham Preschool, Christian Science Church
NCA 5	R8-R20	Mainly residential, some commercial	L5	Adjacent to site boundary	Various commercial and industrial businesses, Wickham Public School
NCA 6	R21-R23	Mixed residential and commercial	L6	Adjacent to site boundary	Various businesses, Hunter Street Medical Centre

Noise catchment area (NCA)	Identified residential receivers	Land use type	Noise monitoring logger location no.	Distance to proposal site boundary	Non-residential land uses
NCA 7	None	Commercial	-	Adjacent to site boundary	Various businesses, Newcastle Dental Laser Clinic
NCA 8	R24	Mixed residential and commercial	L3	42 metres	Catholic Church, Newcastle Community Arts Centre
NCA 9	R25-R38	Mainly residential, some commercial	L7	20 metres	Various businesses

Detailed maps of each NCA and identified receivers are provided in Appendix A.

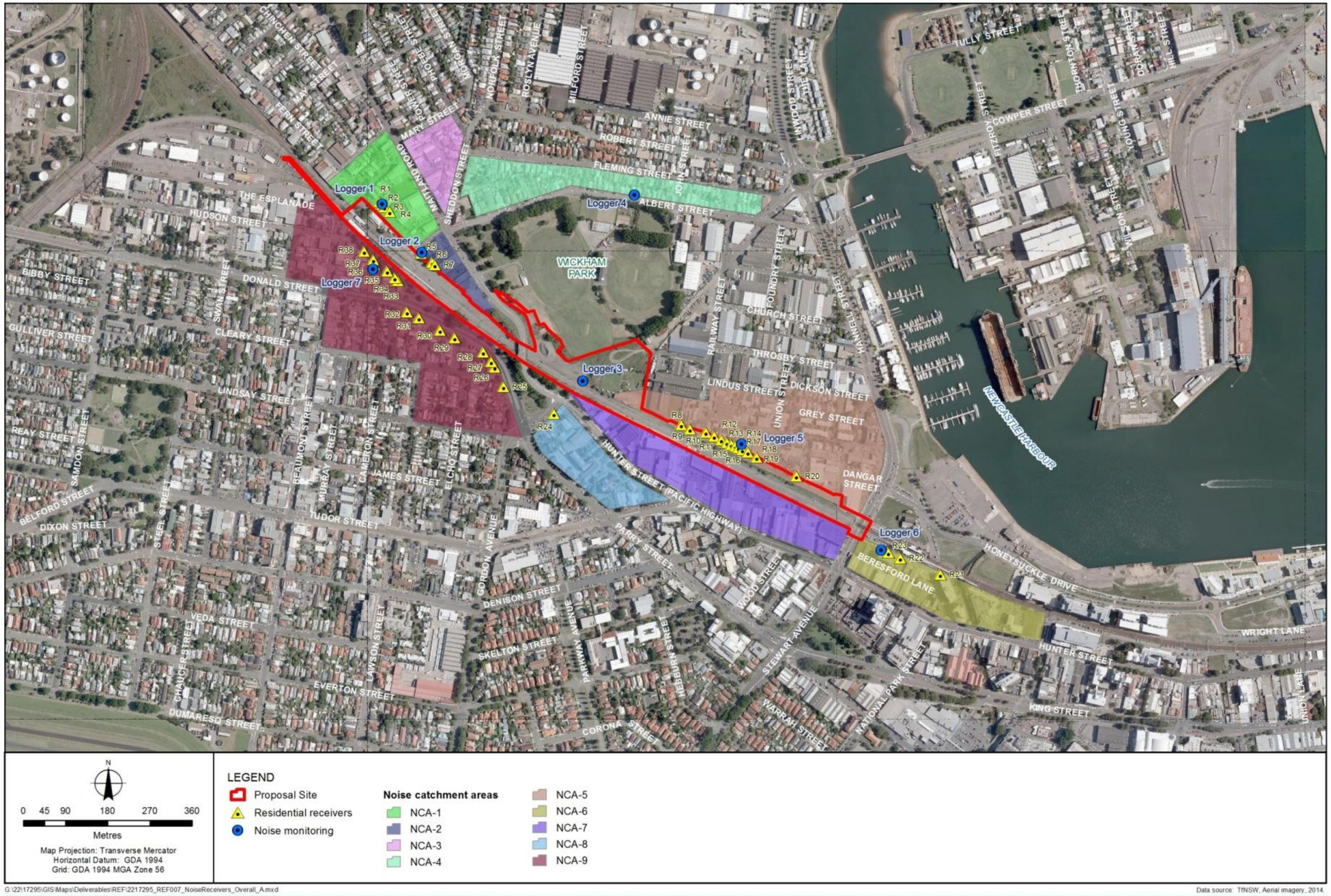


Figure 2.1 Noise and vibration sensitive receivers and monitoring locations

2.2 Background noise monitoring

2.2.1 Noise monitoring methodology

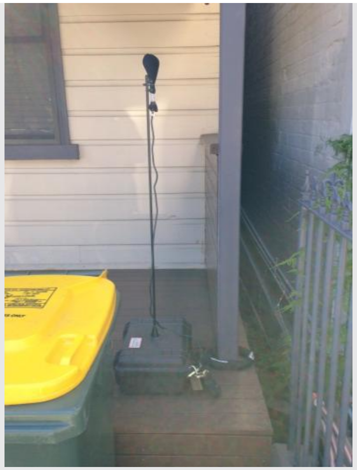
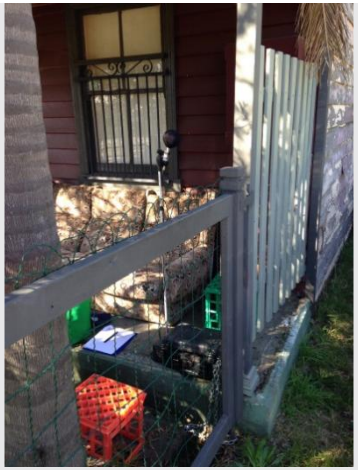
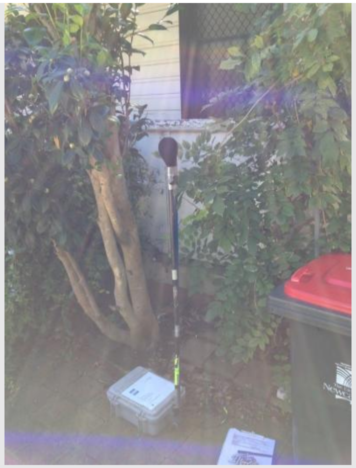
All background noise monitoring activities were undertaken with consideration of the INP long term method. Background noise monitoring took place at six sensitive receiver locations that were considered to provide a good representation of the existing ambient noise environment in the vicinity of the proposal. An additional noise logger (location L3) was placed within the rail corridor with exposure to the existing track and was used to capture train pass-by noise levels.

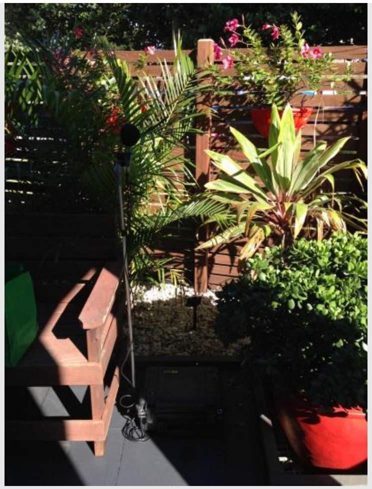
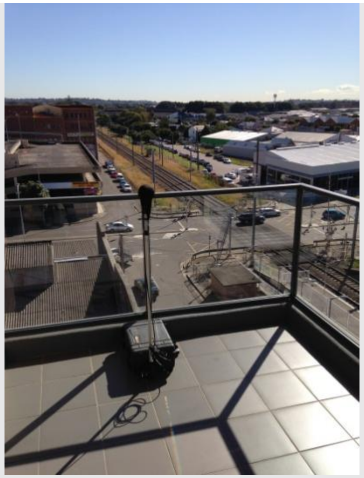
The noise loggers were programmed to accumulate L_{A90}, L_{A10}, L_{Aeq} and L_{Amax} noise descriptors continuously over sampling periods of 15 minutes for the entire monitoring period. The logger at location L3 was also set to capture a 1-second time trace to enable identification of individual train pass-by events. The noise loggers were calibrated using a Quest Type CA-12B sound level calibrator (serial number U1050139).

The data collected by the loggers was downloaded and analysed, and any invalid data removed. Invalid data generally refers to periods of time where average wind speeds were greater than 5 metres per second, or when rainfall occurred. Concurrent half-hourly weather data was sourced from the Bureau of Meteorology's Nobbys Head automatic weather station.

Table 2.2 provides details of the noise loggers used. Figure 2.1 shows the monitoring locations.

Table 2.2 Background noise monitoring locations and equipment details

	Location L1	Location L2	Location L3	Location L4
Location address	25 Fern Street Hamilton	10 Ivy Street Hamilton	Between Hamilton and Wickham Station	69 Albert Street Wickham
Measurement period	Start time:15/05/2014 11:30 Stop time:23/05/2014 10:45	Start time:15/05/2014 12:45 Stop time:23/05/2014 10:45	Start time:12/05/2014 14:00 Stop time:19/05/2104 15:45	Start time:15/05/2014 12:45 Stop time:23/05/2014 11:15
Equipment details	Rion NL52 Type 1 SN:00131631	Svantek 955 Type 1 SN:27622	Svantek 955 Type 1 SN:27624	Rion NL22 Type 1 SN:00852196
Calibration check	Pre:109.9 dB(A) Post:109.8 dB(A)	Pre:110.0 dB(A) Post:109.9 dB(A)	Pre:110.1 dB(A) Post:110.1 dB(A)	Pre:110.0 dB(A) Post:110.0 dB(A)
Equipment settings	A-weighted Fast time response 15 minute intervals	A-weighted Fast time response 15 minute intervals	A-weighted Fast time response 1/3 octave 15 minute intervals	A-weighted Fast time response 15 minute intervals
Photo				

	Location L5	Location L6	Location L7
Location address	43A Station Street Hamilton	Unit 76056, 20-21 Beresford Street, Newcastle West	4 Eva Street Hamilton
Measurement period	Start time:15/05/2014 13:15 Stop time:23/05/2014 11:30	Start time:16/05/2014 12:50 Stop time:23/05/201 10:30	Start time:15/05/2014 12:45 Stop time:23/05/2014 12:00
Equipment details	Svantek 955 Type 1 SN:27621	Svantek 955 Type 1 SN:27623	Svantek 955 Type 1 SN:27625
Calibration check	Pre:109.9 dB(A) Post:109.5 dB(A)	Pre:110.4 dB(A) Post:110.5 dB(A)	Pre:110.0 dB(A) Post:110.1 dB(A)
Equipment settings	A-weighted Fast time response 15 minute intervals	A-weighted Fast time response 15 minute intervals	A-weighted Fast time response 15 minute intervals
Photo			

2.2.2 Background noise monitoring result summary

A summary of the calculated rating background levels (RBL) $L_{A90(period)}$ and ambient $L_{Aeq(period)}$ noise monitoring results is shown in Table 2.3 for each background noise monitoring location. Detailed noise monitoring tables and charts are provided in Appendix B.

Table 2.3 Summary of RBL and ambient noise monitoring results, dB(A)

Location	RBL $L_{A90(period)}$			Ambiant noise levels $L_{Aeq(period)}$		
	Day	Evening	Night	Day	Evening	Night
L1	48	43	37	59	57	53
L2	47	46	42	58	56	53
L3[1]	45	46	44	60	59	62
L4	45	40	36	64	60	56
L5	40	40	38	59	59	56
L6	56	52	45	64	63	60
L7	44	44	40	53	52	49

Note [1]: The sound level meter at L3 was also programmed to capture the 1/3-octave spectral and broadband L_{Aeq} and L_{Amax} at 1-second intervals enabling extraction of each train pass-by observed during the monitoring period.

2.3 Rail noise monitoring

Operator-attended noise monitoring and unattended noise logging was undertaken between Hamilton Station and Wickham Station at location L3 to determine the pass-by noise levels from train movements. The monitoring location was selected as it provided a clear view of the existing rail line and was situated where trains would be travelling at a generally consistent speed between Hamilton Station and Wickham Station.

The sound level meter and logger were programmed to accumulate L_{Aeq} and L_{Amax} noise levels continuously over 1 second sampling periods. The equipment was calibrated in the field using Quest Type CA-12B sound level calibrator (serial number U1050139).

The noise logger was positioned 11.5 metres from the nearest rail at a height of 1.5 metres on a section of straight and level track. Suitable locations for placement of the noise logger were limited due to site constraints including unrelated construction activities within the rail corridor. The selected logger position provided an appropriate location away from the influence of these construction activities. Equipment and monitoring location details are shown in Table 2.4 and Figure 2.1.

Logger data was filtered in accordance with Australian Standard AS2377, Methods for the measurement of rail bound vehicle noise (2002), to exclude data where wind speeds exceeded 10 metres per second or during periods of rainfall. The unattended rail measurement results are summarised in Table 2.5. The data was correlated with timetable information to assist in the identification of train pass-by events. The RING requires the L_{Amax} levels from the 95th and 50th percentile of rail pass-bys to be reported and ensures that a sufficient number of pass-bys are considered in the analysis.

Attended noise measurements were taken at 6 metres and 10 metres from the nearest rail line on deployment and retrieval of the noise logger on 12 May 2014 and 19 May 2014. Suitable locations for attended noise monitoring were limited due to site constraints including unrelated construction activities within the rail corridor. The selected monitoring positions on each respective day provided a safe location away from these construction activities. The attended measurements were undertaken near to the rail line to reduce unwanted influence of other ambient noise sources during the noise surveys. The sound level meter was programmed to capture the 1/3-octave spectral and broadband L_{Aeq} and L_{Amax} at 1-second intervals enabling extraction of each train pass-by observed during the monitoring period (Table 2.6).

Table 2.4 Rail noise monitoring locations and equipment details

Location	L3 (11.5 metres from nearest rail line)
Measurement period	12-19 May 2014
Equipment details	Svantek SV955 Type 1 SN: 27624
Calibration check	Pre:110.1 Post:110.1
Equipment settings	A-weighted Fast time response 1 sec interval
Site photo	

Table 2.5 Summary of unattended rail noise monitoring results

Source	Descriptor	Noise level (dB(A))/event
Total rail track	$L_{Aeq(15hr)}$	55.5
	$L_{Aeq(9hr)}$	52.3
Passenger	SEL (day – average)	80.5
	SEL (night – average)	79.7
	L_{Amax} (95 percentile)	81.3
	L_{Amax} (50 percentile	72.6
	Events per day (average)	172
	Events per night (average)	58

Table 2.6 Summary of attended pass-by noise monitoring results, dB(A)- Location L1

Train type	Train pass-by noise levels			Distance to track	Observed dominant noise source	Direction of travel	Approx. speed
	L_{Aeq} (passby)	SEL (passby)	L_{Amax} (passby)				
Endeavour	69.7	84.8	79.8	10	wheel/rail	East	40
Endeavour	70.1	82.6	79.7	13	wheel/rail	West	50
Endeavour	71.4	84.4	80.8	10	air release	East	50
Endeavour	69.4	81.9	77.2	13	wheel/rail	West	50
Endeavour	72.1	84.6	81.6	10	wheel/rail	East	40
Endeavour	77.3	89.8	87.6	6	wheel/rail	East	50
Hunter Railcar	69.7	82.9	79.7	10	wheel/rail	East	50
Hunter Railcar	65.6	78.9	75.5	13	wheel/rail, engine	West	60
Hunter Railcar	69.5	82.7	78.3	10	wheel/rail	East	40
Hunter Railcar	67.6	79.4	76.9	13	wheel/rail		60
Hunter Railcar	73.3	85.6	84.1	10	wheel/rail	East	50
Hunter Railcar	65.1	78.3	74.5	13	engine	West	50
Hunter Railcar	68.2	80.5	78.2	9	engine	West	70
Hunter Railcar	73.0	86.8	83.8	6	engine	East	60
Hunter Railcar	70.6	81.4	79.5	9	wheel/rail	West	70
OSCAR	68.4	78.8	77.2	10	engine	East	50
OSCAR	64.4	75.6	70.7	13	wheel/rail	West	50
OSCAR	64.1	77.5	72.0	10	engine	East	50
OSCAR	65.2	75.2	71.7	9	wheel/rail	West	70
OSCAR	65.3	77.9	73.1	6	wheel/rail	East	60
V-Set	69.2	81.5	75.0	10	wheel/rail	East	40
V-Set	68.9	80.4	75.6	13	wheel/rail	West	60
V-Set	70.7	84.5	81.2	10	wheel/rail, brakes	East	50
V-Set	66.9	78.7	73.2	13	wheel/rail	West	40
V-Set	69.7	82.9	76.6	10	wheel/rail	East	50
V-Set	73.6	87.2	84.3	6	wheel/rail, flats	East	50
V-Set	76.8	86.8	82.9	9	wheel/rail	West	70
V-Set	72.5	86.1	84.1	6	wheel/rail	East	50

2.4 Rail pass-by vibration levels

Operator-attended vibration monitoring was undertaken concurrently with attended noise measurements on 12 May and 19 May 2014 using an Instantel Minimate ground vibration monitor (serial number BE12721). Measurements were taken at 5 and 10 metres from the nearest track. A summary of the train pass-by vibration levels are detailed in Table 2.7. Note that the Vibration Dose Value (VDV) is based on waveform measurements which were only triggered where vibration levels exceeded 1 mm/s.

Table 2.7 Train pass-by vibration levels

	5 metres from track	10 metres from track
Maximum PPV train pass-by	4.8 mm/s	4.2 mm/s
Average PPV train pass-by	3.0 mm/s	2.5 mm/s
Average VDV train pass-by	0.032 $m/s^{1.75}$	0.027 $m/s^{1.75}$

3. Noise and vibration criteria

3.1 Construction noise and vibration criteria

3.1.1 Construction noise management levels

The ICNG provides guidance for assessment of construction noise. The guideline recommends standard hours for construction activities as:

- Monday to Friday: 7 am to 6 pm
- Saturday: 8 am to 1 pm
- no work on Sundays or Public Holidays.

The ICNG acknowledges that the following activities have justification to be undertaken outside the recommended standard construction hours, assuming all feasible and reasonable mitigation measures are implemented to minimise the impacts to any surrounding sensitive land uses:

- the delivery of oversized plant or structures that police or other authorities determine require special arrangements to transport along public roads
- emergency work to avoid the loss of life or damage to property, or to prevent environmental harm
- maintenance and repair of public infrastructure where disruption to essential services and/or considerations of worker safety do not allow work within standard hours
- public infrastructure works that shorten the length of the proposal and are supported by the affected community
- works where a proponent demonstrates and justifies a need to operate outside the recommended standard construction hours
- works which maintain noise levels at receivers to below the noise management levels outside of the recommended standard construction hours.

Table 3.1 to Table 3.3 detail the noise management levels at sensitive residences and land uses respectively to be applied during construction.

Table 3.1 Construction noise management level at residential receivers

Time of day	Management level	How to apply
Standard construction hours	Noise affected RBL + 10dB(A)	The noise affected level represents the point above which there may be some community reaction to noise. • where the predicted or measured LAeq(15min) is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level • the proponent should also inform all potentially affected residents of the nature of the works to be carried out, the expected noise levels and duration as well as contact details.
	Highly noise affected 75 dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (TfNSW) may require respite periods by restricting the hours that very noisy activities can occur, taking into account: • times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid- morning or mid-afternoon for works near residences • if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard construction hours	Noise affected RBL + 5dB(A)	• a strong justification would typically be required for works outside the recommended standard hours • the proponent should apply all feasible and reasonable work practices to meet the noise affected level • where all feasible and reasonable work practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community.

Table 3.2 Construction noise management levels at non-residential sensitive land uses

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)

Table 3.3 Summary of construction noise management levels at sensitive residential receivers, dB(A)

NCA	Nearest potentially affected receiver	Logger for RBL	Measured RBL L_{A90}			Construction noise management levels L_{Aeq}			
			Day	Evening	Night	Highly noise affected	Standard hours Mon-Fri (7 am-6 pm) Sat (8 am-1 pm) Sun/Pub Hol (Nil)	Outside standard working hours (OOHW) - period 1 Mon-Fri (6 pm-10 pm) Sat (7 am-8 pm) & (1 pm-10 pm) Sun/Pub Hol (8 am-6 pm)	Outside standard working hours (OOHW)-period 2 Mon-Fri (10 pm-7 am) Sat (10 pm-8 am) Sun/Pub Hol (6 pm-7 am)
NCA-1	R1-R4	L1	48	43	37	75	58	48	42
NCA-2	R5-R7	L2	47	46	42		57	51	47
NCA-5	R8-R20	L5	40	40	38		50	45	43
NCA-6	R21-R23	L6	56	52	45		66	57	50
NCA-8	R24	L3	45	46	44		55	51	49
NCA-9	R25-R38	L7	44	44	40		54	49	45

3.1.2 Sleep disturbance criteria during construction

The ICNG states that where works are planned to extend over more than two consecutive nights the assessment should include maximum noise levels, and the extent and number of times the maximum noise level exceeds the rating background level.

The INP application notes regarding sleep disturbance recommend that where the $L_{A1(1min)}$ exceeds the $L_{A90(15min)}$ by more than 15 dB(A), a more detailed analysis is required.

Further guidance is provided in the RNP which concludes, based on the research to date, that:

- maximum internal noise levels below 50-55 dB(A) are unlikely to awaken people from sleep
- one or two noise events per night, with maximum internal noise levels of 65-70 dB(A), are not likely to affect health and wellbeing significantly.

Discussion of potential sleep disturbance impacts during construction is provided in Section 4.2.3

3.1.3 Traffic noise criteria during construction

The RNP provides traffic noise target levels where there is the potential to create additional traffic on arterial and local roads. The road traffic noise target levels are presented in Table 3.4. The application notes for the RNP state that:

> *for existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise level as a result of the development should be limited to 2 dB above that of the noise level without the development. This limit applies wherever the noise level without the development is within 2 dB of, or exceeds, the relevant day or night noise assessment criterion.*

Table 3.4 RNP traffic noise criteria at sensitive receivers and land uses

Category	Day (7 am-10 pm)	Night (10 pm-7 am)
Existing residences affected by additional traffic on existing sub-arterial/arterial roads	External noise level 60 $L_{Aeq(15hr)}$ dB(A)	External noise level 55 $L_{Aeq(9hr)}$ dB(A)
Existing residences affected by additional traffic on existing local roads	External noise level 55 $L_{Aeq(1hr)}$ dB(A)	External noise level 50 $L_{Aeq(1hr)}$ dB(A)
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)	-

Category	Day (7 am-10 pm)	Night (10 pm-7 am)
Child care facilities	Sleeping room internal noise level 35 $L_{Aeq(1hr)}$ dB(A) Indoor play area internal noise level 40 $L_{Aeq(1hr)}$ dB(A) Outdoor play area external noise level 55 $L_{Aeq(1hr)}$ dB(A) (when in use)	-

3.1.4 Construction vibration criteria

Human comfort

Human comfort vibration criteria have been set with consideration to the CNS (Rail Projects) and AVTG. British Standard BS 6472 – 1992, Guide to Evaluation of Human Exposure to Vibration in Buildings (1 Hz to 80 Hz) is recognised by the EPA as the preferred standard for assessing ‘human comfort’.

The BS 6472 human comfort peak vibration criteria and intermittent vibration dose values are shown in Table 3.5 for the frequency range of 1 Hz to 80 Hz. The intermittent vibration dose value is generally applicable to most construction works. BS 6472 outlines vibration limits which would cause minimal adverse reactions from the occupant and does not consider the short term duration of construction projects or working efficiency. BS 5228.2 – 2009, Code of Practice for noise and vibration control on construction and open sites: Part 2 Vibration recommends that the guidance values presented in Table 3.6 are more appropriate for construction works as it is easier to assess the intermittent vibration criteria against a peak value rather than a dose value. BS 5228.2 also recognises that higher vibration levels are tolerable for short term construction projects as undue restriction on vibration levels can substantially prolong construction works and result in greater annoyance.

Table 3.5 Acceptable vibration dose values for intermittent vibration ($m/s^{1.75}$) (BS 6472)

Location	Daytime[1]		Night-time[1]	
	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

Note:

1. Daytime 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 3.6 Guidance on effects of vibration levels (BS 5228.2)

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.

Cosmetic damage

Currently, there is no Australian Standard that sets the criteria for the assessment of building damage caused by vibration. Cosmetic damage criteria have been set with consideration of British Standard BS 7385.2 – 1993 Evaluation and measurement for vibration in buildings (Table 3.7) and German Standard DIN 4150-3: 1999-02 Structural Vibration – Part 3: Effects of vibration on structures (Table 3.8). This assessment has been undertaken with reference to the DIN 4150-3: 1999 standard for heritage listed buildings while BS 7385.2 – 1993 has been considered for residential and commercial properties.

Table 3.7 BS 7385.2 – 1993 Transient vibration guideline values for cosmetic damage

Line	Type of building	Peak component particle velocity in frequency range of predominate pulse	
		4 Hz to 15 Hz	15 Hz and above
1	Reinforced or framed structures. Industrial and heavy commercial buildings	50 mm/s at 4Hz and above	
2	Unreinforced or light framed structures. Residential or light commercial type buildings	15 mm/s at 4Hz increasing to 20 mm/s at 15Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above.

Table 3.8 DIN 4150-3: 1999 Guideline values for short term vibration on structures

Line	Type of structure	Guideline values for velocity, (mm/s)		
		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

3.2 Operational noise and vibration criteria for rail operations

3.2.1 Operational criteria for rail operations

The Sydney Trains' Environment Protection Licence (EPL) 12208, administered under the *Protection of Environment Operations Act 1997*, requires that 'offensive' environmental noise is minimised, regardless of whether specific noise assessment goals are defined in policies or guidelines.

For this assessment, operational rail noise goals applicable for the operation of trains between the Maitland Road overpass and Wickham Station have been derived from the RING.

The RING presents non-mandatory noise goals that trigger the need for an operational noise assessment to be conducted. Such an assessment would address the potential noise impacts and consider possible mitigation measures that may be feasibly and reasonably applied to mitigate these impacts.

The RING applies to both light and heavy rail infrastructure projects. A 'new' heavy rail line development is one where rail infrastructure is to be developed on land that is not currently an operational rail corridor hence the more stringent 'new rail line noise criteria' apply. Whereas the 'redevelopment' of a heavy rail line occurs where a rail infrastructure project is to be developed on land that is either:

- located within an existing and operational corridor where a rail line is or has been operational
- is immediately adjacent to an existing operational rail line which may result in widening of an existing corridor.

Typically the works associated with the 'redevelopment' of an existing rail line will increase its capacity to carry rail traffic or alter the alignment through design changes. In such cases the 'redevelopment of existing rail line' noise criteria apply.

The section of rail between the Maitland Road overpass and the proposed Wickham Station including the operation of a third track (head shunt) has been assessed as a 'redevelopment of an existing heavy rail line' as the proposal will be developed on land that is immediately adjacent to an existing operational rail line and may result in widening of that corridor. Therefore the 'redevelopment of existing rail line' criteria shown in Table 3.9 apply. Assessment criteria for the operation of the proposed Hamilton stabling facility are discussed in Section 3.3. For residential receivers; the noise trigger levels for absolute levels of rail noise have two components, L_{Aeq} and L_{Amax}. The L_{Aeq} contribution level of rail noise is assessed over the day or night period and the maximum noise level (L_{Amax}) from pass-by events. Typically, the trigger values shown in Table 3.9 need to be exceeded to initiate an assessment of rail noise impacts and investigate mitigation measures

Table 3.9 Airborne rail traffic noise trigger levels for residential land uses

Type of Development	Noise trigger levels dB(A) (External)	
	Day (7 am – 10 pm)	Night (10 pm – 7 am)
Redevelopment of existing rail line (external)	Development increases existing $L_{Aeq(period)}$ rail noise levels by 2dB or more, or existing L_{Amax} rail noise levels by 3 dB or more and predicted rail noise levels exceed	
	65 $L_{Aeq(15h)}$ OR 85 L_{AFmax}	60 $L_{Aeq(9h)}$ OR 85 L_{AFmax}

As per the RING, other non-residential sensitive land uses including hospitals, schools and outdoor recreational areas have their own specific noise trigger levels for heavy rail redevelopments that are applicable when the facility or space is in use. Noise trigger levels for these receivers are applicable as internal or external levels depending on the land use. As construction of these buildings is unknown, a conservative 10dB reduction in noise between the external level and internal level has been assumed[1]. The 'redevelopment of existing rail line' criteria are shown Table 3.10.

Table 3.10 Airborne rail traffic noise trigger levels for other sensitive land uses

Other sensitive land use	Noise trigger levels dB(A) – redevelopment of existing rail line (when in use)
	Development increases existing $L_{Aeq(period)}$ rail noise levels by 2dB or more *and* resulting rail noise levels exceed:
Schools, educational institutions and child care centres	45 $L_{Aeq(1h)}$ Internal
Places of worship	45 $L_{Aeq(1h)}$ Internal
Hospital wards	40 $L_{Aeq(1h)}$ Internal
Hospitals – other uses	65 $L_{Aeq(1h)}$ External
Open space – Passive use	65 $L_{Aeq(15h)}$ External
Open space – Active use	65 $L_{Aeq(15h)}$ External

3.2.2 Groundborne noise trigger levels for rail operations

For sensitive receivers, the internal groundborne noise trigger levels are shown in Table 3.11. Groundborne noise is generally only considered a potential issue where levels are higher than the airborne noise levels such as for underground railways. As there are no underground sections of rail associated with the proposal, groundborne noise due to operational rail is not assessed further in this report.

Table 3.11 Groundborne noise trigger levels (RING)

Sensitive land use	Time of day	Internal noise trigger levels, dB(A)
		Development increases existing rail noise levels by 3 dB(A) or more *And* resulting rail noise levels exceed
Residential	Day (7 am – 10 pm)	40 L_{ASmax}
	Night (10 pm – 7 am)	35 L_{ASmax}
Schools, educational institutions, places of worship	When in use	40 to 45 L_{ASmax}

[1] See RING - Technical notes to Tables 1,2 and 3 – Technical Note 6. Allows that a window may be opened to provide adequate ventilation.

3.2.3 Traffic noise criteria during operations

The RNP provides traffic noise target levels where there is the potential to create additional traffic on arterial and local roads. The road traffic noise target levels are presented in Table 3.4.

The application notes for the RNP state that:

> *for existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise level as a result of the development should be limited to 2 dB above that of the noise level without the development. This limit applies wherever the noise level without the development is within 2 dB of, or exceeds, the relevant day or night noise assessment criterion*

3.2.4 Operational vibration criteria

Human comfort

The AVTG provides methods for assessing potential vibration impacts from construction activities as well as rail operations such as ground-induced vibration created by rolling stock movements.

The AVTG is based on guidelines contained in the British Standards BS 6472:1992 Evaluation of human exposure to vibration in buildings (1–80 Hz).

Intermittent vibration is assessed using the VDV. Acceptable VDV's, as outlined in AVTG, are the same as for construction vibration impacts presented in Table 3.5.

Cosmetic damage

The CNS (Rail Projects) recommends the use of British Standards BS-7385-2: 1993 Evaluation and measurement for vibration in buildings for establishing cosmetic damage guideline criteria.

Cosmetic damage criteria have been set with consideration to British Standard BS 7385.2 – 1993 Evaluation and measurement for vibration in buildings (Table 3.7) and German Standard DIN 4150-3: 1999-02 Structural Vibration – Part 3: Effects of vibration on structures (

Table 3.11). This assessment has been undertaken with reference to the DIN 4150-3: 1999 standard for heritage-listed buildings while BS 7385.2 – 1993 has been considered for residential and commercial properties.

3.3 Operational noise criteria for stabling facility and new station

The Sydney Trains' Environment Protection Licence 12208, administered under the *Protection of Environment Operations Act 1997*, requires that 'offensive' environmental noise is minimised, regardless of whether specific noise assessment goals are defined in policies or guidelines.

The RING (Appendix 3) specifically states that train noise from sidings and rail lines exclusively serving industrial premises (e.g. a stabling yard or maintenance facilities) must be assessed in accordance with the INP. In the context of the proposal, this includes noise from train stabling activities including stationary trains and trains entering and exiting the stabling area. Non-rail stationary noise sources at the new station including loudspeaker announcements, air conditioning systems and other mechanical plant are also assessed using the INP criteria and methodology.

The INP includes both intrusive and amenity criteria that are designed to protect receivers from noise significantly louder than the background level, and to limit the total noise level from all sources near a receiver.

The INP noise criteria are planning levels and are not mandatory limits required by legislation, however the noise criteria assist the regulatory authorities to establish licensing conditions. Where noise criteria are predicted to be exceeded, feasible and reasonable noise mitigation strategies should be considered. In circumstances where noise criteria cannot be achieved, negotiation is required with the regulatory authority to evaluate the economic, social and environmental costs and benefits of the proposal against the noise impacts. The regulatory authority then sets statutory compliance levels that reflect the achievable and agreed noise limits from the proposal.

The intrusive noise criteria controls the relative audibility of operational noise compared to the background level at residential receivers. The amenity criteria limit the total level of extraneous noise for all receiver types. Both sets of criteria are calculated and, in the case of steady noise sources, the more stringent of the two in each time period normally apply. For noise sources with intermittent characteristics, both noise criteria should be assessed independently.

Residential receiver areas are characterised into ‘urban’, ‘suburban’, ‘rural’ or other categories based on land uses and the existing level of noise from industry, commerce and road traffic. With consideration to the INP, residential receivers identified in this assessment have been classified as ‘urban’ given the close proximity to existing commercial districts and road traffic noise.

Table 3.12 presents the operational noise criteria for the stabling facility and proposed Wickham Station.

Table 3.12 Operational noise criteria at residential receivers

	Day (7 am to 6 pm)	Evening (6 pm to 10 pm)	Night (10 pm to 7 am)
NCA-1			
Rating background level $L_{90(period)}$)	48	43	37
Intrusiveness criteria $L_{eq(15min)}$	53	48	42
Existing industrial noise contribution $L_{eq(period)}$	Nil		
Amenity criteria (urban) $L_{eq(period)}$ INP Table 2.2 adjusted	60	50	45
Operational noise criteria	**53**	**48**	**42**
NCA-2			
Rating background level L90(period)	47	46	42
Intrusiveness criteria $L_{eq(15min)}$	52	51	47
Existing industrial noise contribution $L_{eq(period)}$	Nil		
Amenity criteria (urban) $L_{eq(period)}$ INP Table 2.2 adjusted	60	50	45
Operational noise criteria	**52**	**50**	**45**
NCA-5			
Rating background level $L_{90(period)}$)	40	40	38
Intrusiveness criteria $L_{eq(15min)}$	45	45	43
Existing industrial noise contribution $L_{eq(period)}$	Nil		
Amenity criteria (urban) $L_{eq(period)}$ IMP Table 2.2 adjusted	60	50	45

	Day (7 am to 6 pm)	Evening (6 pm to 10 pm)	Night (10 pm to 7 am)
Operational noise criteria	**45**	**45**	**43**
NCA-6			
Rating background level $L_{90(period)}$	56	52	45
Intrusiveness criteria $L_{eq(15min)}$	61	57	40
Existing industrial noise contribution $L_{eq(period)}$		Nil	
Amenity criteria (urban) $L_{eq(period)}$ INP Table 2.2 adjusted	60	50	45
Operational noise criteria	**60**	**50**	**40**
NCA-8			
Rating background level $L_{90(period)}$	45	46	44
Intrusiveness criteria $L_{eq(15min)}$	50	51	49
Existing industrial noise contribution $L_{eq(period)}$		Nil	
Amenity criteria (urban) $L_{eq(period)}$ INP table 2.2 adjusted	60	50	45
Operational noise criteria	**50**	**50**	**45**
NCA-9			
Rating background level $L_{90(period)}$	44	44	40
Intrusiveness criteria $L_{eq(15min)}$	49	49	45
Existing industrial noise contribution $L_{eq(period)}$		Nil	
Amenity criteria (urban) $L_{eq(period)}$ INP table 2.2 adjusted	60	50	45
Operational noise criteria	**49**	**49**	**45**

3.4 Sleep disturbance criteria during operations

The Sydney Trains' NVRF provides guidance on the assessment of sleep disturbance based on the INP. The NVRF requires assessment of predicted event L_{Amax} or $L_{A1,\ 1\ minute}$ noise levels at the receiver. The NVRF suggests that sleep disturbance meet the L_{Amax} ≤ background + 15 dB(A) for stations. Other facilities, such as stabling yards, may need to consider alternative sleep awakening criteria as described in the RNP, depending on the nature of the facility.

The NVRF advises that sleep awakening should be considered the worst case measure of sleep disturbance.

In the absence of clear guidelines and criteria, the NVRF recommends that, instead of setting project sleep disturbance goals, levels in the guidelines should be applied as indicators of the potential for sleep disturbance and awakening as part of a comprehensive assessment, that is:

1. Assess the potential for sleep disturbance in accordance with the INP. Take the external sleep disturbance level of (background + 15) $dBL_{A1,1\ minute}$ as the preliminary indicator.
2. Assess the potential for sleep disturbance using the higher noise levels specified in the RNP. Take the internal sleep awakening level of 50 $dBL_{A1,1\ minute}$ as a worst case 'maximum' a project would consider as a project noise emission. Typically this would translate to external levels of 60 $dBL_{A1,1minute}$ with windows sufficiently open to provide adequate ventilation.

3. Conduct a qualitative (descriptive) review of the factors listed above, which may affect the nature and extent of sleep disturbance impacts due to a project.
4. Conduct a quantitative assessment of the predicted $L_{A1,1minute}$ noise levels against the sleep disturbance and sleep awakening levels.

Discussion of potential sleep disturbance during operation of the Hamilton stabling facility is presented in Section 6.1.5.

4. Assessment of construction impacts

4.1 Construction methodology

4.1.1 Construction timing and scheduling

It is anticipated that the majority of work for the proposal would be undertaken during the recommended standard working hours adopted as follows:

- Monday to Friday: 7 am to 6 pm
- Saturday: 8 am to 1 pm
- Sundays and Public Holidays: no work.

However, there is potential that some work could be undertaken outside of the standard working hours, including:

- construction works requiring road occupancy or railway possessions
- construction works at a sufficient distance from sensitive receivers so that the noise levels are maintained to below the noise management levels outside of the recommended standard construction hours.

Construction of the proposal is expected to commence in late 2014. The proposal is anticipated to take approximately 24 months to complete and is expected to commence operation in late 2016.

4.1.2 Construction process

An indicative construction program and methodology is provided in Table 4.1. Construction activities would overlap between the key stages.

- stage 1 – establish site compound at the location of the former Morrow Park Bowling Club behind Wickham Park. Commence early works
- stage 2 – cease train services east of Stewart Avenue. Hamilton Station to operate as the western terminus station of the Newcastle Branch Line
- stage 3 – construct railway sidings north of Hamilton Station
- stage 4 – construct new station and interchange facilities.

Table 4.1 Indicative construction stages and program

Stage	2014			2015			2016		
	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Receive all necessary approvals									
Establish site compound									
Early works									
Cease train services east of Stewart Avenue and close Railway Street level crossing									
Construct Hamilton sidings									
Construct new station and interchange facilities									
New rail facilities open to public									

4.2 Construction noise impacts

4.2.1 Methodology

The noise emissions from the construction of the proposal have been assessed through noise modelling using Computer Aided Noise Abatement (CadnaA v4.4) to predict noise levels at the nearest identified noise sensitive receivers.

CadnaA calculates noise propagation according to ISO 9613-2, Acoustics – Attenuation of sound during propagation outdoors. The ISO 9613-2 algorithm also takes into account the presence of a well-developed moderate ground-based temperature inversion, such as commonly occurs on clear, calm nights or ‘downwind’ conditions which are favourable to sound propagation.

Ground absorption, reflection, terrain and relevant shielding objects are taken into account in the calculations.

Model scenarios and configuration

Construction modelling only considered the following three main stages of construction works:

1. early works
2. construction of Hamilton Sidings
3. construction of new station and interchange facilities.

The remaining construction stages are expected to have minimal impacts.

The following assumptions were made with regard to the model configuration:

- a general ground absorption coefficient of 0.5 was used throughout the model assuming a hard reflective surface. A ground absorption coefficient of 1 was used to represent Wickham Park
- modelling is based on atmospheric conditions of 10˚C and 70% humidity.

The noise modelling assumptions are as follows:

- the noise model was used to predict noise levels during typical worst case 15 minute period of operation where all equipment was operating for 75% of the time
- all noise sources were modelled approximately 2 metres above ground level
- single storey and double storey receivers were modelled at a height of 1.5 metres and 4.5 metres above ground respectively.

Noise generating equipment

The specific construction equipment required for the proposal will be confirmed with the construction contractor and the proposed construction methodology prior to commencement of construction. For the purposes of the assessment, the likely noise generating equipment anticipated to be used for each construction scenario is detailed in Table 4.2 with the corresponding sound power level.

Noise levels have been obtained from CNS (Rail Projects) and AS2436 – 2010 Guide to noise and vibration control on construction, demolition and maintenance sites. Other equipment may be used, however it is anticipated that they would produce similar noise emissions.

Table 4.2 Modelled construction scenario, location and equipment sound power levels, dB(A)

Stage	Scenario modelled	Activity	Indicative plant and equipment	Sound power level
Early works	Substation connection	Trenching	Crane	110
			Backhoe	111
			Hand tools	102
Construct Hamilton sidings	Hamilton sidings	Out of hours works	Crane	110
			Semi-trailer	107
			Boring rig	110
			Excavator (20 tonne)	105
			Concrete truck	112
			Concrete pump	109
			Elevated work platform	102
			Hi rail trucks	95
			Tip truck	108
		Earthworks and retaining wall construction	Excavator (20 tonne)	105
			Air compressors	100
			Crane	110
			Dump trucks	108
			Loader	107
			Flatbed trucks	107
			Concrete truck	112
			Vibratory roller	114
			Vibrating pad compactors	104
			Grader	110

Stage	Scenario modelled	Activity	Indicative plant and equipment	Sound power level
		Track laying and turnouts	Loader	107
			Hi rail dumpers (14 tonne)	95
			Hi rail Hiab	99
			Tamper	111
			Regulator	114
			Rail grinder	112
			Vibratory roller	114
			Excavator	105
			Crane	110
			Rail saw	115
			Welding equipment	105
			Track laying machine	114
			Dynamic stabiliser	111
			Grader	110
			Tip truck	108
Construct new station and interchange facilities	New station at Wickham	OHW works	Crane	110
			Semi-trailer	107
			Boring rig	110
			Excavator (20 tonne)	105
			Concrete truck	112
			Concrete pump	109
			Elevated work platform	102
			Hi rail trucks	95
			Tip truck	108
		Piling works	Piling rigs	110
			Cranes	110
			Loader	107
			Flatbed truck	107
			Dump truck	108
			Concrete truck	112
			Pumps	106
		Station works	Crane	110
			Excavators (20 tonne)	105
			Vibratory roller	114
			Hand tools	102
			Dump trucks	108
			Boring Rig	110
			Semi-trailer	107
			Generators	99
			Concrete truck	112

Stage	Scenario modelled	Activity	Indicative plant and equipment	Sound power level
			Concrete pump	109
			Tip truck	108
			power tools	116
			Loader	107
		Track laying and turnouts	Front End Loaders	107
			Hi rail dumpers (14 tonne)	95
			Hi rail Hiab	99
			Tamper	111
			Regulator	114
			Rail grinder	112
			Vibratory roller	114
			Excavator	105
			Crane	110
			Rail saw	115
			Welding equipment	105
			Track laying machine	114
			Dynamic stabiliser	111
			Grader	110
			Tip truck	108

It should be noted that the magnitude of off-site noise impact associated with construction would be dependent upon a number of factors:

- intensity and location of construction activities
- type of equipment used
- existing local noise sources
- intervening terrain, and
- prevailing weather conditions.

Construction machinery would likely move about the study area altering noise impacts with respect to individual receivers. During any given period, the machinery items to be used in the study area would operate at maximum sound power levels for only brief stages. At other times, the machinery may produce lower sound levels while carrying out activities not requiring full power.

4.2.2 Predicted construction noise impacts

Table 4.3 presents the predicted noise impacts associated with each major stage of works along with a comparison to the relevant construction noise criteria. The assessment is limited to receivers located within the NCAs identified in Section 2. The noise levels outlined in the table would typically be short-term, lasting for the duration of the construction period when works are conducted in the vicinity of each receiver.

Table 4.3 Predicted construction noise impacts, $L_{eq\ (15min)}$ dB(A)

NCA	Nearest potentially affected receiver	CNML			Construction scenario								Maximum noise impacts		Exceedances of CNML		
					Substation connection	Hamilton sidings			Wickham Station								
		Day	Evening	Night	Trenching	Earthworks	Track laying and turnouts	Out of hours works	Piling works	Station works	Track laying and turnouts	Out of hours works	Standard hours	Out of hours (Night)	Day	Evening	Night
NCA-1	R1	58	48	42	**64**	**71**	**72**	70	35	36	44	35	72	70	14	22	28
	R2	58	48	42	**64**	**71**	**72**	70	31	33	46	31	72	70	14	22	28
	R3	58	48	42	**62**	**70**	**71**	69	35	36	46	35	71	69	13	21	27
	R4	58	48	42	58	**71**	**72**	70	39	36	48	39	72	70	14	22	28
NCA-2	R5	57	51	47	54	**78**	**79**	77	35	36	52	35	79	77	22	26	30
	R6	57	51	47	53	**77**	**78**	76	43	43	53	42	78	76	21	25	29
	R7	57	51	47	52	**77**	51	76	42	44	53	42	77	76	20	25	29
NCA-5	R8	50	45	43	33	40	**51**	39	**58**	**58**	**82**	58	82	58	32	13	15
	R9	50	45	43	35	42	**51**	41	**59**	**60**	**83**	59	83	59	33	14	16
	R10	50	45	43	36	44	48	43	**63**	**62**	**82**	63	82	63	32	18	20
	R11	50	45	43	34	44	49	43	**65**	**64**	**85**	65	85	65	35	20	22
	R12	50	45	43	32	42	49	41	**66**	**66**	**86**	66	86	66	36	21	23
	R13	50	45	43	29	42	49	41	**67**	**67**	**85**	67	85	67	35	22	24
	R14	50	45	43	32	41	49	40	**70**	**69**	**84**	71	84	71	34	26	28
	R15	50	45	43	34	40	48	39	**71**	**70**	**83**	72	83	72	33	27	29
	R16	50	45	43	34	41	48	40	**72**	**72**	**82**	73	82	73	32	28	30
	R17	50	45	43	35	42	48	41	**75**	**74**	**81**	75	81	75	31	30	32
	R18	50	45	43	27	42	48	39	**78**	**78**	**79**	78	79	78	29	33	35
	R19	50	45	43	19	42	48	41	**83**	**84**	**84**	83	84	83	34	38	40
	R20	50	45	43	34	42	47	71	**80**	**79**	**79**	78	80	78	30	33	35
NCA-6	R21	66	57	50	31	38	44	37	51	52	61	50	61	50	-	-	-

NCA	Nearest potentially affected receiver	CNML			Construction scenario								Maximum noise impacts		Exceedances of CNML		
					Substation connection	Hamilton sidings			Wickham Station								
		Day	Evening	Night	Trenching	Earthworks	Track laying and turnouts	Out of hours works	Piling works	Station works	Track laying and turnouts	Out of hours works	Standard hours	Out of hours (Night)	Day	Evening	Night
NCA-8	R22	66	57	50	32	39	44	38	55	56	61	54	61	54	-	-	4
	R23	66	57	50	32	39	43	38	57	57	60	56	60	56	-	-	6
	R24	55	51	49	40	51	**59**	50	41	41	**67**	41	67	50	12	-	1
NCA-9	R25	54	49	45	31	**59**	**60**	58	47	48	**59**	47	60	58	6	9	13
	R26	54	49	45	35	**64**	**65**	63	46	47	**57**	46	65	63	11	14	18
	R27	54	49	45	44	**65**	**66**	64	46	47	**57**	46	66	64	12	15	19
	R28	54	49	45	45	**67**	**68**	66	46	47	**57**	46	68	66	14	17	21
	R29	54	49	45	47	**64**	**65**	63	45	46	**56**	45	65	63	11	14	18
	R30	54	49	45	46	**65**	**66**	64	45	45	**55**	44	66	64	12	15	19
	R31	54	49	45	46	**64**	**65**	63	44	44	54	44	65	63	11	14	18
	R32	54	49	45	46	**62**	**63**	61	43	44	54	43	63	61	9	12	16
	R33	54	49	45	50	**69**	**70**	68	43	43	53	43	70	68	16	19	23
	R34	54	49	45	50	**69**	**70**	68	43	43	53	43	70	68	16	19	23
	R35	54	49	45	52	**69**	**70**	68	43	43	53	42	70	68	16	19	23
	R36	54	49	45	47	**68**	**69**	67	42	43	52	42	69	67	15	18	22
	R37	54	49	45	**55**	**69**	**70**	68	42	43	52	42	70	68	16	19	23
	R38	54	49	45	**59**	**69**	**70**	68	42	42	52	42	70	68	16	19	23

Note: **Bold text** indicates exceedance of the noise affected construction management level during recommended construction hours and red text indicates exceedances of the construction management level for out of hours work (night period)

The results presented in Table 4.3 indicate that there is the potential that construction activities could impact on surrounding sensitive receivers, even more so if activities were to be scheduled outside the standard construction hours. The substation connection trenching works are anticipated to be short-term, whereas construction of the Hamilton sidings and new station are expected to progress through the duration of the construction period.

Certain activities, in particular earthworks, track laying and turnout installation have the potential to exceed the standard hours criteria at the nearest sensitive receivers within all NCAs. It is also likely that the out of hours work would generate exceedances in all NCAs if they were to occur. The highly noise affected level of 75 dB(A) may also be exceeded for residences located in NCA-1, NCA-2 and NCA-5, given their close proximity to the proposal. Therefore it is recommended that the CNS (Rail Projects) standard noise mitigation measures and additional noise mitigation measures detailed in Section 4.5 (Table 4.9) be implemented where feasible and reasonable.

In addition, it is recommended that out of hours work be assessed for potential noise impacts and appropriate mitigation measured on a case-by-case basis, once more information is known about the out of hours activities.

4.2.3 Sleep disturbance impacts

There is the potential for sleep disturbance impacts where out of hours construction activities during the night time period are undertaken in the vicinity of sensitive receivers.

The INP application notes provide some guidance on the assessment of sleep disturbance but notes that conclusive research on the subject is limited. The INP application notes indicate that there is the potential for sleep disturbance where the $L_{A1(1min)}$ exceeds the $L_{A90(15min)}$ by more than 15 dB(A) inside the residence's bedroom.

Typically, $L_{A1(1min)}$ noise levels are around 5 dB to 10 dB(A) greater than the $L_{Aeq(15minute)}$ noise levels. Typically a window will provide a 10 dB reduction when open and a 20 dB reduction when closed. To be conservative, it is assumed that windows would be kept open during night-time construction activities. Therefore there is the potential for sleep disturbance impacts where noise levels ($L_{Aeq(15min)}$ outside the bedroom) are more than background plus 15 dB(A).

Once details of the requirements for construction activities outside of the standard construction hours during the night-time period are determined, sleep disturbance impacts at specific residential receivers can be predicted.

4.3 Construction traffic impacts

Construction vehicle movements have the potential to generate temporary adverse noise impacts along access routes which use public roads as vehicles deliver materials to and from the proposal site.

The ICNG does not provide specific guidance in relation to acceptable noise levels associated with construction traffic. For assessment purposes, guidance is taken from the RNP, which aims to protect sensitive receivers against excessive traffic noise levels increases. In assessing feasible and reasonable mitigation measures, an increase of up to 2 dB represents a minor impact that is considered barely acceptable to the average person.

Detailed information regarding construction-related traffic volumes and access routes was not available at the time of this assessment. Therefore, a number of assumptions have been made in the Traffic Report for the purposes of assessing construction traffic noise impacts.

Table 4.4 provides an estimate of construction vehicles and access points to the rail corridor. An additional access route on the southern side of the railway corridor from Donald Street would also be used during early works (an estimated period of 1-2 months). The volumes using this access point would be very low and are therefore not shown in the table.

Table 4.4 Construction traffic generation estimates

Type	Peak hour Volumes (two way)					
	Station Street	Ivy Street	Wickham Park (Maitland Road)	Railway Lane	Railway Street	Total
Heavy Vehicles	32	12	8	28	2	82
Light Vehicles	15	15	16	90	15	151

Most construction vehicle movements would take place during standard daytime construction hours. However, there may be occasions where construction traffic is generated out of standard hours.

For the purposes of this assessment, an estimation of the traffic noise level increases on selected roads from construction traffic has been made. An assumption has been made that existing peak hour volumes account for 10 percent of daily traffic volumes.

Existing road traffic volumes have been sourced from the Traffic and Transport Assessment (GHD 2014) for the roads around the proposal site. Existing traffic volumes are provided below in Table 4.5.

Table 4.5 Assumed existing traffic volumes

Road	Daily traffic	15 Hour (7am to 10pm)	9 Hour (10pm to 7am)
Railway Street	3500	3150 (10% HV)	350 (5% HV)
Station Street	500	450 (5% HV)	50 (0% HV)
Throsby Street	1000	900 (10% HV)	100 (5% HV)
Albert Street, east of Railway Street	4000	3600 (10% HV)	400 (5% HV)
Albert Street, west of Railway Street	2500	2250 (10% HV)	250 (5% HV)

The increase in road traffic noise due to the additional traffic generated by the facility can be calculated using the following relationship:

$$\text{Noise increase (dB)} = 10\log\left(\frac{V1}{V2}\right)$$

Here V1 represents the final volumes and V2 represents the initial volumes.

The predicted increase in road traffic noise due to construction traffic is provided in Table 4.6. Estimates indicate that construction traffic should generally have minimal impacts to the surrounding road networks, in particular to busy roads such as Maitland Road, Hannell Street/Stewart Avenue and Albert Street.

Due to the low traffic volumes (less than 500 vehicles per day), existing traffic noise along Station Street is likely to be under the RNP criteria at residential receivers. However, peak hour construction traffic accessing the site via Station Street has the potential to increase existing traffic noise by more than 2 dB(A) at residential receivers. It is therefore recommended that, as far as practicable, construction traffic movements along Station Street are scheduled during the standard daytime hours.

Table 4.6 Predicted noise level increase due to construction traffic

Road	Daily Traffic	Estimated peak hour movements (10% of daily)	Additional peak hour movements generated by construction traffic	Predicted peak hour increase in road traffic noise dB(A)
Railway Street	3500	350	135[1]	1.4
Station Street	500	50	47	**2.9**
Throsby Street	1000	100	-	-
Albert Street, east of Railway Street	4000	400	67[2]	0.7
Albert Street, west of Railway Street	2500	250	67[2]	1.0

1. *It has been assumed all construction traffic accessing Railway Lane would also travel on Railway Street.*
2. *Construction traffic for Albert Street was not available. It has been assumed all construction traffic accessing Railway Street would also access Albert Street with a 50% split from each direction.*

Haulage routes and construction traffic volumes would be required to be confirmed during future design stages with the exceedances at receivers along these roads to be confirmed at this stage.

It is recommended that the noise mitigation measures detailed in Section 4.5 be implemented where feasible and reasonable. Traffic on local roads will be managed in a traffic management plan which would be prepared prior to commencement of construction detailing specific routes that construction traffic and local traffic would follow throughout the construction phase. These routes where possible would avoid residential areas and other sensitive receivers.

It is recommended that when more detailed construction traffic generation, existing traffic volumes and traffic routes are determined, the construction traffic noise assessment be reviewed and revised.

4.4 Construction vibration impacts

Energy from construction equipment is transmitted into the ground and transformed into vibrations, which attenuates with distance. The magnitude and attenuation of ground vibration is dependent on the following:

- efficiency of the energy transfer mechanism of the equipment (i.e. impulsive; reciprocating, rolling or rotating equipment)
- frequency content
- impact medium stiffness
- type of wave (surface or body)
- ground type and topography.

The CNS (Rail Projects) provides safe working distances for vibration intensive activities, which are provided in Section 4.5.3. Since a detailed plant list and equipment locations are yet to be confirmed identifying specific residences that have the potential to be impacted by construction, this vibration impact assessment has been based on the worst case buffer distances. Therefore, it is recommended that:

- all potentially affected receivers located within 100 metres of the works be informed of the extent and nature of the proposed works
- as a general guide, all vibratory equipment should operate at least 25 metres from buildings or structures in order to prevent cosmetic damage unless the equipment is listed in Section 4.5.3 in which case the corresponding buffer distance may be used. If any buildings are identified within the safe working distances for building damage, the construction contractor should undertake a building condition survey and a copy of the report should be sent to the landholder.

When compared to the structural vibration goals outlined in Section 3.1.4 there is potential for vibration generating construction activities near to heritage structures to exceed the cosmetic criteria outlined in DIN4150-3:1999. Table 4.7 presents a list of the identified heritage structures within 50 metres of the proposal along with their proximities. Table 4.8 presents the nearest anticipated safe working distances to heritage structures.

Table 4.7 Heritage structures within 50 metres of the proposal

Heritage Structure	Address	Approximate distance to the proposal (m)
Sydney Junction Hotel	8 Beaumont Street, Hamilton	On boundary
Hamilton Junction Signal Box	Beaumont Street railway crossing	On boundary
Hamilton Station Hotel	6 Fern Street, Islington	20
Hamilton Railway Depot and Triangle	The Esplanade, Hamilton	On boundary
Hamilton Station Buildings	Beaumont Street, Hamilton	Within proposal site
Residence	22 Maitland Road, Islington	16
Lass O'Gowrie Hotel	14 Railway Street, Wickham	12
Dairy Farmers Building	924 Hunter Street, Newcastle West	50
Former Newcastle Cooperative Store	854-864 Pacific Highway, Newcastle West	On boundary
Wickham Railway Station	Beresford Street, Newcastle West	25
Former School of Arts	20 Hannell Street, Wickham	50
Residence	15 Charles Street, Wickham	10

Table 4.8 Anticipated safe working distance (heritage structures)

Activity	Anticipated safe working distance (Heritage structures) (m)
15 tonne compactor	35
Roller\rock hammer	30
Dozer	15
Excavators, Scrapers, Graders, etc.	7

Vibration results from measurements logged within the Greta Station building during the May 2011 track construction works undertaken as part of the Hunter8 project on the track adjacent to the station indicated a maximum recorded PVS of 2.87 mm/s, which occurred during removal and excavation of the old track. Tamping and ballast regulation generated a maximum PVS of 0.98 mm/s at the floor of the station building. These vibration velocities are within the DIN 4150-3 criteria for heritage structures of 3 mm/s. As similar works are proposed to be undertaken adjacent to Hamilton Station, vibration damage of the station structure is not anticipated, however it is recommended that the mitigation measures detailed in Section 4.5.1 be considered and implemented where feasible and reasonable.

4.5 Construction management and mitigation measures

As discussed in Section 4.2.2, there is the potential that construction activities could impact on surrounding sensitive receivers, even more so if activities were to be scheduled outside the standard construction hours. In practice, all feasible and reasonable measures would be implemented to minimise noise emissions from the construction activities. A Noise and Vibration Management Plan would be prepared and implemented for the proposal including the mitigation measures in the following sections.

The mitigation measures provided are in accordance with the CNS and the ICNG.

4.5.1 Standard mitigation measures

The noise and vibration mitigation measures detailed in Table 4.9 would be implemented to reduce the impact on the surrounding receivers and sensitive land uses.

Table 4.9 Standard mitigation measures for construction noise and vibration

Action required	Details
Management measures	
Implement community consultation measures	• periodic notification (letterbox drop or equivalent) • project website • project info line • email distribution list.
Site inductions	All employees, contractors and subcontractors are to receive an environmental induction. The induction must at least include: • all relevant project specific and standard noise and vibration mitigation measures • relevant licence and approval conditions • standard hours of work • any limitations on high noise generating activities • location of nearest sensitive receivers • construction employee parking areas • designated loading/unloading areas and procedures • construction traffic routes • site opening/closing times (including deliveries) • environmental incident procedures.
Behavioural practices	No swearing or unnecessary shouting or loud stereos/radios on site. No dropping of materials from height, throwing of metal items and slamming of doors.

Action required	Details
Monitoring	A noise monitoring program is to be carried out for the duration of the works in accordance with the Construction Noise and Vibration Management Plan and any licence conditions.
Attended vibration measurement	Attended vibration measurements are required at the commencement of vibration generating activities to confirm that vibration levels are within the acceptable range to prevent cosmetic building damage.
Source controls	
Construction hours and scheduling	Where feasible and reasonable, construction should be carried out during the standard daytime working hours. Work generating high noise and/or vibration levels should be scheduled during less sensitive time periods.
Construction respite period	If highly noise affected impacts are predicted high noise and vibration generating activities may only be carried out in continuous blocks not exceeding three hours each, with a minimum respite period of one hour between each block. If highly noise affected impacts are predicted no more than four consecutive nights of high noise and/or vibration generating work may be undertaken over any seven day period, unless otherwise approved by the relevant authority.
Equipment selection	Use quieter and less vibration emitting construction methods where feasible and reasonable.
Maximum noise levels	The noise levels of plant and equipment must have operating Sound Power or Sound Pressure Levels compliant with the criteria listed in Table 2 of the CNS.
Rental plant and equipment	The noise levels of plant and equipment items are to be considered in the selection of rental plant and equipment and cannot be used on site unless compliant with the criteria in Table 2 of the CNS.
Use and siting of plant	Simultaneous operation of noisy plant within discernible range of a sensitive receiver is to be avoided. The offset distance between noisy plant and adjacent sensitive receivers is to be maximised. Plant used intermittently to be throttled down or shut down. Noise-emitting plant to be directed away from sensitive receivers.
Plan worksites and activities to minimise noise and vibration	Plan traffic flow, parking and loading/unloading areas to minimise reversing movements within the site.
Non-tonal reversing alarms	Non-tonal reversing beepers (or an equivalent mechanism) must be fitted and used on all construction vehicles and mobile plant regularly used on site and for any out of hours work.

Action required	Details
Minimise disturbance arising from delivery of goods to construction sites	Loading and unloading of materials/deliveries is to occur as far as possible from sensitive receivers. Select site access points and roads as far as possible away from sensitive receivers. Dedicated loading/unloading areas to be shielded if close to sensitive receivers. Delivery vehicles to be fitted with straps rather than chains for unloading, wherever possible.
Path controls	
Shield stationary noise sources such as pumps, compressors, fans etc.	Stationary noise sources should be enclosed or shielded whilst ensuring that the occupational health and safety of workers is maintained.
Shield sensitive receivers from noisy activities	Use structures to shield residential receivers from noise such as site shed placement; earth bunds; fencing; erection of operational stage noise barriers (where practicable) and consideration of site topography when situating plant.

4.5.2 Additional mitigation measures

Due to the highly variable nature of the activities and the potential for work needing to be undertaken outside the standard construction hours, the proposal's noise management levels are likely to be exceeded at times. Consultation and cooperation with the neighbours of the site will assist in minimising uncertainty, misconceptions and adverse reactions to noise.

In circumstances where the noise levels are predicted to exceed acceptable levels after implementation of the general work practices, the relevant additional mitigation measures detailed in Table 4.10 should be considered.

Based on the predicted noise levels in Table 4.3, additional mitigation measures detailed in Table 4.9 are likely to be required for works during standard construction hours. For any activities required outside of the standard construction hours where the noise levels in Table 4.3 exceed the noise criteria, the additional mitigation measures detailed in Table 4.10 would be adopted through consultation with the surrounding sensitive receivers and land uses. The additional mitigation measures will also minimise sleep disturbance impacts. Once details of the requirements for construction activities outside of the standard construction hours are determined, sleep disturbance impacts and the additional mitigation measures required at specific residential receivers can be determined.

Table 4.10 Additional mitigation measures (Transport for NSW, CNS)

Criteria		$L_{Aeq(15\ min)}$ noise level above rating background level			
		0 to 10 dBA	10 to 20 dBA	20 to 30 dBA	>30 dBA
Time period		Noticeable	Clearly audible	Moderately intrusive	Highly intrusive
Standard	Weekday (7 am– 6 pm)	-	-	LB, M	LB, M
	Saturday (8 am – 1 pm)				
Evening	Weekday (6 pm–10 pm)	-	LB	M, LB	M, IB, LB, PC, SN
	Saturday (1 pm – 10 pm)				
	Sunday (8 am – 6 pm)				
Night	Weekday (10 pm–7 am)	LB	M, LB	M, IB, LB, PC, SN	AA, M, IB, LB, PC, SN
	Saturday (10 pm – 8 am)				
	Sunday (6 pm – 7 am)				

Monitoring (M): Compliance noise monitoring

Individual Briefings (IB): Individual briefings are used to inform stakeholders about the impacts of high noise activities and mitigation measures that will be implemented. TfNSW representatives would visit identified stakeholders at least 48 hours ahead of potentially disturbing construction activities. Individual briefings provide affected stakeholders with personalised contact and tailored advice, with the opportunity to comment on the proposal.

Letter box drops (LB): Letter box drops or media advertisements.

Phone Calls (PC): Phone calls detailing relevant information would be made to identified/affected stakeholders within seven days of proposed work. Phone calls provide affected stakeholders with personalised contact and tailored advice, with the opportunity to provide comments on the proposed work and specific needs.

Specific Notifications (SN): Specific notifications are letterbox dropped or hand distributed to identified stakeholders no later than seven days ahead of construction activities that are likely to exceed the noise objectives. This form of communication is used to support periodic notifications.

Alternative accommodation (AA)

4.5.3 Vibration buffer distances

In addition to the standard mitigation measures discussed in Table 4.9, recommended safe working distances for vibration intensive plant from the CNS are provided in Table 4.11. These safe working distances are indicative only and may vary depending on the equipment used and the ground conditions.

Table 4.11 Recommended safe working distances for vibration-intensive plant

Plant	Rating/description	Safe working distance[1] (m)	
		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)	n/a
Jackhammer	Hand held	1 (nominal)	Avoid contact with structure

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 the Assessing Vibration: A technical guideline (DEC, 2006).

5. Assessment of rail operational impacts

5.1 Methodology

The methodology applied to the assessment of operational rail noise is summarised as follows:

- existing and future train speeds for the study area were provided by Transport for NSW
- train numbers and types were sourced from a schedule of train movements provided by Transport for NSW
- existing absolute rail L_{Aeq} and L_{Amax} levels were calculated using noise logger data obtained at logger location L3. These results have been used to inform the modelling process
- rail noise pass-by levels for each train type were calculated using attended pass-by noise measurements described in Section 2.3
- modelling and prediction of the operational noise levels was undertaken for 'build' and 'no-build' scenarios at the identified sensitive receivers. In addition to modelling the existing scenario for model calibration purposes, RING requires assessment at two distinct future timeframes:
  - year of project commencement (2016)
  - design year (10 year horizon, 2026)
- as rail volumes are not anticipated to change as a result of the proposal, nor are they foreseeable in the future, only a single 'build' and a single 'no-build' scenario have been modelled for both LAeq and LAmax impacts
- railway noise predictions were undertaken using Computer Aided Noise Abatement (Cadna-A) software v4.4 and the Nordic Prediction Method for Train Noise (NMT) TemaNord 1996:524 algorithm. This algorithm is recognised and accepted by the RING. Train input data was calculated from attended pass-by measurements of Hunter Railcar, OSCAR, V-Sets and Endeavour trains using the NMT method for adding new trains
- comparison of operational rail noise predictions was undertaken to identify potential impacts with consideration to the relevant RING trigger levels.

Note that absolute rail noise levels refer to the noise levels emitted by rail only without the contribution of any other noise source. Whereas ambient noise levels include rail and other noise sources such as traffic noise, industry and wildlife.

5.1.1 Train volumes and details adopted

Rail line volumes have been extracted from data provided by Transport for NSW. The train types, volumes, and train lengths are detailed in Table 5.1 for each train type.

Table 5.1 Adopted train volumes and train details

Train	Direction	Trains entering or exiting new station: Day (7 am – 10 pm)	Night (10 pm – 7 am)	Train Class/ Type	Train ID	Train length (m)
OSCAR (8-car)	Up	2	0	Passenger Electric	OD 6901–6999, 6843–6854 ON 5901–5949, 5821–5826 ONL 5951–5999, 5871–5876	163
	Down	2	0	Passenger Electric		
OSCAR (4-car)	Up	12	7	Passenger Electric		81.5
	Down	13	6	Passenger Electric		
V-Set (8-car)	Up	9	6	Passenger Electric	8000/9000 V-sets	192
	Down	8	7	Passenger Electric		
V-Set (4-car)	Up	17	2	Passenger Electric		96
	Down	17	2	Passenger Electric		
Hunter Railcar (2-car)	Up	34	11	Passenger Diesel	HM 2701-2707 HMT 2751-2757	50.5
	Down	35	10	Passenger Diesel		
Endeavour (2-car)	Up	12	3	Passenger Diesel	TE 2801-2815 LE 2851-2865	50.5
	Down	12	3	Passenger Diesel		

5.1.2 Determining the existing rail noise L_{Aeq}

Data obtained from the noise logger at location L3 was reviewed and analysed to identify train pass-by events which occurred during the monitoring period and capture the L_{Aeq} and L_{Amax} representative of each train pass-by noted during the monitoring period.

Having regard to the assessment requirements of RING, the existing absolute rail noise L_{Aeq} at the monitoring locations were determined as follows:

$$L_{Aeq(T)} = 10\log_{10}\frac{1}{T}\Sigma\left(n_i \times 10^{\left(\frac{L_{AEi}}{10}\right)}\right)$$

Where:

- T is the total time in the relevant period (day or night) in seconds
- n_i is the number of each type of event

L_{AEi} is the representative event L_{AE} for each type of event as determined from individual measurements at the most affected receiver, which is the summed over the different types of events occurring at the site.

$$L_{AEi} = L_{Aeq(period)} + 10\log_{10}T$$

The absolute rail noise L_{Aeq}'s have been used to inform the modelling process.

5.1.3 Rail noise model setup

Acoustic modelling was undertaken using CadnaA to predict the effects of rail traffic noise from the proposed project. The Nordic prediction method for train noise (NMT), TemaNord 1996:524 was used for modelling as this is able to produce L_{Aeq} and L_{Amax} levels.

The proposed development has been modelled based on data available at the time of the assessment, and as such, should be used for comparison purposes only. The model reflects the status of the design at the time of the assessment, which may change through design development.

Atmospheric conditions

The following atmospheric conditions were implemented in the model configuration:

- atmospheric conditions of 10°C and 70% humidity were used
- neutral weather conditions.

Model configuration

Further noise model inputs and assumptions are presented in Table 5.2.

Table 5.2 Railway model inputs and assumptions

Inputs/assumption	Data incorporated into noise model
Facade correction	+2.5 dB(A) to account for sound reflected from the facade.
Ground absorption	A ground absorption coefficient of 0.5
Receiver heights	Ground floor – 1.5 m above building ground level. First floor – 4.5 m above building ground level.
Ground topography	0.2 metre terrain contours (within 200 metres of the project area) 1 metre terrain contours (200 to 600 metres from the project area)
Rail alignment	Existing and proposed alignments provided by Transport for NSW
Railway sources	Refer to Section 5.1.1
Railway volumes	For the year 2026 rail volumes refer to Table 5.1.

Inputs/assumption	Data incorporated into noise model
Railway speeds	Main track (Up and Down) – 60 km/h Head shunt – 40 km/h
Source height	Top of rail 0.17 metres above ballast. Train source heights vary based on source type and spectra as per NMT.
Turnouts and crossings	+6 dB(A) correction applied as per NMT.

5.1.4 Rail source noise levels

Rail noise levels to input into the noise model for each train type were calculated using the NMT method for adding new trains and data obtained from attended pass-by noise measurements described in Section 2.3. The NMT method for adding new trains involves the adjustment of noise measurement data for each train type to a normalised speed, distance and train length. The NMT prediction model is then able to use this input data for calculation of noise levels across the model area. A summary of the noise source data for each train type (considering the operating conditions provided in Table 5.1 and Table 5.2) is provided in Table 5.3.

Table 5.3 Summary of NMT noise source data for each train type, dB(Lin)

Train	Normalised train noise spectra, SELn dB(Lin) (NMT)[2]							
	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz
OSCAR (Electric)	29.2	27.7	29.1	24.8	16.6	12.3	6.8	1.6
V-Set (Electric)	28.5	30.4	33.2	31.5	22.1	18.6	17.1	7.1
Hunter Railcar (Diesel)	34.2	31.4	35.7	31.7	25.4	21.2	15.8	14.2
Endeavour (Diesel)	35.3	37.8	37.7	34.8	26.1	24.8	19.2	14.0

5.1.5 Noise model verification

The noise modelling process was verified against the absolute existing rail noise levels $L_{Aeq(15hr)}$ and $L_{Aeq(9hr)}$ and $L_{Amax(95th\ percentile)}$ calculated from data obtained at logger location L3. The noise monitoring methodology and data is summarised in Section 2.2 and the process to extract absolute rail noise levels is described in Section 5.1.2.

Transportation noise models are generally deemed to be verified if the average difference between the measured and calculated values are within +/-2 dB(A).

A comparison of the modelling and monitoring results is shown in Table 5.4. The predicted results and measured results have an acceptable variance of within 2 dB(A). Therefore, the results provide a reasonable level of confidence in the accuracy of the noise model used for predicting the noise levels at the receivers for each scenario.

[2] Normalised to 60 km/h for 100 metres train length at a position 10 metres from track centre line.

Table 5.4 Noise model verification results, dB(A)

Location	Measured absolute existing 2014 rail noise levels (dB)			Noise model predictions, 2014 existing scenario (dB)		
	Day L_{Aeq} (15hr)	Night L_{Aeq} (9hr)	L_{Amax} (95th Percentile)	Day L_{Aeq} (15hr)	Night L_{Aeq} (9hr)	L_{Amax}
L3 (11.5 m from nearest track)	55.5	52.3	81.3	55.2	52.9	81.3

5.2 Predicted airborne rail noise levels

The predicted airborne rail noise levels at the nearest sensitive receivers identified in Figure 2.1 are detailed in Appendix B. The L_{Amax}, $L_{Aeq(15hr)}$ day and $L_{Aeq(9hr)}$ night noise contour plots are shown in Appendix C. There are no nearby noise sensitive receivers that are anticipated to exceed the RING airborne noise trigger levels. Airborne rail noise level ranges for each NCA are provided in Table 5.5 for the build and no-build scenarios. Note that the predicted noise levels include a 2.5 dB(A) facade correction.

Where the existing rail line is removed to the east of Stewart Avenue, rail noise levels decrease significantly for NCA 6. The removal of the level crossing at Railway Street is also predicted to reduce L_{Aeq} and L_{Amax} noise levels at nearby receivers within NCA-5, however the introduction of a head shunt track and reduction of separation distance to residences within NCA-5 will marginally increase noise levels. Also the introduction of turnouts between the proposed Wickham Station and Maitland Road overbridge are expected to marginally increase rail airborne noise levels within NCA-8.

The predicted noise levels and relative increase at the nearest identified sensitive receivers is provided in Appendix C. Noise contours are shown in Appendix D.

Table 5.5 Airborne rail noise levels at nearby residential receivers, dB(A)

Receiver		Scenario 1 Existing base case			Scenario 2 Proposal opening year/ 10 year horizon			Change in noise levels		
ID	NCA	L_{Aeq} Day	L_{Aeq} Night	L_{Amax}	L_{Aeq} Day	L_{Aeq} Night	L_{Amax}	L_{Aeq} Day	L_{Aeq} Night	L_{Amax}
R1 to R4	NCA 1	45 to 46	42 to 44	67 to 71	45 to 46	42 to 44	67 to 71	0 to 0.1	0 to 0.2	-0.1 to 0
R5 to R7	NCA 2	51 to 52	49 to 50	74 to 75	51 to 52	49 to 50	75 to 75	0 to 0.1	0.1 to 0.1	-0.1 to 0.3
R8 to R20	NCA 5	53 to 55	50 to 53	76 to 83	47 to 57	45 to 55	74 to 80	-6 to 2.3	-5.9 to 2.7	-3.4 to 3.6
R21 to R23	NCA 6	45 to 48	42 to 45	67 to 70	36 to 38	34 to 36	50 to 52	-11.7 to -8.1	-11.4 to -7.9	-18.2 to -15.4
R24	NCA 8	43 to 43	41 to 41	66 to 66	49 to 49	47 to 47	73 to 73	5.7 to 5.7	5.9 to 5.9	6.8 to 6.8
R25 to R38	NCA 9	43 to 50	41 to 48	64 to 73	45 to 50	43 to 48	64 to 73	0 to 1.8	0 to 1.9	-0.1 to 0.3

5.3 Other operational rail noise impacts

5.3.1 Impact on existing rail network

The RING states that, ‘the guideline does not apply to the mitigation of noise from existing rail lines where no rail infrastructure projects are proposed (rail noise abatement programs are to be developed to provide relief for those acutely affected by rail noise).’ Therefore there is no requirement under the current guideline to provide mitigation treatments to residences exposed to higher rail volumes on the existing rail network outside the proposal area.

5.3.2 Horn noise

The RING states that, ‘the noise triggers in this guideline apply to noise from safety devices such as warning horns and bells at level crossings as this is a normal part of operational rail noise. This noise should be taken into account when predicting noise levels and reported in terms of $L_{Aeq(15hr)}$, $L_{Aeq(9hr)}$ and L_{Amax}. It is recommended that the design of new and upgraded railway lines consider noise from safety devices and aim to reduce noise levels from such devices whenever possible.’

With the removal of the Railway Street and Stewart Avenue crossings, train horn and level crossing bell events are anticipated to be reduced in the vicinity of these areas for trains heading in both directions. It is expected that trains leaving the new station and head shunt track would not use horns when departing.

Train horn usage within the stabling area is discussed in Section 6.1.

5.3.3 Wheel curve squeal

'Lateral slip of the tread running surface of the wheel across the rail-head is the most probable cause of wheel squeal’[3], which excites natural modes in the wheel which generate tonal noise at mid to high frequency. There is the potential that wheel curve squeal can occur on curved tracks at levels of up to L_{Amax} 100 dB(A) at 15 metres and is considered more annoying due to the tonal characteristics.[4] Wheel curve squeal should be controlled through management measures such as gauge face lubricators, track maintenance and rolling stock maintenance.

As the proposal consists of a relatively straight section of track, wheel squeal is not anticipated. Additional noise through turnouts and crossovers has been considered in the operational rail noise model.

5.3.4 Braking

Braking can result in brake squeal which could produce similar noise emissions to wheel curve squeal. Brake squeal is generated through the brake and the wheel and can be controlled through rolling stock wheel maintenance or low squeal brake blocks. The L_{Amax} criterion refers to the maximum noise level not exceeded for 95 percent of rail pass by events. Accordingly, with appropriate maintenance, brake squeal may not occur for more than 5 percent of the time and has therefore not been included in the predicted L_{Amax} noise levels for the proposal.

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[3] Rail Wheel Squeal – Some Causes and a case study of freight car wheel squeal reduction (Tickell, C.E. et al 2004)

[4] RAC Line Based Noise PRP Study Noise Source Working Paper (Report 10-1142-R1 September 2000)

5.4 Operational vibration impacts

Human comfort

The AVTG provides a methodology to assess human comfort using VDV levels where there are repeated events of variable magnitude.

Vibration monitoring was undertaken based on existing passenger rail movements at location L3. Based on the measurement data, at 5 metres from the track, the average pass-by VDV level for triggered events generating at least 1 mm/s vibration velocity was 0.03 $mm/s^{1.75}$ when passenger trains were operating at approximately 60 km/h.

The nearest residential receiver is approximately 10 metres from the proposed stabling area, where train speeds will be less than 25 km/h, therefore compliance with the criteria at the measurement location indicates compliance at all sensitive receivers.

Based on the supplied rail movements and conservatively assuming all trains run on the nearest track, the estimated VDV values are presented in Table 5.6.

Table 5.6 Predicted VDV at 5 metres from the rail line ($m/s^{1.75}$)

VDV	Criteria	Distance
		5 metres
Day (15 hour)	0.2	0.11
Night (9 hour)	0.13	0.08

Vibration estimates indicate that VDV values are below the human comfort criteria at 5 metres from the rail line. VDVs for the night time are lower than daytime due to there being fewer rail movements per hour during the night period.

Since all residential receivers are further than 5 metres from the proposal, no adverse vibration impacts are anticipated in relation to human comfort.

Cosmetic damage

Vibration estimates indicate that the vibration criteria will be achieved at 5 metres from the railway for residential structures. Between the Maitland Road overbridge and the new station, all receivers and buildings are further than 5 metres from the railway therefore cosmetic damage impacts are not anticipated where trains would be travelling at speeds of up to 60 km/h.

West of the Maitland Road overbridge, the development at 12 Maitland Road will be located approximately 4 metres from the nearest siding where trains may travel at slower speeds of 25 km/h. As vibration is a function of train speed and applicable vibration guideline levels are 15 mm/s for buildings of this nature, cosmetic damage is not anticipated at this location.

Therefore, cosmetic damage due to rail operations are not anticipated any sensitive receivers for the proposal.

5.5 Airborne rail noise mitigation measures

As there are no predicted exceedances of RING airborne rail noise criteria at nearby identified receivers for the future horizon project ‘build’ scenario, no mitigation measures are required in relation to operational rail noise.

6. Assessment of operational noise impacts from fixed infrastructure

6.1 Hamilton stabling facility

Noise from the proposed stabling facility is assessed against the NSW INP, separate to operational rail noise. The Sydney Trains NVRF has also been considered in the assessment of stabling facility noise. All activities associated with the movement and stabling of trains on the new tracks west of the Maitland Road overpass have been assessed. In total, there are four sidings within the stabling facility, along with the required turn-outs to connect the stabling tracks to the two existing tracks and proposed head shunt track.

6.1.1 Modelling methodology

Noise emissions from the stabling facility have been assessed through noise modelling using CadnaA v4.4 to predict sound pressure levels at the nearest identified noise sensitive receivers.

CadnaA was configured to calculate sound propagation according to ISO 9613-2, Acoustics – Attenuation of sound during propagation outdoors. The ISO 9613-2 algorithm also takes into account the presence of a well-developed moderate ground-based temperature inversion, such as commonly occurs on clear, calm nights or ‘downwind’ conditions which are favourable to sound propagation.

Ground absorption, reflection, terrain and relevant shielding objects are taken into account in the calculations.

6.1.2 Modifying factor adjustments

The INP requires that modifying factor adjustments are applied if the noise sources contain tonal, intermittent or low frequency characteristics, which have the potential to increase annoyance. According to the definitions provided in the INP, the noise sources at the stabling facility are not likely to require the addition of modifying factors, with the exception of air release during exhaustion of the brake pipe. Conservatively, a 5 dB modifying factor has been applied to this noise source to account for this potentially impulsive characteristic.

6.1.3 Modelling configuration

When a train enters a stabling facility, a number of operational activities take place. The train will enter slowly and once the train comes to a standstill, the brake pipe would be exhausted and the parking brake would be engaged. Exhausting the brake pipe releases compressed air to the atmosphere, causing a short term noise event. The air typically exhausts from underneath the train at the two end carriages (of a four-carriage train).

After the parking brake is engaged, the trains will idle for approximately 45 minutes while decanting takes place. During this time, it has been assumed that all auxiliary equipment will continue to operate, including the motor-alternators, air compressors and air conditioning fans. Once decanting is completed, the trains will then be stabled with all auxiliary equipment shut down. While stabled, train interiors are cleaned. Once the train is shut down, there are expected to be negligible noise emissions. Trains will start up again 30 minutes prior to departing the stabling facility. During this time, it has been assumed that all auxiliary equipment will operate, including the motor-alternators, air compressors and air conditioning fans.

It is assumed that the stabling facility would be primarily used for decanting and general maintenance/cleaning of trains. It has been assumed that none of the following activities would occur within the stabling facility:

- wheel lathe works or other noisy maintenance activities
- audible alarm system or PA system announcements
- train washing (external).

Train movements within the stabling facility will occur at low speeds and therefore train noise emissions would be mainly dominated by on board equipment (such as motor generators, air compressors and air conditioners) rather than wheel rail noise.

Based on the current train schedule, there would be a total of 24 movements into or out of the stabling facility each 24-hour period. Of these, nine movements occur during the day (7 am to 10 pm) and the remaining 15 movements occur during the night (10 pm – 7 am). Since the night-time period generally exhibits lower background noise levels relative to the evening and day periods, the night-time is expected to be the most sensitive time period.

Table 6.1 presents the sound power levels adopted for train noise sources within the stabling facility. Sound power levels have been derived based on noise measurements taken by GHD of idling trains at Newcastle Station, unless otherwise specified. Noise levels provided in Table 6.1 are consistent with those provided in Table 3 of Sydney Trains NVRF.

Based on the current train schedule, operations at the stabling yard will generally comprise of the following:

- minimal to no use between the daytime hours of 7 am to 6 pm other than occasional use as a layover area for both electric and diesel passenger trains
- evening and night-time arrivals – a number of electric trains arrive at the stabling facility between the hours of 6 pm and 10:30 pm. A small number of electric trains also depart the facility during this time
- night-time operations – up to six electric train movements throughout the night, but with the majority of trains stabled during the night
- early morning departures – the bulk of electric trains depart the stabling facility in the early morning (4 am to 6 am) ready for operation.

Following completion and commissioning of the new station at Wickham and Hamilton Stabling Yard works, trains would temporarily layover during the day time in the stabling yard, head shunt track, and at the new station (Platform 3) for activities such as cleaning, decanting, maintenance inspections, amalgamation and division, prior to re-entering service. Only electric trains would be stabled at the Hamilton stabling yard overnight. Diesel trains would be stabled elsewhere near Broadmeadow Station.

A number of operational scenarios have been modelled to represent potential worst-case noise emissions from the stabling facility.

Table 6.1 Stabling facility train sound power levels Lw dB re 10^{-12} W

Source	SWL dB(A)	Location	Comments
Air conditioning fans	78 L_{Aeq}	Top of carriage	Occurs at two locations on each carriage.
Motor alternator	98 L_{Aeq}	Under floor	Noise source is at two locations on a 4-carriage train. Assumed to be located on carriage 1 and 4.
Air compressor cycle	93 L_{Aeq}	Under floor	Noise source is at two locations on a 4-carriage train. Assumed to be located on carriage 1 and 4. Sound power averaged over complete compressor cycle.
Horn	138 L_{Amax}[1]	End of train, under floor	Assumed to be at front of train. Sound power based on a short 'toot'. It has been assumed that the horn would be used to signal that a train is about to move. Horn assumed to occur for 0.5 seconds.
Brake air release	112 L_{Amax}[2]	Under floor	Noise source is at two locations on a four-carriage train. Assumed to be located on carriage 1 and 4.
Diesel train stationary	103 L_{Aeq}[3]	At side of carriage	Based on Hunter Rail Car - Idling
Diesel train 15km/h	108 L_{Aeq}[3]	At side of carriage	Based on Hunter Rail Car – Notch 2

1. Horn noise source: Engineering Standard Rolling Stock. RSU 600 – Minimum operating standards for rolling stock – multiple unit train specific interface standards, Version 1.6, June 2013. Horn noise level based on ‘Town horn’ generating 90 dB(A) at 100 metres in front of a stationary train.

2. Brake air release source: North West Rail Link, Noise and vibration technical paper for operations and additional construction works, prepared by SLR Consulting, October 2012. Includes 5 dB adjustment for impulsive characteristic.

3. Diesel train noise level based on Hunter Rail Car data from GHD noise level database.

It has been assumed that Siding 4 (outside track) will be used first, followed by the three remaining sidings. In this sequence, the first train to be stabled for the night can enter and shut down in Siding 4, which is nearest to sensitive receivers on Fern Street and Ivy Street. With a train shut down in Siding 4, the body of the train would provide shielding of noise from other trains in the stabling facility as well as noise from Hamilton Station.

It has also been assumed that this train would be the last to depart, thus providing shielding from other trains as they depart. Table 6.2 presents the modelled scenarios for stabling facility operations.

Table 6.2 Modelled stabling facility scenarios

Scenario	Operating conditions
Scenario 1	Train entering and idling in Siding 4. No other trains in stabling facility.
Scenario 2	Train in Siding 4 is turned off. Train idling in Siding 3.
Scenario 3	Train in Siding 4 is turned off. Train idling in Sidings 2 and 3.
Scenario 4	Train in Siding 4 is turned off. Train idling in Sidings 1, 2 and 3.
Scenario 5	Diesel train entering, then idling at western end of Siding 1 during the daytime only. No other trains in stabling facility.

For all scenarios, the body of the outer train was included in the noise model to provide shielding from trains stabled on inner sidings. For Scenarios 1 to 4, an eight-carriage train was modelled in Siding 4. For Scenario 3, an eight-carriage train was modelled in Siding 2 and for Scenario 4, an eight-carriage train was modelled in Siding 1. To represent worst-case conditions, all trains in the stabling facility have been modelled with eight carriages for Scenarios 1 to 4.

From Table 6.1, the primary noise source on stabling trains, while systems are operating, is the motor-alternator located under the first and fourth carriages of each four-carriage train. It has been assumed that the motor-alternators will operate for the full 15-minute assessment period, representing either the 45 minutes where a train idles on arrival, or the 30 minutes where a train starts-up prior to departure.

6.1.4 Predicted stabling facility noise impacts

Results of the stabling facility operational noise modelling indicate that impacts are greatest where a train enters and idles within Siding 4, however where this train is switched off it provides an effective noise barrier to northern NCAs for trains entering and using subsequent sidings.

The results are presented below in Table 6.3. Noise contour maps for scenario 4 are shown in Appendix E.

Table 6.3 Predicted stabling facility noise levels – $L_{eq\ (15\ minute)}$ dB(A)

Modelled scenario	NCA	Most affected residential receiver(s)	Residential criterion Leq dB(A)			Highest predicted Leq dB(A)	Highest exceedance dB(A)		
			Day	Evening	Night		Day	Evening	Night
Scenario 1	NCA-1	R4	53	48	42	**45**	-	-	3
	NCA-2	R5, R6, R7	52	51	47	**67**	15	16	20
	NCA-9	R33, R34, R35	49	49	45	**46**	-	-	1
Scenario 2	NCA-1	R4	53	48	42	41	-	-	-
	NCA-2	R5, R6, R7	52	51	47	**52**	-	1	5
	NCA-9	R33, R34, R35	49	49	45	**48**	-	-	3
Scenario 3	NCA-1	R4	53	48	42	**51**	-	3	9
	NCA-2	R5, R6, R7	52	51	47	**53**	1	2	6
	NCA-9	R33, R34, R35	49	49	45	**51**	2	2	6
Scenario 4	NCA-1	R4	53	48	42	**53**	-	5	11
	NCA-2	R5, R6, R7	52	51	47	**54**	2	3	7
	NCA-9	R33, R34, R35	49	49	45	**52**	3	3	7
Scenario 5 (daytime only)	NCA-1	R1, R2, R3, R4	53	48	42	**57**	4	n/a (daytime only)	
	NCA-2	R5, R6, R7	52	51	47	52	-		
	NCA-9	R33, R34, R35, R36, R37, R38	49	49	45	**55**	6		

6.1.5 Sleep disturbance

Short-term high noise level events such as train horns and brake air releases have the potential to cause sleep disturbance at sensitive receivers if they rise significantly above the background level. The INP does not specifically address sleep disturbance from these types of noise level events.

The INP Application Notes refers to the RNP and suggests that the $L_{A1,1min}$ noise level should not exceed the background L_{A90} level by more than 15 dB(A). This value is used as a screening test to identify potential for sleep disturbance.

Further guidance is provided in the RNP which concludes, based on the research to date, that:

- maximum internal noise levels below 50-55 dB(A) are unlikely to cause awakening reactions
- one or two events per night, with maximum internal noise levels of 65-70 dB(A), are not likely to affect health and well-being significantly.

Horn noise and noise from brake air release has been modelled as separate activities for assessment against the sleep disturbance criterion (due to their short duration and higher maximum noise levels). L_{Amax} noise impacts have been predicted at the most exposed sensitive receivers in each NCA. This has been achieved by modelling the horn and brake air release noise sources at a number of possible locations within each of the four sidings, and taking the maximum predicted noise level for each receiver.

Table 6.4 shows the predicted L_{Amax} noise levels in each of the NCA around the stabling facility for horn noise and brake air release noise. The model results indicate that significant exceedances of the sleep disturbance indicator levels are predicted at the most affected residential receivers, particularly from the use of train horns within the stabling facility. For this reason, it is strongly recommended that an alternative warning system be implemented during the night-time for use within the stabling facility, if required. Further noise mitigation measures are discussed in Section 6.1.7.

L_{Amax} levels from brake air release noise is also predicted to exceed the sleep disturbance indicator levels at the most exposed residential receivers in NCA-1, NCA-2 and NCA-9, with a maximum exceedance of up to 20 dB with a train on the nearest siding during the night time period. With trains on sidings located further away, impacts would decrease. Based on the current daily train schedule, there would be up to 15 movements within the stabling facility per night, each with the potential for brake air release noise. The above factors indicate there is potential for adverse sleep disturbance impacts at the nearest identified receivers from brake air release noise, particularly those within NCA-2 on Ivy Street. It is therefore recommended that as far as practicable, trains within the stabling facility between the night-time hours of 10pm to 7am use sidings 1, 2 or 3 and a train is stabled in Siding 4 to shield noise from these trains at sensitive receivers on Fern Street and Ivy Street. Further noise mitigation measures are discussed in Section 6.1.7.

Table 6.4 Predicted L_{Amax} noise levels

Noise Source L_{Amax}	NCA	Most affected residential receiver(s)	L_{Amax} dB(A) Sleep disturbance indicator	Predicted
Brake air release	NCA-1	R4	52	63
	NCA-2	R5, R6, R7	57	77
	NCA-9	R33, R34, R35	55	56
Horn	NCA-1	R4	52	74
	NCA-2	R5, R6, R7	57	98
	NCA-9	R33, R34, R35	55	76

6.1.6 Interim operational stabling scenario

During construction, trains will be stabled overnight on the existing tracks between Hamilton Station and approximately 250 metres east of the Maitland Road overpass. Trains will be stabled in this way until the proposed stabling facility is constructed and operational (approximately 2 years). This situation poses potential for noise impacts from idling trains that have not been assessed under the operational noise impact assessment.

Similarly to operation of the stabling facility, noise from trains stabling in the interim scenario should also be assessed against the INP and sleep disturbance criteria.

Operational noise impacts

To represent a worst-case scenario for this interim stabling scenario, a series of idling trains has been modelled on both tracks from the eastern end of Hamilton Station platform to approximately 250 metres east of Maitland Road overpass. This scenario represents all possible arrangements of idling trains along this section of track. As discussed previously, idling train noise is dominated by the motor-alternator, located under the floor of carriage one and four of a four-carriage train.

During the interim stabling scenario, residential receivers within NCA-2, NCA-8 and NCA-9 have the greatest potential for exposure to stabled train noise. Predicted worst-case interim stabling noise levels are shown in Table 6.5. Predicted results indicate that compliance with the day; evening and night-time INP criteria would be achieved in NCA-2 and NCA-8. Under the worst-case modelled scenario, residential receivers within NCA-9 are predicted to exceed the INP criteria during evening and night-time periods by up to 10 dB(A).

Table 6.5 Predicted interim stabling noise levels – $L_{eq\ (15\ minute)}$ dB(A)

NCA	Most affected residential receiver(s)	Residential criterion L_{eq} dB(A)			Highest predicted L_{eq} dB(A)	Highest exceedance dB(A)		
		Day	Evenin g	Nigh t		Day	Evenin g	Night
NCA-2	R5, R6, R7	57	51	47	45	-	-	-
NCA-8	R24	55	51	49	49	-	-	-
NCA-9	R25-R32	54	49	45	**55**	1	6	10

Sleep disturbance

Noise from trains operating horns and brake air release systems also has the potential to generate sleep disturbance impacts during the night-time. As a worst-case scenario, horn noise and noise from brake air releases have been modelled along the sections of stabling areas. Table 6.6 presents predicted results for the L_{Amax} assessment. Predicted results indicate that the sleep disturbance indicator levels are met for brake air release noise, however are exceeded for horn noise at the most affected receivers within NCA-2, NCA-8 and NCA-9.

Table 6.6 Predicted interim stabling L_{Amax} noise levels

Noise Source	NCA	Most affected residential receiver(s)	L_{Amax} dB(A)	
			Sleep disturbance indicator	Predicted
Brake air release	NCA-2	R5, R6, R7	52	47
	NCA-8	R24	57	52
	NCA-9	R25 – R32	55	53
Horn	NCA-2	R5, R6, R7	52	**63**
	NCA-8	R24	57	**77**
	NCA-9	R25-R32	55	**79**

6.1.7 Best practice noise management measures for stabling yards

Sydney Trains NVRF states that where noise levels from a stabling facility are predicted to exceed the recommended goals, feasible and reasonable noise management and mitigation options should be applied to reduce the noise levels as far as practicable.

Sydney Trains NVRF provides best practice options for managing noise emissions from stabling facilities in Section 4.3 of the document. It identifies the following standard practice noise management options:

- ensure that horns are used only to the extent required to meet safety and engineering procedures and criteria (i.e. no excessive use of horns)
- educating employees to bear in mind neighbouring properties (keep voices down, stand away from receivers to talk).

Best practice noise management and mitigation measures, as outlined in Section 4.3.2 of Sydney Trains NVRF include:

- the use of alternative horn test and warning procedures or removing the requirement to test the horn altogether
- powering down trains whenever possible, rather than idling
- the use of ‘barrier trains’ to shield noise from other trains within the stabling facility
- scheduling noisy activities to less sensitive time, such as day or evening times
- consultation with the affected residents.

In addition to these measures, and specifically to reduce predicted horn noise impacts, Transport for NSW will liaise with NSW TrainLink to revise their horn testing procedure such that horns will be tested east of Maitland Road, west of Railway Street, away from sensitive receivers.

The INP highlights three main strategies for noise control, being:

- controlling noise at the source
- controlling the transmission of noise
- controlling noise at the receiver.

Noise control at the source is addressed above. Further options for noise control in the pathway and at the receiver are discussed below.

Controlling noise in the pathway

Once all strategies have been employed to control noise at the source, the next most effective approach is to control noise in the transmission path, between the source and the receiver.

Controlling noise in the transmission path is typically achieved through the use of a noise barrier. Barriers are more effective the closer they are to the noise source, or the receiver. The effectiveness of barrier performance is also determined by the materials used (absorptive or reflective, density). Noise barriers typically require a density of at least 15 kg/m^2 to be effective.

The use of noise barriers to control noise from the stabling facility has been incorporated into the noise model. As previously identified, the primary noise source from an idling train within the stabling facility is the motor-alternator, located under the floor of the train, at a height of approximately 0.5 metres above the rail.

For the purposes of demonstrating their likely effectiveness, a noise barrier of three metres in height has been modelled along the boundary fence, adjacent to Ivy Street and Fern Street to shield receivers in NCA-1 and NCA-2. A barrier of three metres in height has also been modelled along the southern boundary fence, adjacent to Hamilton Station, running parallel to the most southern existing platform.

The assumed noise barriers were found to have a small mitigating effect at the nearest residential receivers in NCA-1 (Fern Street) and NCA-9 (Eva Street), with a reduction in noise levels of less than 2 dB(A). This is primarily due to the distances between the noise source, barrier and receiver. A barrier closer to the dominant train noise sources would provide the most effective path attenuation. However, the location of the noise barrier would need to be considered in the context of stabling facility site activities and space available to the operating main line.

Due to the smaller separation distance, a noise barrier was found to be effective at reducing noise levels at residential receivers along Ivy Street in NCA-2. Reductions of 8-10 dB(A) at the most affected receiver were achieved. While this reduction is substantial, based on the predicted results shown in Table 6.3, exceedances of the adopted criteria are still likely at the most affected receivers. Therefore, other noise mitigation options or locations of noise barriers (closer to the source) would need to be investigated.

Controlling noise at the receiver

Another option for noise control is at the receiver. Noise control at the receiver may be in the form of negotiations (as identified in the Sydney Trains NVRF) and/or architectural treatment to protect the internal environment of the receiver. Architectural treatment typically consists of increased insulation, upgraded glazing on windows and acoustic seals around windows and doors. Architectural treatment aims to control the transmission of noise to internal parts of the residence. To allow for windows to be closed, air conditioning is typically required to be installed. As architectural treatment may be less effective in some building types (e.g. weatherboard homes), as a last resort, property acquisition may be required.

Based on the above strategies, it may be possible to reduce operational noise from the stabling facility to acceptable levels during the day and evening period, however it will be difficult to achieve compliance with the external night-time noise criteria.

Further investigation into suitable noise mitigation options would be undertaken as part of subsequent design stages in consultation with affected residences.

Interim stabling yard operations

Although this stabling scenario will be temporary, it may last for a period of up to 2 years during project construction. Therefore, the above mitigation measures would also be relevant to the interim situation, specifically:

- construction of temporary noise walls close to the stabling areas to minimise LAeq and LAmax noise levels at residential receivers within NCA-9
- limit the use of train horns during the night-time period, or, preferably, use alternative (non-audible) warning means, if required.

6.2 New station operational noise

Noise from operation of the public address (PA) system, air conditioning units and other mechanical plant from the new station is also assessed against the INP criteria.

The nearest residential receivers to the new station are located on Station Street. The nearest residence is located immediately adjacent to the station at approximately 20 metres, however most residences are located at least 50 metres from the station and platforms.

Prediction of operational noise from the PA system and mechanical plant is not practical at this stage given the limited design detail available around the design of the new station. Station noise should be considered in more detail at later design stages when specifics of these noise sources are better known.

PA systems can typically be designed to minimise noise impact at surrounding receivers through the use of measures such as speaker selection, orientation and placement. It is expected that with appropriate design and best practice management measures in place, noise from the PA system should not cause adverse noise impacts at nearby sensitive receivers. It is recommended that the operation of the PA system during the night-time (10 pm to 7 am) be minimised.

Noise from mechanical plant associated with the operation of the new station (such as air conditioning units) would also be managed through design measures, such as locating sources away from residential receivers.

Potential noise impacts from the new station would be assessed in more detail as part of subsequent design stages, when information such as speaker location and mechanical plant locations are known.

7. Operational traffic noise impacts

Operation of the proposal is expected to generate additional traffic on local road networks. Essentially, traffic (including light vehicles and busses) which currently access Newcastle Station, would access the new station following the proposal.

It is anticipated that the majority of vehicles accessing the new station will make use of Station Street, Railway Street and Albert Street. Throsby Street may also be used to access Hannell Street from Railway Street, or vice versa.

The majority of traffic generated by the proposal is expected to be light vehicles, consisting of taxis or private vehicles. There will also be a small number of coaches accessing the new station for transport of patrons to regional areas.

7.1 Existing traffic

Existing traffic noise on Albert Street was measured at logging location L4. Measured existing traffic noise levels are provided below in Table 7.1. With consideration to the RNP, Albert Street is considered as a sub-arterial road. Existing traffic noise on Albert Street currently exceeds the RNP criteria during both day and night time periods by up to 3 dB.

Observations made at logging location L5 indicated that existing noise in this area was primarily influenced by noise sources other than road traffic noise, such as rail noise, commercial noise and insects. Therefore, the measured road traffic noise indicators are not considered representative of actual road traffic noise levels on Station Street. To provide an estimate of existing levels of road traffic noise, the United Kingdom's Calculation of Road Traffic Noise (CoRTN) was used with CadnaA noise modelling software to predict traffic noise at residential receivers along Station Street. Existing traffic volumes were modelled as per those in Table 4.5.

With consideration to the RNP, Station Street is considered as a local road.

Table 7.1 Existing traffic noise levels, dB(A)

Location	Criteria		Existing traffic noise levels	
	Day (7 am – 10 pm)	Night (10 pm – 7 am)	Day $L_{Aeq(15hr)}$ (7 am – 10 pm)	Night $L_{Aeq(9hr)}$ (10 pm – 7 am)
Logger 4 – Albert Street	60 $L_{Aeq(15hr)}$	55 $L_{Aeq(9hr)}$	63 $L_{Aeq(15hr)}$	57 $L_{Aeq(9hr)}$
Station Street[1]	55 $L_{Aeq(1hr)}$	50 $L_{Aeq(1hr)}$	50 $L_{Aeq(1hr)}$	< 50 $L_{Aeq(1hr)}$[2]

1. Predictions include a facade correction for reflection of + 2.5 dB. Predictions based on a distance of 10 metres to the road.
2. While existing traffic volumes on Station Street during the night-time were not available, they are expected to be very low. Traffic noise estimate is very conservative.

7.2 Traffic generation

An estimate of traffic volumes generated by the proposal is provided in Table 7.2.

Table 7.2 Assumed additional operational traffic generation

Street	Operational Traffic (VPD)	
	Taxis	Private vehicles
Station Street	100	500
Railway Street, south of Throsby Street	100	500
Railway Street, north of Throsby Street	50	250
Throsby Street	50	250
Albert Street, east of Railway Street	30	150
Albert Street, west of Railway Street	20	100

7.3 Operational traffic noise impacts

The increase in road traffic noise due to the additional traffic generated by the operation of the proposal was calculated using the same equation as detailed in Section 4.3.

The predicted increase in road traffic noise level is provided in Table 7.3.

Table 7.3 Predicted operational road traffic noise level increase

Roadway	Existing VPD (2014)	Generated light and heavy vehicle movements per day	% increase in total traffic	Predicted noise level increase (based on total traffic) dB(A)
Railway Street	3500	600	18	0.7
Station Street	500	600	120	3.4
Throsby Street	1000	300	30	1.1
Albert Street, east of Railway Street	4000	180	5	0.2
Albert Street, west of Railway Street	2500	120	5	0.2

The predicted growth in traffic due to proposal operations would increase the existing traffic noise by less than 2 dB(A) at Railway Street, Throsby Street and Albert Street. The RNP states that an increase of 2 dB(A) represents a level which is considered barely perceptible to the average person.

Due to a substantial increase in vehicle volumes on Station Street, road traffic noise levels are predicted to increase by more than 3 dB(A). While this could be noticeable, due to the relatively low total vehicle volumes on Station Street (even with the addition of the proposal), the RNP road traffic noise criteria is expected to continue to be met. It is recommended that further assessment be made at detailed design phase of the proposal, when more accurate traffic volumes and predictions are available.

8. Conclusion

Transport for NSW has engaged GHD to prepare a noise and vibration assessment as part of the Review of Environmental Factors for the proposed Wickham Transport Interchange Project. This assessment has led to the following conclusions, which are subject to the limitations outlined in Section 1.3.

Construction works during standard construction hours have the potential to exceed the construction noise management levels at the surrounding residential receivers. Standard noise mitigation measures have been recommended for implementation which will reduce impacts at surrounding residential receivers. However, it is unlikely that implementation of the standard noise mitigation measures would reduce noise levels to below the construction noise criteria under all circumstances.

Out of hours works is likely to cause exceedances at nearby sensitive receivers. It is recommended that out of hours work be considered and assessed in more detail when more information about specific activities during out of hours work are known.

Estimates indicate that construction traffic should generally have minimal impacts to the surrounding road networks, in particular to busy roads such as Maitland Road, Hannell Street/ Stewart Avenue and Albert Street.

Peak hour construction traffic accessing the site via Station Street has the potential to increase existing traffic noise by more than 3 dB. It is therefore recommended that, as far as practicable, construction traffic movements along Station Street are scheduled during the standard daytime hours.

Construction traffic on local roads should be managed in a traffic management plan which would be prepared by TfNSW detailing specific routes that local and construction traffic would follow throughout the construction phase.

Based on the safe working distances, when high vibration generating activities occur within 100 metres of adjacent residences it is recommended that the potentially impacted residents be informed of the nature of the works, duration and project contact details.

Based on the safe working distances, having regard to the potential for cosmetic building damage, the expected magnitude of ground vibrations should not be sufficient to cause damage if the equipment operates at distances greater than 25 metres from structures.

There is the potential for vibration generating construction activities within 35 metres of heritage structures (Hamilton Station) to exceed the cosmetic criteria. A number of management and mitigation options are discussed in this report.

Operational rail vibration impacts have been predicted and assessed against the vibration criteria outlined in the AVTG at sensitive receivers potentially impacted by noise from the proposal. Vibration estimates indicate that the vibration criteria will be achieved at 5 metres from the railway. All receivers and buildings that are further than 5 metres from the railway are accordingly unlikely to receive cosmetic damage or human comfort impacts from the proposal.

Operational rail noise impacts have been predicted and assessed against the rail trigger noise levels outlined in the RING at sensitive receivers potentially impacted by noise from the proposal. Operational rail noise levels are not predicted to exceed the trigger levels, accordingly no mitigation measures are required.

Groundborne noise is generally only considered a potential issue where levels are higher than the airborne noise levels such as for underground railways. As there are no underground sections of rail associated with the proposal, groundborne noise due to rail operations is not considered likely.

While trains are idling within the stabling facility, with auxiliary systems operating, there is potential for the industrial noise criteria to be exceeded at the most affected residential receivers, particularly during the night-time period. Operations of train horns and brake air release systems also have the potential to generate sleep disturbance impacts at the most affected residential receivers. Further consideration of reasonable and feasible mitigation measures (e.g. noise walls, architectural treatment or as a last resort, property acquisition) would be undertaken during subsequent design stages to manage predicted exceedances of noise goals.

Interim stabling operations during construction of the proposal have been considered. Similar to the predicted impacts for operation of the stabling facility, noise impacts have been predicted at the nearest sensitive receivers. Noise impacts during this interim stabling scenario will be temporary. Operation of train horns and brake air release systems also have the potential to generate sleep disturbance impacts at the most affected residential receivers during this temporary stabling scenario. A number of management and mitigation options are discussed in this report.

9. References

Australian Standards 2002, AS 2377 – 2002, Acoustics – Methods for the measurement of railbound vehicle noise

Australian Standards 2010, AS 2436 - 2010, Guide to noise and vibration control on construction, demolition and maintenance sites

Australian Standards 1997, AS 1055 – 1997, Description and Measurement of Environmental Noise

British Standards 2009, BS 5228.2 – 2009, Code of Practice Part 2 Vibration for noise and vibration on construction and open sites – Part 2: Vibration

British Standards 1993, BS-7385-2: 1993, Evaluation and measurement for vibration in buildings

British Standards 1992, BS 6472 – 1992, Guide to Evaluation of Human Exposure to Vibration in Buildings (1 Hz to 80 Hz)

Bureau of Meteorology's Nobbys Head Automatic Weather Station data

Department of Environment and Conservation 2006, Assessing Vibration; A Technical Guideline, Sydney

Department of Environment and Climate Change 2009, Interim Construction Noise Guideline, Sydney

Department of Environment, Climate Change and Water 2011, Road Noise Policy, Sydney

Environmental Protection Authority 2000, Industrial Noise Policy, Sydney

Environment Protection Authority 2013, Rail Infrastructure Noise Guideline, Sydney

GHD 2014, Wickham Transport Interchange Project, Traffic and Transport Assessment

Roads and Traffic Authority 2001, Environmental Noise Management Manual, Sydney

Sydney Trains 2013, Environmental Management System Guide Noise and Vibration Rail Facilities

Transport Construction Authority 2010 Construction Noise Strategy (Rail Projects)

Tickell, C.E. et al 2004 Rail Wheel Squeal – Some Causes and a case study of freight car wheel squeal reduction

Nordic Council of Ministers 1996, TemaNord 1996:524, Railway Traffic Noise – Nordic Prediction Method, Copenhagen

Appendices

Appendix A – Noise catchment areas

G:\22\17295\GIS\Maps\Deliverables\REF\Noise\2217295_N001_NoiseReceivers_DDP_A.mxd

Data source: TfNSW, Aerial imagery, 2014; LPI, DTDB, 2012

G:\22\17295\GIS\Maps\Deliverables\REF\Noise\2217295_N001_NoiseReceivers_DDP_A.mxd

Data source: TfNSW, Aerial imagery, 2014; LPI, DTDB, 2012

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Data source: TfNSW, Aerial imagery, 2014; LPI, DTDB, 2012

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Data source: TfNSW, Aerial imagery, 2014; LPI, DTDB, 2012

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Data source: TfNSW, Aerial imagery, 2014; LPI, DTDB, 2012

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Data source: TfNSW, Aerial imagery, 2014; LPI, DTDB, 2012

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Data source: TfNSW, Aerial imagery, 2014; LPI, DTDB, 2012

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Data source: TfNSW, Aerial imagery, 2014; LPI, DTDB, 2012

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Data source: TfNSW, Aerial imagery, 2014; LPI, DTDB, 2012

Appendix B – Noise monitoring results and charts

Table B-1 Noise monitoring results – Location L1, db(A)

Date	Background L_{90} noise levels			Ambient noise levels L_{eq}			Road traffic noise descriptors		
	Day (7 am to 6 pm)	Evening (6 pm to 10 pm)	Night (10 pm to 7 am)	Day (7 am to 6 pm)	Evening (6 pm to 10 pm)	Night (10 pm to 7 am)	$L_{eq\ (15hr)}$ (7 am to 10 pm)	$L_{eq\ (9hr)}$ (10 pm to 7 am)	$L_{10(18hr)}$ (6 am to 12 am)
Friday 16/5/14	47	45	40	57	57	55	57	55	59
Saturday 17/5/14	46	43	39	60	56	54	60	54	61
Sunday 18/5/14	44	43	35	60	57	52	59	52	58
Monday 19/5/14	49	41	36	59	55	52	58	52	59
Tuesday 20/5/14	48	43	37	58	55	53	57	53	59
Wednesday 21/5/14	49	46	37	58	59	52	59	52	59
Thursday 22/5/14	48	46	38	58	57	53	58	53	60
Friday 23/5/14	49	-	-	59	-	-	59	-	61
RBL	**48**	**43**	**37**	**-**	**-**	**-**	**-**	**-**	**-**
$L_{eq,\ (day/evening/night)}$	**-**	**-**	**-**	**59**	**57**	**53**	**-**	**-**	
Road traffic noise descriptors (weekdays)	**-**	**-**	**-**	**-**	**-**	**-**	**58**	**53**	**59**

Table B-2 Noise monitoring results – Location L2, dB(A)

Date	Background L_{90} noise levels			Ambient noise levels L_{eq}			Road traffic noise descriptors		
	Day (7 am to 6 pm)	Evenin g (6 pm to 10 pm)	Night (10 pm to 7 am)	Day (7 am to 6 pm)	Evenin g (6 pm to 10 pm)	Night (10 pm to 7 am)	$L_{eq\ (15hr)}$ (7 am to 10 pm)	$L_{eq\ (9hr)}$ (10 pm to 7 am)	$L_{10(18hr)}$ (6 am to 12 am)
Thursday 15/5/14	46	48	43	57	57	52	57	52	58
Friday 16/5/14	46	48	44	57	56	55	57	55	59
Saturday 17/5/14	46	46	43	61	55	54	60	54	61
Sunday 18/5/14	46	44	37	60	54	51	58	51	58
Monday 19/5/14	49	43	39	57	54	51	56	51	58
Tuesday 20/5/14	48	45	38	58	55	53	57	53	58
Wednesday 21/5/14	47	46	42	59	59	51	59	51	59
Thursday 22/5/14	47	47	42	57	56	52	57	52	59
Friday 23/5/14	50	-	-	58	-	-	58	-	60
RBL	**47**	**46**	**42**	**-**	**-**	**-**	**-**	**-**	**-**
$L_{eq,\ (day/evening/night)}$	**-**	**-**	**-**	**58**	**56**	**53**	**-**	**-**	
Road traffic noise descriptors (weekdays)	**-**	**-**	**-**	**-**	**-**	**-**	**57**	**53**	**59**

Table B-3 Noise monitoring results – Location L3, dB(A)

Date	Background L_{90} noise levels			Ambient noise levels L_{eq}			Road traffic noise descriptors		
	Day (7 am to 6 pm)	Evening (6 pm to 10 pm)	Night (10 pm to 7 am)	Day (7 am to 6 pm)	Evening (6 pm to 10 pm)	Night (10 pm to 7 am)	$L_{eq\ (15hr)}$ (7 am to 10 pm)	$L_{eq\ (9hr)}$ (10 pm to 7 am)	$L_{10(18hr)}$ (6 am to 12 am)
Monday 12/5/ 14			33			58	-	58	-
Tuesday 13/5/14	45	47	44	61	59	57	61	57	57
Wednesday 14/5/14	45	46	45	59	61	57	59	57	55
Thursday 15/5/14	45	47	43	64	61	57	63	57	54
Friday 16/5/14	45	48	45	58	60	69	59	69	54
Saturday 17/5/14	46	46	44	57	49	49	56	49	55
Sunday 18/5/14	46	44	39	54	49	55	52	55	53
Monday 19/5/14	48	-	-	57	-	-	57	-	55
RBL	**45**	**46**	**44**	-	-	-	-	-	-
$L_{eq,\ (day/evening/night)}$	-	-	-	**60**	**59**	**62**	-	-	
Road traffic noise descriptors (weekdays)	-	-	-	-	-	-	**60**	**63**	**55**

Table B-4 Noise monitoring results – Location L4 dB(A)

Date	Background L_{90} noise levels			Ambient noise levels L_{eq}			Road traffic noise descriptors		
	Day (7 am to 6 pm)	Evening (6 pm to 10 pm)	Night (10 pm to 7 am)	Day (7 am to 6 pm)	Evening (6 pm to 10 pm)	Night (10 pm to 7 am)	$L_{eq\ (15hr)}$ (7 am to 10 pm)	$L_{eq\ (9hr)}$ (10 pm to 7 am)	$L_{10(18hr)}$ (6 am to 12 am)
Thursday 15/5/14	43	40	37	64	60	56	63	56	65
Friday 16/5/14	42	40	38	64	60	56	63	56	67
Saturday 17/5/14	43	42	36	62	59	55	62	55	65
Sunday 18/5/14	47	38	35	64	60	57	63	57	62
Monday 19/5/14	45	38	35	64	59	57	63	57	65
Tuesday 20/5/14	46	40	36	65	59	57	63	57	65
Wednesday 21/5/14	45	41	36	64	61	56	63	56	63
Thursday 22/5/14	43	40	36	64	60	57	63	57	66
Friday 23/5/14	47	-	-	65	-	-	65	-	69
RBL	**45**	**40**	**36**	-	-	-	-	-	-
$L_{eq,\ (day/evening/night)}$	-	-	-	**64**	**60**	**56**	-	-	
Road traffic noise descriptors (weekdays)	-	-	-	-	-	-	**63**	**57**	**65**

Table B-5 Noise monitoring results – location L5 dB(A)

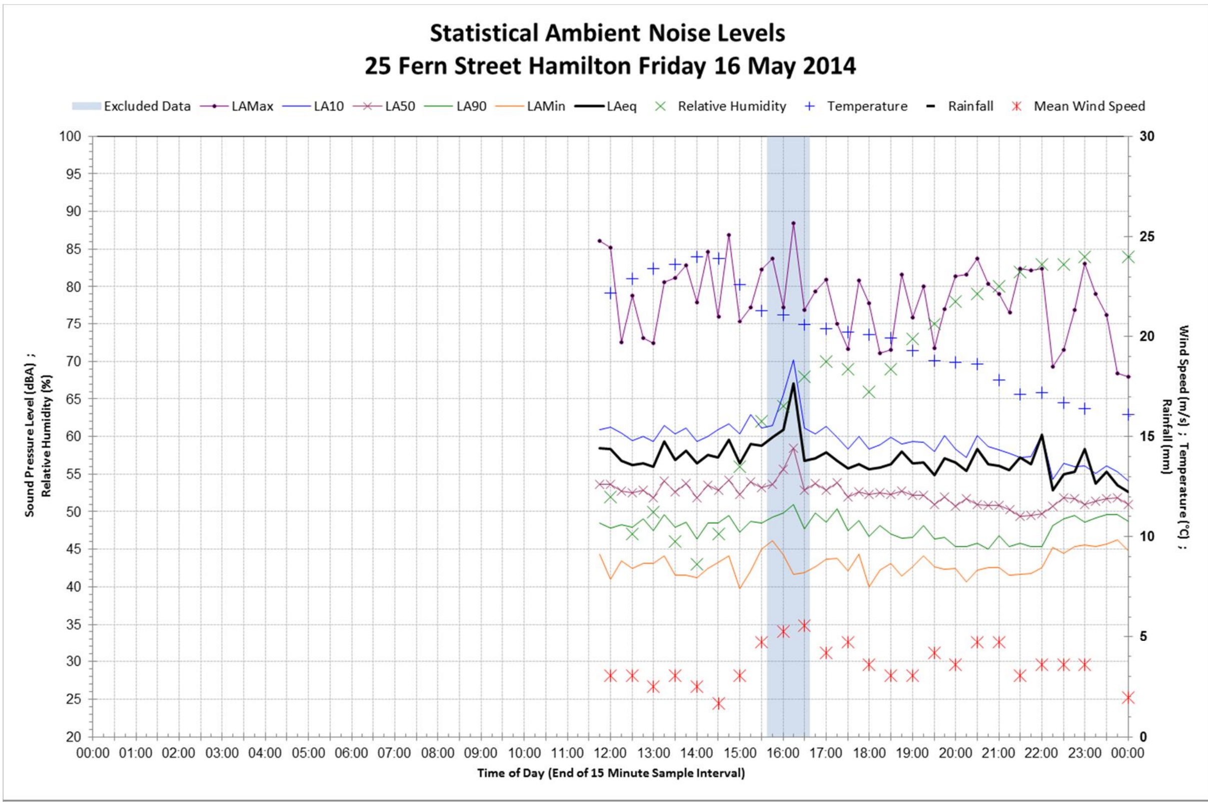
Date	Background L_{90} noise levels			Ambient noise levels L_{eq}			Road traffic noise descriptors		
	Day (7 am to 6 pm)	Evening (6 pm to 10 pm)	Night (10 pm to 7 am)	Day (7 am to 6 pm)	Evening (6 pm to 10 pm)	Night (10 pm to 7 am)	L_{eq} (15hr) (7 am to 10 pm)	$L_{eq\ (9hr)}$ (10 pm to 7 am)	$L_{10(18hr)}$ (6 am to 12 am)
Thursday 15/5/14	40	41	38	59	56	53	58	53	52
Friday 16/5/14	40	41	39	59	58	48	59	48	53
Saturday 17/5/14	39	39	38	62	44	44	60	44	49
Sunday 18/5/14	39	39	35	53	55	54	54	54	47
Monday 19/5/14	43	38	36	59	63	55	61	55	52
Tuesday 20/5/14	42	40	35	56	57	63	56	63	52
Wednesday 21/5/14	42	40	38	60	61	51	60	51	53
Thursday 22/5/14	40	42	38	59	60	56	59	56	53
Friday 23/5/14	44	-	-	62	-	-	62	-	57
RBL	**40**	**40**	**38**	-	-	-	-	-	-
$L_{eq,\ (day/evening/night)}$	-	-	-	**59**	**59**	**56**	-	-	-
Road traffic noise descriptors (weekdays)	-	-	-	-	-	-	**60**	**57**	**53**

Table B-6 Noise monitoring results – location L6 dB(A)

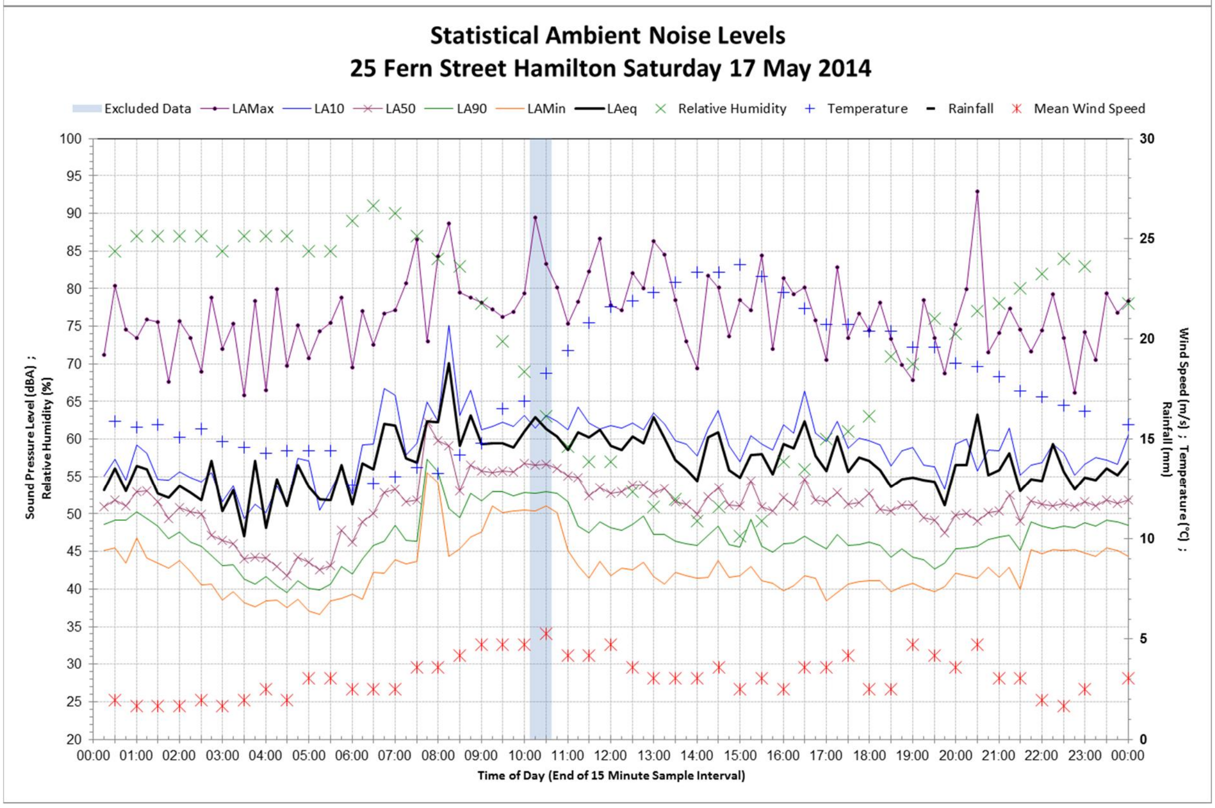
Date	**Background L_{90} noise levels**			**Ambient noise levels L_{eq}**			**Road traffic noise descriptors**		
	Day (7 am to 6 pm)	**Evening (6 pm to 10 pm)**	**Night (10 pm to 7 am)**	**Day (7 am to 6 pm)**	**Evening (6 pm to 10 pm)**	**Night (10 pm to 7 am)**	**L_{eq} (15hr) (7 am to 10 pm)**	**$L_{eq\ (9hr)}$ (10 pm to 7 am)**	**$L_{10(18hr)}$ (6 am to 12 am)**
Friday 16/5/14	56	53	47	65	63	58	64	58	64
Saturday 17/5/14	55	52	47	62	59	56	61	56	64
Sunday 18/5/14	55	49	43	62	58	60	60	60	62
Monday 19/5/14	57	50	45	65	65	62	65	62	65
Tuesday 20/5/14	57	50	43	65	63	61	64	61	64
Wednesday 21/5/14	56	52	46	65	63	61	65	61	65
Thursday 22/5/14	57	54	45	65	65	61	65	61	65
Friday 23/5/14	57	-	-	65	-	-	65	-	66
RBL	**56**	**52**	**45**	-	-	-	-	-	-
$L_{eq,\ (day/evening/night)}$	-	-	-	**64**	**63**	**60**	-	-	-
Road traffic noise descriptors (weekdays)	-	-	-	-	-	-	**65**	**61**	**65**

Table B-7 Noise monitoring results – location L7 dB(A)

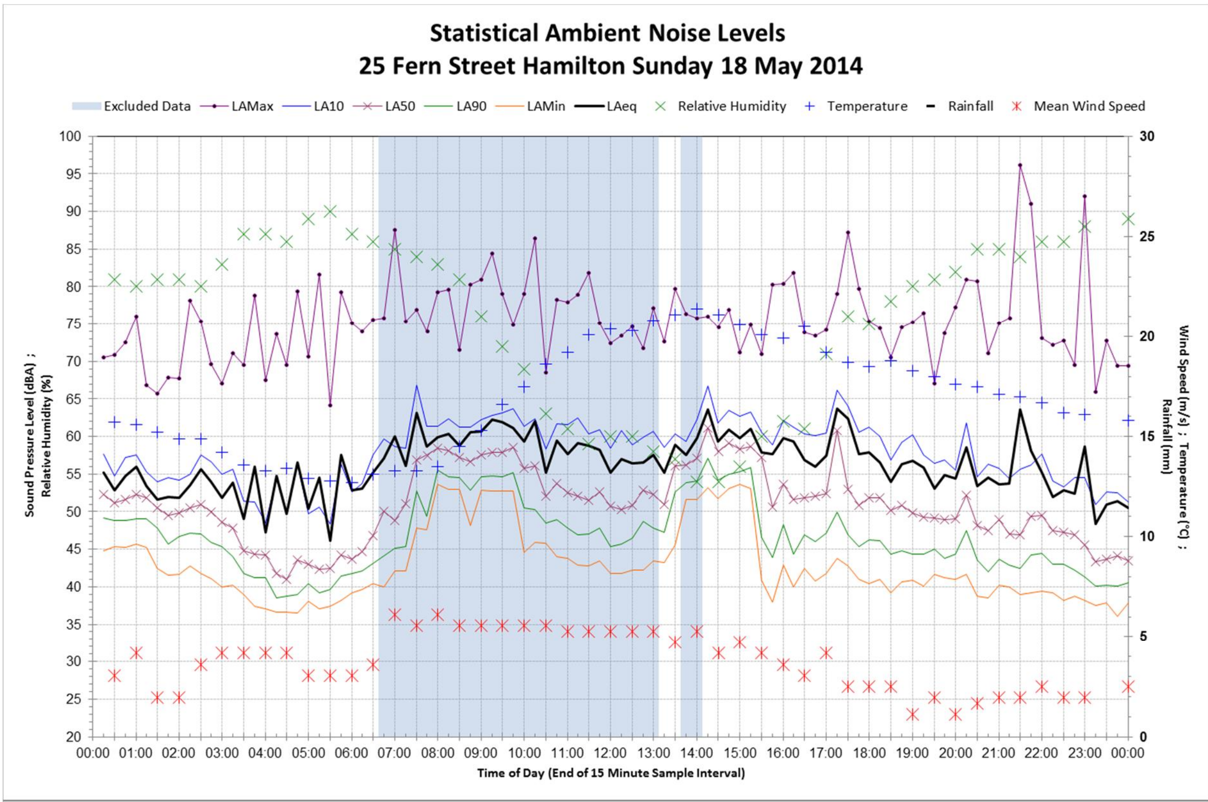
Date	Background L_{90} noise levels			Ambient noise levels L_{eq}			Road traffic noise descriptors		
	Day (7 am to 6 pm)	Evening (6 pm to 10 pm)	Night (10 pm to 7 am)	Day (7 am to 6 pm)	Evening (6 pm to 10 pm)	Night (10 pm to 7 am)	L_{eq} (15hr) (7 am to 10 pm)	$L_{eq\ (9hr)}$ (10 pm to 7 am)	$L_{10(18hr)}$ (6 am to 12 am)
Thursday 15/5/14	43	46	42	53	54	50	53	50	55
Friday 16/5/14	43	46	43	54	53	49	53	49	55
Saturday 17/5/14	44	44	43	54	51	49	53	49	53
Sunday 18/5/14	43	42	37	53	51	47	52	47	53
Monday 19/5/14	44	40	37	53	52	52	53	52	54
Tuesday 20/5/14	44	42	34	53	53	49	53	49	55
Wednesday 21/5/14	44	44	41	54	52	48	53	48	55
Thursday 22/5/14	43	45	39	53	53	48	53	48	54
Friday 23/5/14	45			54	-	-	54	-	55
RBL	**44**	**44**	**40**	**-**	**-**	**-**	**-**	**-**	**-**
$L_{eq,\ (day/evening/night)}$	**-**	**-**	**-**	**53**	**52**	**49**	**-**	**-**	**-**
Road traffic noise descriptors (weekdays)	**-**	**-**	**-**	**-**	**-**	**-**	**53**	**49**	**55**

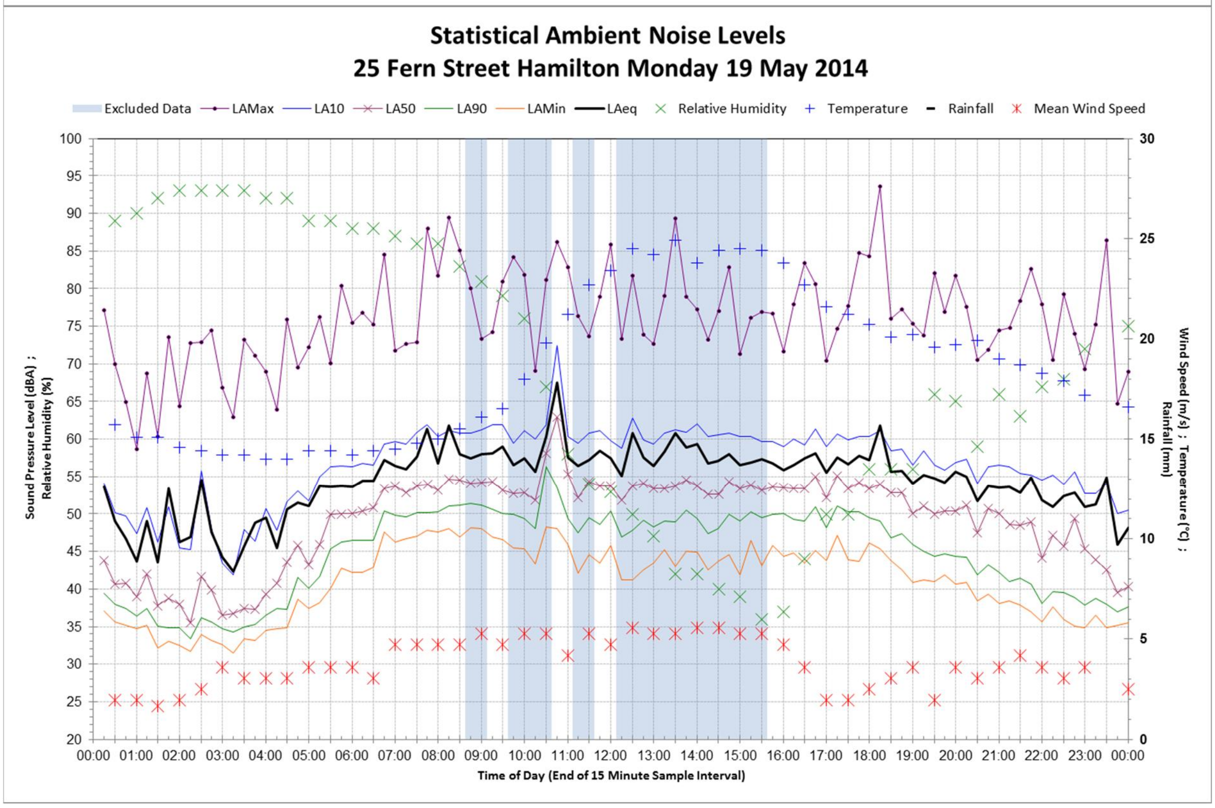


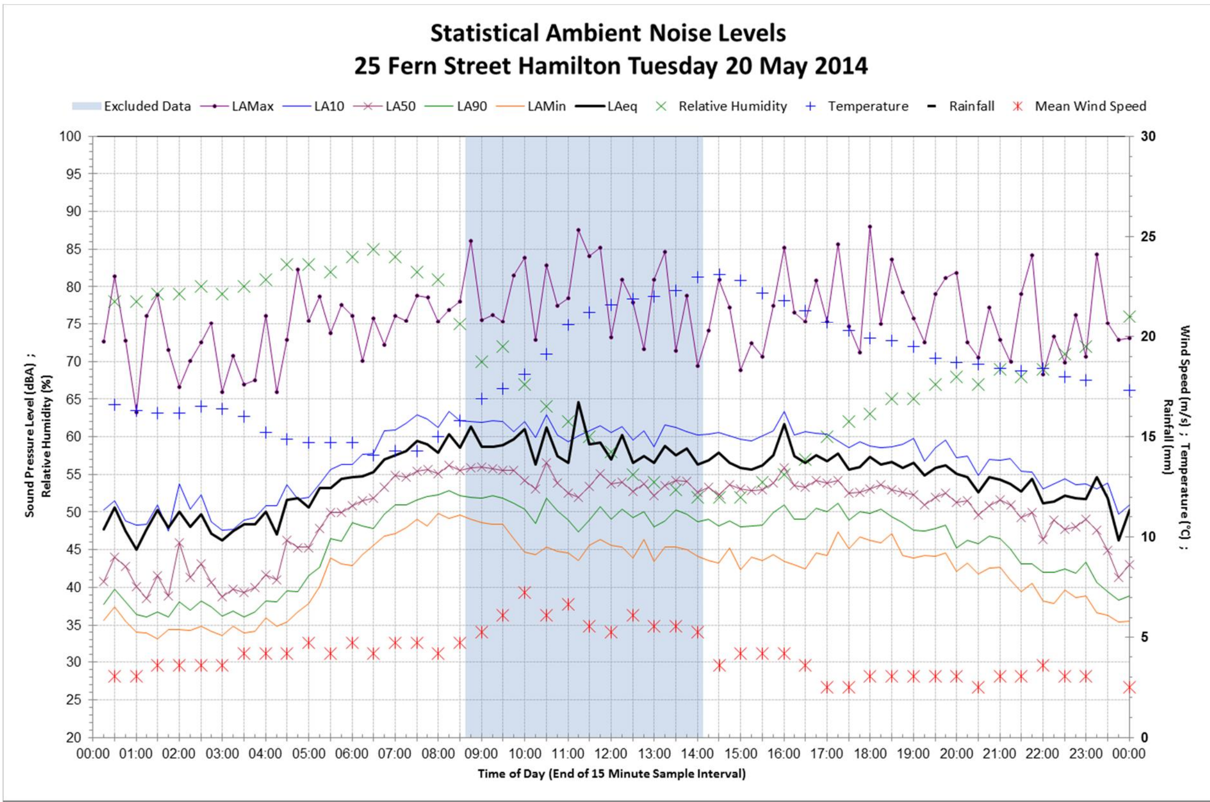
Statistical Ambient Noise Levels
25 Fern Street Hamilton Friday 16 May 2014
Excluded Data
LAMax
LA10
LA50
LA90
LAMin
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

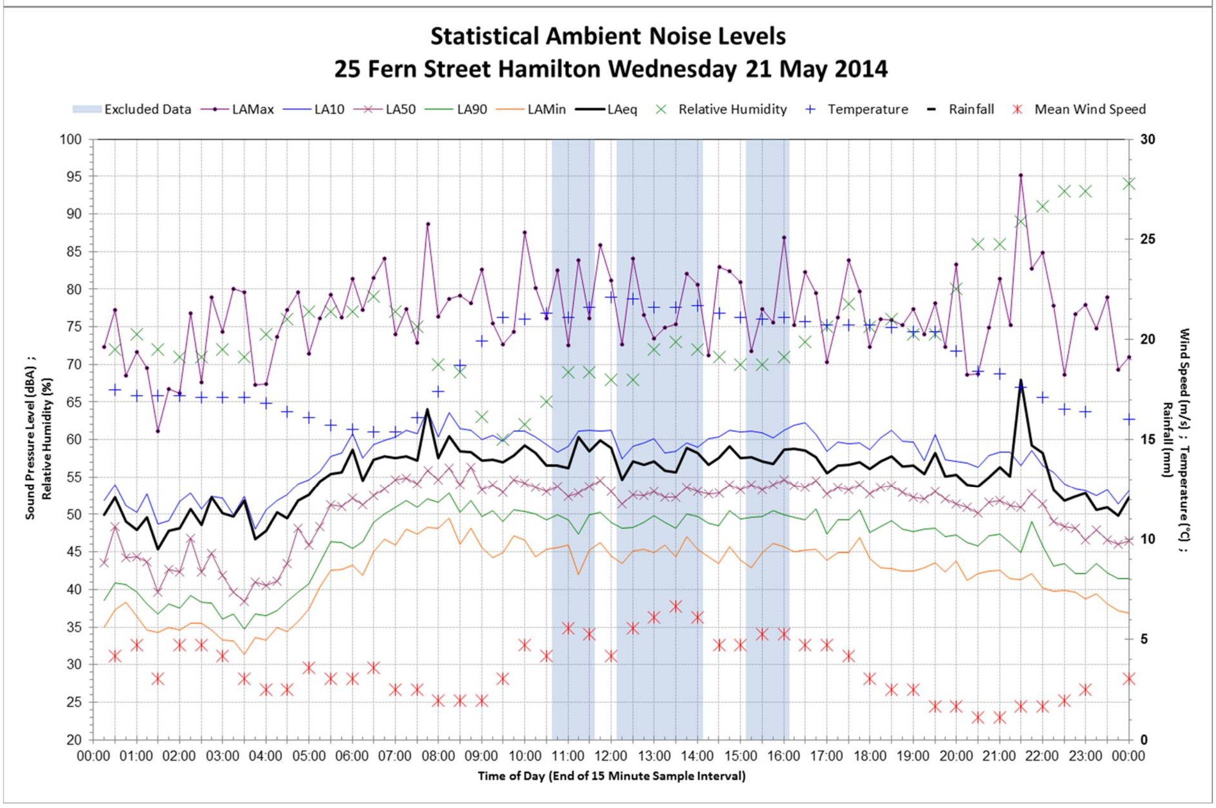


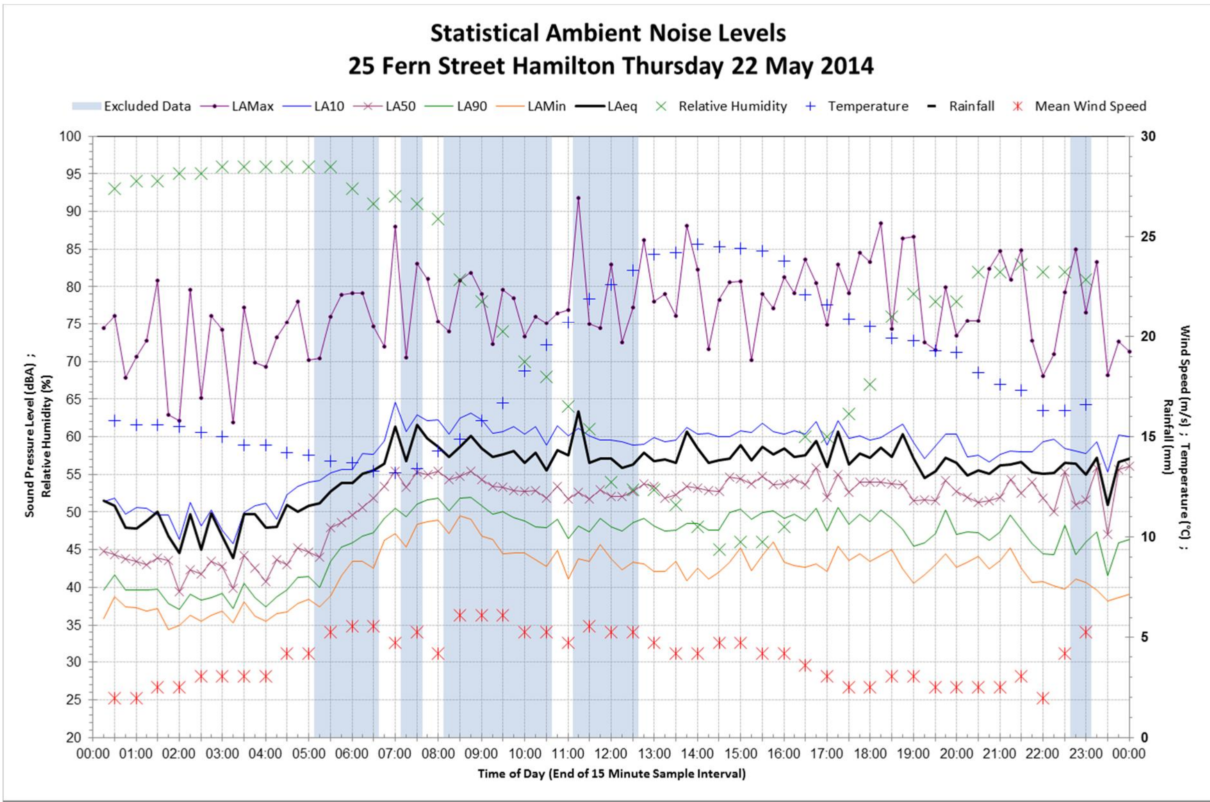
Statistical Ambient Noise Levels
25 Fern Street Hamilton Saturday 17 May 2014
Excluded Data
LAMax
LA10
LA50
LA90
LAMin
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
25 Fern Street Hamilton Sunday 18 May 2014
Excluded Data
LAMax
LA10
LA50
LA90
LAMin
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

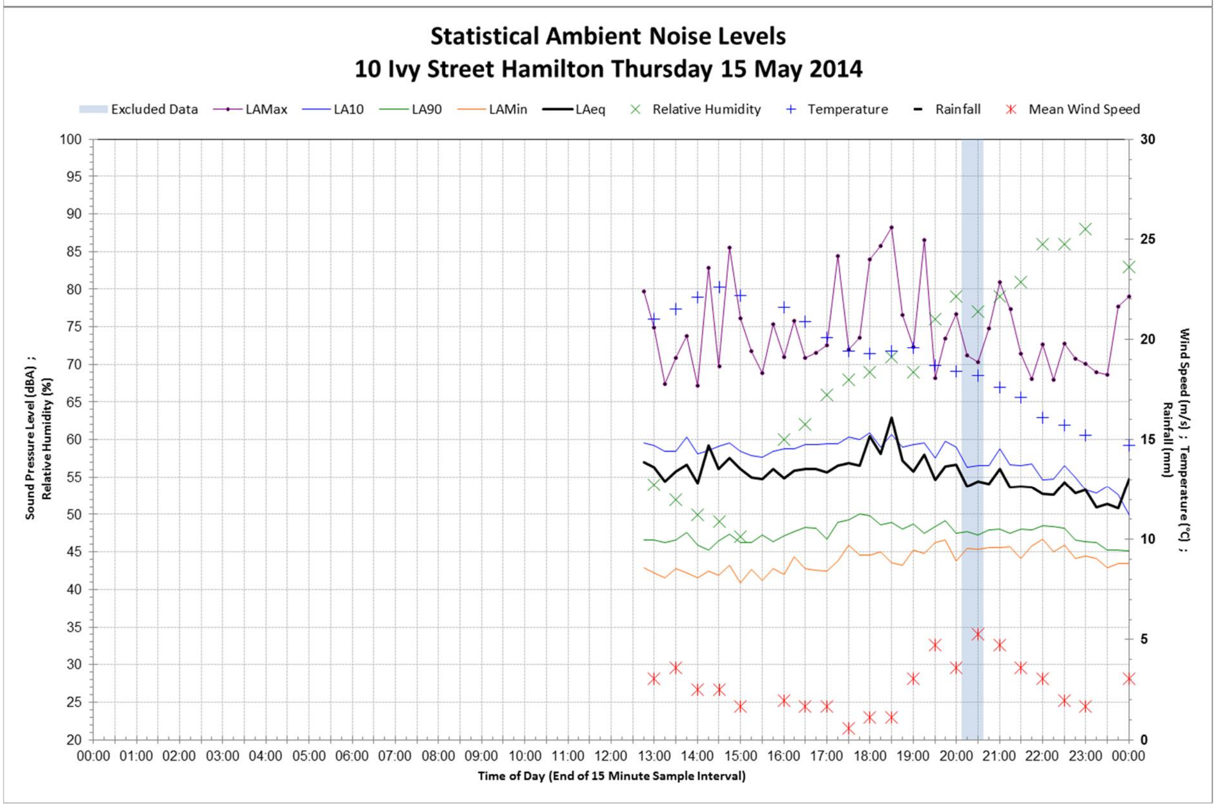

Statistical Ambient Noise Levels
25 Fern Street Hamilton Monday 19 May 2014
Excluded Data
LAMax
LA10
LA50
LA90
LAMin
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
25 Fern Street Hamilton Tuesday 20 May 2014
Excluded Data
LAMax
LA10
LA50
LA90
LAMin
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

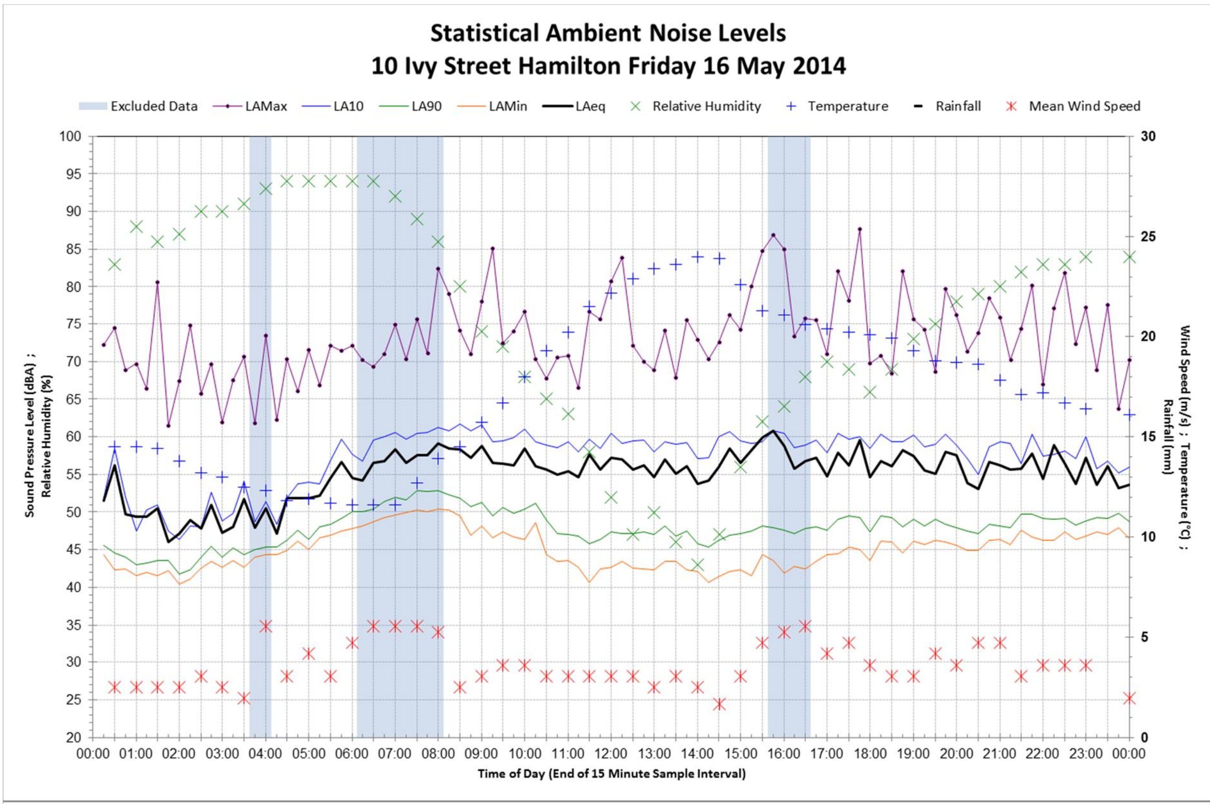

Statistical Ambient Noise Levels
25 Fern Street Hamilton Wednesday 21 May 2014
Excluded Data
LAMax
LA10
LA50
LA90
LAMin
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)



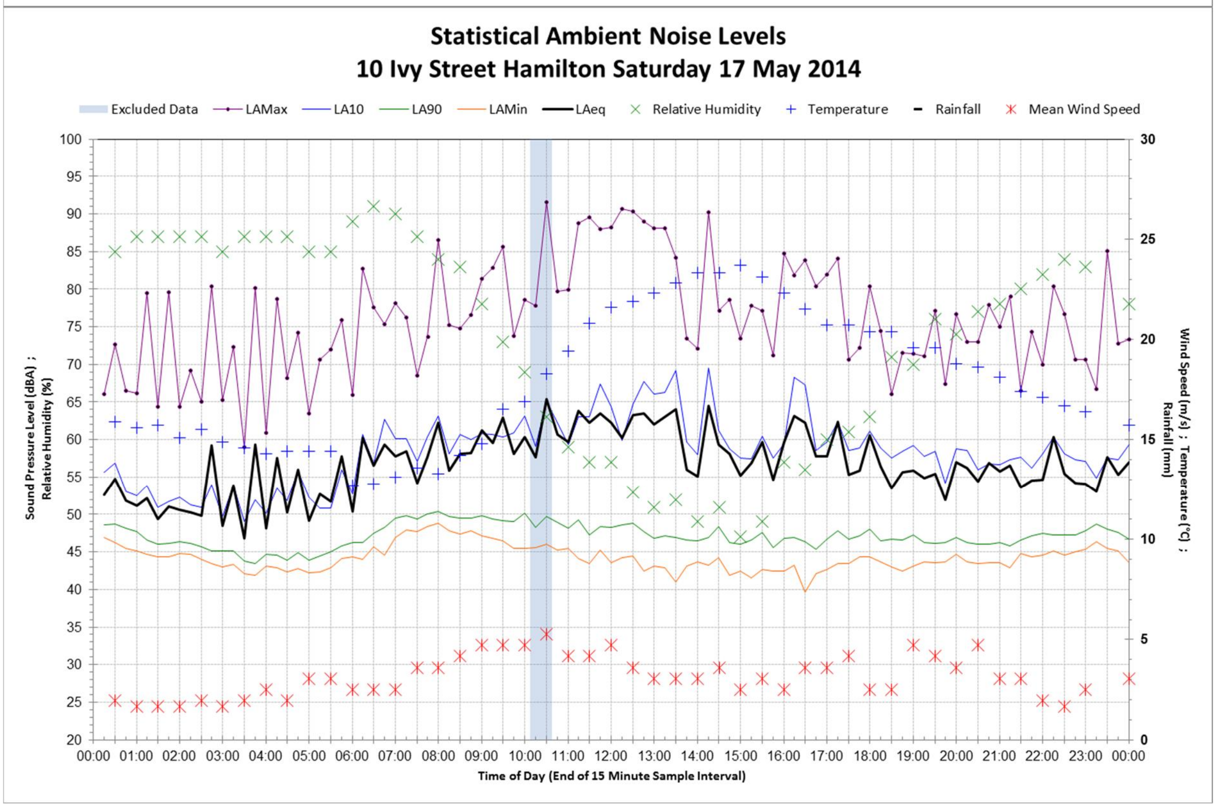
Statistical Ambient Noise Levels
25 Fern Street Hamilton Thursday 22 May 2014
Excluded Data
LAMax
LA10
LA50
LA90
LAMin
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)



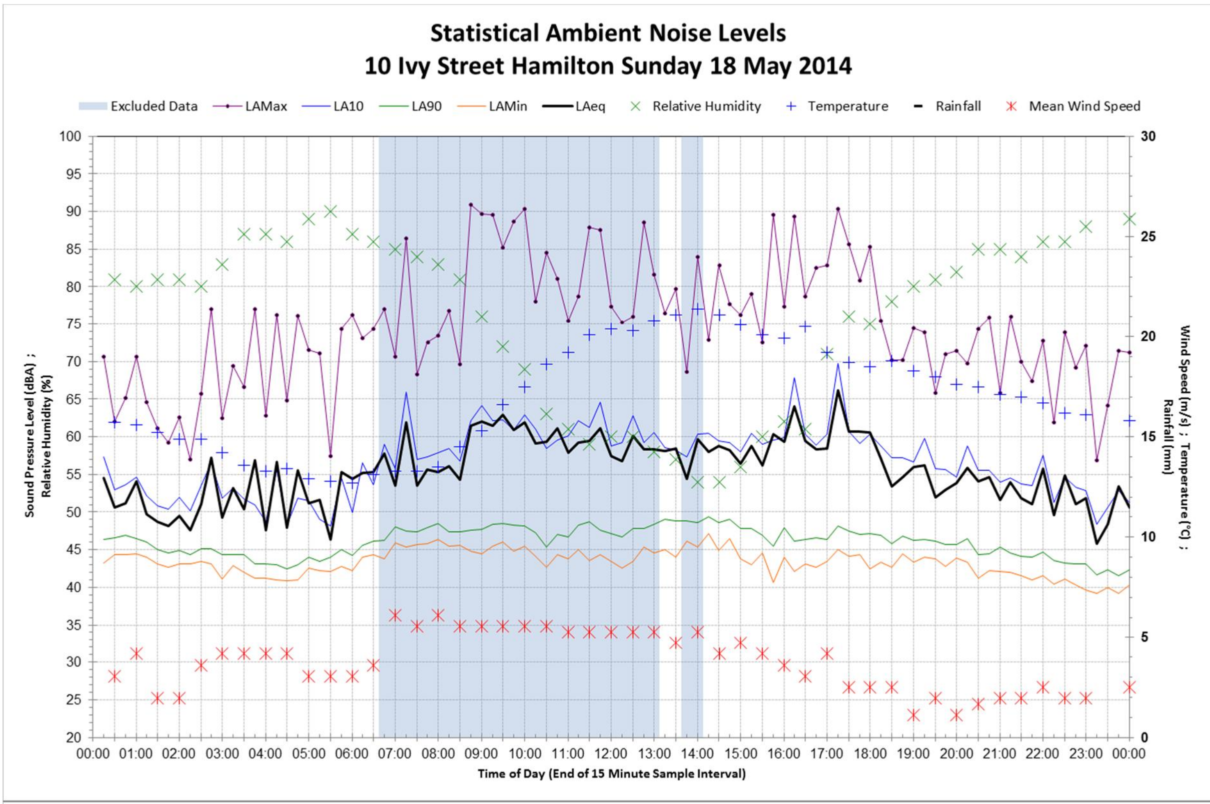
Statistical Ambient Noise Levels
10 Ivy Street Hamilton Thursday 15 May 2014
Excluded Data
LAMax
LA10
LA90
LAMin
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

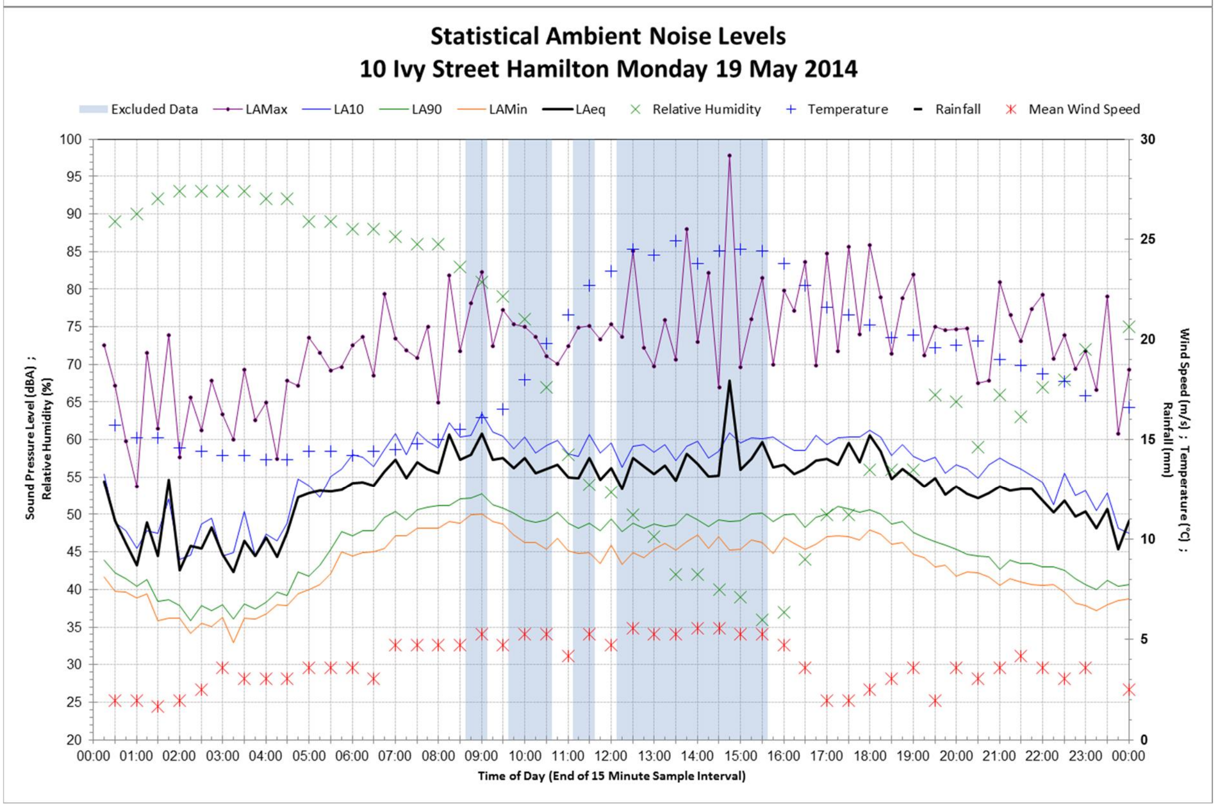


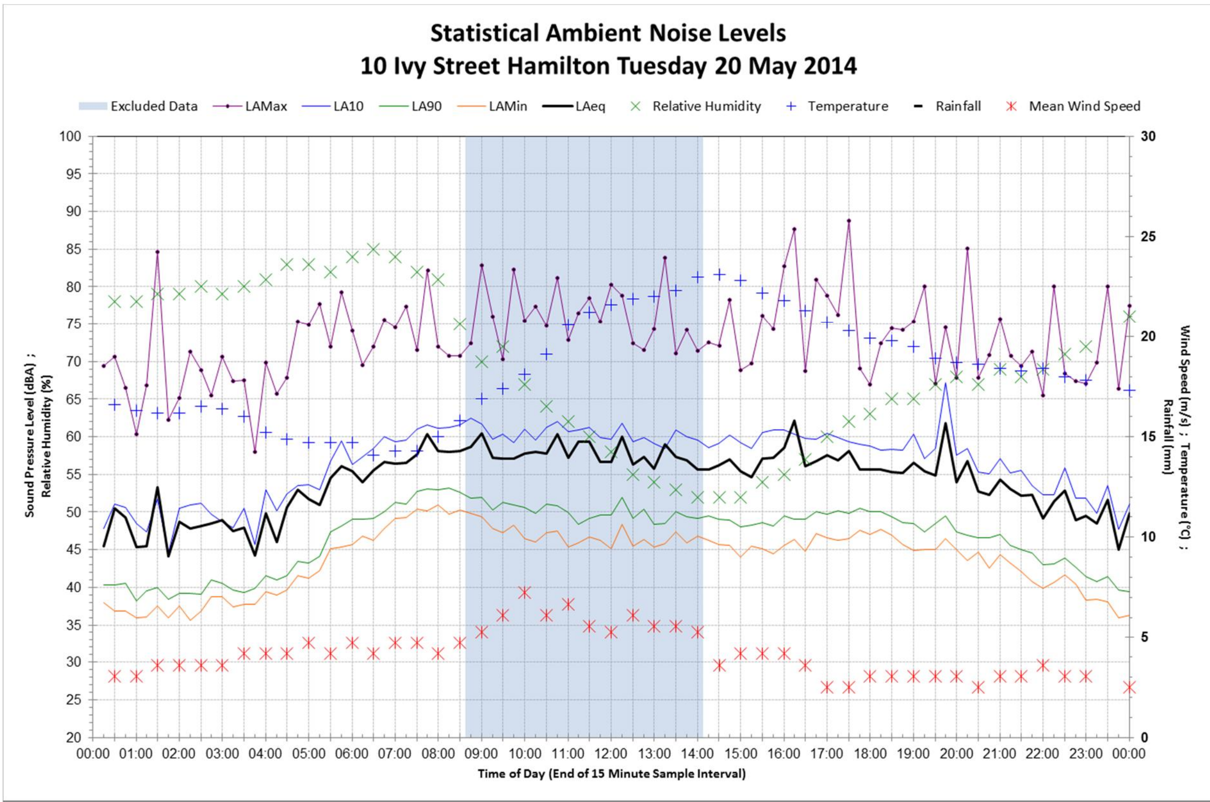
Statistical Ambient Noise Levels
10 Ivy Street Hamilton Friday 16 May 2014
Excluded Data
LAMax
LA10
LA90
LAMin
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

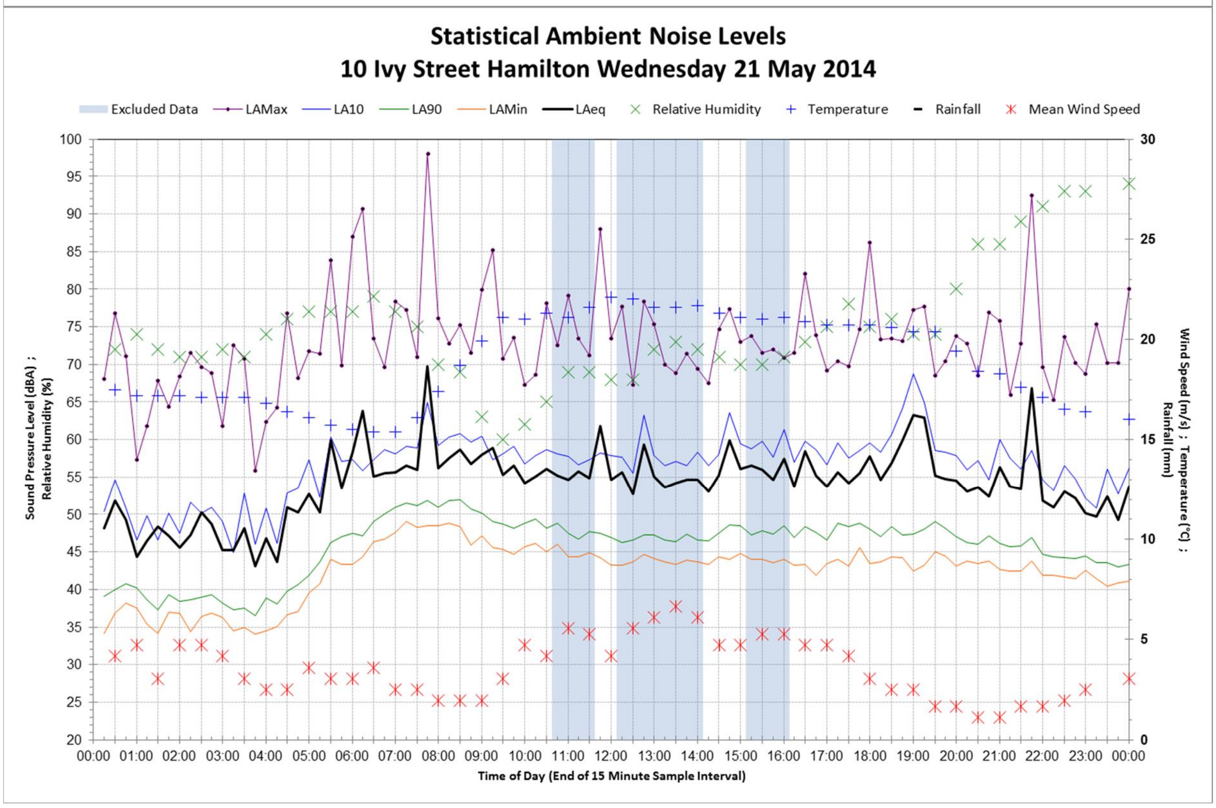


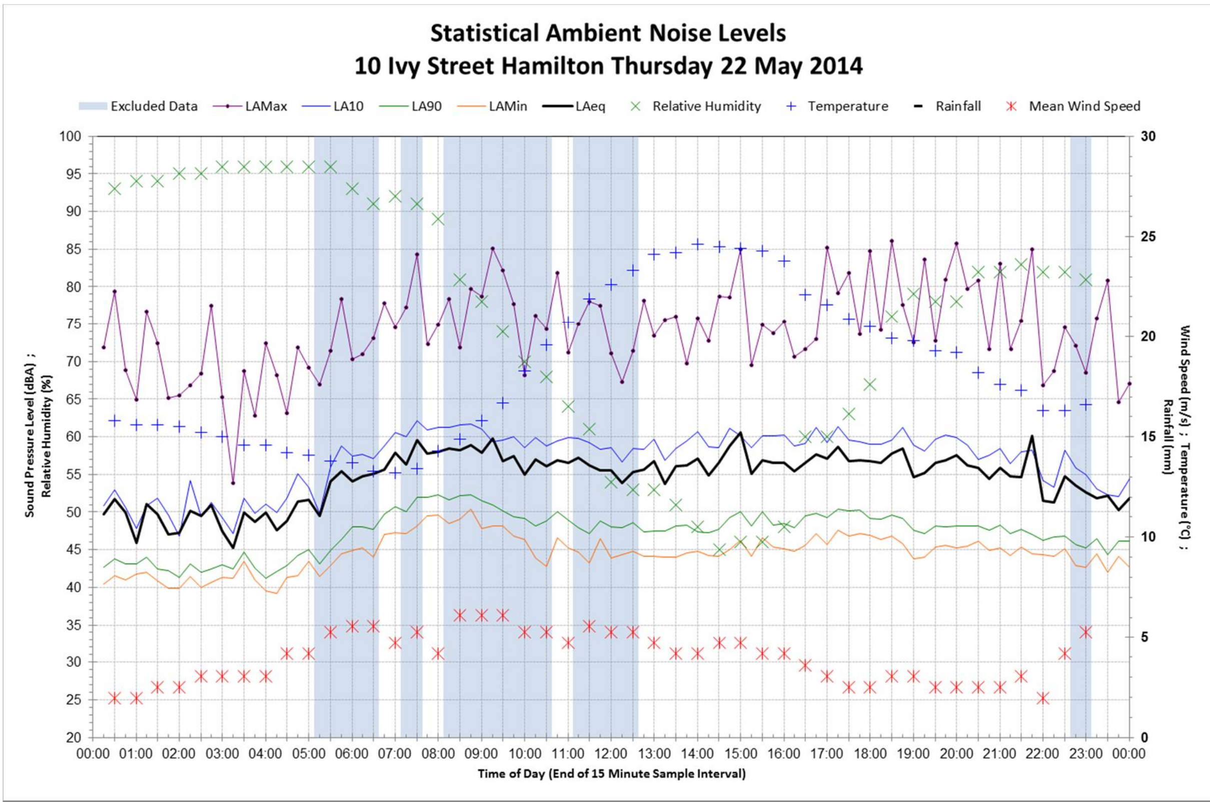
Statistical Ambient Noise Levels
10 Ivy Street Hamilton Saturday 17 May 2014
Excluded Data
LAMax
LA10
LA90
LAMin
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
10 Ivy Street Hamilton Sunday 18 May 2014
Excluded Data
LAMax
LA10
LA90
LAMin
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

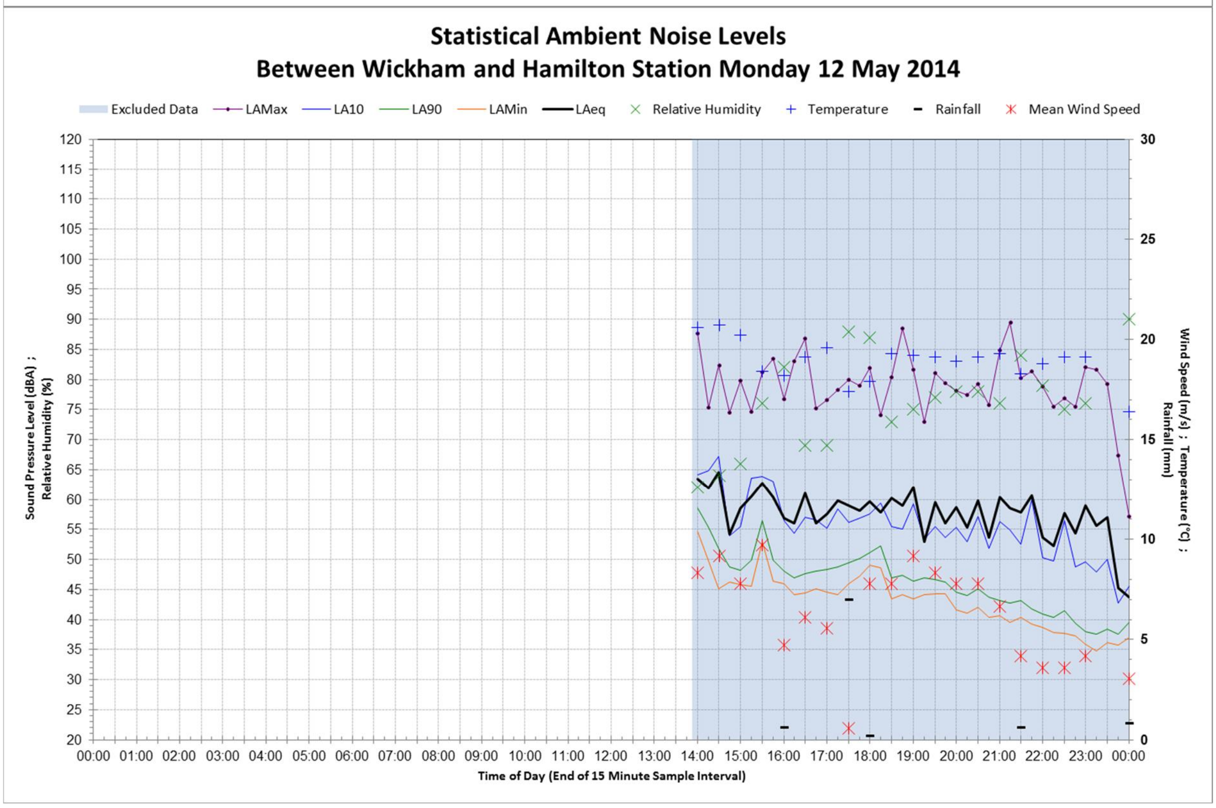

Statistical Ambient Noise Levels
10 Ivy Street Hamilton Monday 19 May 2014
Excluded Data
LAMax
LA10
LA90
LAMin
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
10 Ivy Street Hamilton Tuesday 20 May 2014
Excluded Data
LAMax
LA10
LA90
LAMin
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

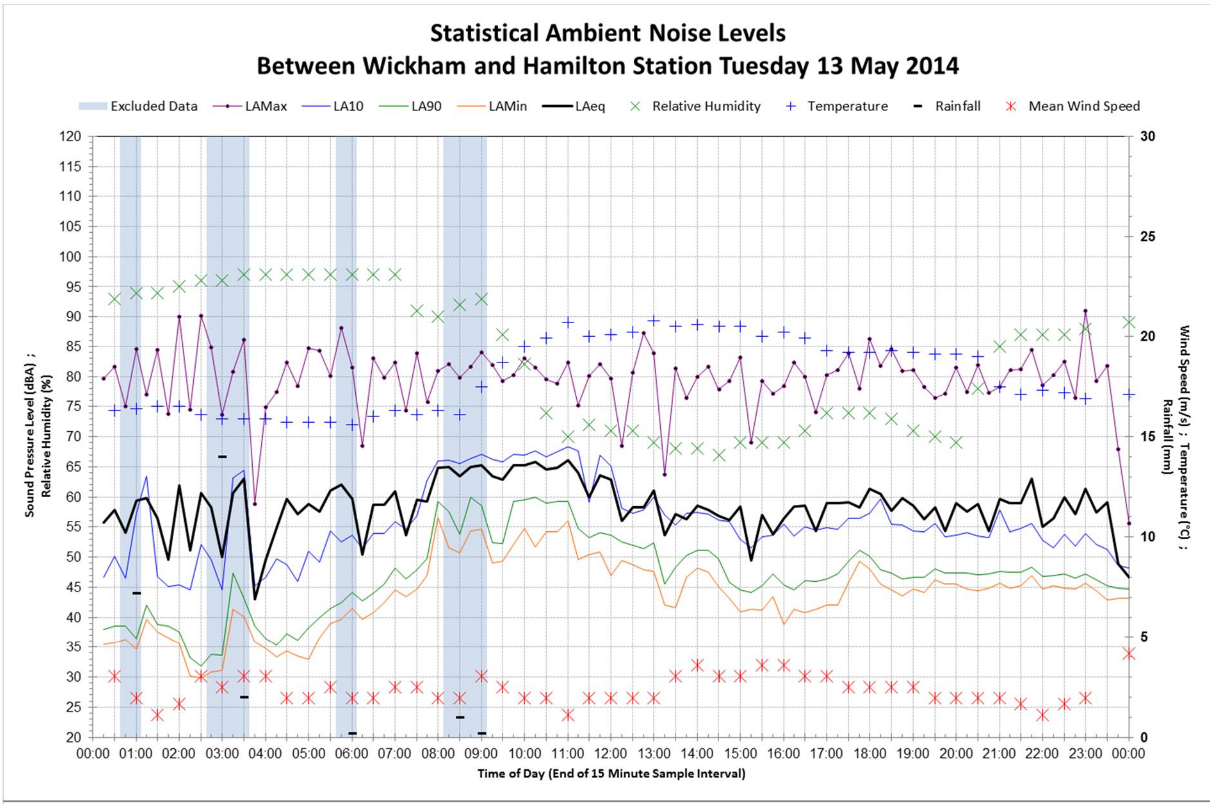

Statistical Ambient Noise Levels
10 Ivy Street Hamilton Wednesday 21 May 2014
Excluded Data
LAMax
LA10
LA90
LAMin
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

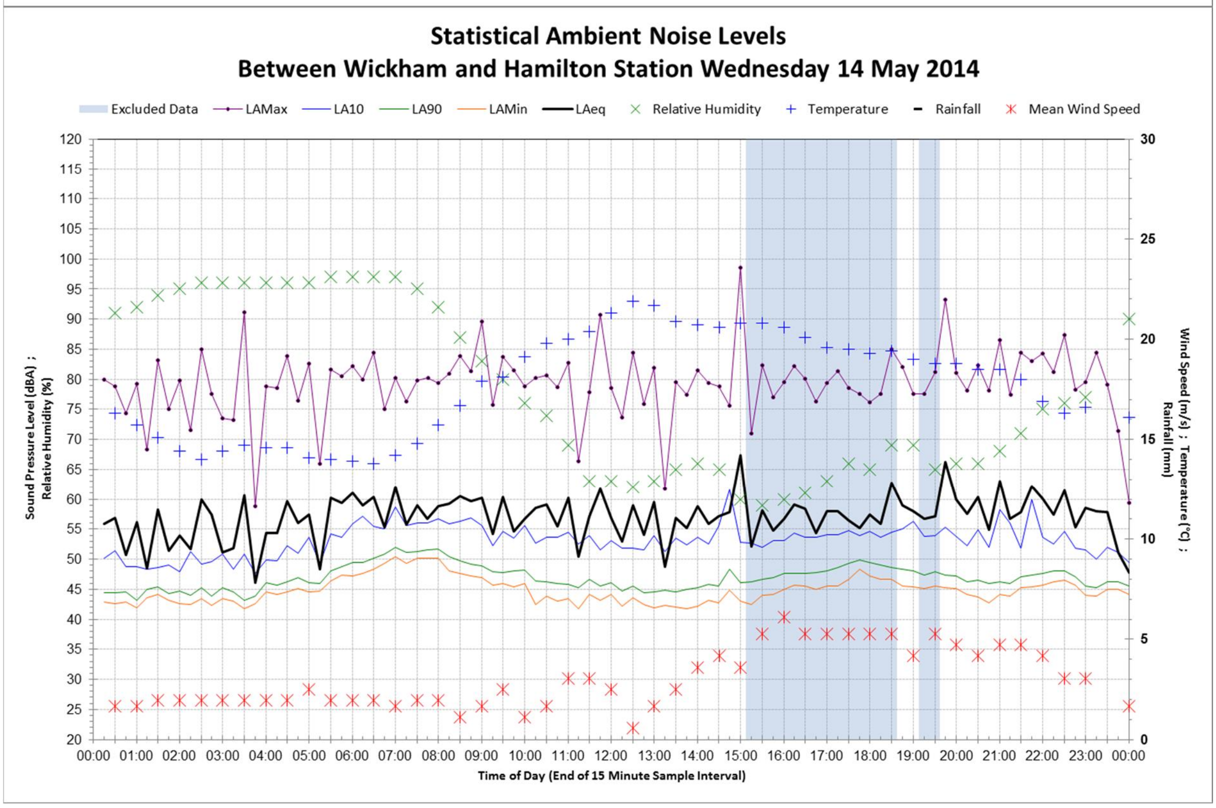


Statistical Ambient Noise Levels
10 Ivy Street Hamilton Thursday 22 May 2014
Excluded Data
LAMax
LA10
LA90
LAMin
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)



Statistical Ambient Noise Levels
Between Wickham and Hamilton Station Monday 12 May 2014
Excluded Data
LAMax
LA10
LA90
LAMin
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
Between Wickham and Hamilton Station Tuesday 13 May 2014
Excluded Data
LAMax
LA10
LA90
LAMin
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
Between Wickham and Hamilton Station Wednesday 14 May 2014
Excluded Data
LAMax
LA10
LA90
LAMin
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

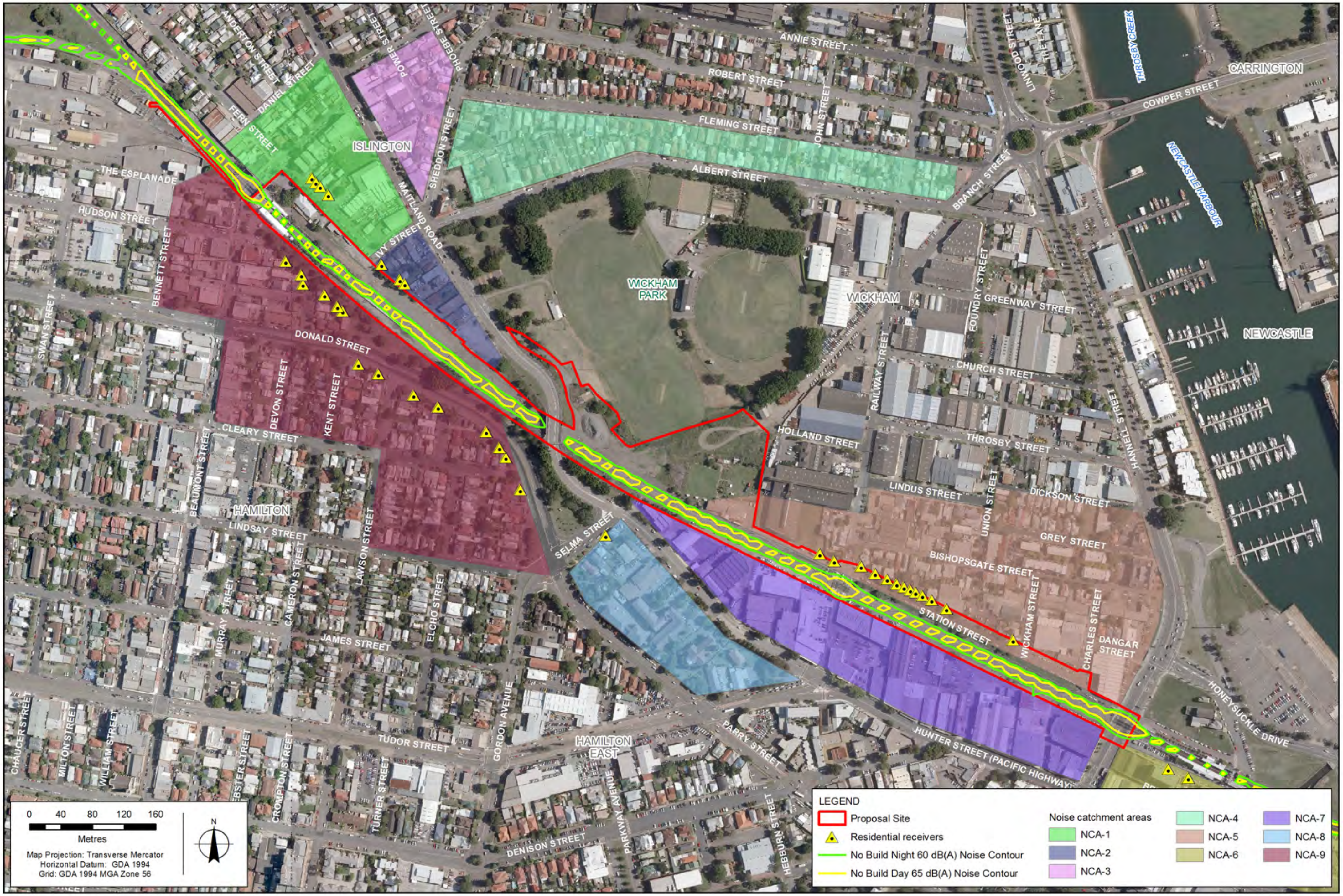
Appendix C – Predicted airborne rail noise levels

Table C-1 Airborne rail noise levels at nearby residential receivers[5], dB(A)

Receiver		Scenario 1 Existing base case			Scenario 2 Proposal opening year / 10 year horizon			Change in noise levels		
NCA	ID	L_{Aeq} Day	L_{Aeq} Night	L_{Amax}	L_{Aeq} Day	L_{Aeq} Night	L_{Amax}	L_{Aeq} Day	L_{Aeq} Night	L_{Amax}
NCA-1	R1	46	44	71	46	44	71	0	0	0
NCA-1	R2	46	44	70	46	44	70	0.1	0.1	0
NCA-1	R3	46	44	70	46	44	69	0	0	-0.1
NCA-1	R4	45	42	67	45	42	67	0.1	0.2	0
NCA-2	R5	51	49	74	51	49	75	0	0.1	0.3
NCA-2	R6	52	50	75	52	50	75	0.1	0.1	-0.1
NCA-2	R7	52	50	75	52	50	75	0.1	0.1	-0.1
NCA-5	R8	55	53	80	57	55	80	2.3	2.7	-0.5
NCA-5	R9	55	53	83	57	55	80	1.5	2	-3.4
NCA-5	R10	55	52	80	55	53	78	0.5	1.1	-2.2
NCA-5	R11	54	51	78	56	54	78	1.9	2.5	0.4
NCA-5	R12	53	51	76	55	53	79	1.6	2.1	2.6
NCA-5	R13	53	51	76	54	53	79	1.2	1.7	3
NCA-5	R14	53	51	76	54	52	80	0.6	1	3.6
NCA-5	R15	53	51	76	53	51	79	-0.1	0.3	3.1
NCA-5	R16	53	51	76	52	50	78	-1	-0.7	2.4
NCA-5	R17	53	51	76	51	49	77	-1.7	-1.4	0.8
NCA-5	R18	53	50	76	50	48	74	-2.4	-2.2	-1.9
NCA-5	R19	53	51	76	49	47	75	-3.8	-3.6	-1.6
NCA-5	R20	53	51	76	47	45	74	-6	-5.9	-1.9
NCA-6	R21	45	42	68	36	34	50	-8.1	-8	-18.2
NCA-6	R22	46	44	67	38	36	52	-8.1	-7.9	-15.4
NCA-6	R23	48	45	70	36	34	52	-11.7	-11.4	-17.7
NCA-8	R24	43	41	66	49	47	73	5.7	5.9	6.8
NCA-9	R25	43	41	64	45	43	64	1.8	1.9	0
NCA-9	R26	47	45	70	48	46	70	0.7	0.7	0
NCA-9	R27	49	47	71	49	47	71	0.3	0.4	-0.1
NCA-9	R28	50	48	73	50	48	73	0.1	0.1	0
NCA-9	R29	49	47	70	50	47	70	0.3	0.3	-0.1
NCA-9	R30	49	46	69	49	47	69	0.4	0.4	-0.1
NCA-9	R31	47	45	67	48	45	68	0.4	0.4	0.3
NCA-9	R32	46	43	65	46	44	65	0.5	0.5	0.2
NCA-9	R33	49	47	71	49	47	71	0.1	0.1	-0.1
NCA-9	R34	49	47	72	50	47	72	0.1	0.1	0
NCA-9	R35	50	48	73	50	48	73	0.1	0.1	0
NCA-9	R36	48	46	71	48	46	71	0	0	0
NCA-9	R37	50	48	73	50	48	73	0.1	0.1	0
NCA-9	R38	49	47	72	50	47	72	0.1	0.1	0

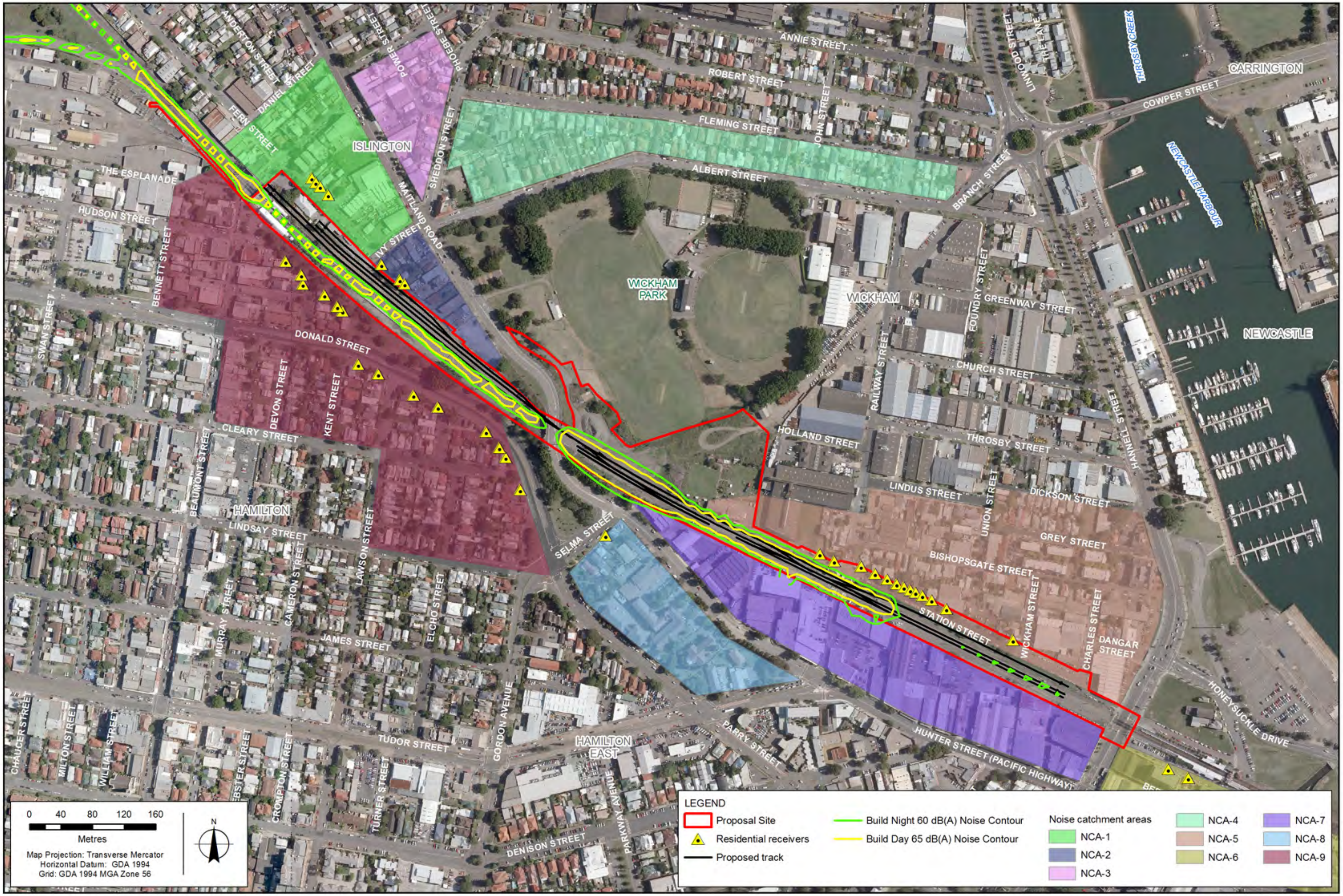
[5] inclusive of 2.5 dB façade correction

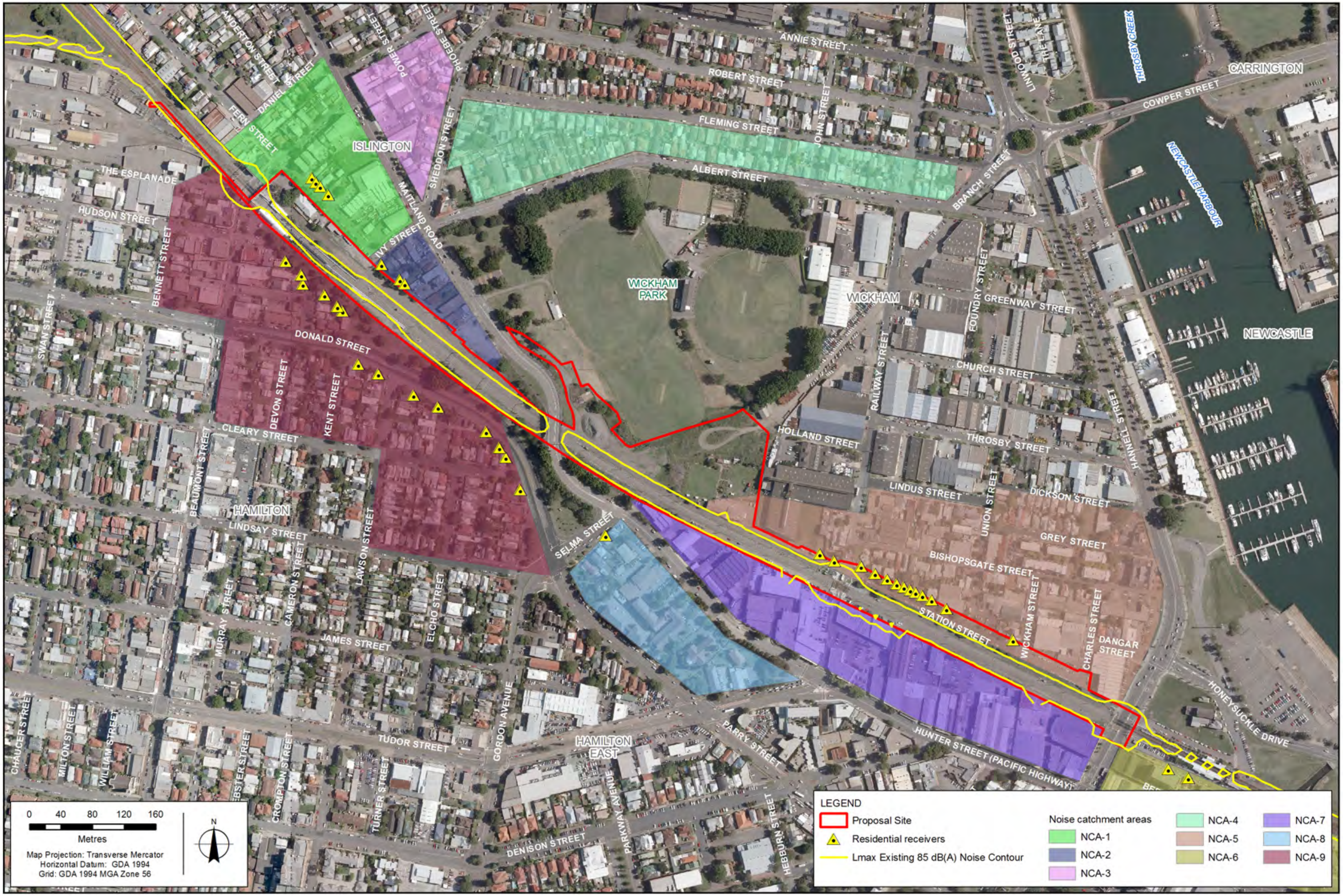
Appendix D – Noise contour maps – rail operations



G:\22\17295\GIS\Maps\Deliverables\REF\Noise\2217295_N003_NoiseContours_NoBuild_A.mxd

Data source: TfNSW, Aerial imagery, 2014; LPI, DTDB, 2012.


ANNIE STREET
ROBERT STREET
FLEMING STREET
ALBERT STREET
CARRINGTON
COWPER STREET
THROSBY CREEK
NEWCASTLE HARBOUR
NEWCASTLE
ISLINGTON
WICKHAM PARK
WICKHAM
HAMILTON
HAMILTON EAST
ANDERTON STREET
DANIEL STREET
FERN STREET
POWER STREET
PHOEBE STREET
SHEDDON STREET
JOHN STREET
LINWOOD STREET
THE LANE
BRANCH STREET
MAITLAND ROAD
IVY STREET
THE ESPLANADE
HUDSON STREET
BENNETT STREET
SWAN STREET
DONALD STREET
DEVON STREET
KENT STREET
CLEARY STREET
BEAUMONT STREET
LINDSAY STREET
LAWSON STREET
CAMERON STREET
MURRAY STREET
JAMES STREET
ELCHO STREET
GORDON AVENUE
SELMA STREET
TUDOR STREET
CHAUCER STREET
MILTON STREET
WILLIAM STREET
CROMPTON STREET
TURNER STREET
PARKWAY AVENUE
DENISON STREET
PARRY STREET
HUNTER STREET (PACIFIC HIGHWAY)
FOUNDRY STREET
GREENWAY STREET
RAILWAY STREET
CHURCH STREET
HOLLAND STREET
THROSBY STREET
LINDUS STREET
UNION STREET
DICKSON STREET
HANNELL STREET
GREY STREET
BISHOPSGATE STREET
STATION STREET
WICKHAM STREET
CHARLES STREET
DANGAR STREET
HONEYSUCKLE DRIVE
0 40 80 120 160
Metres
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56
N
LEGEND
Proposal Site
Residential receivers
Proposed track
Build Night 60 dB(A) Noise Contour
Build Day 65 dB(A) Noise Contour
Noise catchment areas
NCA-1
NCA-2
NCA-3
NCA-4
NCA-5
NCA-6
NCA-7
NCA-8
NCA-9



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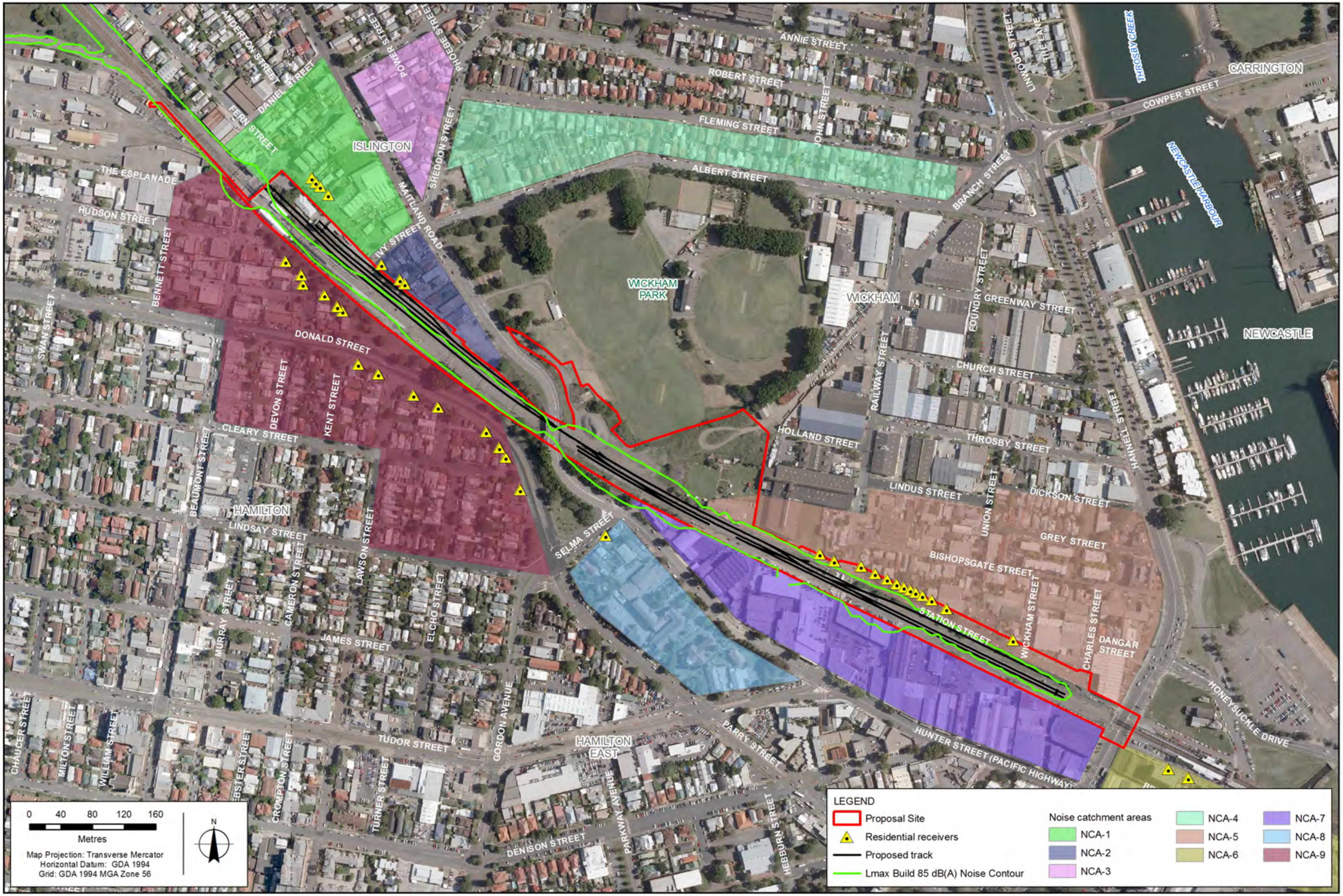
Data source: TfNSW, Aerial imagery, 2014; LPI, DTDB, 2012.



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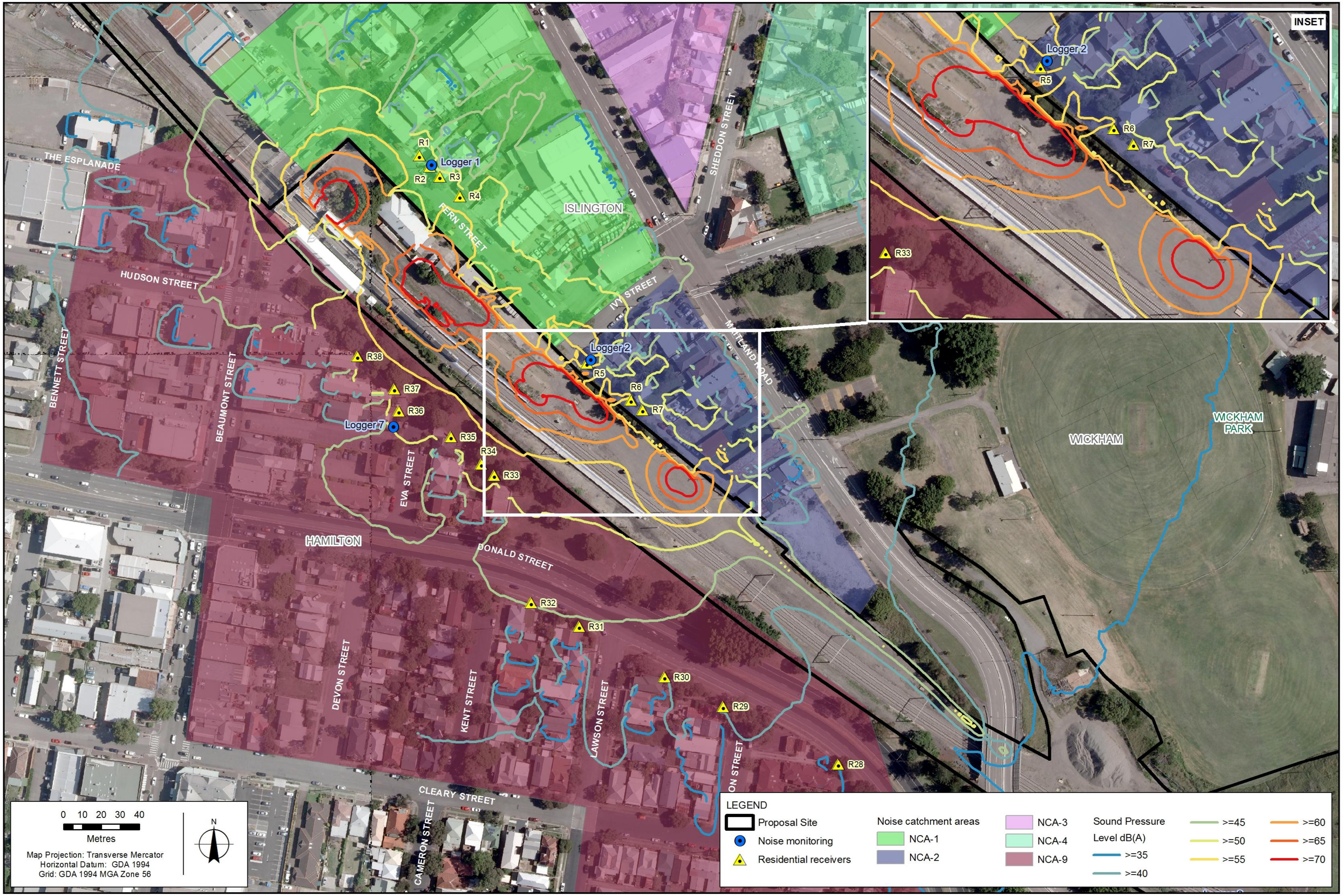
Data source: TfNSW, Aerial imagery, 2014; LPI, DTDB, 2012; URS, Proposed Track, 2014.

Appendix E – Noise contour maps – stabling facility


INSET
Logger 1
Logger 2
Logger 7
R1
R2
R3
R4
R5
R6
R7
R28
R29
R30
R31
R32
R33
R34
R35
R36
R37
R38
THE ESPLANADE
HUDSON STREET
BENNETT STREET
BEAUMONT STREET
EVA STREET
FERN STREET
ISLINGTON
SHEDDON STREET
IVY STREET
MAITLAND ROAD
HAMILTON
DONALD STREET
DEVON STREET
KENT STREET
LAWSON STREET
CLEARY STREET
CAMERON STREET
WICKHAM
WICKHAM PARK
0 10 20 30 40
Metres
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56
LEGEND
Proposal Site
Noise monitoring
Residential receivers
Noise catchment areas
NCA-1
NCA-2
NCA-3
NCA-4
NCA-9
Sound Pressure Level dB(A)
>=35
>=40
>=45
>=50
>=55
>=60
>=65
>=70

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GHD otherwise disclaims responsibility to any person other than Transport for New South Wales arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer section 1.3 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

GHD

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Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	S Ritchie	C Evenden	*C Evenden*	G Marshall	*G Marshall*	22/07/2014
1	S Ritchie	C Evenden		G Marshall		28/07/2014

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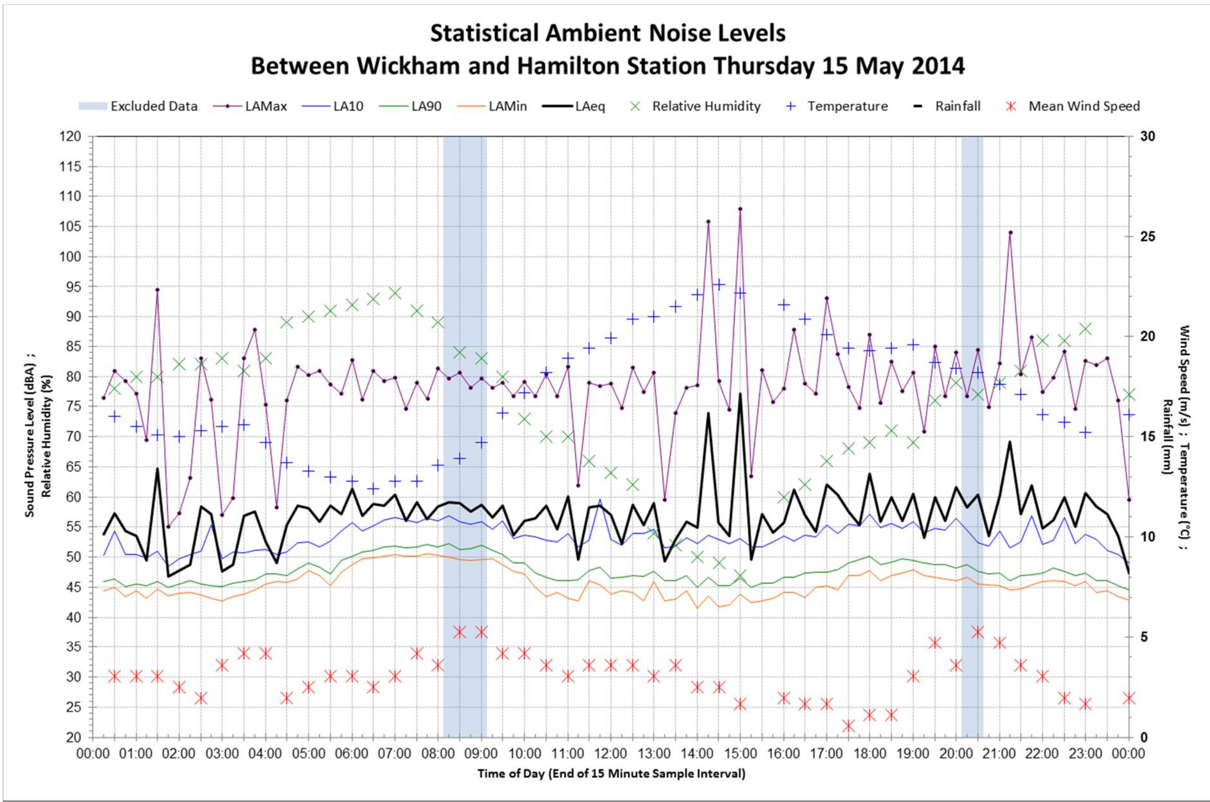
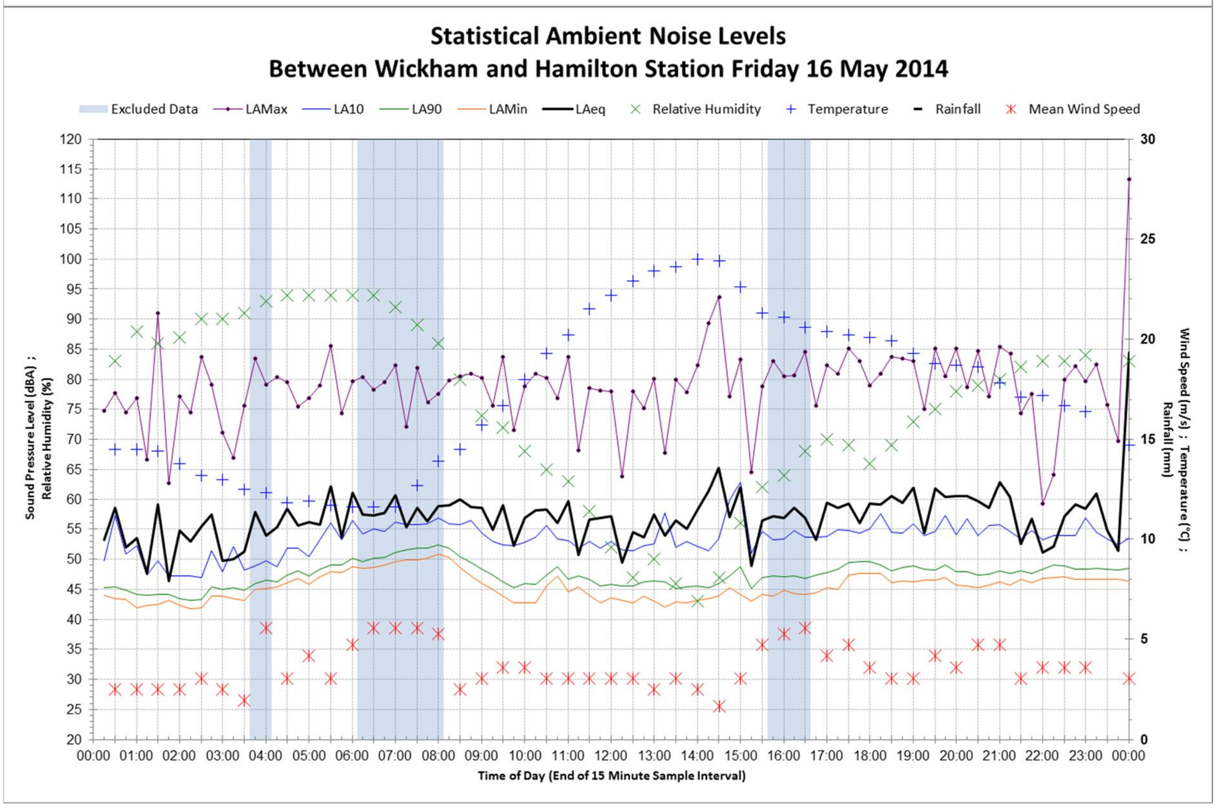

Statistical Ambient Noise Levels
Between Wickham and Hamilton Station Thursday 15 May 2014
Excluded Data
LAMax
LA10
LA90
LAMin
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
Between Wickham and Hamilton Station Friday 16 May 2014
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LA90
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LAeq
Relative Humidity
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Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
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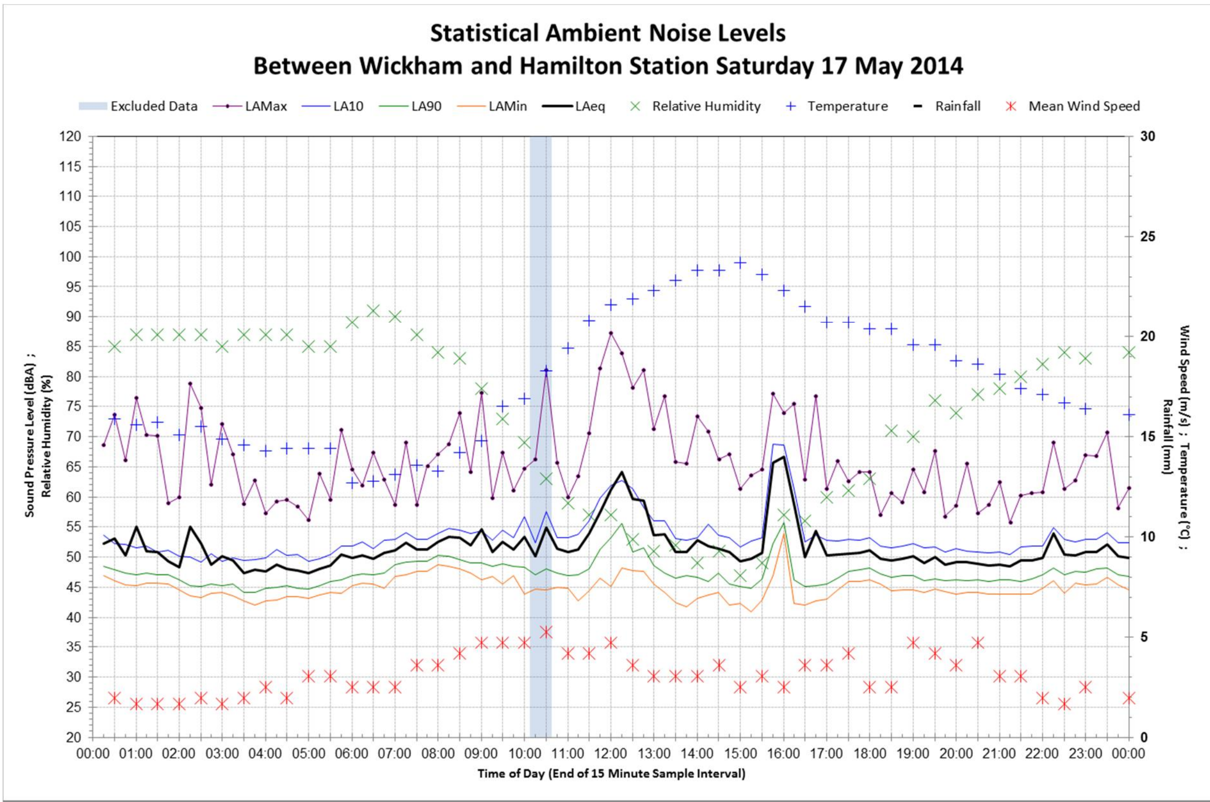
Statistical Ambient Noise Levels
Between Wickham and Hamilton Station Saturday 17 May 2014
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LA90
LAMin
LAeq
Relative Humidity
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Rainfall
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Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
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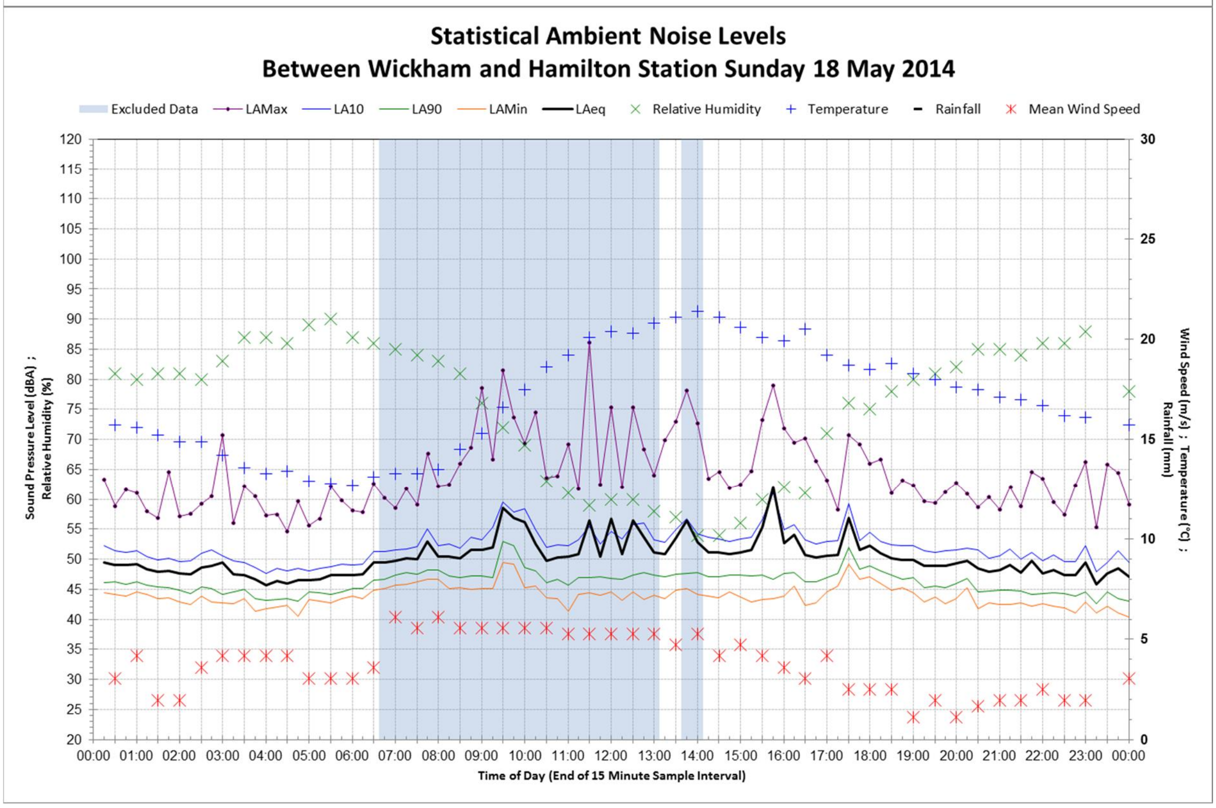
Statistical Ambient Noise Levels
Between Wickham and Hamilton Station Sunday 18 May 2014
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LA10
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LAeq
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Rainfall
Mean Wind Speed
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Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
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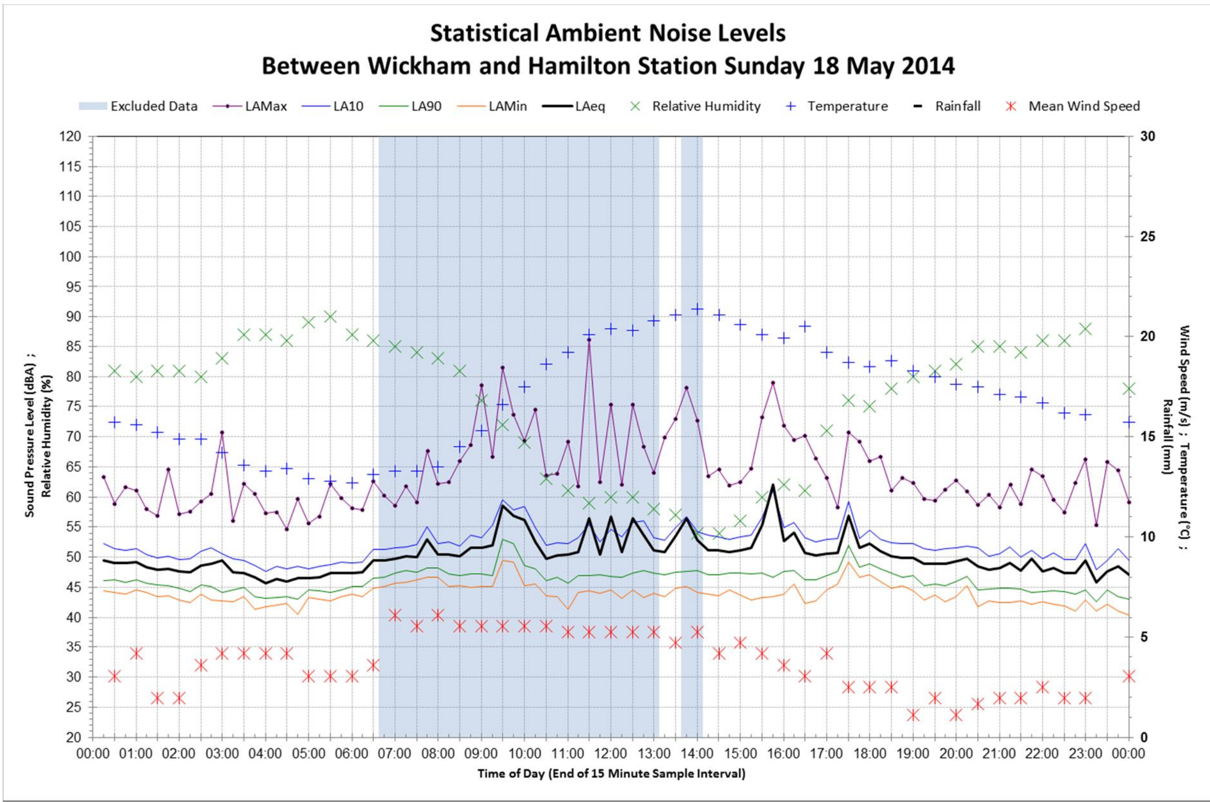
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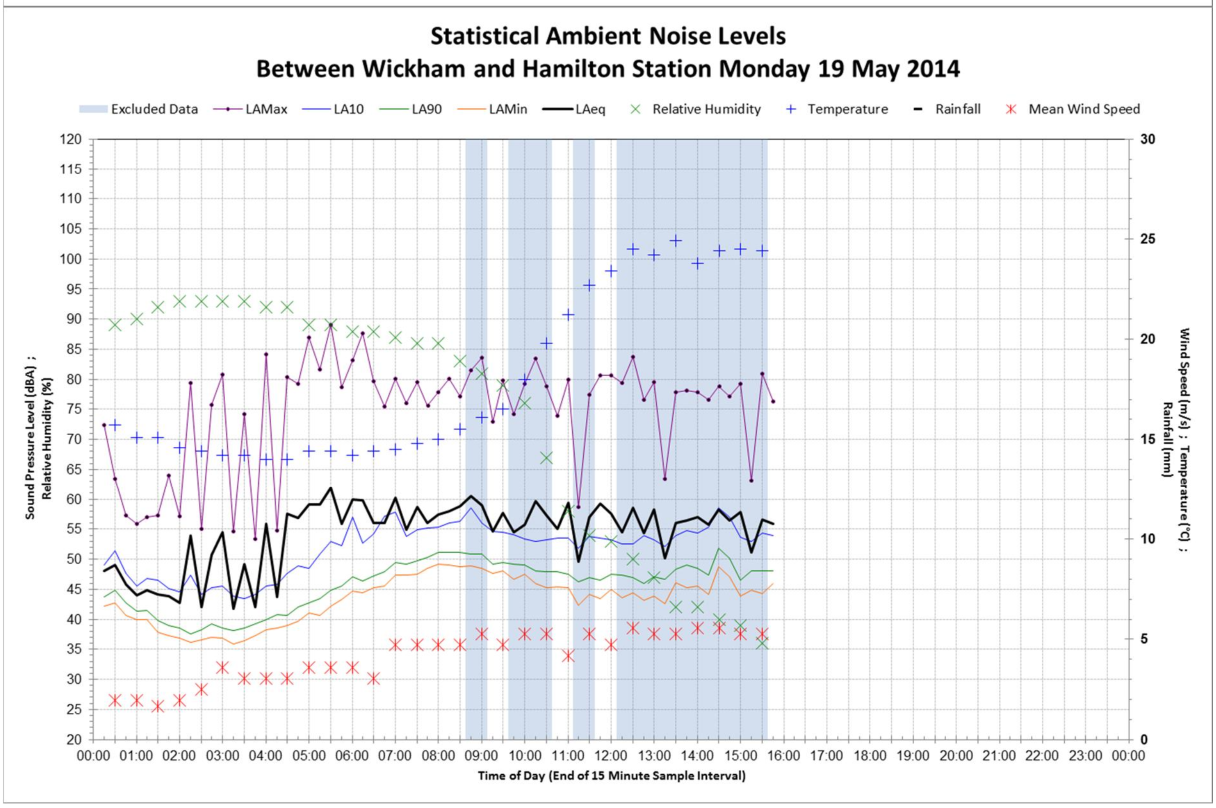
Statistical Ambient Noise Levels
Between Wickham and Hamilton Station Monday 19 May 2014
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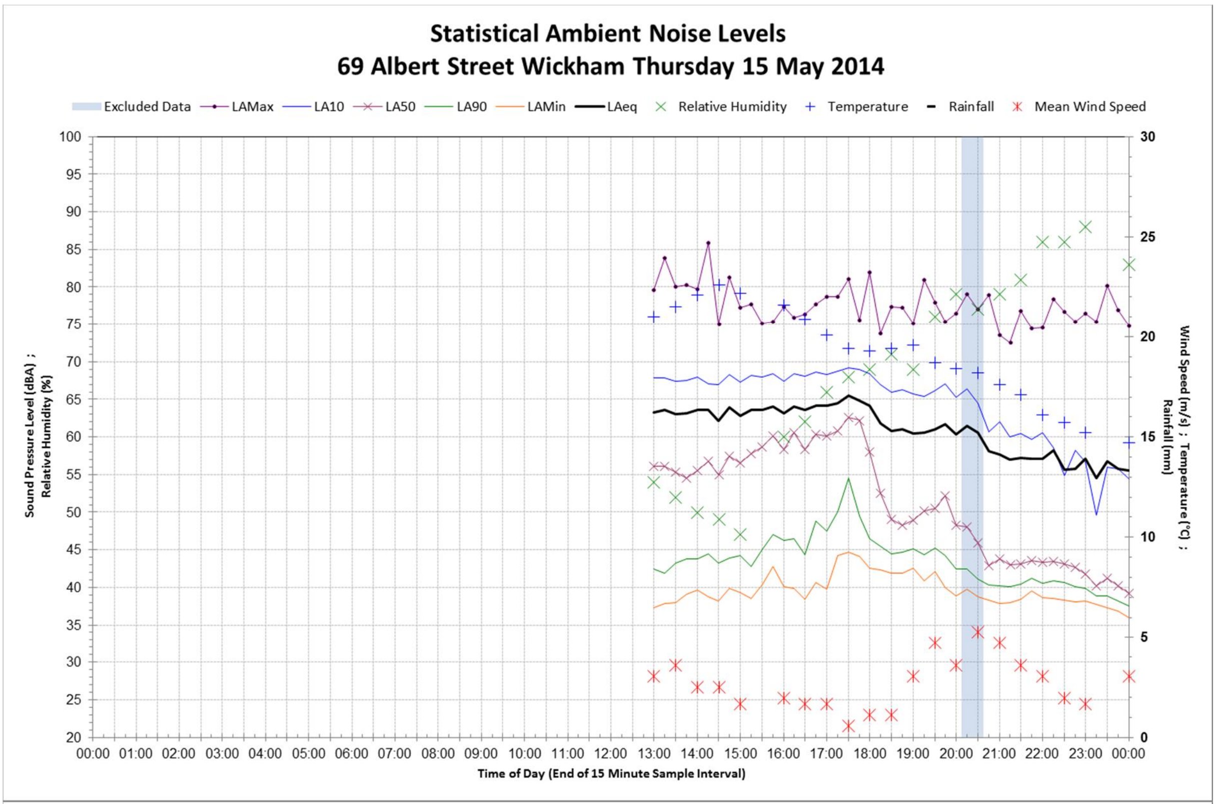
Statistical Ambient Noise Levels
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LA90
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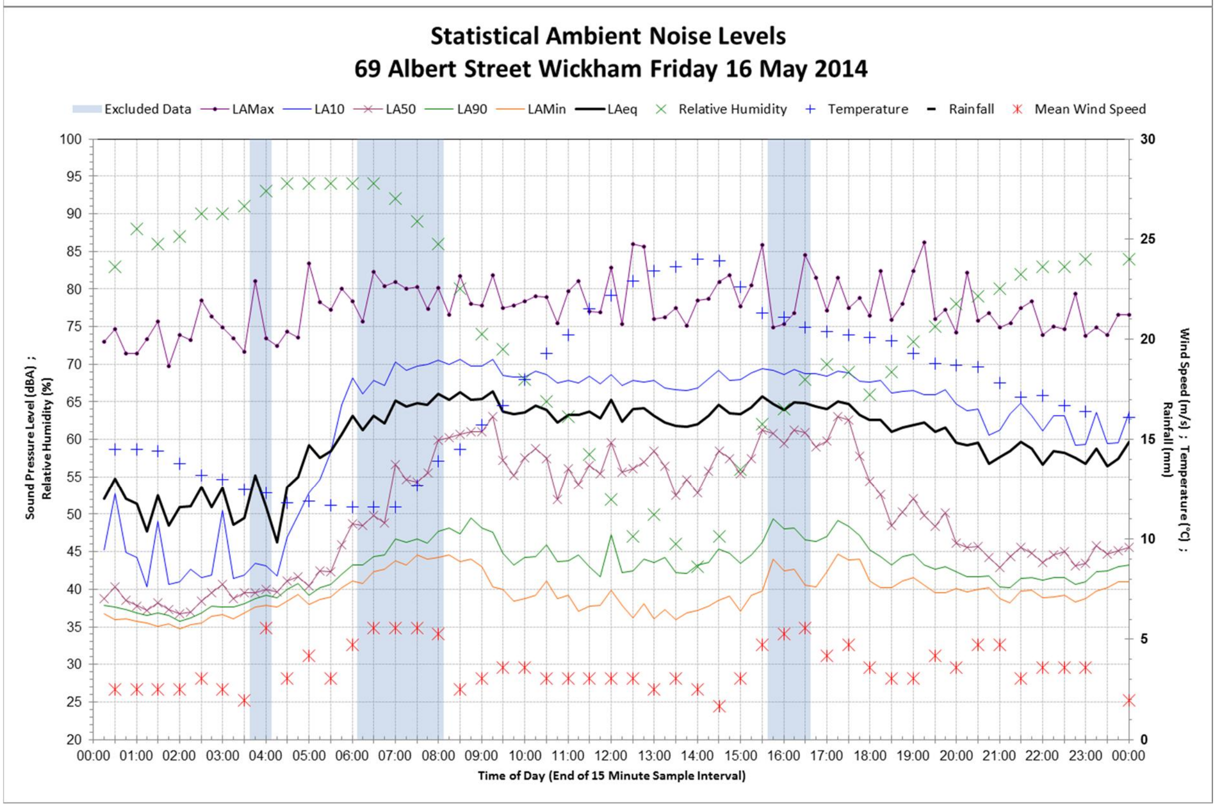
Statistical Ambient Noise Levels
69 Albert Street Wickham Friday 16 May 2014
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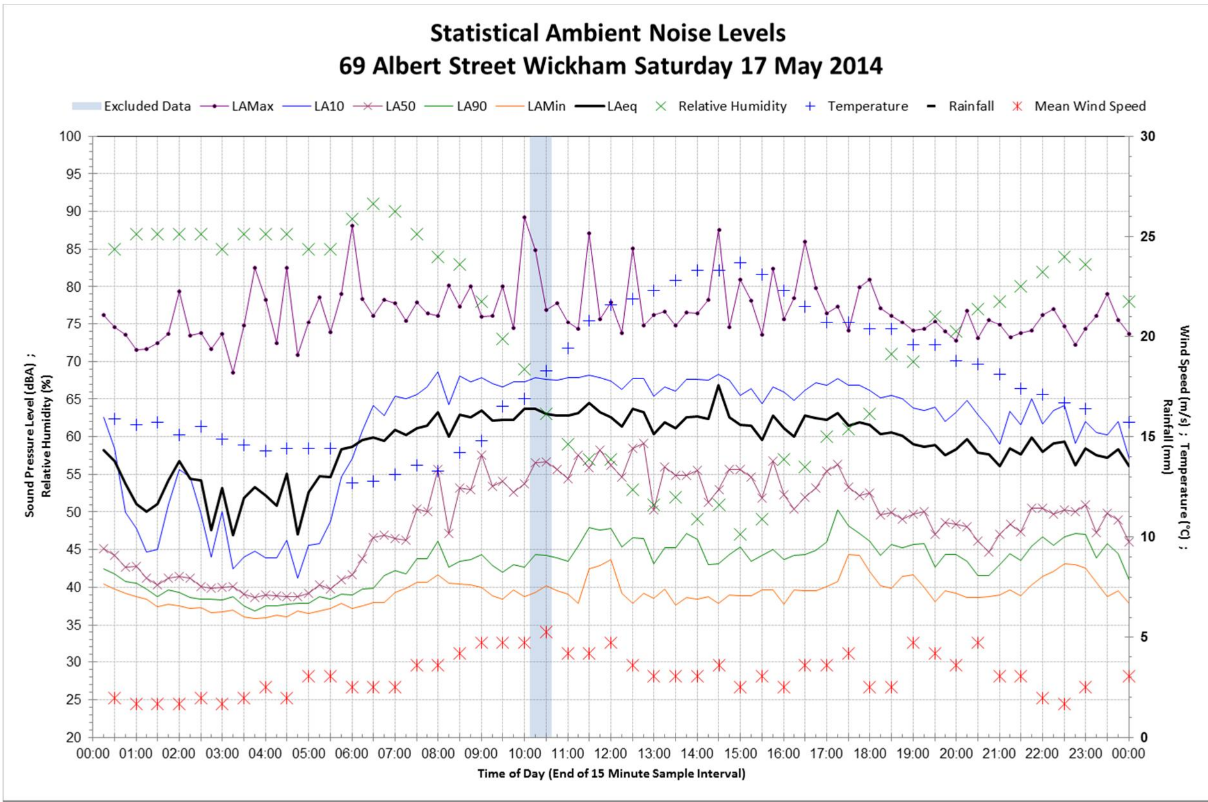
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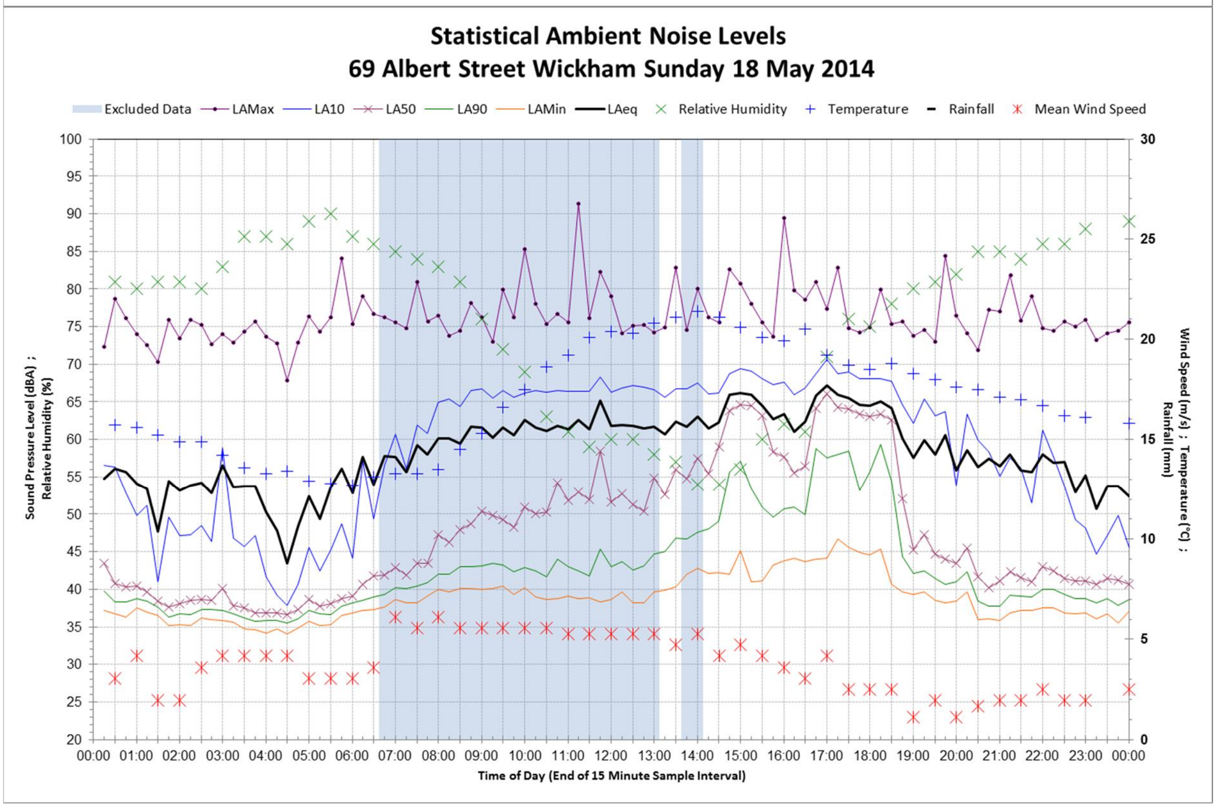
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69 Albert Street Wickham Sunday 18 May 2014
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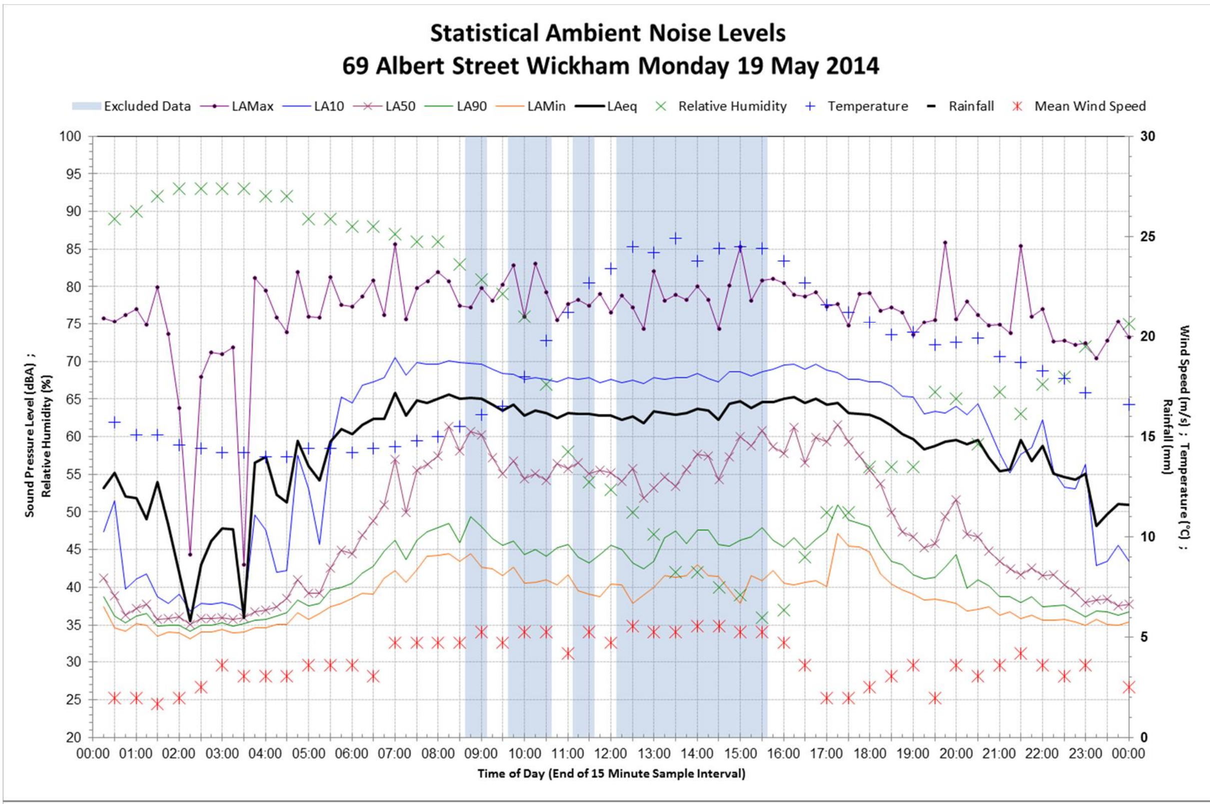
Statistical Ambient Noise Levels
69 Albert Street Wickham Monday 19 May 2014
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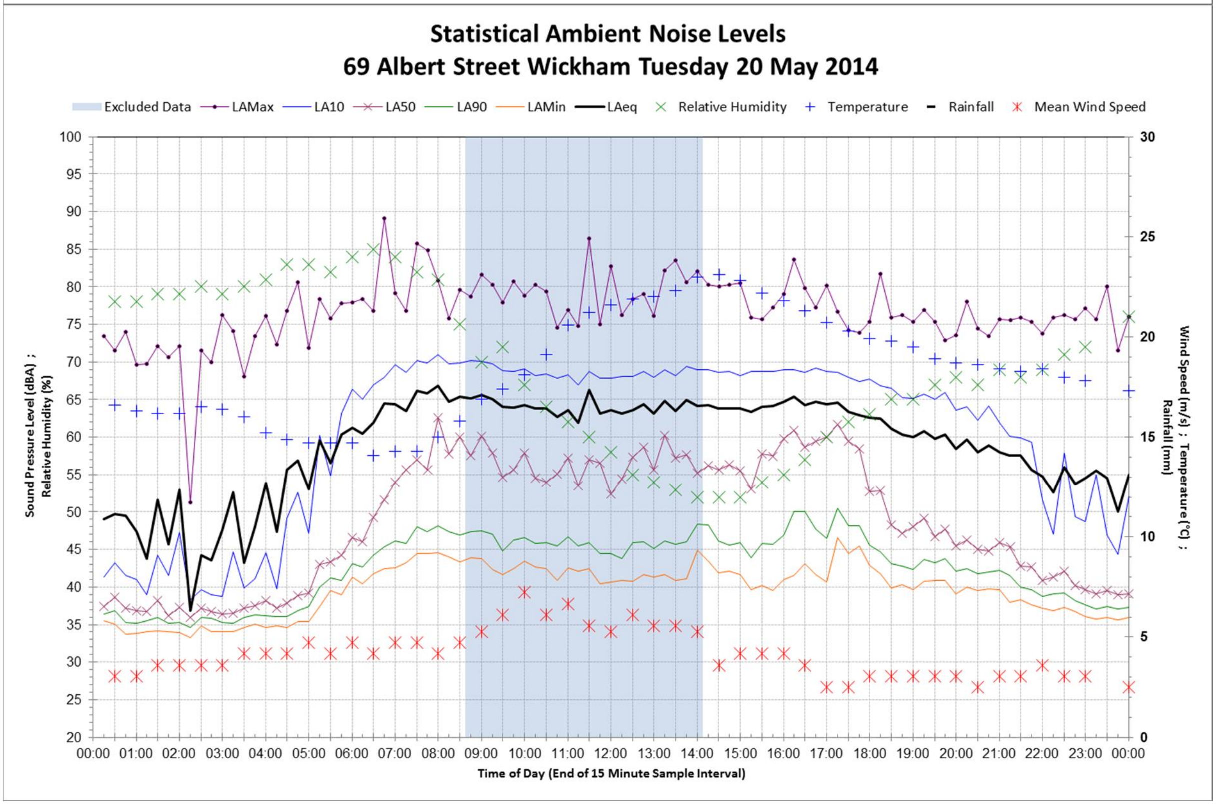
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
69 Albert Street Wickham Tuesday 20 May 2014
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LA90
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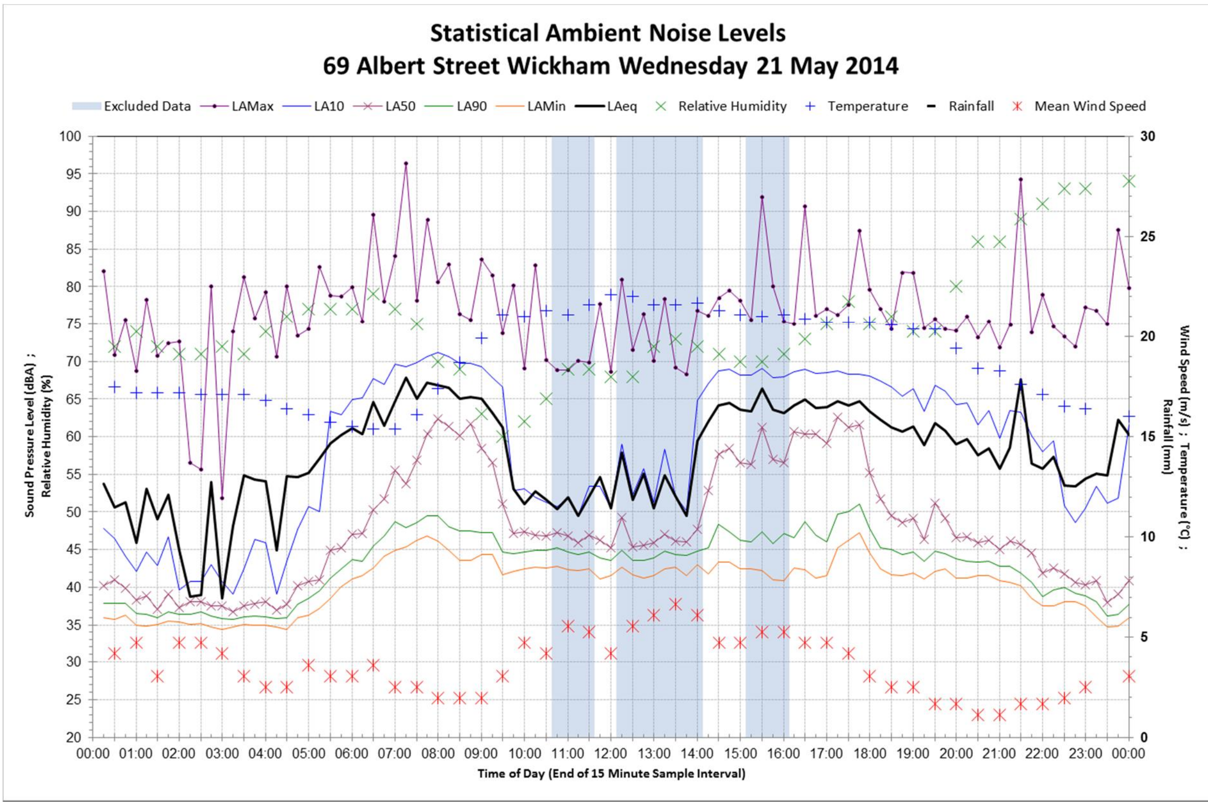
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
69 Albert Street Wickham Wednesday 21 May 2014
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Relative Humidity
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Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
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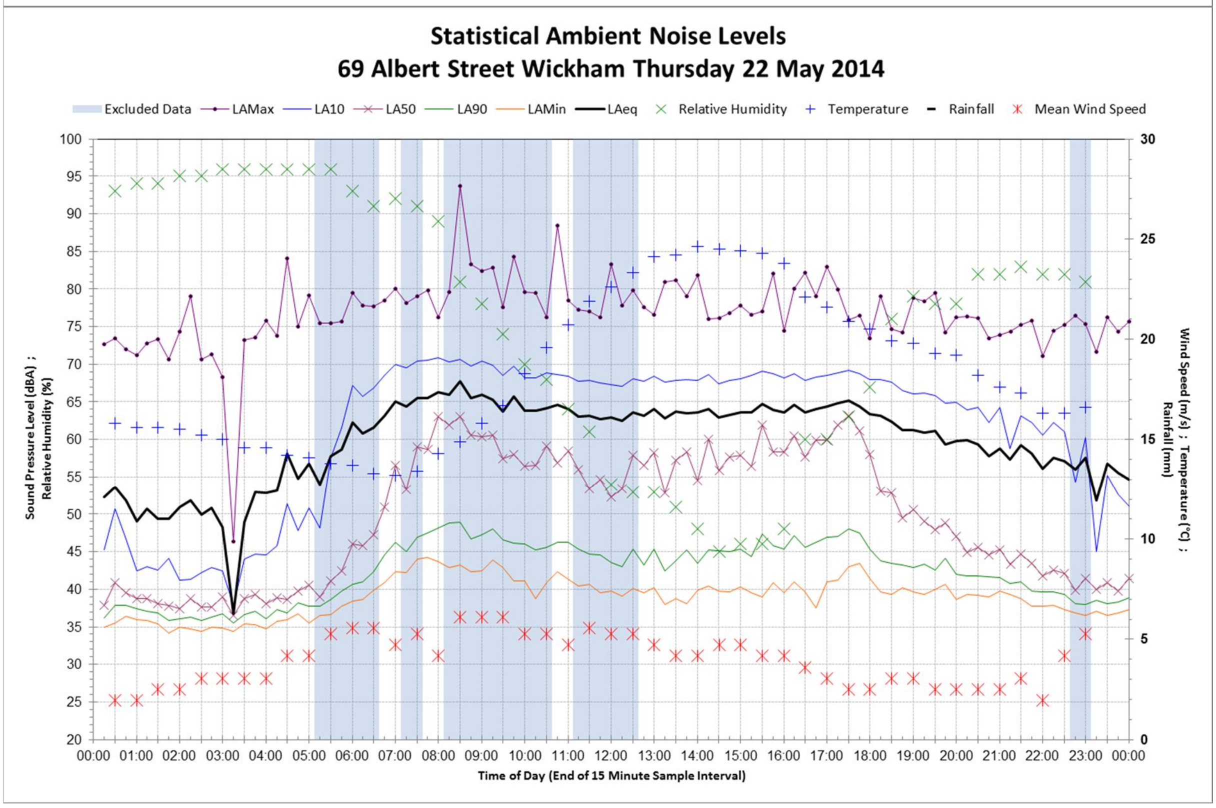
Time of Day (End of 15 Minute Sample Interval)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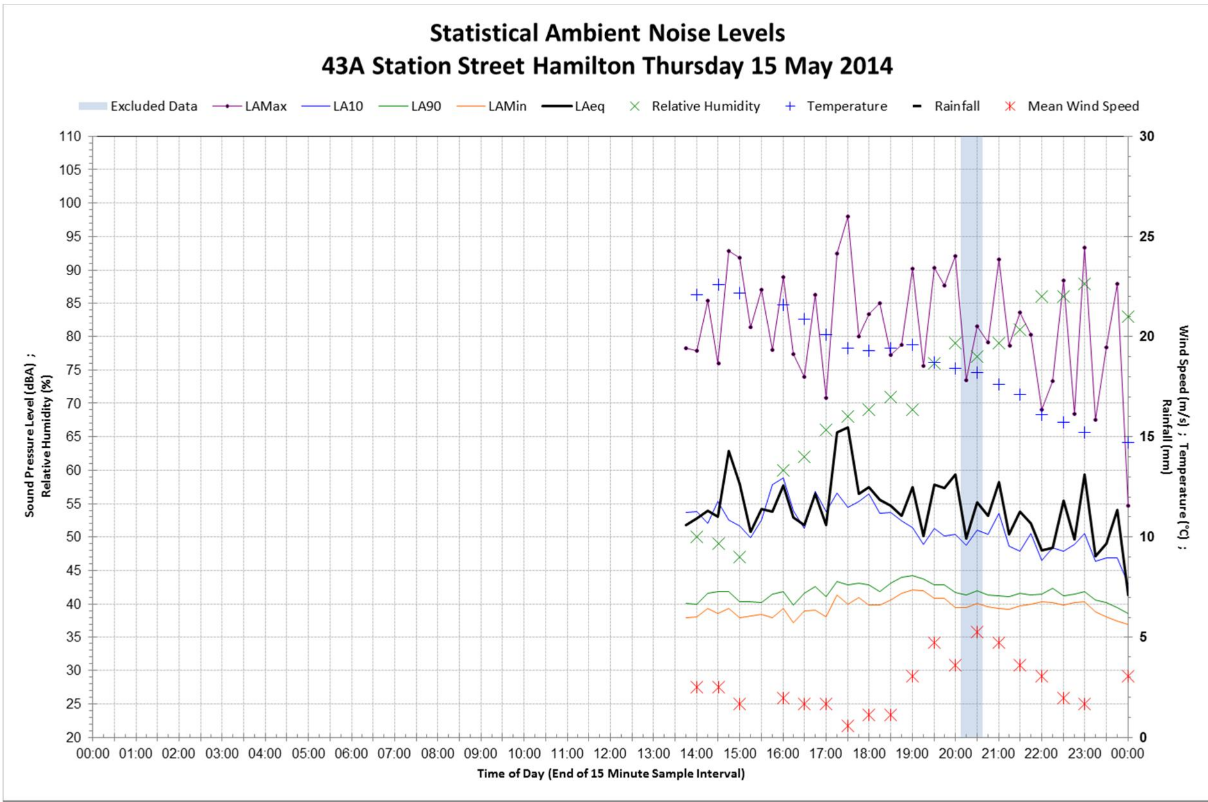

Statistical Ambient Noise Levels
43A Station Street Hamilton Thursday 15 May 2014
Excluded Data
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Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
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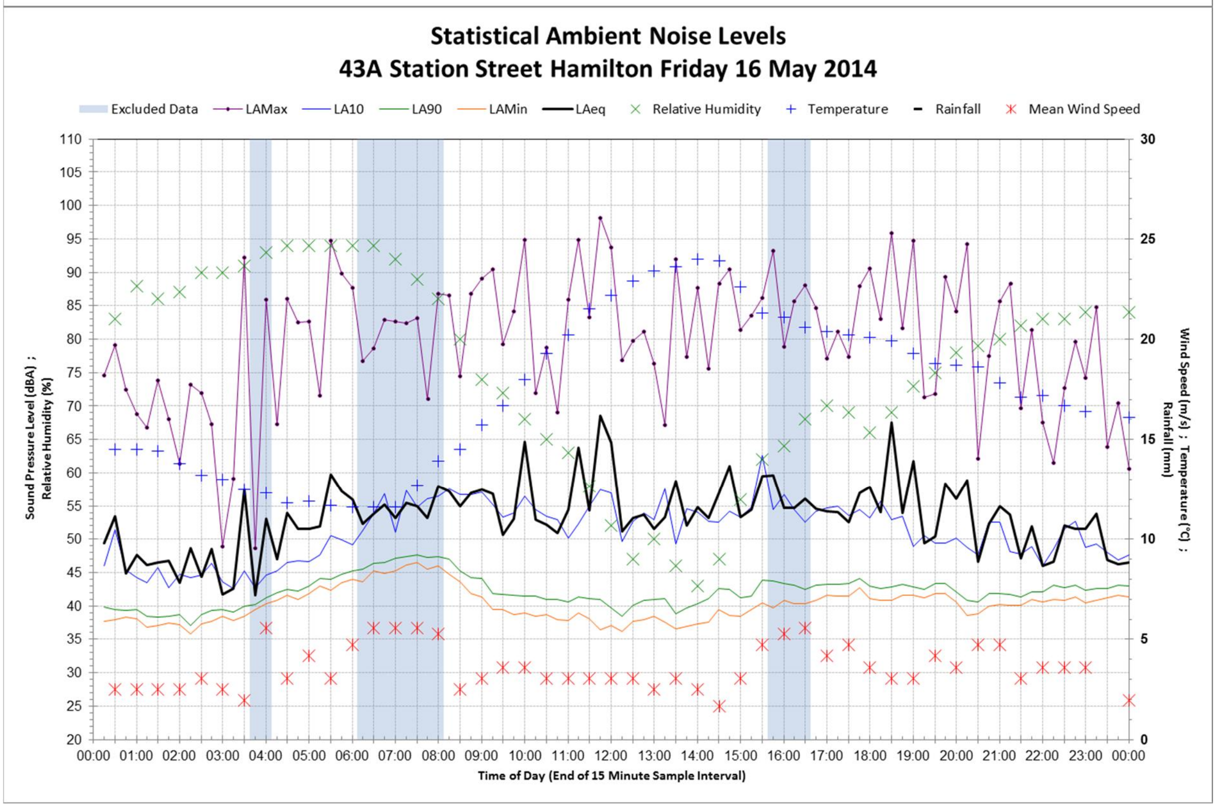

Statistical Ambient Noise Levels
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Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
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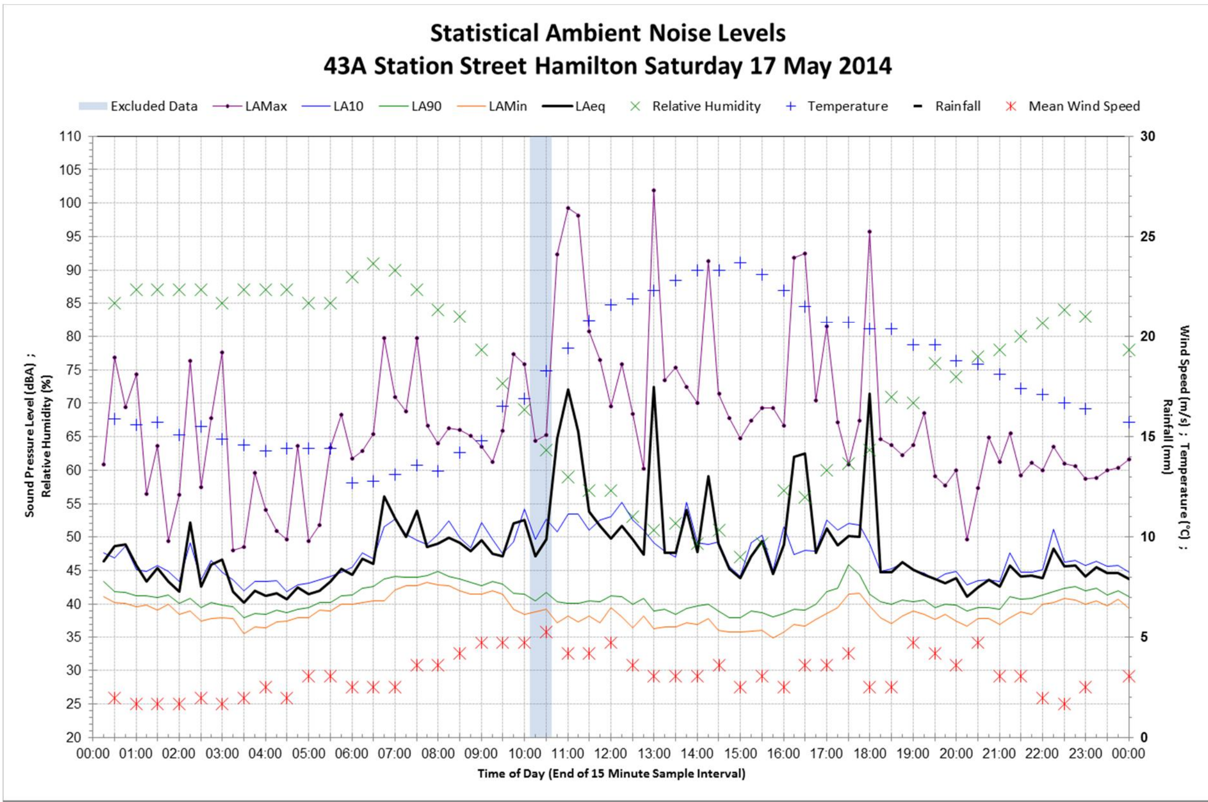
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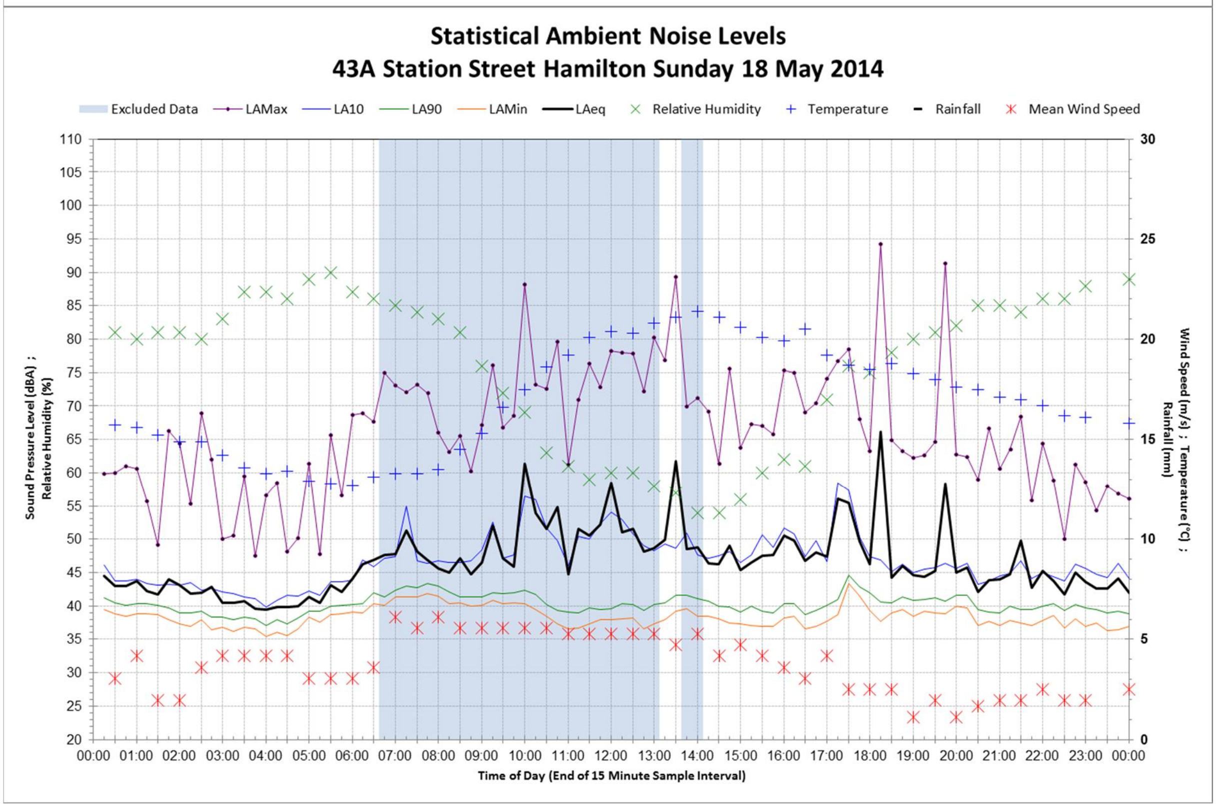
Statistical Ambient Noise Levels
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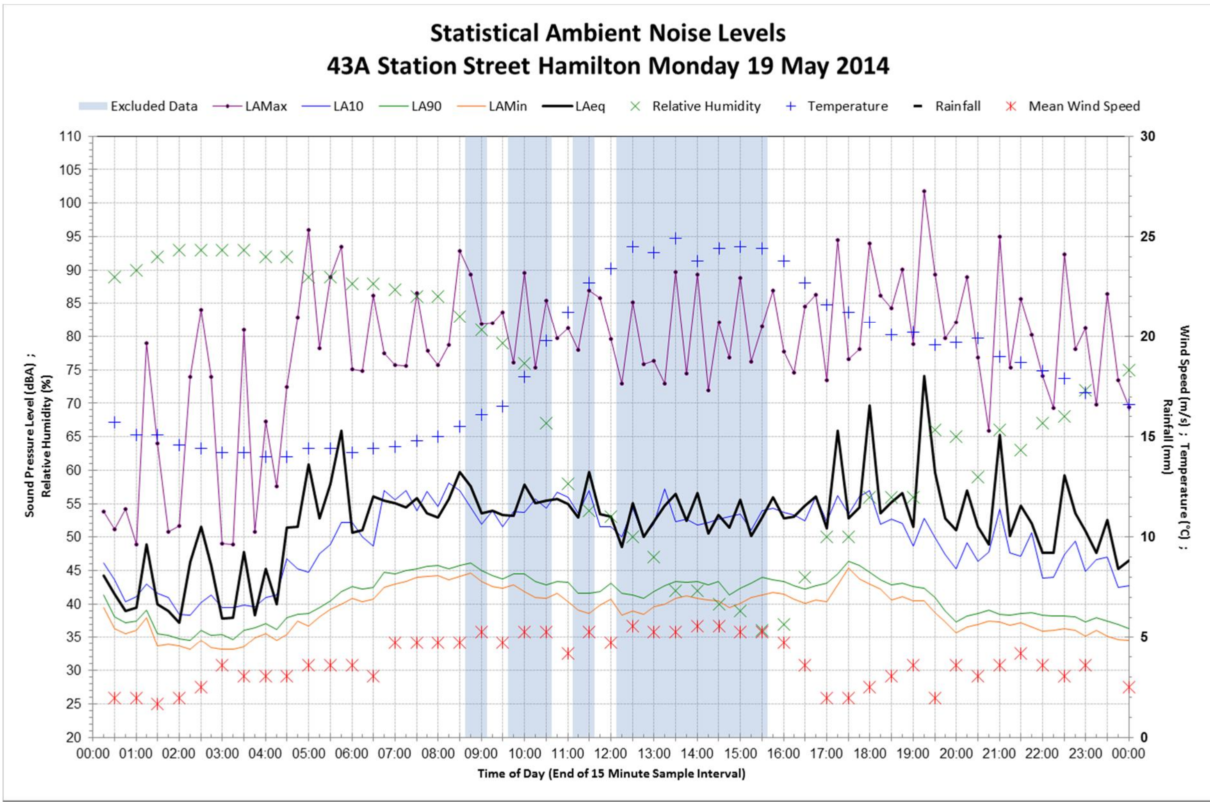

Statistical Ambient Noise Levels
43A Station Street Hamilton Monday 19 May 2014
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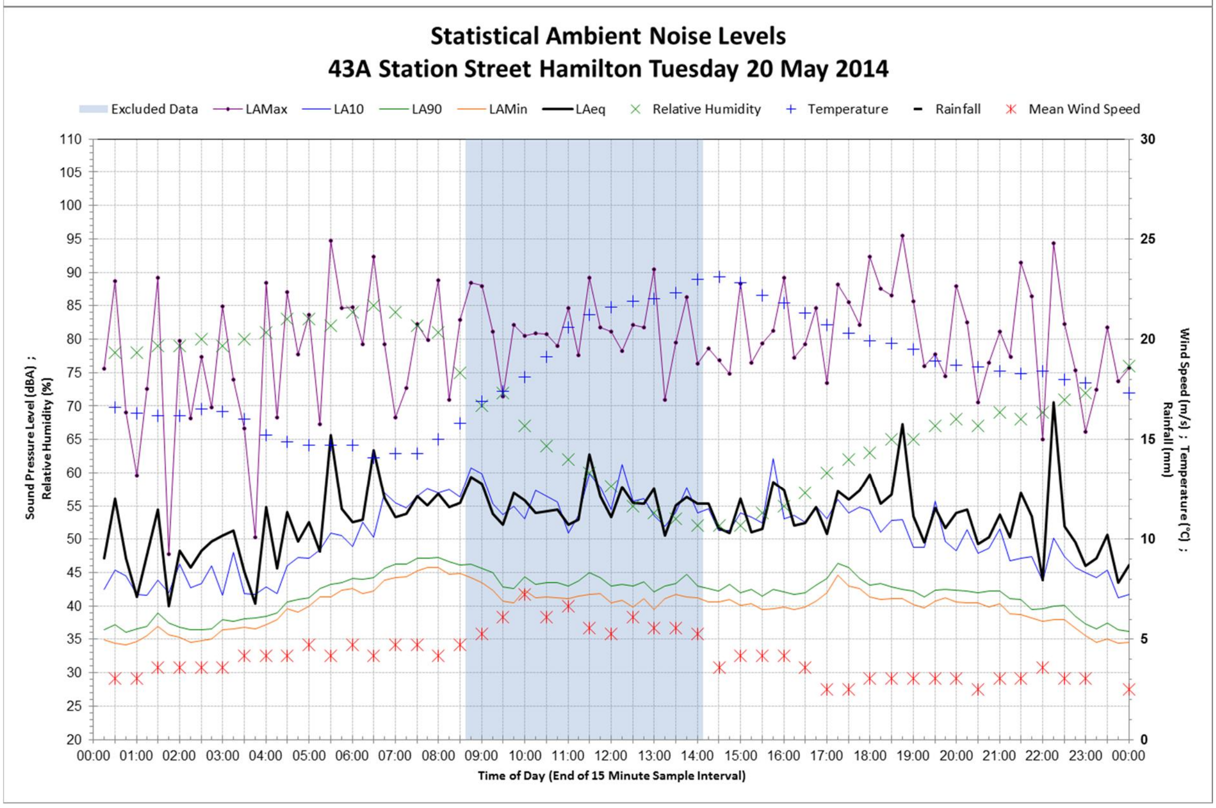

Statistical Ambient Noise Levels
43A Station Street Hamilton Tuesday 20 May 2014
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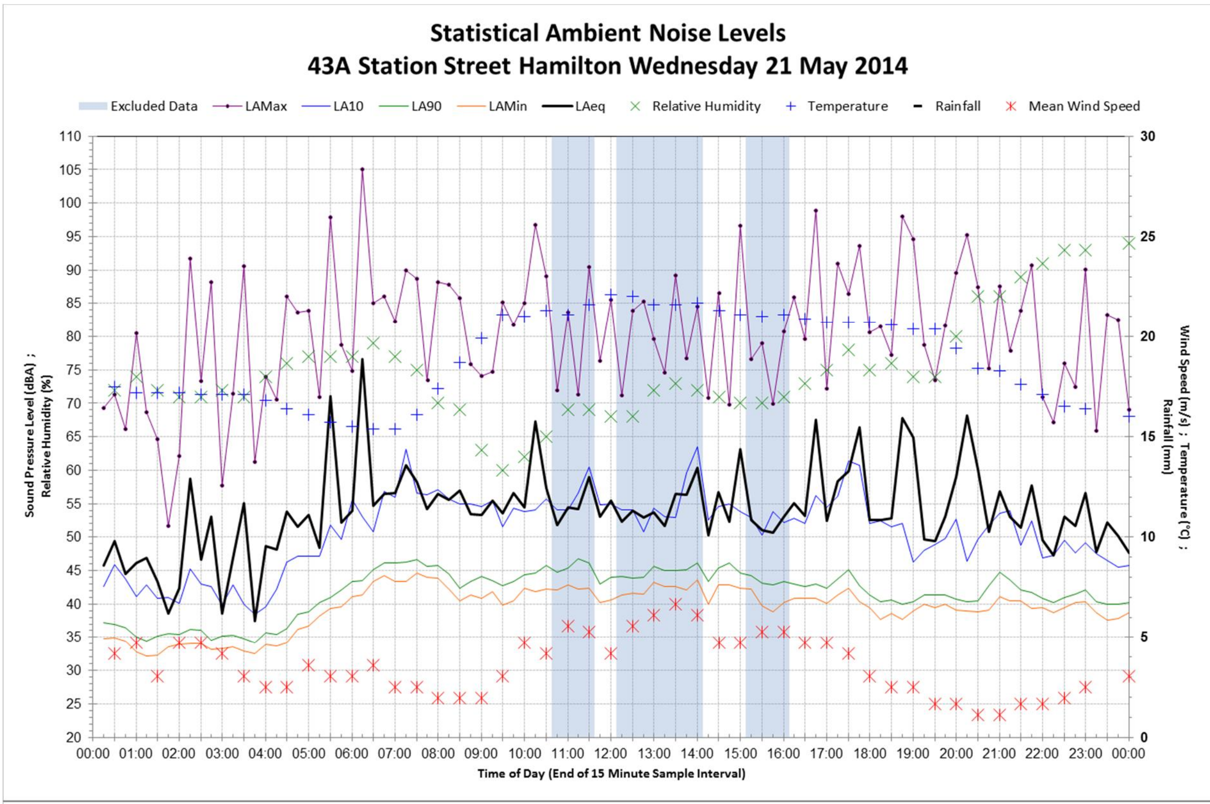

Statistical Ambient Noise Levels
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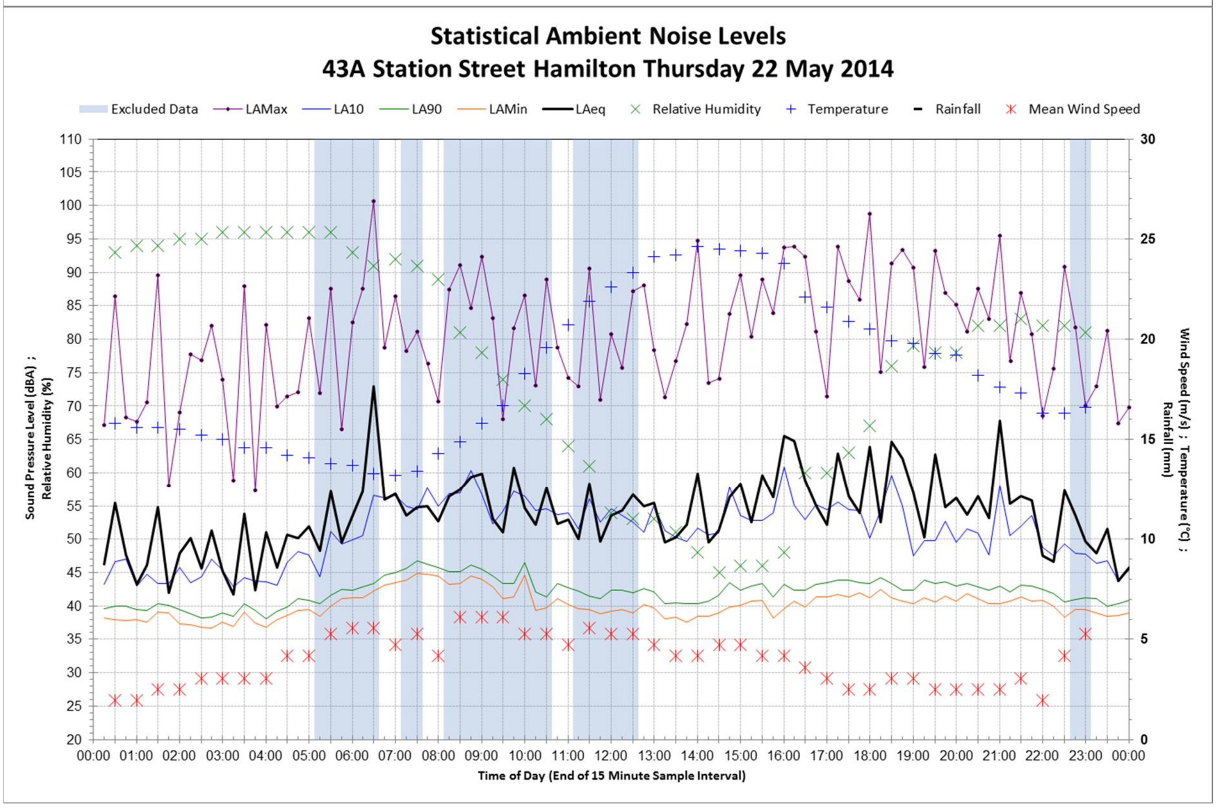

Statistical Ambient Noise Levels
43A Station Street Hamilton Thursday 22 May 2014
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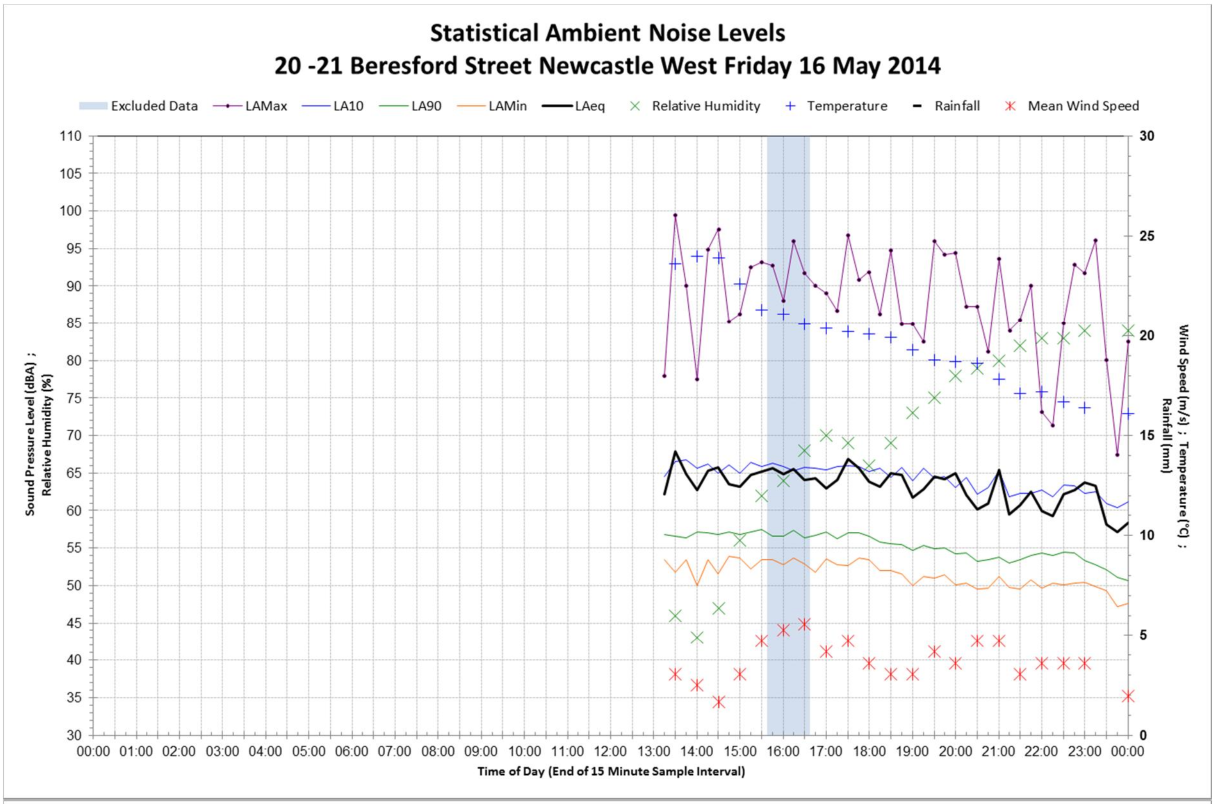
Statistical Ambient Noise Levels
20 -21 Beresford Street Newcastle West Friday 16 May 2014
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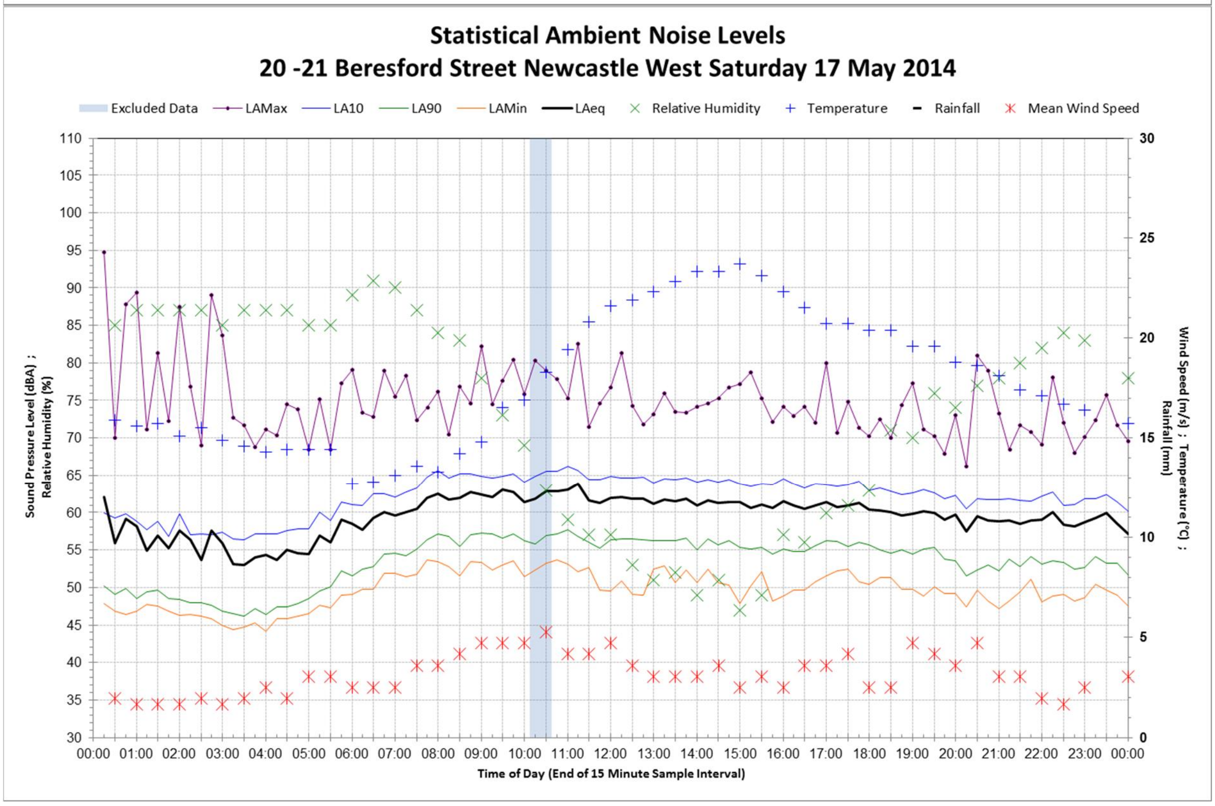
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20 -21 Beresford Street Newcastle West Saturday 17 May 2014
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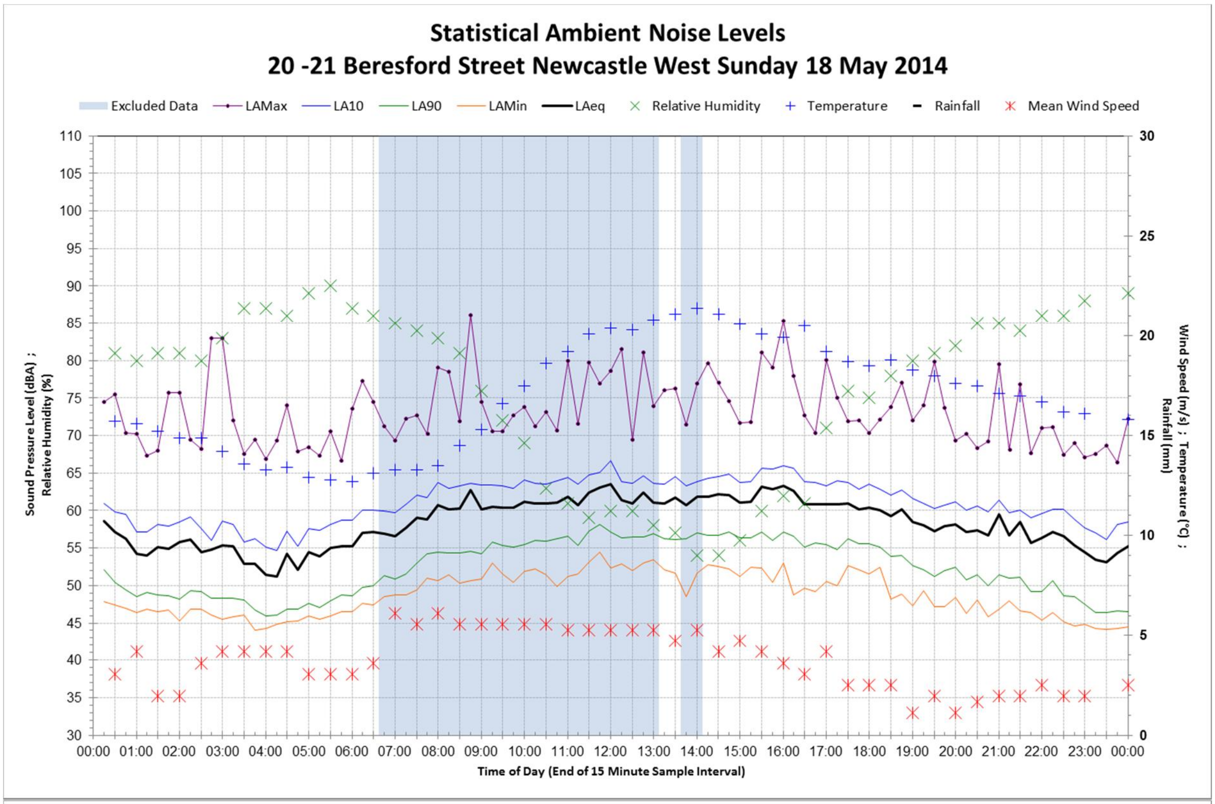
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20 -21 Beresford Street Newcastle West Sunday 18 May 2014
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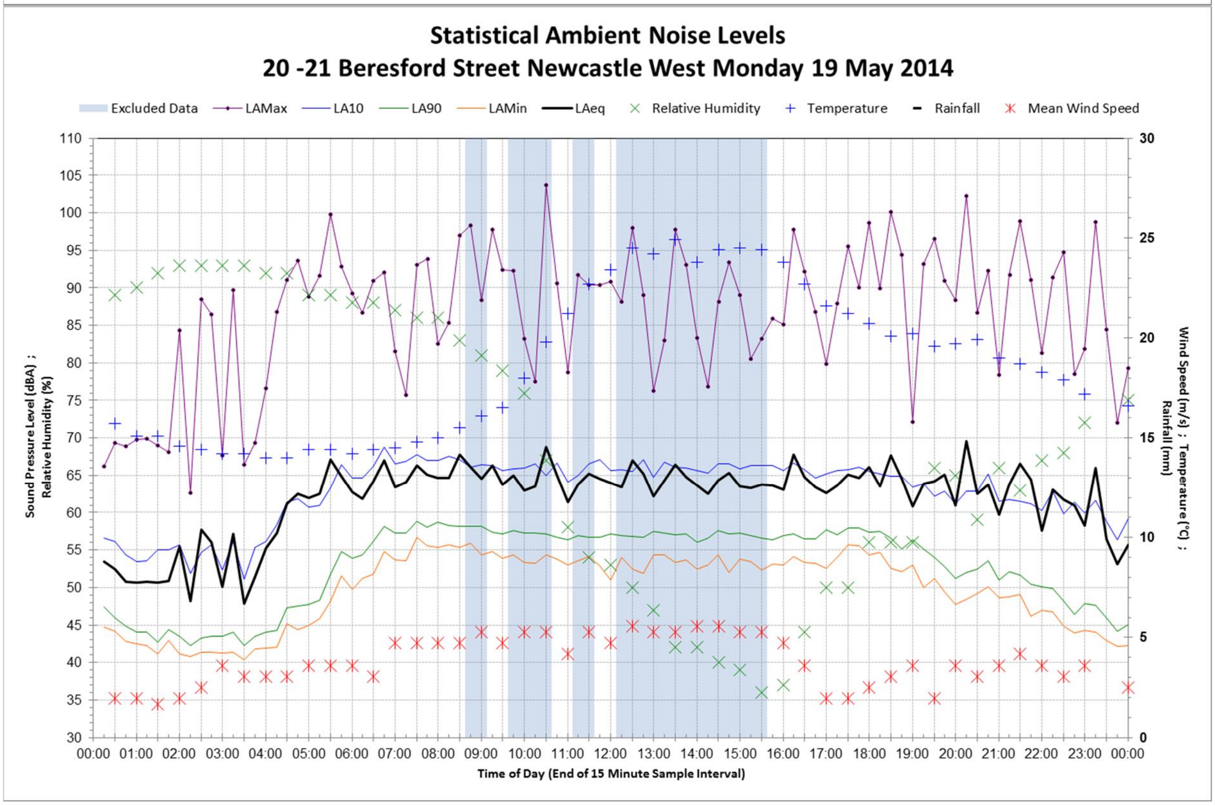
Statistical Ambient Noise Levels
20 -21 Beresford Street Newcastle West Monday 19 May 2014
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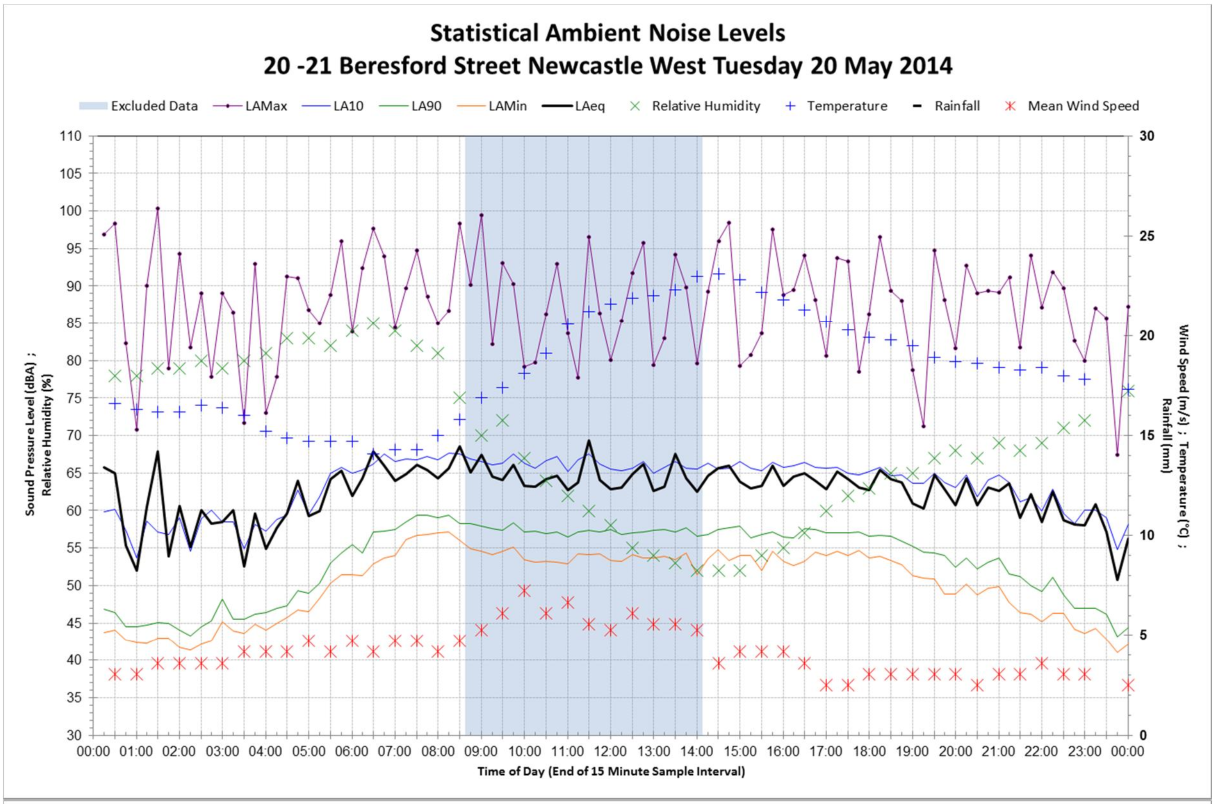
Statistical Ambient Noise Levels
20 -21 Beresford Street Newcastle West Tuesday 20 May 2014
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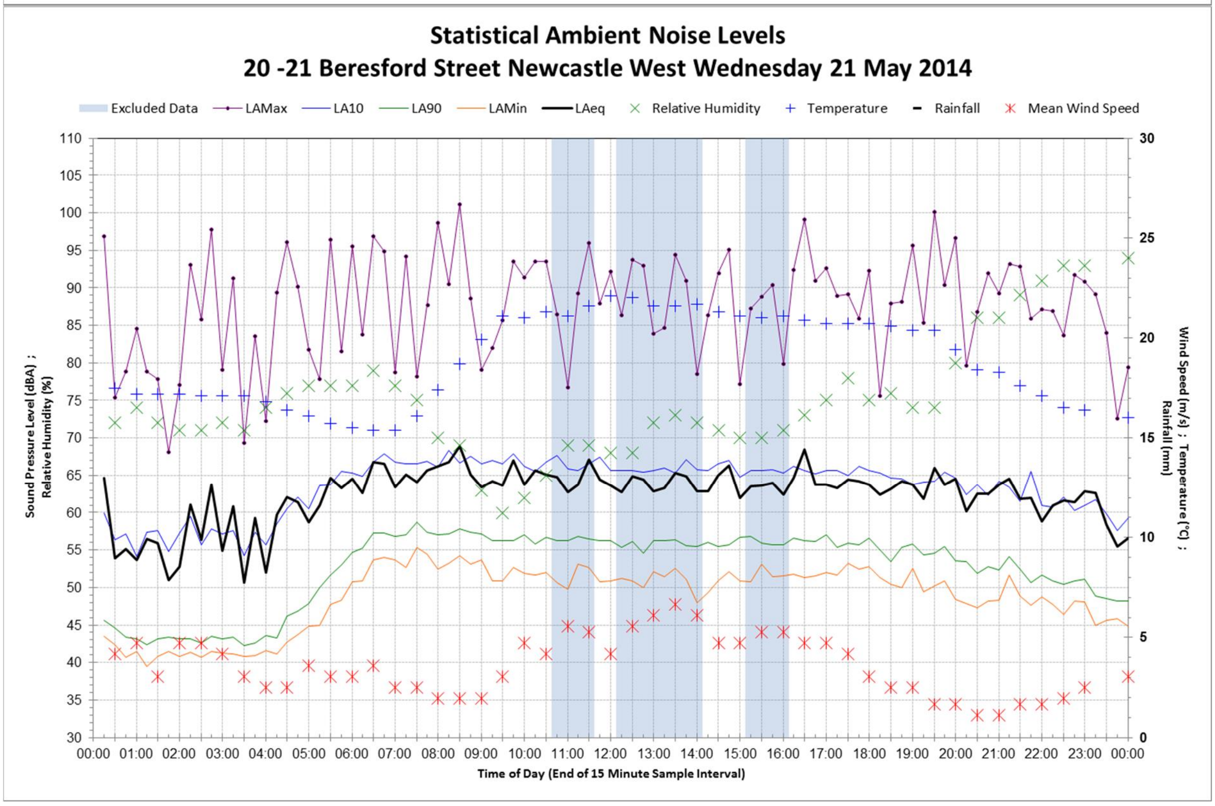
Statistical Ambient Noise Levels
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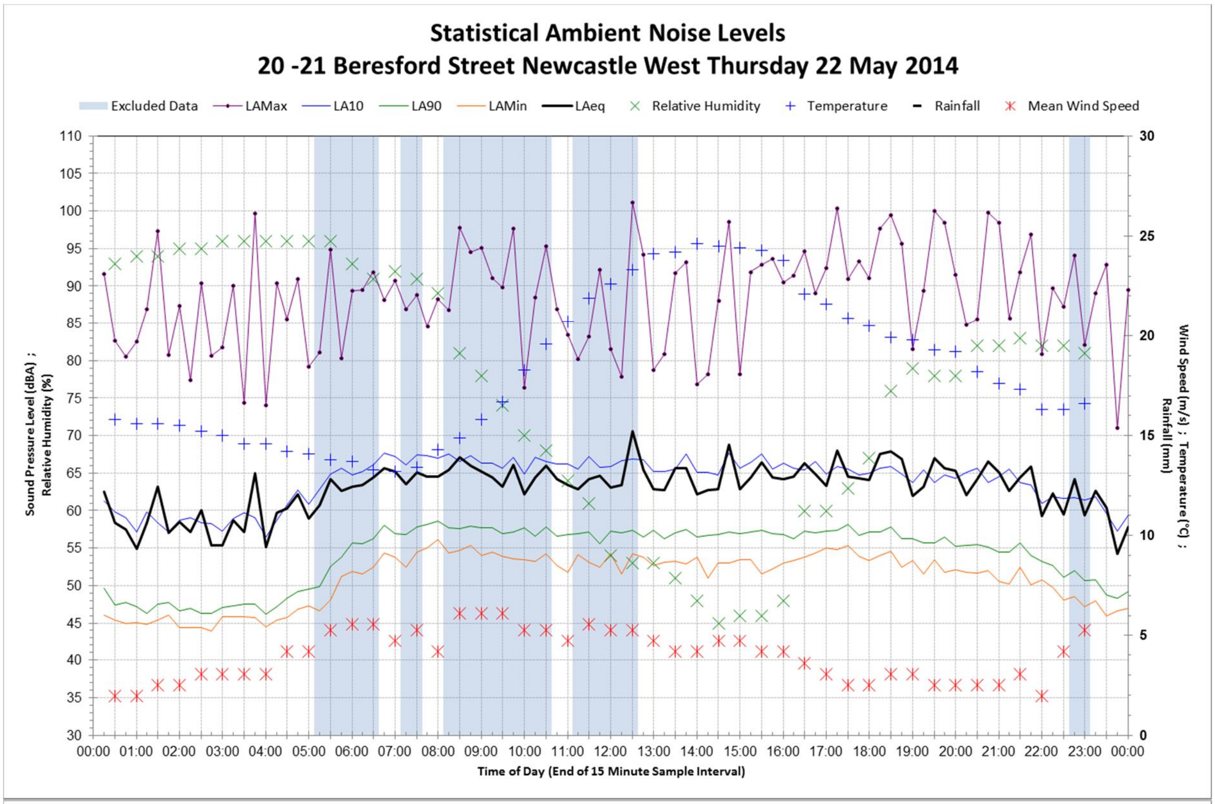
Statistical Ambient Noise Levels
20 -21 Beresford Street Newcastle West Thursday 22 May 2014
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Relative Humidity
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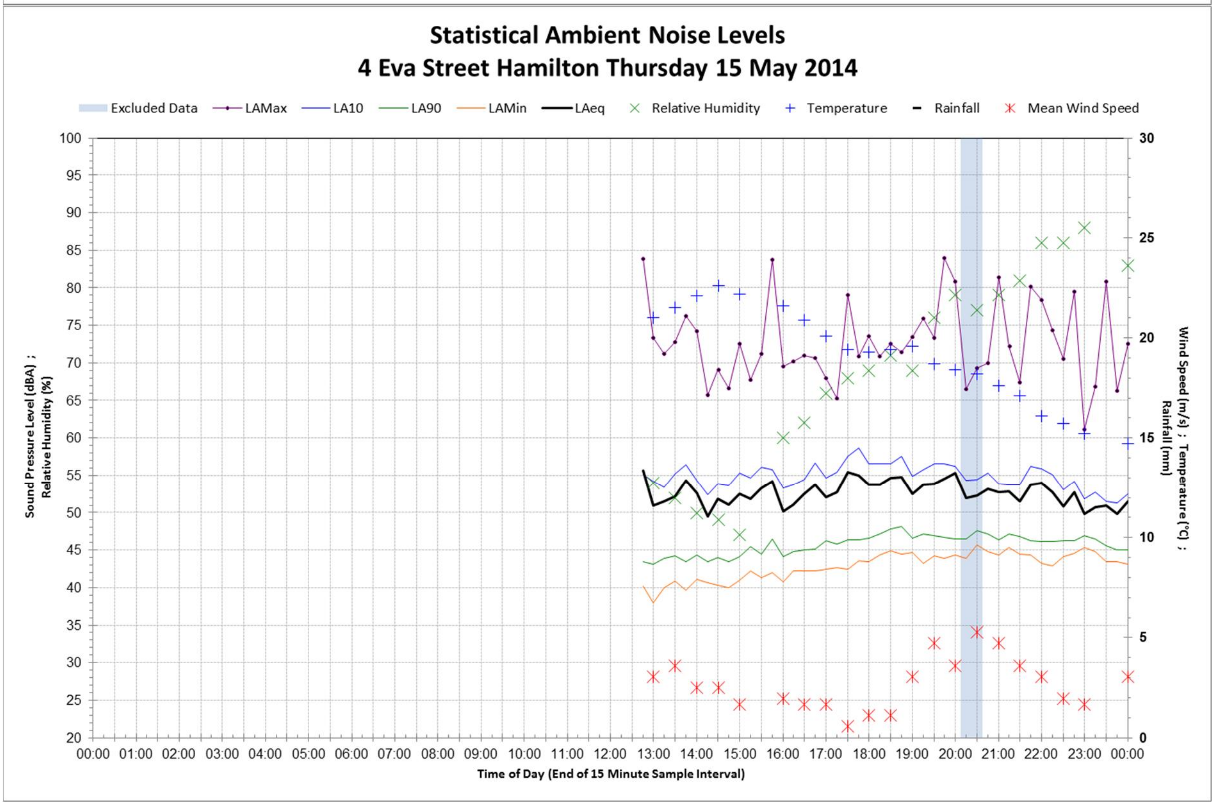
Statistical Ambient Noise Levels
4 Eva Street Hamilton Thursday 15 May 2014
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LAMin
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Relative Humidity
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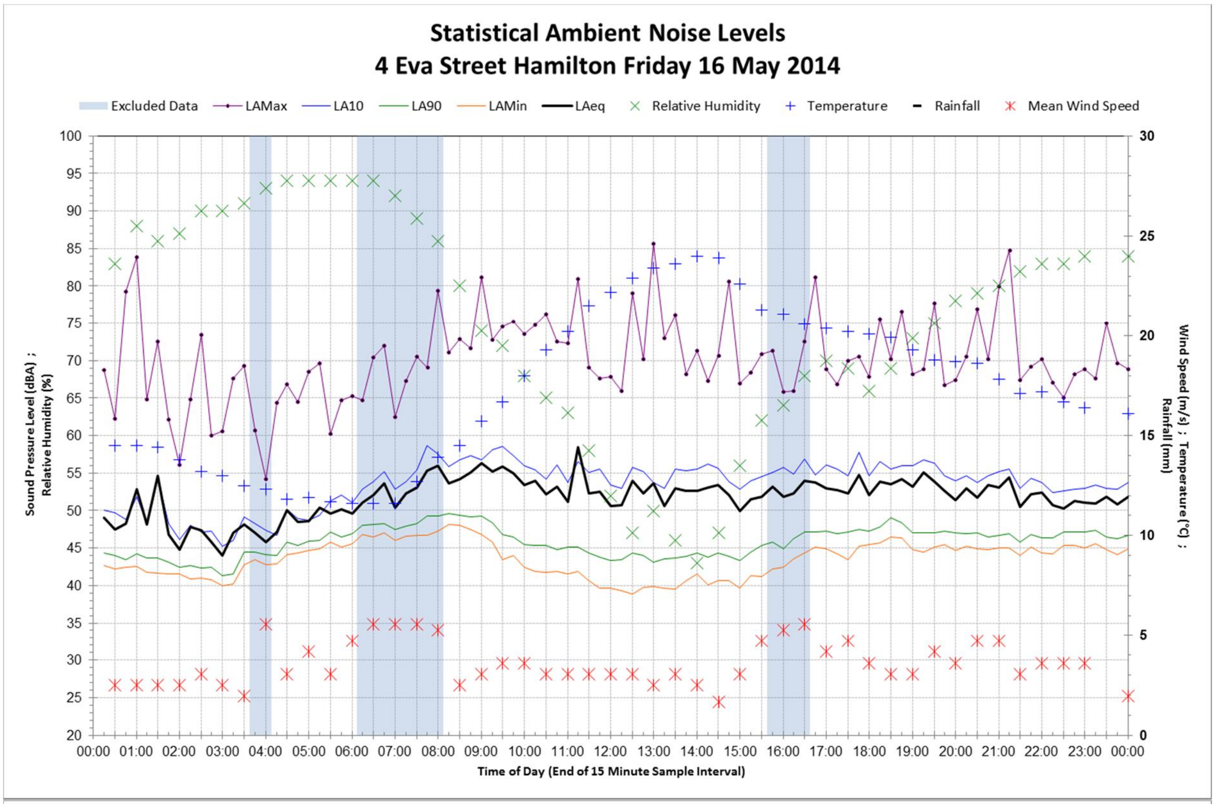

Statistical Ambient Noise Levels
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LAMin
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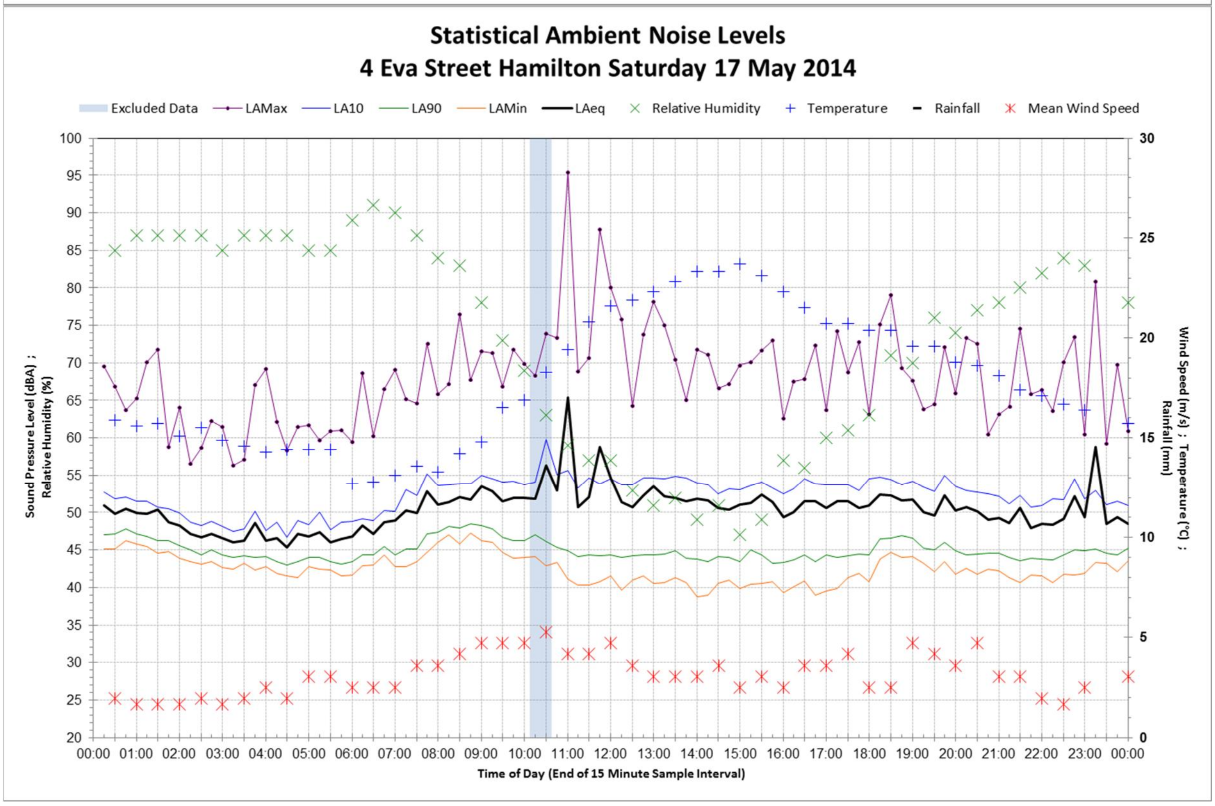

Statistical Ambient Noise Levels
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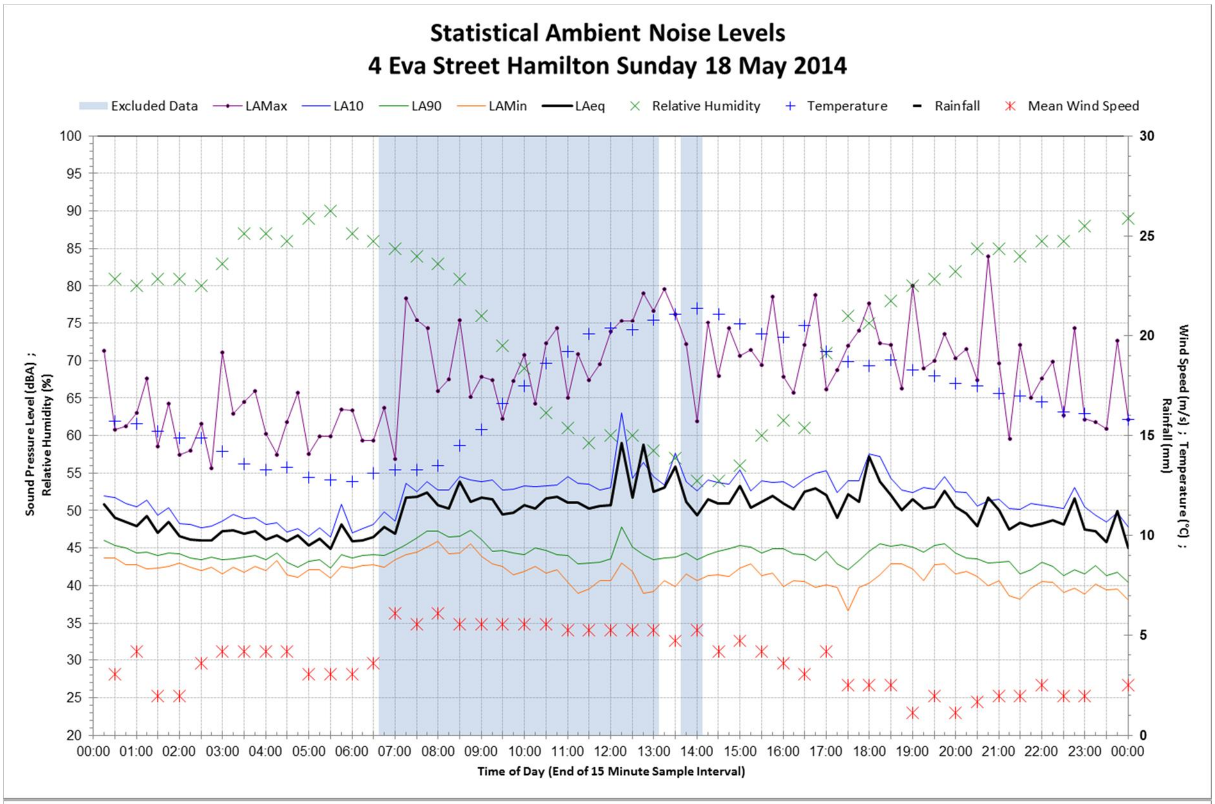
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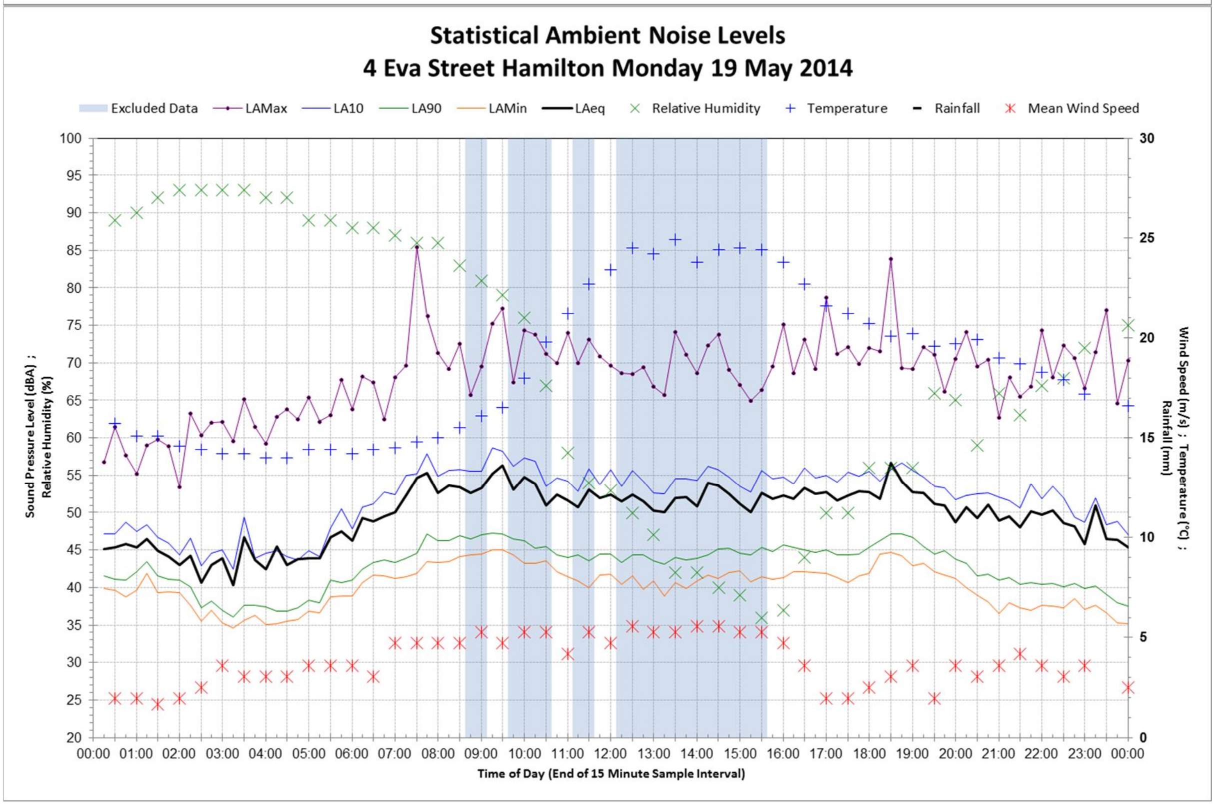
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4 Eva Street Hamilton Monday 19 May 2014
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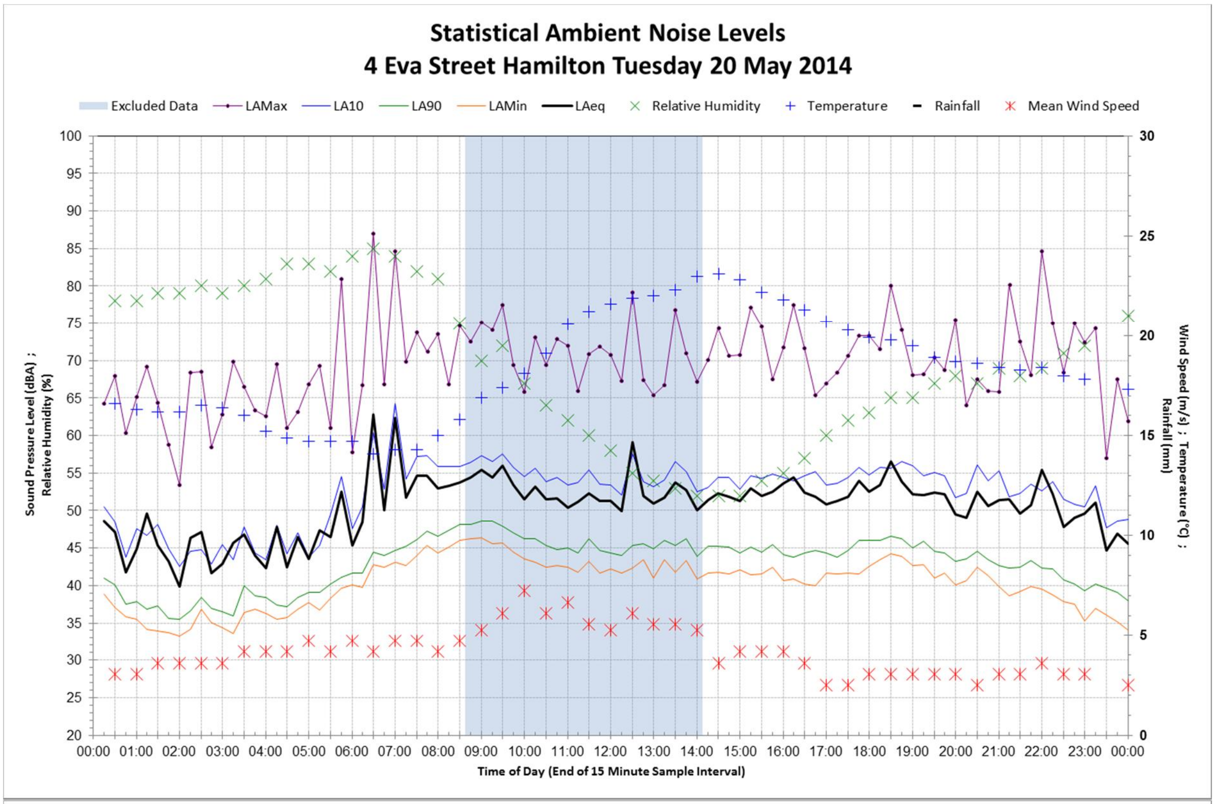
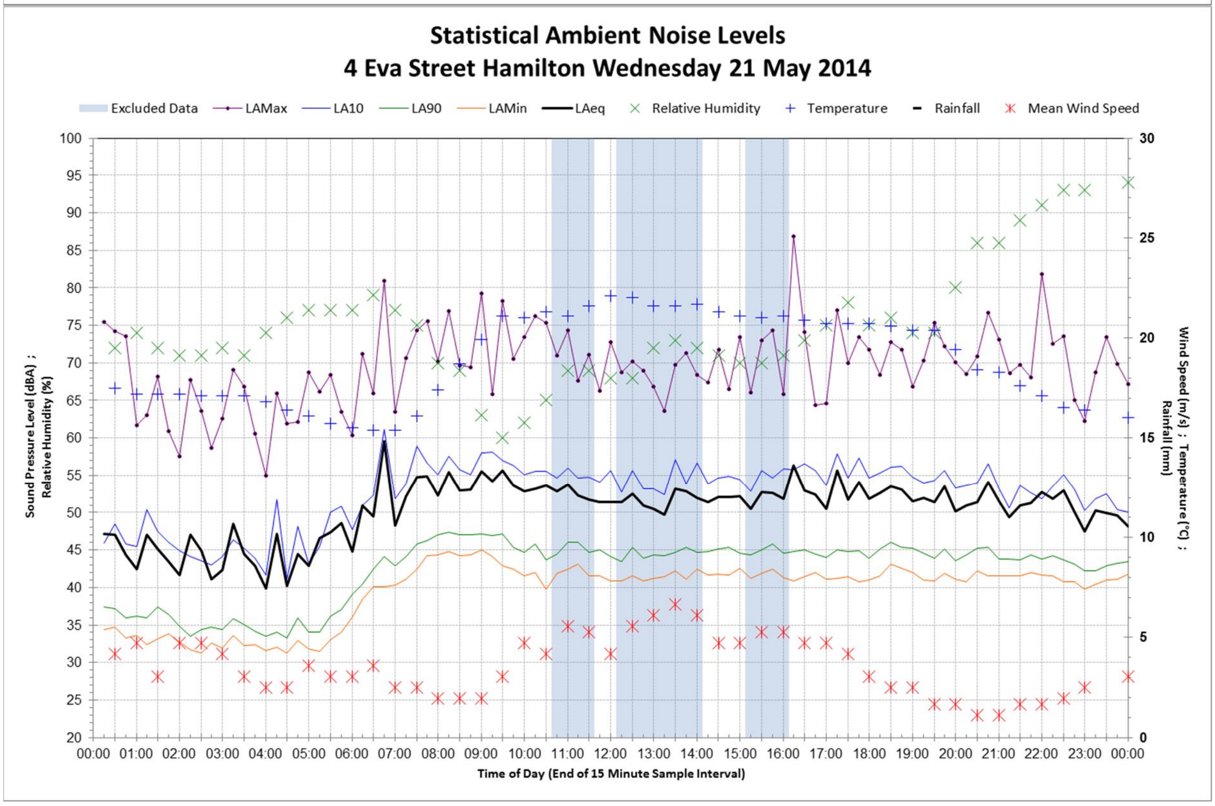
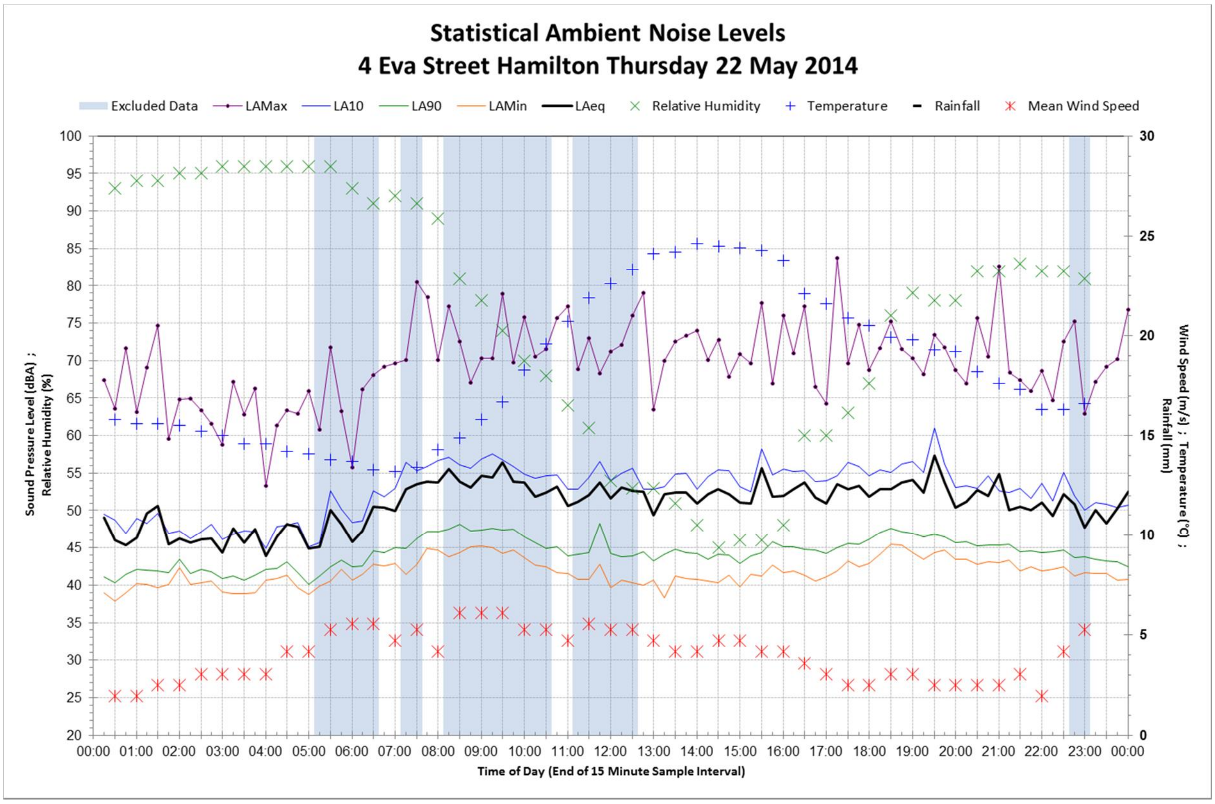
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
4 Eva Street Hamilton Tuesday 20 May 2014
Excluded Data
LAMax
LA10
LA90
LAMin
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
4 Eva Street Hamilton Wednesday 21 May 2014
Excluded Data
LAMax
LA10
LA90
LAMin
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
4 Eva Street Hamilton Thursday 22 May 2014
Excluded Data
LAMax
LA10
LA90
LAMin
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)