NSW GOVERNMENT | Planning & Infrastructure

STATE SIGNIFICANT INFRASTRUCTURE ASSESSMENT:
North West Rail Link – Stations, Rail Infrastructure and Systems (SSI-5414)

Director-General's
Environmental Assessment Report
Section 115ZA of the
Environmental Planning and Assessment Act 1979

April 2013

ABBREVIATIONS

CIV	Capital Investment Value
CPTED	Crime Prevention Through Environmental Design
Department	Department of Planning & Infrastructure
DGRs	Director-General's Requirements
Director-General	Director-General of the Department of Planning & Infrastructure
ECRL	Epping to Chatswood Rail Link
EIS	Environmental Impact Statement
EMF	Environmental Management Framework
EP&A Act	*Environmental Planning and Assessment Act 1979*
EP&A Regulation	*Environmental Planning and Assessment Regulation 2000*
EPI	Environmental Planning Instrument
EPL	Environment Protection Licence
ESD	Ecologically Sustainable Development
ICNG	Interim Construction Noise Guideline
IGANRIP	Interim Guideline for the Assessment of Noise from Rail Infrastructure Projects
INP	NSW Industrial Noise Policy
MD SEPP	State Environmental Planning Policy (Major Development) 2005
Minister	Minister for Planning & Infrastructure
NWGC	North West Growth Centre
NWRL	North West Rail Link
PFM	Planning Focus Meeting
PIR	Preferred Infrastructure Report
Proponent	Transport for NSW
RBL	Rating Background Level
RNP	NSW Road Noise Policy
RtS	Response to Submissions
SRD SEPP	State Environmental Planning Policy (State and Regional Development) 2011
Stage 1 EIS	*NWRL Environmental Impact Statement Stage 1-Major Civil Construction Works Incorporating Staged Infrastructure Modification Assessment* dated April 2012
Stage 2 EIS	*NWRL Environmental Impact Statement Stage 2-Stations, Rail Infrastructure and Systems* dated October 2012
TSF	Train Stabling Facility

Cover Photograph: Artist's Impression, Castle Hill Station

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EXECUTIVE SUMMARY

The North West Rail Link (NWRL) project has been identified by the NSW Government as a key priority railway transport infrastructure project. It is consistent with strategic land use policy for Sydney, and would provide considerable benefits to the outer north western suburbs of Sydney, and Sydney as a whole. The provision of heavy rail has been identified as providing significant advantages in comparison to other public transport modes with respect to maximising connectivity and patronage to public transport.

The NWRL project, including alignment and stations, was originally approved at a conceptual level during 2006-2008. Since Concept Plan approval, the proposal has been optimised to ensure that it appropriately responds to the travel needs of Sydney commuters, and provides a better product outcome for the community. Transport for NSW (the Proponent) subsequently lodged a request to modify the Concept Plan (staged State significant infrastructure) approval to address refinements to the project (including relocating the station to provide better customer outcomes and reducing construction impacts on Castle Hill Showground), and submitted two State Significant Infrastructure applications to deliver the NWRL through a two-stage process with separate applications and approvals: Stage 1: Major Civil Construction Works and Stage 2: Stations, Rail Infrastructure and Systems.

The NWRL alignment will stretch 23km from Epping to Rouse Hill. It will consist of two 15.5km underground rail tunnels between Epping and Bella Vista and a 4.2km above ground twin track viaduct from Bella Vista and Rouse Hill. It will include eight new stations at Cherrybrook, Castle Hill, Showground, Norwest, Bella Vista, Kellyville, Rouse Hill and Cudgegong Road. The NWRL would join the rail network at the existing tunnel stubs located immediately north of the underground Epping to Chatswood Rail Link.

On 25 September 2012, the Minister approved Stage 1, subject to conditions. Stage 1 includes 16 construction sites along the alignment from which excavation of tunnels and underground station boxes, construction of above ground infrastructure including viaduct spans and bridges and earthworks would be carried out.

At the same time, the Minister approved a modification to the existing staged State significant infrastructure approval which confirmed the project as a heavy rail line integrated with the existing rail network, provided for two new stations, realigned the NWRL within the North West Growth Centre, and provided for the vertical realignment between Bella Vista and Rouse Hill.

On 25 October 2012, the Proponent submitted a request to modify Stage 1, to change the location of Showground Station (previously Hills Centre Station), construction site boundary and construction access/egress arrangements. This modification was approved on 18 April 2013 under delegated authority by the Executive Director, Development Assessment Systems and Approvals.

Stage 2 (the subject of this report) relates to construction works for the NWRL and operation of the railway, including stations and associated precincts, services facilities, a train stabling facility at Tallawong Road, and rail infrastructure and systems.

Following a detailed assessment of the Proponent's EIS and Submissions Report, and the submissions received during the exhibition period for the project, the Department identified the project's key issues as:

- Traffic and Transport;
- Noise and Vibration;
- Hydrology; and
- Surface Water Quality.

Other issues that were assessed by the Department relate to ecology, visual impact, landscaping and urban design, historic and Aboriginal heritage, local business impacts, land

use and community facilities, soils and groundwater, air quality, waste generation and climate change and greenhouse gases.

These issues were reflected within the 322 submissions received from Government agencies, local Councils, and the local community during the exhibition of the Stage 2 EIS.

As a result of the issues raised within submissions, and design refinements, a modification was made to the layout and alignment of Bella Vista Station, which was outlined in a Preferred Infrastructure Report submitted as a component of the Submissions Report for the project. This amendment has resulted in improved access to adjoining development and did not result in substantial changes to the environmental impacts of the project. The Submissions Report also clarified the intersection arrangement proposed at Old Windsor Road, Balmoral Road and Miami Street and the proposed bus servicing arrangements around Cherrybrook Station.

Potential impacts have been addressed by the Proponent through a suite of environmental mitigation measures and a construction environmental management framework. Notwithstanding, the Department acknowledges that residual impacts will occur, but considers that these can be managed to within an acceptable level. This is reflected within the recommended conditions of approval, including environmental performance requirements; construction environmental management; and several conditions related to ongoing operational environmental management.

The project represents a vital infrastructure asset which will provide significant benefits across Metropolitan Sydney, particularly to existing and developing centres located in the outer north western suburbs of Sydney including the North West Growth Centre. Benefits include; a viable and efficient transport alternative to car use, improved access to employment and social opportunities within existing and planned centres, and an increase in overall connectivity.

Consequently, the Department recommends that the Minister for Planning and Infrastructure approve Stage 2 of the NWRL project, subject to the recommended conditions of approval.

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1. BACKGROUND

The North West Rail Link (NWRL) project has been identified by the NSW Government as a key priority railway transport infrastructure project. The NWRL project, including alignment and stations, was considered at a concept level during 2006-2008.

On 6 May 2008, Concept Plan approval was granted for the western section of the North West Metro (MP 06_0157). This concept plan was assessed and approved under the then Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The Concept Plan defined the North West Metro as being the construction and operation of a new electrified passenger rail line between Epping and Rouse Hill, including:

- six new stations at Cherrybrook, Castle Hill, Showground, Norwest, Kellyville and Rouse Hill;
- stabling facilities; and
- associated ancillary infrastructure.

An overview of the route is shown in Figure 1.1.

Figure 1.1: Route Overview

On 1 October 2011, Part 3A of the EP&A Act was repealed. Under clause 5 of Schedule 6A of the EP&A Act, the Concept Plan approval was transitioned to a State Significant Infrastructure (SSI) approval under Part 5.1 of the EP&A Act.

The project is now being delivered through a two stage process with separate applications being lodged for assessment and approval consistent with the transitioned SSI staged approval. On 14 December 2011, the Proponent, Transport for New South Wales (TfNSW) submitted a request to modify the staged SSI approval to address refinements to the project, and an application for the NWRL Stage 1: Major Civil Construction Works.

On 25 September 2012, the SSI modification and Stage 1: Major Civil Construction Works, were approved subject to conditions. Stage 1: Major Civil Construction works includes 16 construction sites along the alignment from which the following will be carried out:

- excavation of tunnels and underground station boxes;
- construction of above ground infrastructure including viaduct spans and bridges; and
- earthworks.

On 25 October 2012, the Proponent submitted a request to modify Stage 1, to modify the location of Showground Station (previously Hills Centre Station), vertical alignment, construction site boundary and construction access/egress arrangements. This modification was approved on 18 April 2013 under delegated authority by the Executive Director, Development Assessment Systems and Approvals.

On 30 July 2012, the Proponent further submitted an application for the NWRL Stage 2: Stations, Rail Infrastructure and Systems. The assessment of this application is the subject of this report. Stage 2 relates to the operation of the railway as well as the construction of those elements of the NWRL not assessed by Stage 1, including:

- stations and wider precincts, services facilities a stabling facility at Tallawong Road, and rail infrastructure and systems; and
- additional land take for certain construction works around the station precincts such as road works, pedestrian/cycle facilities and landscaping).

2. PROPOSED PROJECT

2.1. Project Description

The NWRL between Epping and Tallawong Road comprises the following main components:

- eight new stations located at Cherrybrook, Castle Hill, Showground, Norwest, Bella Vista, Kellyville, Rouse Hill and Cudgegong Road;
- a direct underground connection into the existing ECRL at Epping, with trains operating between the north west and Chatswood;
- an underground section of alignment comprising of 15.5km of two track railway in a twin tunnel configuration with cross passages at regular intervals between Epping and Bella Vista;
- a 7.5km above ground section of alignment from Bella Vista to the Tallawong Stabling Facility, Rouse Hill, which would be a combination of viaduct, embankment, at grade and cutting;
- a Stabling Facility at Tallawong Road;
- an intermediate service facility between Epping and Cherrybrook; and
- a service facility at Epping.

In general, the areas between Epping and Bella Vista Station along the alignment are urbanised. Surrounding land uses include high and low density residential, commercial, local centre, specialised infrastructure and public open space/conservation zones.

The surroundings from Bella Vista Station to Cudgegong Road Station and Stabling Facility are undergoing development and currently consist of rural residential lands. Developed densities through this section are lower and surrounding land uses include low density or rural residential, commercial and open space/conservation zones.

Planned future development is anticipated to take place at locations along the alignment and construction compounds. Known initiatives include the continued development of the Epping Town Centre, expansion of Castle Towers Shopping Centre, development of the Balmoral Release Area, development of the Northern Frame of Rouse Hill Town Centre, and the development of Area 20.

The key construction components of the project are listed in Table 2.1, and the key operational components of the project are listed in Table 2.2.

Table 2.1: Key Project Components – Construction

Aspect	***Description***
Station construction and fit out	Underground stations (Castle Hill, Showground, Norwest) – indicative construction and fit-out timeframe 2017-2018, involves the construction of platforms, vertical supports, intermediate floors, roof slabs (covering the station box for cut and cover stations, and covering the plant rooms for open cut stations), platform canopies (for open cut stations), and mechanical, electrical and architectural fit-out. Elevated stations (Kellyville, Rouse Hill) – indicative construction and fit-out timeframe 2016-2018, involves support columns and foundations for the station structure, emergency egress stairs, the platform structure, the vertical transport structure, the platform canopy, the station buildings, and mechanical, electrical and architectural fit-out. Open cut stations (Cherrybrook, Bella Vista, Cudgegong Rd) – indicative construction and fit-out timeframe 2016-2018, involves support columns and foundations for vertical transport structures and the station buildings, the platform structure, vertical transport structure and the pedestrian accesses, the platform canopy, the emergency egress stairs, the station buildings, and mechanical,

Aspect	Description
	electrical and architectural fit-out.
Station precinct works	Precinct works would involve a range of activities including roadworks, building works and landscaping. These works would include the construction of roads and car parks, including earthworks, drainage works, kerb and guttering, surfacing including asphalt, concrete and pavers, bus shelters and other buildings, and line marking, signage and other finishes.
Services facility construction and fit out	Epping and Cheltenham services facilities – indicative construction and fit-out timeframe 2016-2017, works involve lining of the shafts by a bottom-up sequence with any reinforcement required fabricated on the surface and lifted into the shaft. Installation of services would also follow a bottom-up sequence. At the conclusion of the installation of services the architectural wall and ceiling cladding fit-out would occur, followed by the final fit-out of all services.
Stabling and maintenance facility construction and fit out	Tallawong Stabling Facility – indicative construction and fit-out timeframe 2016-2018, involves building construction using conventional steel frame methods, with access roads and car parking constructed using the methods as for station precinct works. Rail systems fit-out as per the at-grade surface fit-out.
Tunnel systems fit out	Tunnel and tunnel rail systems fit-out works would include ventilation fit-out, track slab and rail fastening, rail installation, fixing and welding, cable and equipment installation including signalling, communications and electricity, overhead wiring installation, and other equipment (including lighting, drainage works, and fire and life safety systems).
At-grade surface and viaduct systems fit out	At-grade and viaduct systems fit-out works would include track and rail fastening, rail installation, fixing and welding, cable and equipment installation including signalling, communications and electricity, overhead wiring structures installation, and other equipment (including lighting, drainage works, noise attenuation where required, and fire and life safety systems).
Testing and commissioning	Once all services fit-out works are complete, testing and commissioning would occur in the following stages: - assemble testing procedures and pre-checks; - installation and operation tests; and - site acceptance tests.

Table 2.2: Key Project Components – Operation

Aspect	Description
Tunnels	The tunnels would provide space for trains and tracks, as well as various equipment including rail signalling, controls and communication, overhead traction power, fire systems and emergency access walkway.
Skytrain and surface tracks	The skytrain would run between Kellyville to beyond Rouse Hill and have a width of approximately 11 to 14m, incorporating two railway lines plus signalling, overhead wiring, acoustic treatment and maintenance walkways for rail workers.
Rail infrastructure and systems	Trackform – track system consisting of the rail and its supports. Rail signalling and control systems – advanced signalling technology, including Automatic Train Protection and Automatic Train Regulation / timetabling, and an integrated information control system to allow communication with passengers or any staff member via audio and visual links at the station or on the train. Traction power supply – traction substations at Epping West, Cherrybrook, Castle Hill, Showground, Norwest and Tallawong stabling and maintenance facility. A sectioning hut would be required at the Cheltenham Services Facility and at Rouse Hill. In addition, an off precinct traction substation would be required at Bella Vista.
Station design	The eight stations would be designed to provide: - ease of access for all customers, including those with specific accessibility needs (eg wheelchair users, those with restricted mobility, reduced vision and hearing, and customers with strollers); - a safe and comfortable environment; - emergency access and egress; - a comfortable environment (eg weather protection, ventilation/cooling, daylighting);

Aspect	Description
	- customer facilities (eg toilets, seating, ticket facilities, coverage for modern telecommunications and bicycle storage); - public areas (ie unpaid concourse, paid concourse and platforms); - activation opportunities such as retail space; - staff facilities; and - station systems – electrical and mechanical services.
Services facilities	Epping Services Facility – includes a traction power substation, a ventilation and equipment building (within one facility) and onsite stormwater detention. The facility would require maintenance access via Beecroft Road and would also be used for rail personnel (no heavy equipment) to access the tunnel during track / tunnel maintenance periods. Cheltenham Services Facility – includes emergency access and egress, plant rooms, a sectioning hut (for railway systems operation), access for maintenance personnel and onsite stormwater detention facilities. Following construction of the facility, items that had been displaced would be re-established, such as the netball training courts and it is proposed to upgrade the existing sports amenities building. The areas of bushland cleared as a result of Stage 1 works would be rehabilitated following completion of the services facility.
Stabling and maintenance activities at Tallawong Road	The site would include internal access roads, train stabling area, train wash, wheel lathe within a building, maintenance building, infrastructure maintenance facilities, administration buildings including operational control centre, staff car park, landscaping, lighting and CCTV, fencing, and a bulk power sub-station and transformer facilities with secure access.
Rail operations	The NWRL would provide frequent rail services seven days a week with operating hours throughout the day from early morning until late at night. The indicative service frequency would be: - weekday peak: train every five minutes (12 trains per hour); - weekday off-peak: train every 10 minutes (six trains per hour); and - weekends: train every 10 minutes (six trains per hour). The NWRL would connect directly with the existing ECRL providing access to the existing rail stations located at Epping, Macquarie University, Macquarie Park, North Ryde and Chatswood. The trip from Cudgegong Road to Chatswood is expected to take approximately 37 minutes on a rapid transit train, including dwell time at stations. All trains operating on the NWRL would be new, modern single deck rapid transit trains. Each train would have eight carriages and be capable of transporting up to 1,300 people.

2.2. Project Need and Justification

Sydney's population is expected to increase by 1.3 million, to approximately 5.6 million people by 2031. Greater Western Sydney will be home to more than half of Sydneysiders by 2031. The *Draft Metropolitan Strategy for Sydney to 2031 (2013)* sets the strategic direction for Sydney's future growth and is fully integrated with the *Long Term Transport Master Plan* and the *State Infrastructure Strategy*. The vision for Sydney contained in the *Draft Metropolitan Strategy* is for a strong global city and a liveable local city.

For Sydney to maintain its status as a strong global city, it must maximise the productivity advantages of supporting economic investment, employment growth and activity in centres. Investment in public transport must also support urban renewal and development of new centres that will improve the liveability of Sydney's local neighbourhoods.

The *Draft Metropolitan Strategy* supports a framework for balanced growth that

- focuses housing and employment growth in centres;
- uses land in both infill and greenfield areas efficiently;
- strengthens and grows local and strategic centres; and
- makes Sydney easier to travel around in.

To deliver these outcomes, nine 'city-shapers' have been identified in areas with major opportunities for transformative change for Metropolitan Sydney. The NWRL corridor has itself been identified as a city-shaping corridor which will capitalise on improved public transport connections to Sydney's North West. Priorities for the NWRL corridor, outlined in the *Draft Metropolitan Strategy* include and create opportunities to design and develop new neighbourhoods around stations that reflect the best principles of transit-orientated design, and well designed high quality public spaces and community facilities.

The Global Economic Corridor has also been identified as a city shaper in the *Draft Metropolitan Strategy*. The Global Economic Corridor is a 25 kilometre arc of significant agglomeration of economic activity, stretching from Sydney Airport to Macquarie Park. One of the main priorities for the Global Economic Corridor is to extend it from Macquarie Park to Norwest. The NWRL will help deliver this strategic priority. It will connect North Western Sydney to the Global Economic Corridor and support 25,000 new jobs at Castle Hill, Norwest and Rouse Hill.

The *Draft Metropolitan Strategy* contains a number of specific objectives for Sydney, such as:

- deliver well designed and active centres that attract investment and growth;
- achieve productivity outcomes through investment in critical and enabling infrastructure;
- plan and deliver transport and land use that are integrated and promote sustainable transport choices;
- improve access to major employment hubs and global gateways; and
- improve accessibility and connectivity for centres and for new urban areas.

The NWRL – along with associated projects along the NWRL corridor – will have a critical role in helping to meet these objectives.

The Department, in its previous assessment of the North West Metro Concept Plan, found that such a proposal was justified on the following grounds:

- the project is wholly consistent with and builds on the strategic land use and transport objectives for Sydney identified in the *Sydney Metropolitan Strategy* (2005); *State Infrastructure Strategy* (2006); *NSW State Plan* (2006) and *Urban Transport Statement* (2006);
- the project provides significant advantages in terms of the frequency and reliability of service, which is integral to encouraging the shift to more sustainable forms of transit; and
- the project provides significant benefits to existing and developing centres including the North West Growth Centre (NWGC) by:
    - providing a viable and efficient transport alternative to car use, with associated personal and wider-social benefits including less fuel costs, congestion relief and air quality benefits; and
    - improving access to employment and social opportunities within existing and planned centres, particularly to the 'Global Economic Corridor' which is of significant economic importance to Sydney and to other major centres previously inaccessible by rail.

Additionally, as a result of further assessment of Stage 1, the Department found that the proposal was justified on the following grounds:

- currently, the outer north western suburbs of Sydney are heavily reliant on private cars and bus services for transport options, therefore with increased demand on road

networks, it is vital that transport networks and services are expanded to the region to support ongoing development and to connect the NWGC to existing centres;

- the NWRL will support employment generation by maximising connectivity and patronage numbers utilising public transport in the region, a key component in encouraging sustainable transport orientated development along the corridor, stations and surrounding centres;
- the *NSW Long Term Transport Master Plan*, identifies the NWRL as a key component in delivering a modern rail system and services to the North West and in particular the NWGC; and
- the *State Infrastructure Strategy* confirms the NWRL as a key project for the NSW Government, to be built in the short term (within the next 5 years)
- the NWRL is wholly consistent with the relevant goals of renovating infrastructure and returning quality services in *NSW 2021*, by reducing travel times by providing key rail services and facilitating a road to rail modal shift, by increasing public transport patronage by providing an attractive transport alternative in a growing region of Sydney, and by improving road safety as a result of having fewer cars on the road network.

In June 2012 Transport for NSW announced a new rail plan for Sydney, *Sydney's Rail Future*. *Sydney's Rail Future* is a long term plan to increase the capacity of Sydney's rail network through investment in new services and upgrading of existing infrastructure. A central aim of the plan is to transform and modernise Sydney's rail network so that it can grow with the population and meet the needs of customers now and into the future.

The NWRL would be a key component of the introduction of a rapid transit sector, a customer focused public transport plan to modernise Sydney's rail network and trains. The NWRL would be the first part of a new, modern high frequency rail network. NWRL trains would use the existing ECRL to provide services between Chatswood and Cudgegong Road, Rouse Hill. Figure 2.1 illustrates the proposed *Sydney's Rail Future* network, the Rapid Transit Network shown in blue.

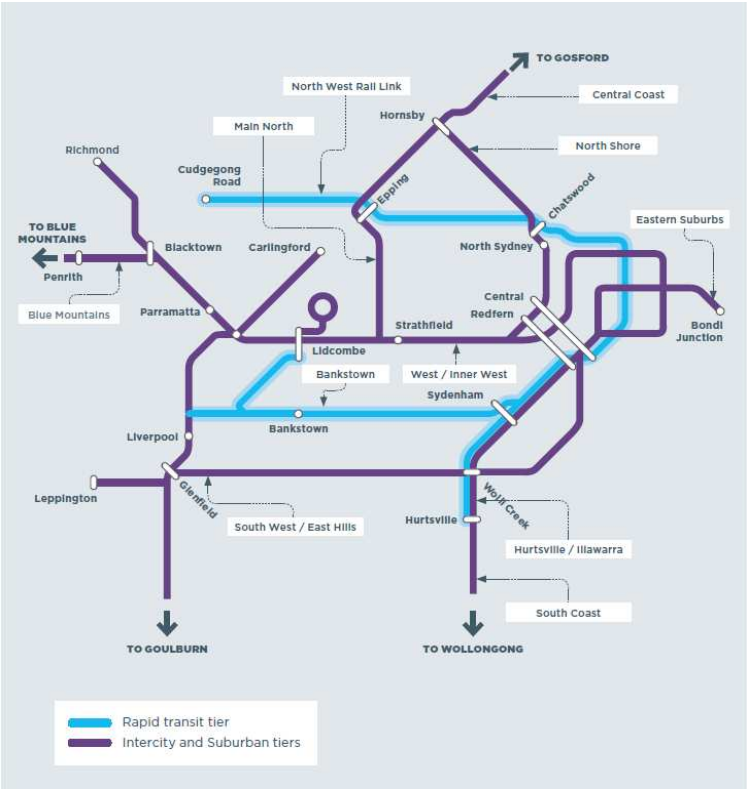

Figure 2.1: Network Plan – Sydney's Rail Future

For the above reasons, the Department considers that the NWRL and by extension, the Stage 2: Stations, Rail Infrastructure and Systems is justified on the basis that is represents a vital infrastructure asset which is beneficial to the public interest. The impacts of not proceeding with the project in the long term would prove detrimental to road capacity, air quality, accessibility to housing and jobs and planned land release development of the NWGC and the wider region.

2.3. Station Precinct Planning

As well as addressing the demand for better transport access, the NWRL will act as a catalyst for further development in North West Sydney, including an opportunity to implement a fully integrated approach to transport and land use planning in the region.

The NWRL project will be designed and constructed to accommodate potential future development through provision of a robust street pattern, local access arrangements and an integrated approach, including structural support, servicing and access.

Residual land would remain following completion of construction of the NWRL project. In some areas, surplus land would provide development opportunities within the immediate station precincts themselves, such as areas identified as *Future Use to be Determined by Master Plan* on the indicative layouts of each station. These areas would comprise commercial and retail type activities, open space and areas of public domain and would be developed on an interim and permanent basis over a number of years.

Development of these residual areas would require subsequent approvals, assessed and determined by the relevant approval authority under the Act.

In addition to this, a wider station precinct planning and land use integration process, parallel and separate to the NWRL assessment, is also underway. This involves a collaborative approach with TfNSW and local Council's to develop and implement station precinct planning work to maximise sustainable land use development opportunities that have arisen as a result of the NWRL project.

The main aims of this process are to enable future transit orientated development associated with the NWRL project to achieve:

- a mix of employment, retail and community services within a five minute (400 metre) walkable catchment to reduce the need for trips to meet daily needs;
- precincts that promote connectivity and access to stations, interchange facilities, key activities and uses; and
- a population density within walking distance (generally 800 metres) to support a range of activities and uses.

The outcomes of the precinct planning working group will be used to facilitate community and stakeholder discussion about the desired future character of the station precincts which, in turn, will inform future planning controls and infrastructure requirements to support growth scenarios along the NWRL corridor. This approach is also consistent with the Government's strategic planning framework, as outlined in *A New Planning System for NSW: White Paper 2013.*

This wider station precinct planning process has been encapsulated into the *North West Rail Link Corridor Strategy*, which includes a draft Structure Plan for each station precinct, and is currently being publicly exhibited by the Department. Figure 2.2 outlines the NWRL Draft Corridor Structure Plan.

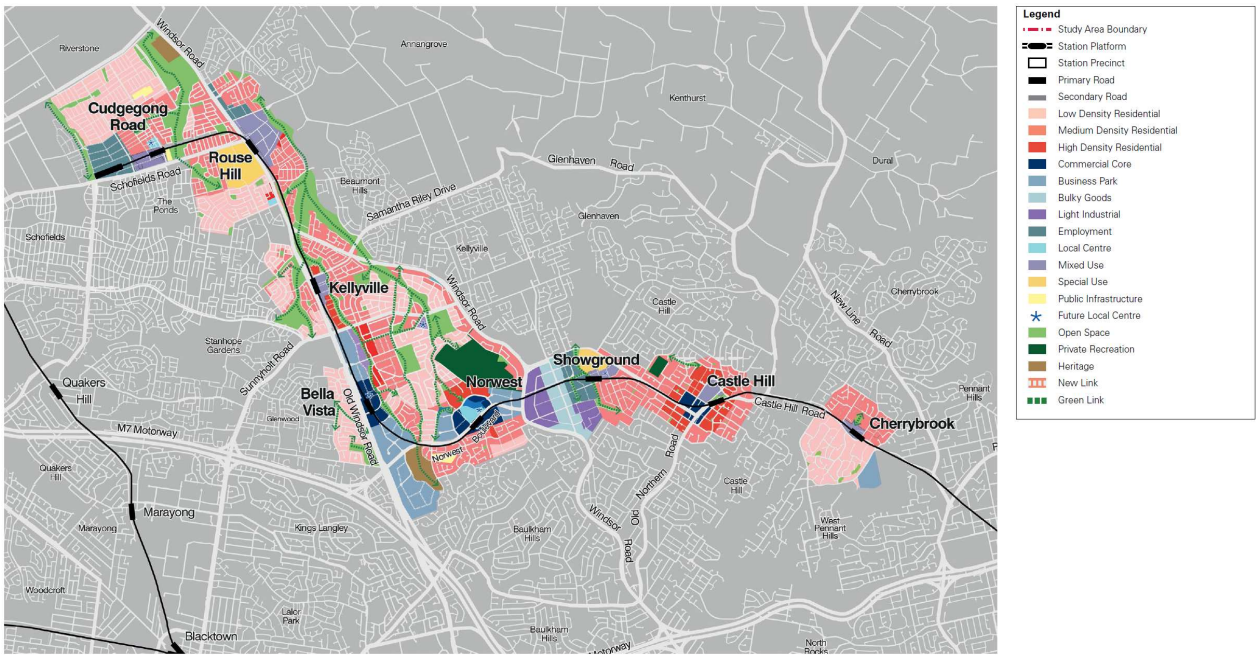

Figure 2.2: NWRL Draft Corridor Structure Plan

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3. STATUTORY CONTEXT

3.1. State Significant Infrastructure

On 6 May 2008, the then Minister for Planning granted Concept Plan Approval for the North West Metro, under Part 3A of the EP&A Act. The Concept Plan Approval protects the North West Metro corridor as identified within the Concept Plan, through the *State Environmental Planning Policy (Infrastructure) 2007* (Infrastructure SEPP), as land that the Minister has granted approval for under Part 3A for a concept plan for a project comprising development for the purpose of a railway.

Pursuant to section 115U(4) of the EP&A Act, and under the *State Environmental Planning Policy (State and Regional Development) 2011* (SRD SEPP), Schedule 4, Part 1, the North West Metro Concept Plan is identified as transitional development, and declared to be SSI.

The Concept Plan approval is therefore now an approval for staged SSI under Part 5.1 of the EP&A Act pursuant to section 115ZD of the EP&A Act. The staged approval does not, however, permit the carrying out of works, and a separate detailed environmental assessment and approval is required for the project, or each part of the project, before construction can commence.

The Proponent submitted a request on 14 December 2011, to modify the staged SSI approval (Concept Plan Approval dated 6 May 2008), to address refinements to the project (including the project definition, and adjustments to the project alignment including station locations) and submit an application for the NWRL Stage 1: Major Civil Construction Works.

The Proponent has subsequently submitted an application for Stage 2: Stations, Rail Infrastructure and Systems, the subject of this report.

3.2. Critical Infrastructure

Pursuant to section 115V of the EP&A Act, the SRD SEPP, Schedule 5(2), identifies the NWRL as Critical SSI. This listing recognises the importance of the NWRL as a project that is essential to the State for economic, environmental or social reasons.

3.3. Permissibility

The NWRL is defined as a rail infrastructure facility under the Infrastructure SEPP. As a rail infrastructure facility being carried out by a public authority it is identified as development that is permissible without consent under clause 79 of the Infrastructure SEPP.

3.4. Environmental Planning Instruments

With the exception of the Infrastructure SEPP and SRD SEPP, there are no State Environmental Planning Instruments that apply to the carrying out of the NWRL project.

3.5. Objects of the EP&A Act

Decisions made under the EP&A Act must have regard to the objects of the Act, as set out in Section 5 of the Act. The relevant objects are:

(a) to encourage:

(i) the proper management, development and conservation of natural and artificial resources, including agricultural land, natural areas, forests, minerals, water, cities, towns and villages for the purpose of promoting the social and economic welfare of the community and a better environment,

(ii) the promotion and co-ordination of the orderly and economic use and development of land,

(iii) the protection, provision and co-ordination of communication and utility services,

(iv) the provision of land for public purposes,

(v) the provision and co-ordination of community services and facilities, and

(vi) the protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities, and their habitats, and

(vii) ecologically sustainable development, and

(viii) the provision and maintenance of affordable housing, and

(b) to promote the sharing of the responsibility for environmental planning between the different levels of government in the State, and

(c) to provide increased opportunity for public involvement and participation in environmental planning and assessment.

The objects stipulated under Section 5(a) are significant factors informing determination of the application. The Department, in its assessment, has considered the need to encourage the appropriate management and conservation of natural and artificial resources, including natural water resources, flora and fauna, and towns and centres for the purpose of promoting the social welfare of the community. The Department has also considered the proposed project in relation to the orderly development of land, the protection of communication and utility services, the provision of land for public purposes, the co-ordination of community services and facilities, and the protection of the environment.

Object 5(b) is relevant as the project involves the sharing of responsibility and information for environmental planning to provide key rail infrastructure through key strategic centres and the NWGC. Object 5(c) is also relevant to the project as the issues raised by the community during the exhibition period of the EIS form a part of the assessment of the project and the Departments consideration.

3.6. Ecologically Sustainable Development

The EP&A Act adopts the definition of Ecologically Sustainable Development (ESD) found in the *Protection of the Environment Administration Act 1991*. Section 6(2) of that Act states that ESD requires the effective integration of economic and environmental considerations in decision-making processes and that ESD can be achieved through the implementation of:

(a) the precautionary principle,

(b) inter-generational equity,

(c) conservation of biological diversity and ecological integrity,

(d) improved valuation, pricing and incentive mechanisms.

The principles of ESD have been addressed in the EIS prepared by the Proponent. The EIS includes detailed discussion on the sustainability of the project, as well as detailed studies in the form of Technical Papers, in the areas of construction and operational traffic and transport management, noise and vibration, heritage, ecology, and surface water and hydrology. The results of these studies have been summarised and integrated in the body of the EIS to ensure that the principles of ESD have been adequately addressed as part of the assessment of the project. The Proponent has set out a series of mitigation and management measures that would be implemented during Stage 2 of the project.

On this basis, and the Department's assessment of key issues, the Department is satisfied that the proposal promotes the principles of ESD.

3.7. Environment Protection and Biodiversity Conservation Act

The Stage 1 Application identified that should the Department for Sustainability, Environment, Water, Population and Communities (SEWPaC) identify the project to be a controlled action under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), an approval would be required.

There is currently no bilateral agreement in place between the NSW and Commonwealth governments. The Proponent therefore made a referral directly to SEWPaC under the EPBC Act for potential significant impact on Cumberland Plain Woodland and Blue Gum High Forest.

On 21 May 2012, SEWPaC determined that the NWRL is a Controlled Action and therefore the project also requires assessment and approval under the EPBC Act. An approval under the EPBC Act was granted on 11 April 2013 (EPBC 2012/6360).

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4. CONSULTATION AND SUBMISSIONS

4.1. Exhibition

Under section 115Z(3) of the EP&A Act, the Director-General is required to make the EIS of an application publicly available for at least 30 days. After accepting the EIS, the Department publicly exhibited it from 31 October 2012 until 3 December 2012 on the Department's website, and at the following exhibition locations:

- Department of Planning and Infrastructure Information Centre;
- Transport for NSW Information Centre;
- Hornsby Shire Council;
- Hornsby Shire Libraries – Pennant Hills, Epping and Hornsby Branches;
- Hills Shire Council;
- Hills Shire Libraries – Castle Hill, Vinegar Hill Memorial and Baulkham Hills Branches;
- Blacktown City Council; and
- Blacktown Council Libraries – Max Webber Library and Denis Johnston Library.

The Department also advertised the public exhibition in the Hills Shire Times on 30 October 2012, and the Sydney Morning Herald, Daily Telegraph, Blacktown Advocate and North Shore Times on 31 October 2012, and notified State and local government authorities directly in writing.

The Department received 322 submissions during the exhibition of the EIS. This included 10 submissions from public authorities and 312 submissions from the general public and special interest groups.

A summary of the issues raised in submissions is provided below. The Department has considered the issues raised in submissions in its assessment of the project.

4.2. Public Authority Submissions

The key issues raised in public authority submissions are listed in Tables 4.1 and 4.2. Many of the issues raised in submissions fell within the scope of what was assessed and approved in Stage 1. Where this has occurred, these issues have not been repeated here as they have already been addressed in the Department's assessment of Stage 1.

Table 4.1 – Key issues raised by Councils

Council	*Key issues raised*
Blacktown City Council	- surface water and flooding – stormwater management planning required for locations including Tallawong TSF and Riverstone East Precinct; - construction traffic management – heavy vehicle movements into and out of Schofields Road and requests for information and delivery of local road upgrades and signalisation of intersections; - operational traffic impacts – support for proposed upgrade of Samantha Riley Drive / Newbury Avenue / Old Windsor Road intersection; - noise and vibration – noise monitoring for properties at Kilbenny Street, Farrier Way, Kellyville Ridge, Brentwood Terrace, Stanmore Gardens and the Tallawong TSF to ensure mitigation measures are effective. - impacts to open space provision and quality in the Area 20 Precinct of the North West Growth Centre; and - pedestrian access to Bella Vista, Kellyville and Cudgegong Stations and lighting at Old Windsor Rd at Bella Vista and Kellyville Stations.
Parramatta City Council	- consideration to impact on future infrastructure including the potential future F3 Freeway and M5 Motorway link;

Council	Key issues raised
	- impacts of traffic associated with the Epping Services Facility; - visual impact of the Epping Services Facility from Beecroft Road; - construction and operational noise and vibration impacts and mitigation measures; and - potential for discharge of sediment into waterways.
Hornsby Shire Council	- affect of ventilation emissions on adjoining land uses; - community facilities – amenities requested and mitigation measures suggested for Cheltenham Oval; - construction noise impacts at Cherrybrook station; - cumulative impacts on the community, in particular local businesses, resulting from Stage 1 and Stage 2 works; - management of groundwater issues, assessment of contaminated water and disposal of wastewater; - construction traffic impacts on local roads and on car parking; - increase of general dust due to construction traffic; - increased rail connections required for passengers resulting from the change to single deck trains; - improvements needed for pedestrian and bicycle access; - operational Noise and Vibration - particularly the Veterinary Hospital at Castle Hill Rd and Cherrybrook station; - ecology – suggestions covering various environmental issues including offset packages for Blue Gum High Forest at Cherrybrook station; - heritage impacts resulting from Cheltenham and Epping Services Facility and Cherrybrook Station; and - visual impact – boundary wall and high acoustic sheds within sites at Epping and Cheltenham Services Facility and Cherrybrook Station.
Hills Shire Council	- noise impacts at night; - maintenance of noise dampeners and absorption material; - historic heritage – view impacts to Mungerie House; - local business impacts – support for small businesses; - development of a stormwater management plan and flooding evacuation plan; - soils and groundwater – monitoring program for groundwater impacts; - land use planning – consultation over planning for key sites around stations; and - visual – design and impact of the viaduct on local amenity.

Table 4.2 – Key issues raised by public authorities

Council	Comments
Office of Environment and Heritage	- Aboriginal heritage – cumulative impacts and long term storage and curation arrangements for objects recovered from the investigation program and triggers for Phase 2 investigations; - Flooding – flood events resulting in an increase in flood level of up to 0.5m in the PMF in Old Windsor Road and the Transitway near the intersection with Samantha Riley Drive. An Emergency Response Plan should be prepared; - Flooding – a precautionary approach should be adopted and mitigation measures identified to offset flood impacts arising from the development of the North West Growth Centre; and - Flooding – more frequent floods such as a two year ARI should be considered in the of onsite detention strategy.
RailCorp	- Railcorp supported the project as it would provide a beneficial linkage to the existing Epping to Chatswood Rail Line (ECRL) and the CBD; - Interfaces with the existing network at Epping and Chatswood require further consultation with Railcorp in the upcoming phases as would the Epping to Chatswood management transition; and - Railcorp is in consultation with TfNSW regarding rail authority status on both the ECRL and the NWRL.
Roads and Maritime Services	- RMS generally supported the collaborative approach that has been established to meet Whole-of-Government transport objectives and operational requirements;

Council	Comments
	- RMS will manage permanent traffic and transport measures/infrastructure that will become RMS assets as a result of the project through the Works Authorisation Deed process; - The existing NWRL Transport and Traffic Liaison Group, which is currently responsible for construction phase traffic management requirements, should be broadened to include permanent traffic and transport measures required to accommodate functionality at all stations, service facilities and related intersections; and - A series of conditions are recommended to manage construction traffic and to provide requirements in relation to proposed infrastructure works, road restoration works, vehicular access roads and signalised intersections located along the State road network.
Environment Protection Authority	- Construction noise and vibration – to address highly noise affected recievers many of the construction noise and vibration related conditions imposed in Stage 1 should be replicated together with the preparation of a Construction Transport Management Noise Strategy and a requirement to manage cumulative construction impacts; - Operational noise and vibration – a series of conditions are recommended including a requirement for the Proponent to design and operate the project to meet applicable ground borne vibration and noise and airborne noise criteria, identify sensitive land uses and to prepare an Operational Noise and Vibration Review, with an associated compliance assessment; - Groundwater quality – Information is not considered to be adequate and the EPA recommends a condition of approval requiring the delineation of groundwater quality in areas where groundwater quality is unknown or where the data is inconclusive; - A condition should be included to require that water of suitable quality be reused on site; - Insufficient information in the EIS on alternative options for groundwater disposal if the discharge standards at Lady Game Drive Water Treatment Plant are unable to be met. To ensure that the plant is capable of treating the groundwater from the project, the requirement for the commissioning water monitoring program has been recommended as part of the approval; - Water quality – monitoring should be undertaken, including similar requirements to those detailed in the Stage 1 approval; and - Soil and waste management – reuse of spoil should be investigated prior to disposal to landfill.
Heritage Council of NSW	- The Heritage Council of NSW recommended a series of conditions to mitigate and manage impacts to historic heritage.
Dept of Education and Communities	- Noise and vibration – monitoring of mitigation measures to ensure success, proximity of sky train to Kellyville Public School; - Air Quality – construction impacts of dust on air quality and mitigation measures required; and - Community facilities - existing enrolment boundaries may need to be adjusted, possibility of NWRL to provide for new school campus sites through increased access.

4.3. Public Submissions

The Department received 312 submissions from the public. This included submissions from a number of special interest groups, including businesses, recreation and sporting clubs, schools, community interest groups, resident interest groups, and transport interest groups.

In its consideration of submissions, the Department noted that a number of submissions were made by the same submitter, resulting in more submissions than documented. Where this was the case, the submissions were considered as supplementary to the respective initial submission.

Of the 312 public submissions received, 200 (64%) objected to the project, 15 (5%) supported the project and 97 (31%) provided general comment. Three submissions also

included signed petitions. Two residents collected petitions totalling 13 signatures, and the Local Castle Hill residents group collected an additional 15 signatures.

The key issues raised in public submissions are listed in Table 4.3.

Table 4.3: Summary of Issues Raised in Public Submissions

Issue	***Issue summary***	***Proportion of submissions raising issue***
Traffic and Transport	- The implications of the governments rail strategy and associated issues such as forced interchange and travel time impacts (discussed in Section 5.1); - Construction traffic impacts, including restrictions on heavy vehicle routes, parking and access impacts, bus diversions and local area traffic impacts; and - Operational traffic and access issues including: the need to provide a high level of pedestrian and cycle access, amenity and infrastructure to ensure an optimum integration of transport and land uses; local traffic impacts and potential traffic infiltration around stations into local residential areas; access and parking constraints, including potential impact on business, community and other operations; the adequacy and allocation of parking and the management of on-street parking and parking impacts on other users; and the need to provide appropriate short and long term bus layover facilities.	56%
Noise and Vibration	- The main concerns related to the level of construction noise and vibration impact predicted and the measures proposed to mitigate and manage these impacts, particularly around Cherrybrook and Showground Stations. The possibility that operational noise and vibration impacts could have a detrimental affect on existing amenity, could cause damage to the integrity of nearby buildings and equipment within them along both the under and above ground sections of the rail alignment.	27%
Air Quality	- Increased traffic and the affect this will have on health and air quality. Toxic vapours from fuel storage at Cherrybrook station, tunnelling activity impacts on air quality and the need for dust monitoring from ventilation shafts.	5%
Land Use and Community Facilities	- In relation to community facilities a number of submissions were concerned with the disruption to local areas, loss of local aesthetic amenity and loss of community facilities. In relation to land use a majority of submissions were concerned with the future use of master planned sites.	4%
Ecology	- Issues were raised in relation to increased traffic along Franklin Road (from Cherrybrook Station) and its impact to endangered species found in the area, the access proposed for Cheltenham Services Facility and the, noise levels in the vicinity of Chilworth Conservation Reserve.	3%
Visual Impact, Landscaping and Urban Design	- The potential visual impact that developing in and around several station precincts could have on existing amenity, particularly at Cherrybrook and Castle Hill Stations, and the need for high quality urban design was identified. Night-time Impacts from light spill.	3%

Issue	Issue summary	Proportion of submissions raising issue
Local Business Impacts	- Disruption to local businesses from construction was raised, particularly from changes to existing access arrangements, noise and vibration impacts and associated loss of trade.	2%
Surface Water	- The need to maintain vegetation buffers to filter contaminants.	0.5%
Waste Management	- Lead contamination of soil and the measures in place to ensure its safe disposal. Suggestions were also put forward to reuse spoil in other major projects.	0.5%

4.4. Proponent's Response to Submissions

The Proponent provided a response to the issues raised in submissions (see Appendix C). As a result of the public exhibition process and submissions made on the project, and further design refinements, the Proponent has made an amendment to the project. This change has been summarised below:

Bella Vista preferred design

The proposed changes to the project as outlined in the Preferred Infrastructure Report would modify the layout and alignment of Bella Vista Station within the footprint described in Stage 2. Design change to single deck, rapid frequency transit trains has created the opportunity to optimise the Bella Vista Station design and precinct layout.

The preferred design includes the station box relocated to Old Windsor Road, adjacent to a traffic controlled extension of Lexington Drive north of Celebration Drive. Development can be created on the eastern side of the station with the western portion of the precinct dedicated to car-based uses (commuter car park and McDonalds and BP outlets).

The main benefit of the changes will be the better integration of the station within the precinct, resulting in an improved customer and public experience. An overview of the potential changes identified the following key environmental aspects:

Operational Transport and Traffic: Existing and forecast delays will be mitigated by increasing capacity at key intersections to create an all movements four way intersection. Relocation of the commuter car park would slightly increase the walking distance to the station platform, however this will be mitigated by providing two station entries and improving pedestrian access via a marked foot crossing.

Noise and Vibration: Minor changes to the predicted noise levels are expected. Construction noise to the east may exceed Noise Management Levels by 1dB as a result of the station being closer to receivers.

Land Use and Community Facilities: Beneficial impacts would be expected, in particular the McDonalds and BP service station (see Section 5.1). The station could act as a catalyst for future development between the station and Old Windsor Rd on the western side of the alignment.

Whilst there would be a change in impacts from those presented in the EIS, the impacts summarised above are anticipated to be minor with the implementation of the revised mitigation measures. The change has been fully considered as part of the Department's assessment in Section 5 of this report.

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5. PROJECT ASSESSMENT

In assessing the merits of the project, the Department has considered:

- the EIS, submissions and the Submissions Report (including the Preferred Infrastructure Report) on the project (Appendices A to C);
- the Proponent's revised management and mitigation measures;
- the relevant environmental planning instruments, guidelines and policies; and
- the objects of the EP&A Act, including the object to encourage ecologically sustainable development.

The Department considers the key issues relate to traffic and transport, noise and vibration, hydrology and surface water.

The Department's assessment of key issues is provided in Sections 5.1 to 5.4 below, while the Department's consideration of all other issues is provided in Section 5.5 below.

5.1. Traffic and Transport

Construction Traffic

The assessment of construction traffic impacts for Stage 2 was based on traffic count information and the use of traffic modelling software (i.e. LINSIG) to determine intersection performance including level of service (LoS) and the degree of saturation (DoS).

The LoS provides an indication of the overall traffic performance of an intersection, traffic lane or roadway as outlined in Table 5.1. The DoS provides the ratio of arrival volumes to capacity where a value greater than 1.0 would represent oversaturated conditions and a value of less than 1.0 would indicate that there is spare capacity.

Table 5.1 – Level of Service (LoS) criteria for intersections

LoS	Average delay per vehicle (seconds)	Traffic signals and roundabouts	Give way and stop signs
A	Less than 14	Good operation	Good operation
B	15 to 28	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study is required
D	43 to 56	Operating near capacity	Near capacity and accident study is required
E	57 to 70	At capacity, at signals incidents will cause excessive delays	At capacity, another control mode required
F	Greater than 70	Over capacity, unstable operation	Over capacity, unstable operation

Note: A LoS of F is defined as forced flow, the amount of traffic approaching the point exceeds that which can pass it. Flow breakdown occurs as well as queuing and delays.

Potential construction traffic impacts would result from the increase in heavy vehicle movements and light vehicles (cars and utes) on surrounding roads associated with the construction of Stage 2 of the project. These movements may result in increased congestion and impacts on intersection performance as well as impacts to bus services, pedestrians, cyclists and various existing parking arrangements. Traffic flow is generally proposed to be maintained in the vicinity of construction works but there may be the need to temporarily close certain roads to allow for construction works such as at Old Northern Road to provide construction truck access.

A summary of the main construction traffic impacts for each of the construction worksites associated with Stage 2 is provided below. Management of construction traffic would be documented in specific Construction Traffic Management Plans for each site.

- Epping Services Facility – A LoS C is expected to remain the same in the AM peak for the Carlingford Road/Beecroft Road intersection but reduce from C to D in the PM peak although the DoS is not expected to change. The pedestrian footpath on the western side of Beecroft Road would be closed and pedestrians redirected via Ray Road and Kandy Avenue.
- Cheltenham Services Facility – A LoS B is predicted for the new intersection and minimal traffic impact is expected along Kirkham Street. An option exists for heavy vehicles to access and exit the site to and from the M2 Motorway but this is subject to agreement with the motorway operator and RMS. Impacts to pedestrian movements, bus services or on-street parking are not expected.
- Cherrybrook Station – Slight deterioration in performance is expected at the Glenhope Road/Castle Hill Road intersection from A to B in the PM peak. Bus routes would be unaffected and the impact on on-street parking would be minimal. The northern footpath on Castle Hill Road adjacent to the construction site between Franklin and Glenhope Roads would be closed. A marked pedestrian path would be provided on either side of Franklin Road to maintain pedestrian access for the two schools.
- Castle Hill Station – The LoS at the Old Northern Road/McMullen Avenue intersection is expected to deteriorate slightly in the AM peak from C to D and the Castle Hill Road/Pennant Street/McMullen Avenue intersection would change from a LoS in the PM peak of E to F. The Castle Street/Pennant Street intersection is also expected to deteriorate in the PM peak from LoS C to E. The footpath on the western side of Old Northern Road, between Terminus Street/Old Northern Road intersection and Old Castle Hill Road/Crane Road would be closed as would pedestrian access through Arthur Whitling Park. Pedestrian crossing facilities would be provided across Old Castle Hill Road and Old Northern Road for the duration of construction.
- Showground Station – Approximately 200 off-street parking spaces would be lost. Impacts to on-street parking would be negligible.
- Norwest Station – The southern footpath along the frontage of the construction site would be closed. A pedestrian underpass would be provided under Norwest Boulevard for pedestrians to access the northern and southern footpaths. It may also be necessary to restrict parking along one side of Brookhollow Avenue.
- Bella Vista Station and Balmoral Road – the Old Windsor Road/Celebration Drive intersection, is expected to deteriorate slightly from LoS D to E in the PM peak
- Balmoral Road and Memorial Avenue – the Old Windsor Road/Memorial Avenue intersection is expected to continue to operate over capacity and in the AM peak construction traffic would increase the DoS from 0.97 to 1.08 at this intersection. There may be a need to periodically close the T-way in the vicinity of Burns Station and this would need to be managed to minimise impacts to bus services. Approximately 159 car parking spaces at the Burns T-way bus station car park would be impacted.
- Kellyville Station – the Old Windsor Road/Samantha Riley Drive intersection is expected to continue to operate over capacity at a LoS F. It is also expected that the T-way would operate normally; however of the 141 car park spaces at the Riley T-way station car park, approximately 90 spaces would need to be relocated within the rail corridor to the north of Samantha Riley Drive with the remaining 50 to remain in-situ.

- Rouse Hill Station – the modelling shows that there would be minimal traffic impacts with intersection performance remaining unchanged except at Windsor Road/White Hart Drive in the AM peak which is expected to deteriorate slightly from LoS A to B. The Rouse Hill station construction site would occupy the existing bus interchange and therefore all bus stops and layover areas would need to be relocated. Informal east-west pedestrian routes through the existing T-way interchange would be lost with pedestrians being redirected resulting in a diversion of an additional 200 metres. The key cycle route on the western side of Old Windsor Road would not be affected, however the cycle lockers would need to be relocated.
- Cudgegong Road Station and Tallawong Stabling Facility – the LoS at The Ponds Boulevard/Schofields Road intersection would deteriorate in both AM and PM peak periods from LoS B to C and the LoS at the Cudgegong Road/Schofields Road intersection would reduce from LoS A to B in the AM peak only. An existing bus route (T75) may need to be re-routed for part of the construction period via Cudgegong Road if Tallawong Road is closed for any length of time.

Road improvements proposed as part of Stage 1 works to mitigate construction traffic impacts would remain in place to mitigate impacts associated with the construction works for Stage 2. These include the signalisation of the Franklin and Castle Hill Road intersection at Cherrybrook Station as well as the new intersection on Showground Road at the Showground Station construction site.

A number of submissions raised issues relating to construction traffic impacts, including restrictions on heavy vehicle routes, parking and access impacts (particularly at key centres, Brookhollow Ave and Castle Hill Showgrounds), bus diversions and local area traffic impacts. Requests were also made to limit construction activities during holiday periods and for ongoing consultation.

The Department acknowledges that major infrastructure projects such as the NWRL will have unavoidable traffic and access impacts during construction, but is cognisant that Stage 2 impacts are generally consistent with or less than Stage 1 impacts due to generally less intensive heavy vehicle movements which will utilise heavy vehicle routes established during Stage 1. Of particular note is the substantial reduction of heavy vehicle numbers expected at Cherrybrook Station, Showground Station, Bella Vista Station and Cudgegong Road Station / Tallawong Stabling Facility as significant earthworks will have been completed.

To address the expected traffic impacts, the Proponent has formulated a comprehensive Construction Traffic Management Plan and Control Plan framework, and has carried over relevant Stage 1 mitigation measures and included additional measures to address parking and access issues at Showground Station and at a number of T-Way bus stops.

To further address these impacts and to strengthen the Proponent's commitments on these matters, the Department has recommended that Stage 1 conditions be adopted with some minor revisions. These conditions require the Proponent to:

- establish a Traffic and Transport Liaison Group to inform the detailed design of temporary and permanent traffic and transport measures and the ongoing management in relation to construction of the project;
- undertake further supplementary analyses as required by the Traffic and Transport Liaison Group and where relevant undertake modelling of traffic changes;
- do certain work around the loss of parking, including minimising the loss or the provision of alternative parking arrangements;
- to consult with key stakeholders on traffic and access management measures, including RMS, Councils, transport operators and adjoining major land holders; and
- prepare a Construction traffic Management Plan(s) to detail traffic control and management measures.

With the addition of a number of conditions to strengthen the Proponent's commitments during construction of Stage 2, the Department considers unavoidable impacts can generally be managed to minimise and reduce anticipated negative traffic and transport outcomes during the construction of the project.

Operational Traffic and Access

The NWRL would operate as a 'Tier 1" rapid transit single deck train system, initially operating between the North West and Chatswood, with a cross platform interchange at Chatswood to suburban services. In line with the NWRL, an upgrade of the Epping to Chatswood Rail Link to a high capacity rapid transit system would be required as a separate project to the NWRL. Stations have been designed as 'interchange places' to facilitate a high degree of integration with surroundings.

The operation of the NWRL will require changes to the road and bus network to facilitate a high level of access to stations and integration between transport modes. The resultant change in travel behaviour and travel modes will also have traffic impacts at a regional and local level, and the project has been designed to address the capacity constraints of a number of high order intersections within the vicinity of the project and not to preclude planned network changes. It is expected that the overall impact of the NWRL will be to reduce car trips in the North West corridor, however, there will be impacts at a local level, which will be the focus of this assessment. It is important to note that there will be substantial increases in traffic flows in the NWRL corridor between 2011 and 2021, driven by the planned growth in the corridor, irrespective of the NWRL.

The following main changes to bus services in the North West are anticipated with the NWRL:

- Replacement of long haul M2 Express bus services from the western part of the NWRL corridor with rail services;
- A major bus-rail and bus-bus interchange at Rouse Hill;
- A major interchange at Castle Hill between the NWRL and bus services from the extensive central part of the corridor;
- Minor bus interchanges at Kellyville, Bella Vista and Norwest; and
- A minor interchange at Showground Station between NWRL and Kellyville bus services;

Each station would include key transport and traffic facilities, with facilities commensurate with the expected role of the station. Facilities include: commuter car spaces, kiss and ride spaces, taxi spaces, pedestrian facilities, bicycle parking spaces, bus spaces and road and intersection upgrades.

Road network impacts were assessed at a local level to inform the need for and design of road network changes. The level of service analysis of intersections was undertaken based on the Level of Service (LoS) criteria for intersections during the 2012 AM peak and as specified in the RMS *Guide to Traffic Generating Developments.*

Service facilities at Epping and Cheltenham and the Tallawong Stabling facility are not expected to be significant generators of road based or pedestrian traffic.

Rail Service Strategy

With the announcement of Sydney's Rail Future and the identification of the NWRL as a 'Tier 1" rapid transit single deck train system, the project has adopted a rail service strategy, which will initially have the NWRL operate as a shuttle service between Cudgegong Road and Chatswood at a peak frequency of 12 trains per hour. Existing CityRail services running via the Epping Chatswood Rail Link will be rerouted via Strathfield. This configuration is illustrated in Figure 5.1.

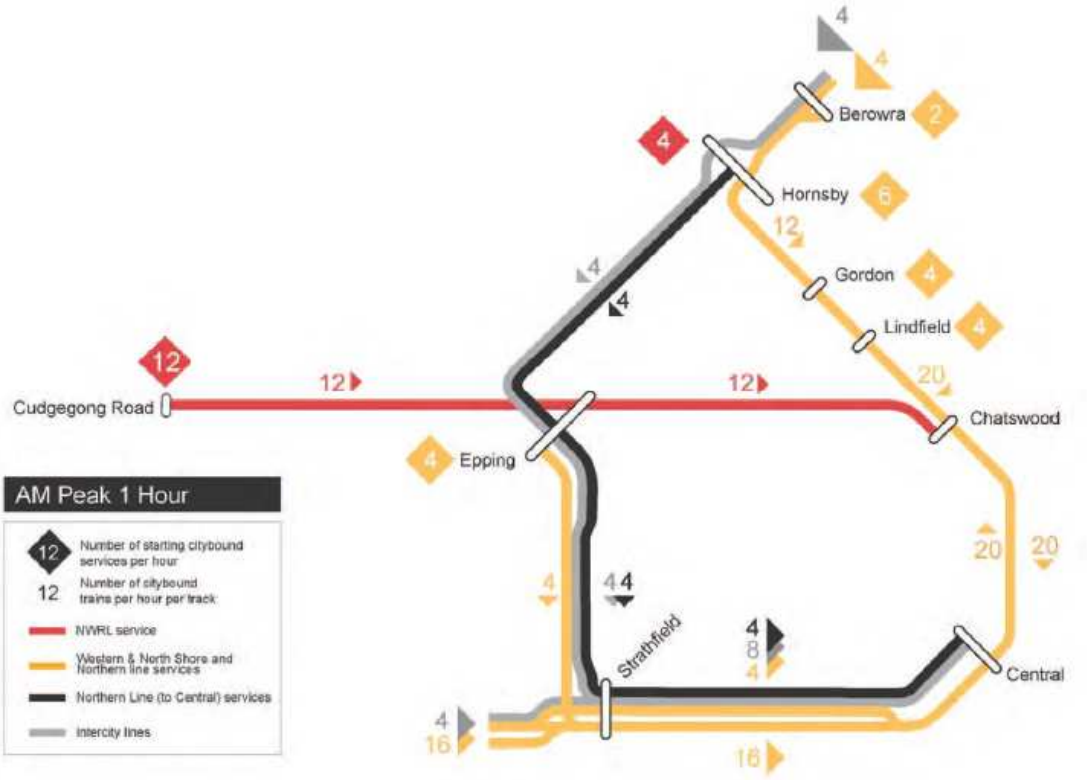

Figure 5.1 Rail Service Strategy

The longer term vision in Sydney's Rail Future is for NWRL to be extended under the harbour and to link with lines to the south as part of a new discrete sector of the rail network.

While there is no current plan to extend the NWRL beyond the Tallawong Rd stabling and maintenance facility, further investigations into growth in the region and potential travel demand are also being undertaken by Transport for NSW. The outcomes of these studies will inform the further development of the strategic transport plan for Sydney.

Submissions raised concern about the Government's proposed Rail Service Strategy, including the impacts of a varied level of service and forced interchange time on commuter actions and responses, and the potential impacts that these responses will have on traffic, particularly at a regional level. Submissions also raised the issue of delivering a project that can accommodate a suburban train rather than limiting the project to metro style vehicles. The Department acknowledges these concerns but also notes that proposed operating scenarios will provide various travel options to commuters and that existing travel times will be comparable to existing services due to the proposed frequency of trains on the NWRL. Accordingly the Department accepts the Proponent's response to these issues and the Government's commitment to develop a Tier 1 Rapid Transit Network in the longer term, including the completion of a harbour tunnel, which will provide direct rail services to the Sydney CBD and beyond. Accordingly, these issues are not further addressed in this report.

Bus Services

There are a number of bus services operating in the North West region, which will be influenced by the operation of the NWRL. Of particular note are bus services operating from the Hills district to the Sydney CBD and North Sydney via the M2.

It is anticipated that the majority of the M2 city express bus services which currently perform the trunk line haul service to North Sydney and the Sydney CBD could be withdrawn from those suburbs with good access to the NWRL once the NWRL is operational. These buses would then be used more efficiently to provide enhanced feeder services into NWRL stations and increased frequency to key centres such as Castle Hill and Macquarie Park. Parramatta

and Blacktown T-Way services, which perform a different but complementary function, would be retained with the NWRL in operation. The proposed integrated bus network for the NWRL is illustrated in Figure 5.2.

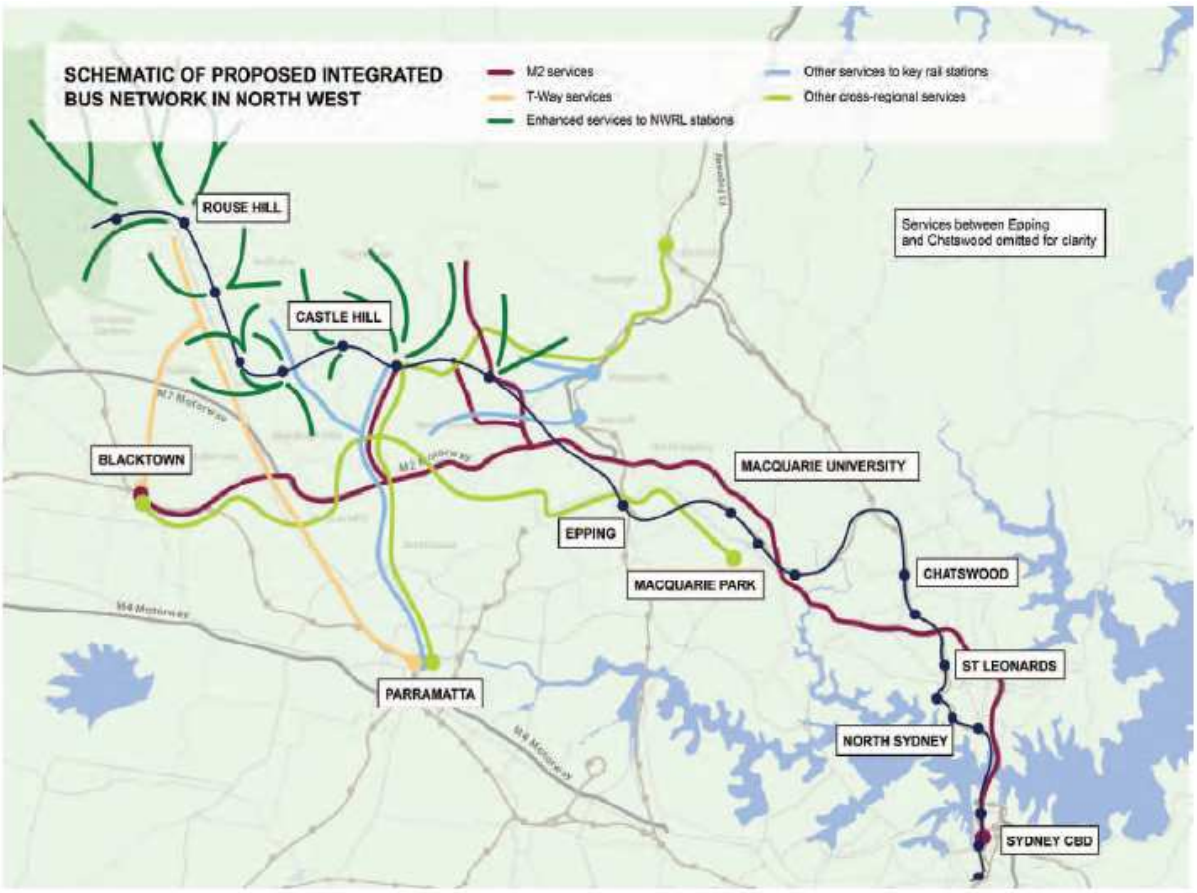

Figure 5.2 Proposed integrated bus network in North West Sydney

The integration of the bus network and the provision of infrastructure that facilitates bus integration at stations was raised in submissions, and the Department notes that the current design of stations is based on accessibility principles which support these objectives. Submissions also raised issue in relation to the inevitable changes to the bus network as a result of the project. The Department acknowledges these concerns, but as such matters will be addressed by TfNSW in its bus servicing strategies, which do not form part of the project, they are not considered further in this assessment.

Station Access and Traffic

Most of the proposed stations are located close to the arterial road network, which will provide access from the surrounding suburbs to the NWRL. In some cases there are local roads in place or planned as part of the NWRL and these are expected to see an increase in traffic, primarily from within the suburb itself accessing the station facilities. At each station a range of traffic management facilities is proposed, such as road widening and intersection enhancements.

Kellyville station – The station is located near the intersection of Old Windsor Road and Samantha Riley Dr, within The Hills Shire LGA. The proposed station would mainly serve the Beaumont Hills, Kellyville and Stanhope Gardens areas which are currently being served by buses. Existing bus services in the vicinity of the proposed station are currently confined to the T-Way and along Samantha Riley Drive. The T-Way and adjacent Riley T-Way stop will continue to operate once the NWRL commences operations, with services focussing on the Rouse Hill to Parramatta and Blacktown corridors.

There is currently a car park area with a capacity of approximately 140 vehicles provided for the Riley T-Way stop. Some of this parking is likely to be incorporated into the station parking area with a total of 1,360 spaces to be provided for use by NWRL and T-Way passengers. This will be located both adjacent to, and under, the rail viaduct, north and south of the station, and to the south east of the station on the opposite side of the station access road. This will be one of the largest commuter car parks at any station in the Sydney rail network and will generate substantial commuter traffic movements in peak periods. Access to the car parks is proposed off two new access roads, one coming from a signalised all movements intersection on Samantha Riley Drive close to Elizabeth Macarthur Creek, and a second left-in/left-out only intersection just to the east of the Samantha Riley Drive / Old Windsor Road intersection and T-Way. The proposed access layout is presented in Figure 5.3.

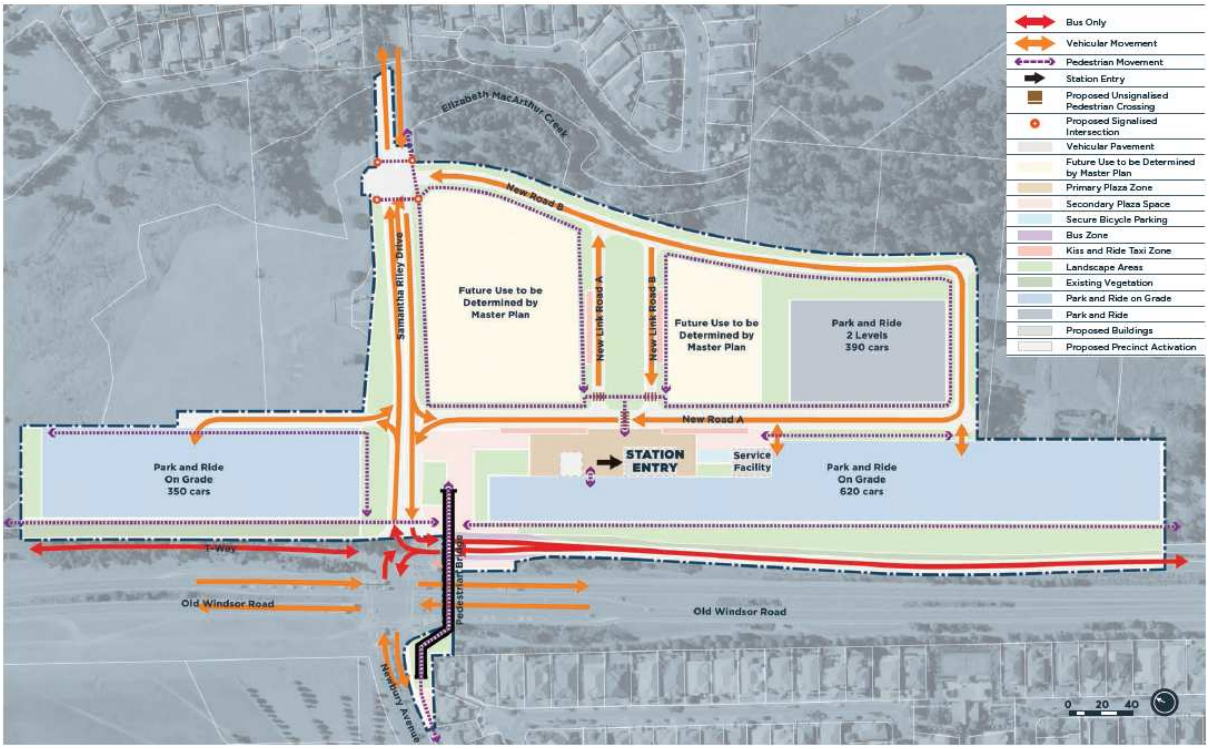

Figure 5.3 Kellyville Station Access

The traffic analysis has identified that of the intersections in the immediate vicinity of the station, only the Old Windsor Rd / Samantha Riley Dr / Newbury Ave intersection is predicted to operate beyond its existing available capacity and that this capacity issue is primarily related to background traffic growth. To improve the operation of this intersection to a more adequate standard, it is likely that additional capacity will need to be provided i.e. by upgrading the intersection arrangement to include a further through lane in each direction on Old Windsor Road, as well as an additional right turn lane on Newbury Avenue.

Bella Vista station – The station would mainly serve the north western part of the Bella Vista business park as well as the existing Bella Vista and Glenwood suburbs and the future developments in the Balmoral Road release area. Bus routes in the area of the proposed station are currently largely confined to the North West T-Way. The Celebration T-Way stop on the western side of Old Windsor Road, directly opposite Celebration Drive, would continue to operate as normal during the operation of the station.

The area surrounding the proposed station currently has high levels of pedestrian activity due to commercial land uses such as the adjoining McDonalds food outlet. Pedestrian pathways are provided along both sides of Celebration Drive and Lexington Drive. In addition, cycle/pedestrian paths are provided along both sides of Old Windsor Road. A pedestrian bridge is proposed across the T-Way and Old Windsor Road to connect the residential area on the western side of Old Windsor Road to the station precinct. The

provision of 800 car parking spaces for Bella Vista station would also be utilised for T-Way patrons. The proposed access layout as presented in the EIS is presented in Figure 5.4.

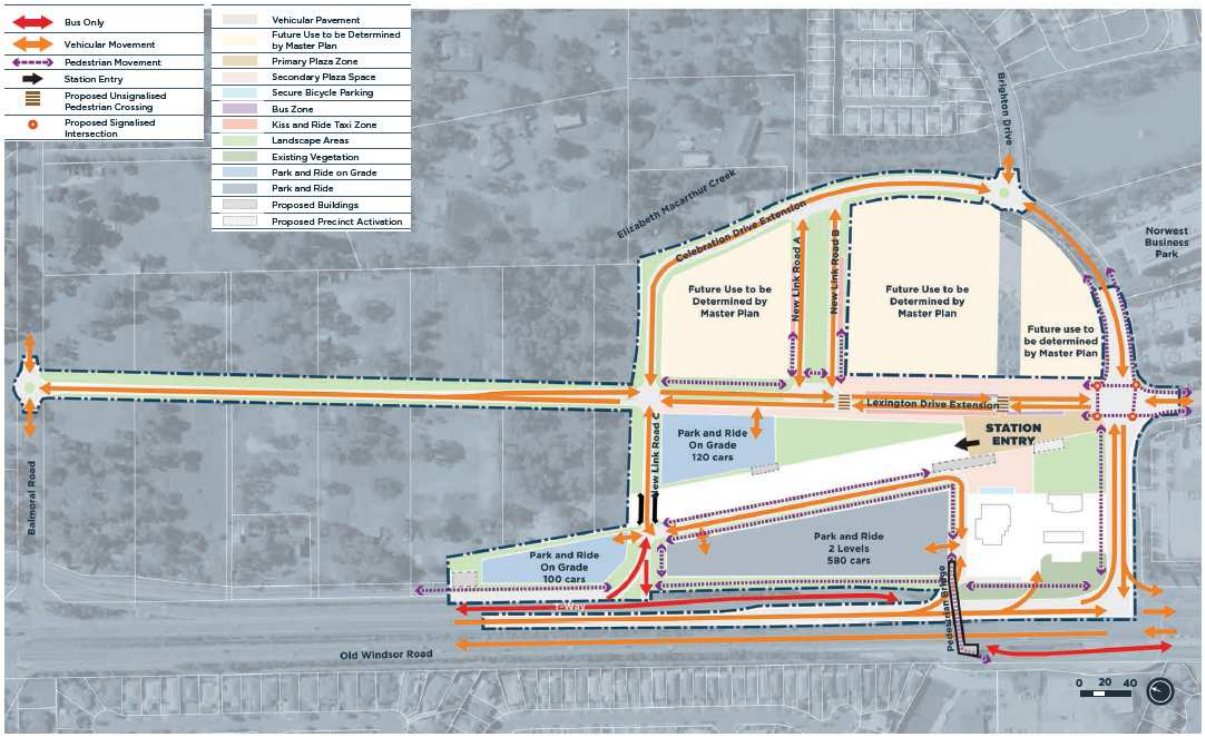

Figure 5.4 Bella Vista Station Access

Bella Vista station will function as a major park and ride station, but will also be a destination station. Although the Celebration T-Way stop is located west of the station (catering for routes between Rouse Hill and Parramatta), the number of passengers likely to interchange here is expected to be low and there are no plans to relocate the T-Way stop. The introduction of a new north-south extension of Lexington Drive, eventually providing access to the north through the corridor between Old Windsor Road and NWRL on the west, and Elizabeth Macarthur Creek, offers a substantial opportunity for land use change.

The traffic analysis has identified that the Old Windsor Road intersections are predicted to operate above existing capacity and that this congestion is primarily a result of general traffic growth, but which warrants further consideration and analysis, including the amplification of Old Windsor Road, which is outside the scope of the proposal.

Submissions, including from key businesses in the locality (BP and McDonalds) raised concern about traffic and access impacts at the site (during construction and operation) and the need to integrate these businesses into the design of the station. The Submissions Report clarified a revised intersection arrangement at the Old Windsor Road / Balmoral Road / Miami Street intersection, following consultation with key stakeholders including the RMS. The design, including the realignment of Balmoral Road, and the relocation of the Balmoral T-Way stop, would generally improve the pedestrian and vehicle accessibility of the station, including improved east west connectivity. Development opportunity can also now be created on the eastern side of the station with the western portion of the precinct dedicated to car based uses (commuter car park, McDonalds and BP Outlets). The Department acknowledges the improvements that this access provides to these car based businesses. However, it also accepts that infrastructure of this scale will have some unmitigated impacts that are offset by the broader social and environmental gains delivered by the project. The revised access layout as presented in the Submissions Report is presented in Figure 5.5.

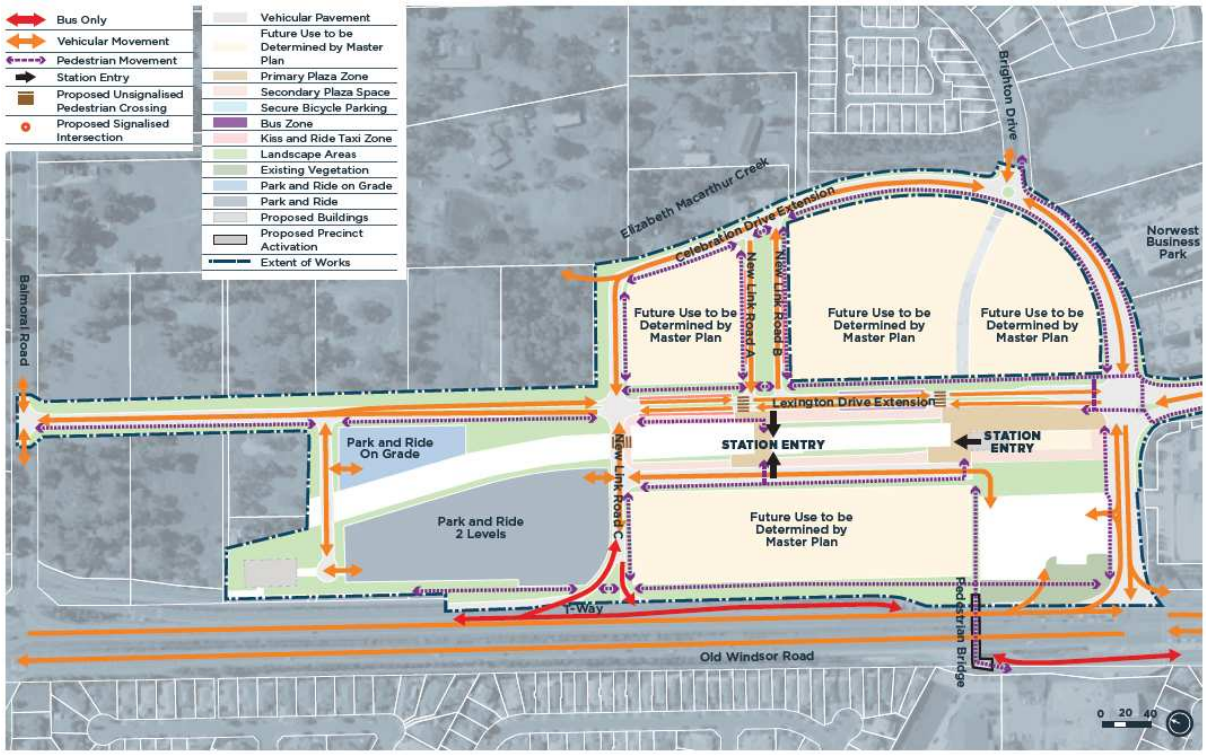

Figure 5.5 Revised Bella Vista Station Access

Showground station – The station would mainly serve the residential areas of Castle Hill located to the north and east and of the southern areas of Kellyville. It would also provide access for workers to the industrial/commercial area located to the south. The station will complement Castle Hill station in that it would, to a degree, capture customers from the same catchment as the proposed Castle Hill station. However, unlike Castle Hill, the proposed Showground station would provide a park and ride option.

Park and ride traffic is anticipated to originate mainly in the Kellyville area, to the north of Showground Rd and would access the station either via Victoria Avenue and Carrington Road, or Showground Road. The station precinct 'front door' will be to Doran Drive and internal new roads will manage kiss and ride and park and ride movements within the station precinct. Bus stops located in Doran Drive will provide for bus access to the station. The proposed access layout is presented in Figure 5.6.

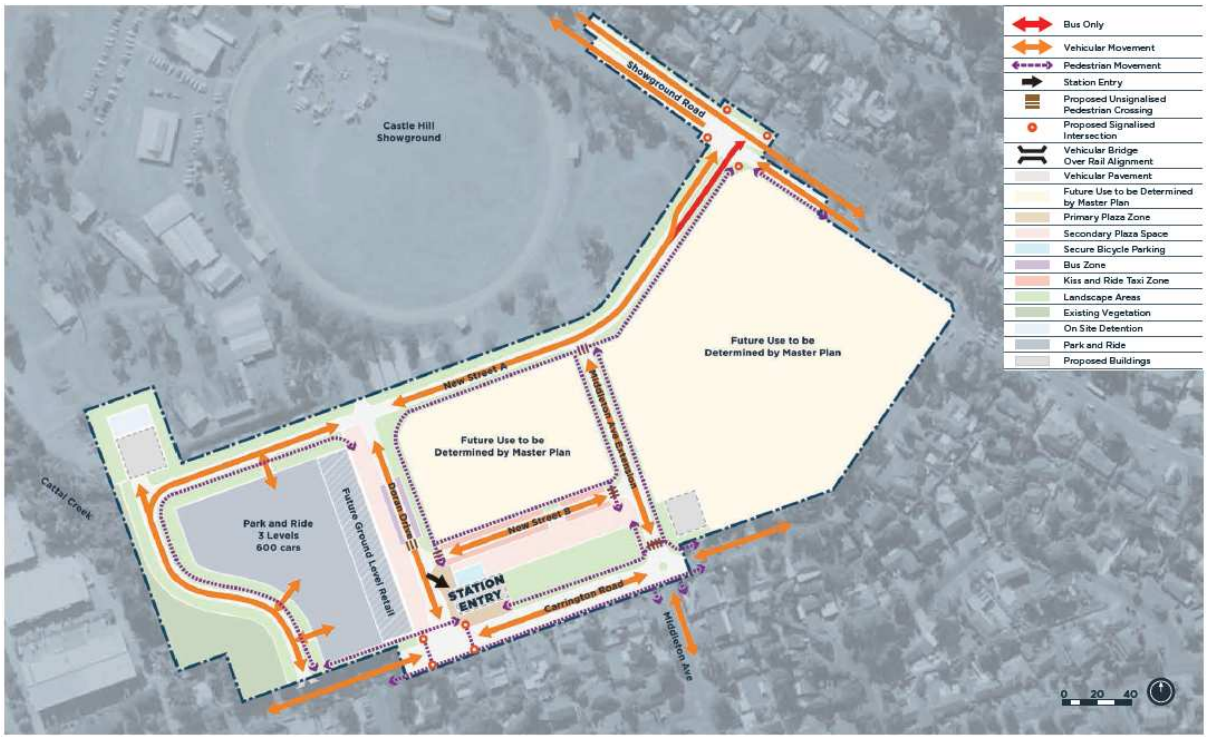

Figure 5.6 Showground Station Access (source: TfNSW EIS Stage 2-Station, Rail Infrastructure and Systems)

Traffic modelling has identified that the existing and future traffic conditions (without the project) within the vicinity of the station are constrained due to existing and background traffic growth. In most circumstances the introduction of the NWRL will exacerbate these conditions and in particular the Middleton Avenue / Carrington Road, and Victoria Avenue / Carrington Road intersections. This analysis suggests that consideration should be given to remodelling impacts and the introduction of signals at these intersections. Submissions raised concern with local traffic impacts, including those associated with of Doran Drive and general access and parking impacts within the showground.

Cherrybrook station – Access to the station precinct is proposed to be to and from Castle Hill Road (via Robert and Franklin Roads for vehicles; and from Glenhope Road for pedestrians from the south), as well as via Robert and Franklin Roads for local access. In addition to the provision of 400 park and ride spaces, bus route changes are proposed to provide links from the suburbs to the north of the station and also from the West Pennant Hills Valley to the south. The proposed access layout is presented in Figure 5.7.

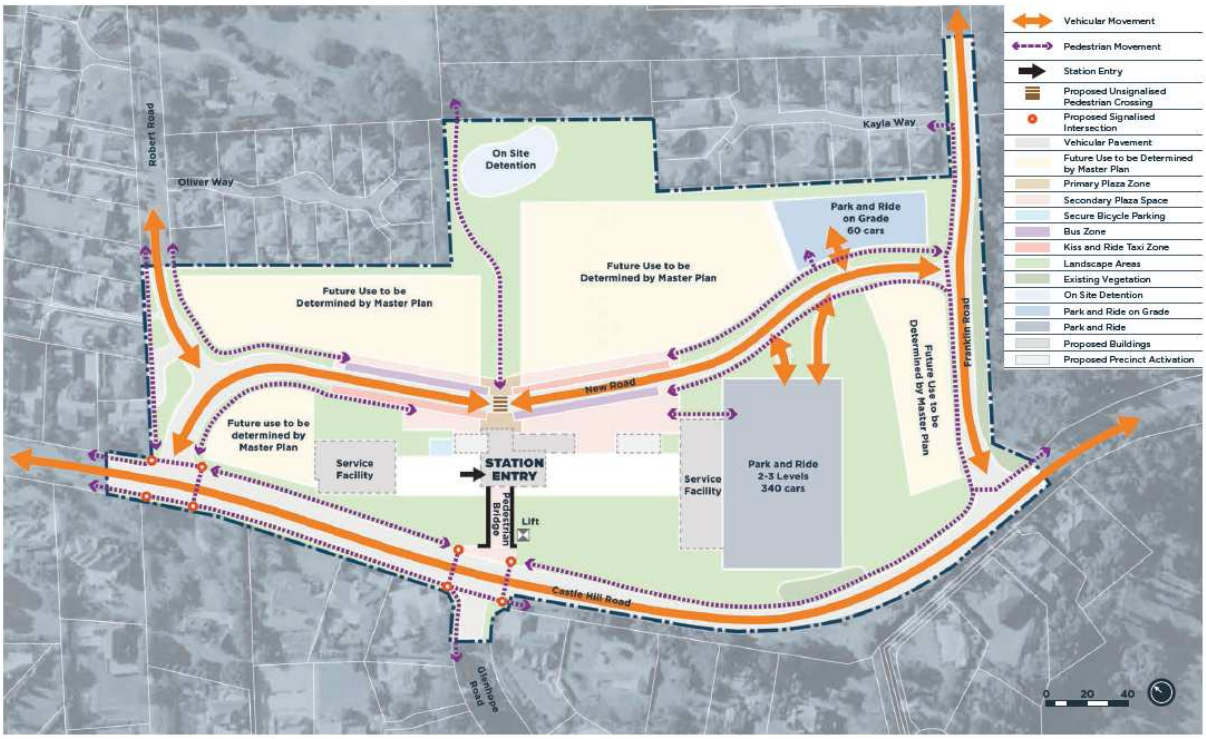

Figure 5.7 Cherrybrook Station Access

The majority of traffic generated by the station is expected to be from the suburbs to the north and west of the station. In most cases this traffic would approach the station precinct along Castle Hill Road from Old Northern Road or County Drive. In this respect, the design of the station provides priority for vehicles accessing the site from Castle Hill Road. However, it is expected that approximately 50% of the local traffic generation may approach along Robert Road or Franklin Road to the car parks or kiss and ride drop off points at the station.

It is proposed that buses will generally approach the station along Franklin Road and Robert Road from the north and access bus stops provided on the proposed access road located immediately north of the station. These buses would be originating from the areas of Cherrybrook, Castle Hill, Round Corner and Dural areas to the north of the proposed station. This would be achieved through the diversion of existing routes which already pass in close proximity to the station precinct.

A modest increase in eastbound traffic in Castle Hill Road in the vicinity of the station (3%); and an increase in westbound traffic on Castle Hill Road approaching the station (15%), but substantial increases in local access streets, particularly from the north (150% - though this is on a base of very low levels of traffic) is expected. Notwithstanding, the traffic assessment has identified that intersection performance in the vicinity of the station will be at similar or improved levels.

A range of submissions raised concerns regarding access and traffic issues associated with the station. In summary these issues included:

- pedestrian and cyclist impacts and the need to improve pedestrian and cycle access and safety to and beyond the station;
- local traffic impacts on surrounding street networks, including bus and through traffic along Robert Road and Franklin Road and associated safety, amenity and infrastructure impacts, and the need to consider alternate routes, such as County Drive and Castle Hill Road;
- lack of justification for proposed bus routes;
- the classification of and unsuitability of local roads to be used for buses due to insufficient width and poor geometry;

- loss of on street parking due to the need to accommodate proposed bus routes, and associated traffic, safety and amenity impacts;
- traffic impacts on Tangara and Inala Special Schools (Franklin Road) and associated safety concerns; and
- the need to implement local area traffic management schemes.

In its submission, Hornsby Council also expressed a preference for bus access to the station via County Drive and Castle Hill Road. Further investigations on this matter were undertaken by the Proponent, which identified that the diversion of existing bus services from John Road to the station via Robert Road was the most efficient solution. However, given the concerns raised in submissions the Proponent has agreed to undertake a more detailed assessment of bus access options to and from the station during detailed design.

These investigations would then feed into the broader network planning for Bus Region 4 (as identified in the NSW Long Term Transport Master Plan), which includes the area around Cherrybrook Station). Ultimately, bus access to Cherrybrook Station would be determined by the Proponent following the review of Region 4 bus services, due to occur as part of the restructure of Sydney's bus system. This review would determine the required service changes to the bus network within Region 4 in response to land use change, transport infrastructure upgrades, population increase and transport policy at the time of the review. The timing for the redesign of the bus network across Sydney has yet to be determined, but is expected to be undertaken and implemented prior to the opening of the NWRL.

The Department acknowledges the range of traffic and access issues raised in relation to Cherrybrook Station, and in particular concerns with resultant bus traffic and other non local traffic, and the associated safety and amenity impacts. It also notes that the rerouting of bus services, whilst related to the project, does not formally comprise part of the project, but rather will be considered as part of broader bus network planning. Notwithstanding, the Department considers that with further consideration of these issues, the Proponent, within the parameters of the Stage 1 approval, has the ability to review and potentially reduce impacts during detailed design and through it's future bus review.

Accordingly, the Department has recommended that the Proponent undertake a review of bus and vehicular access options for Cherrybrook Station, with the objective of reducing potential impacts on local roads within the vicinity of the Station at the detailed design stage. The review will address issues including transport access hierarchy; modal interchange; safety and amenity; local traffic and parking loss. The outcomes of the review would consequently be considered in the recommended station access plans.

The Department has also recommended conditions on a range of transport and access impacts that would assist in addressing the issues raised in relation to Cherrybrook Station and which are also applicable to stations across the project. These include, a traffic and related networks facilities review, the preparation of a pedestrian and cyclist network and facilities strategy, and a parking management strategy, which are discussed further in other sections of this assessment.

Cudgegong Road - The Cudgegong Road station will primarily serve the residents of the release areas of the North West Growth Centre (NWGC), with approximately 60,000 new dwellings to be built in the NWGC over the next 25 to 30 years. The station includes the provision of 1000 park and ride spaces to service this expansion. The station will be located to the north of Schofields Road between Tallawong and Cudgegong Roads, which will provide access for both kiss and ride and park and ride customers, and a small town centre is expected to develop, mainly on the north side of the station. East-west access streets will be established on the north and south sides of the station, linking Tallawong and Cudgegong Roads. The station will have its 'front door' to these east-west streets.

Traffic modelling has not identified any serious issues with the performance of the surrounding road network. The proposed access layout is presented in Figure 5.8.

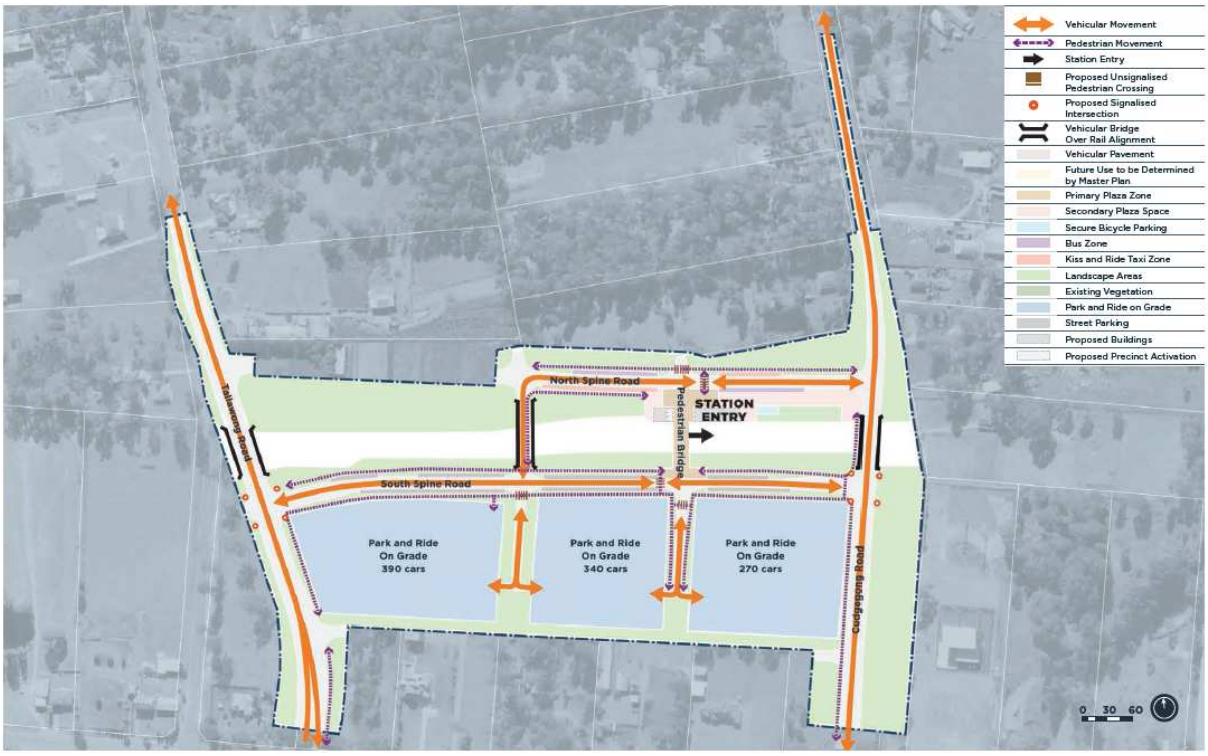

Figure 5.8 Cudgegong Road Station Access

As noted, other stations will not have park and ride facilities and therefore the traffic impacts at these stations are localised and more related to the reconfiguration of the adjoining road network to facilitate transport interchange, kiss and ride, and pedestrian and cycle access.

In relation to Castle Hill station, a key issue relating to operation is the identification of alternate short and long term bus layovers, with appropriate bus driver facilities, which has yet to be finalised. This issue was raised by Busways Group, which requested ongoing discussion with the Proponent to address these concerns. The Department considers that this is an important issue to be resolved during detailed design, as the objectives of the project can not be met without the full integration of bus services. Accordingly it has recommended a condition requiring the Proponent to consult with bus operators in relation to the provisions of both short and long term bus layover facilities, including driver facilities, and that the reasonable requests of bus operators are met.

The Norwest Station is a destination station and therefore the project is expected to improve traffic conditions as a result of a modal shift and the station design is focused on improving pedestrian access and safety, which includes the potential for a future tunnel access across Norwest Boulevard. The Department also notes that the need for enhanced crossing at Norwest Boulevard has been raised in submissions as has general traffic and parking impacts.

The Rouse Hill town centre will continue to serve as a major bus hub for T-Way and local services to the North West and the station will serve as both a destination and origin station. Accordingly, the Rouse Hill interchange needs to serve the Rouse Hill Town Centre as well as the intermodal needs of station customers bound for other locations. Therefore providing a pedestrian-friendly and safe interchange will be a critical element in the station's success. Although there will be no commuter parking at the station, some NWRL customers may seek to park cars near the station and therefore management of kerbside parking will be required. These issues have also been raised in submissions received during exhibition, including the ongoing consultation with GPT (owners and managers of the Rouse Hill Town Centre). Busways Group also raised concern about bus layover facilities (during construction and operation).

The Department notes that the project will have localised traffic impacts as a result of patrons accessing the stations in peak periods. In most circumstances the Proponent has been able

to identify road improvements to manage and reduce these impacts or has identified the need to undertake further design review.

The need to further refine station access design in consultation with key stakeholders, such as the RMS and Council's is considered to be a key process in delivering accessible stations that minimise traffic impacts on the surrounding and regional road network. In this respect, the Department acknowledges the limitations of the current modelling and that the project will have impacts, which may exacerbate existing traffic situations. However, in most circumstances the identified impacts are comparable to those associated with background growth, in the absence of the project, and which arguably lie outside the scope of the project.

Notwithstanding, the Department also acknowledges that the project should be designed to the greatest extent practicable to minimise or improve traffic impacts within the context of the proposed accessibility hierarchy. It is recommended that such design refinement is required to be undertaken with key stakeholders, comprehensively analysed and to appropriate engineering designs. In this respect the Department has recommended the continuation of the Stage 1 Traffic and Transport Liaison Group and design related conditions.

The Department also considers that successful transport integration is a key component in ensuring the success of the project and in addressing traffic impacts by ensuring that there is, to the greatest extent practicable, a seamless transport experience, which emphasises non private vehicle modes, thus reducing private vehicle usage. In this respect, the Department supports the Proponent's access hierarchy, which emphasises this approach. In order to reinforce this concept and to facilitate it's holistic and comprehensive delivery, the Department has recommended that the Proponent prepare and implement Station Access Plan(s). These Plans would be independently prepared in consultation with the Traffic and Transport Liaison Group, which includes representatives from RMS, Councils, transport operators, emergency services and the Department (Land Release).

Cycle and Pedestrian Facilities

Pedestrian facilities will be required to ensure safe and easy access to stations, which would encourage and facilitate future rail passengers choosing to walk to stations where possible. There is a limited network of on-road and off-road cycle ways in the vicinity of the proposed stations, with only the stations of Showground, Bella Vista, Kellyville and Rouse Hill having cycle paths and lanes in close proximity, although it is noted that Councils have plans at varying stages of development, that could be integrated with the project. The Proponent has stated that pedestrian and cycle connections beyond the immediate surrounds of station are not part of the scope of the project. Submissions have raised the need to provide pedestrian and cycle infrastructure beyond the immediate scope of the project to improve accessibility and overall patronage.

As noted above, the Department considers that pedestrian and cycle accessibility is a key component of the project and does not accept the Proponent's position that connections beyond the immediate surrounds of stations do not form part of the project. In its assessment of other major rail projects, including the post approval delivery of pedestrian and cycle facilities, the Department has gained practical experience in this matter and concludes that these matters need to be addressed and integrated into the detailed design of stations.

In this respect the Department has recommended that the Proponent prepare a Pedestrian and Cyclist Network and Facilities Strategy. The Strategy would identify pedestrian and cycle paths and associated facilities that are to be provided as part of the project with the objective of providing seamless, coherent, visible, and safe pedestrian and cycle access to, from and through stations. The Strategy would be incorporated into the Station Access Plans as discussed above.

Parking

Parking is considered to be an important element of the project as it expands the catchment area of the proposed stations and thus reduces private vehicle trips on the wider regional

road network. Park and ride demand for the NWRL will be about double the Sydney average for CityRail stations due to regional high underlying levels of car ownership and usage, particularly in the western part of the corridor, where there is also a less developed bus network.

These aspects of the NWRL corridor are an important factor for the approach adopted on car access provisions and as a result, a higher provision of park and ride spaces is targeted at the western stations of Kellyville and Cudgegong Road. Parking also mitigates to some degree, on street parking impacts, which will need to be actively managed during operations. Parking is proposed at Cherrybrook (400 spaces), Showground (600 spaces), Bella Vista (800 spaces), Kellyville (1,200 spaces) and Cudgegong Road (1,000 spaces) stations, for a total of 4,000 spaces. This approach is diagrammatically represented in Figure 5.9.

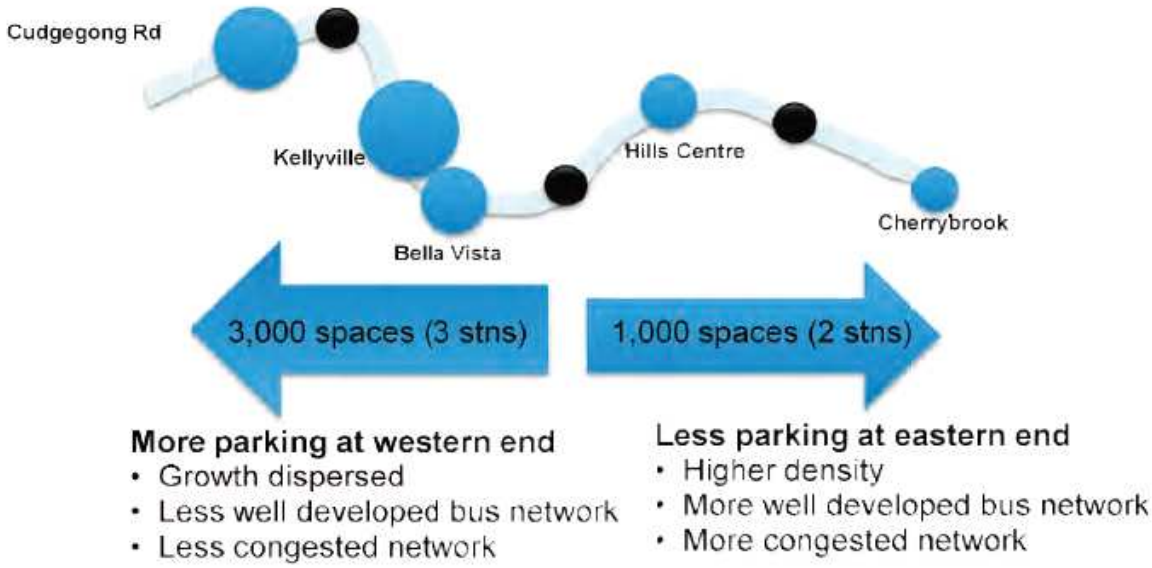

Figure 5.9 Parking Provision

Submissions raised the issue of on street parking impacts at and around stations, including the need for the Proponent to manage on-street parking impacts associated with project. The Proponent has acknowledged the potential of this impact regardless of the significant amount of parking to be provided and improvements to transport integration along the line, but considers this matter to be primarily the responsibility of Councils.

In relation to the parking at stations and in particular potential on-street parking impacts, the Department shares the community concerns on this matter, particularly as expected demand for car parking will be relatively high, due to high underlying levels of car ownership and usership in the region. Whilst the Department acknowledges that the Proponent has based the level of commuter car parking on these assumptions, it does not accept the Proponent's position that the responsibility of on street parking should be wholly transferred to Council. Accordingly it has recommend a condition that Proponent prepare and coordinate the implementation of a Parking Management Strategy, which requires the monitoring of on-street parking impacts and the identification of resultant management measures, such as residential parking schemes, should on-street parking demand have a detrimental impact on the local community.

5.2. Noise and Vibration

The EIS includes a noise impact assessment undertaken in accordance with the ICNG, IGANRIP, INP and the RNP.

The existing noise environment varies along the length of the rail corridor, and includes a range of land uses. A noise affectation area extending 200 metres from each construction

location, 100 metres either side of the rail alignment for operational rail noise and 50 metres for tunnelled track sections was adopted for the purposes of the assessment as this is the extent to which noise and vibration could impact on surrounding receivers.

Potential noise and vibration emissions were modelled at the most exposed receivers taking into account prevailing meteorological conditions. The resultant predictions were compared against defined criteria to determine the magnitude of impact and to inform the development of measures to minimise, mitigate and manage these impacts.

The Department and the EPA are satisfied with the methods used to calculate the relevant statistical noise levels, that the noise criteria have been developed in accordance with applicable policies and guidelines and that the modelling is sufficiently conservative such that the predictions represent a worst case scenario.

The project would generate noise and vibration from both the construction and operational stages of the project and have been assessed by the Department in the following sub-sections:

- construction noise and vibration;
- construction traffic noise; and
- operational noise and vibration (including groundborne noise and vibration and airborne noise).

Construction Noise and Vibration

During construction, the project has the potential to have an impact on surrounding receivers in the form of construction noise, vibration and road traffic noise. Each of these potential impacts is considered in turn below.

Construction Noise

Construction noise impacts have been assessed in accordance with the ICNG. For residential receivers, a Noise Management Level (NML) of RBL+10dB(A) $L_{Aeq(15\ minute)}$ has been assigned for construction activities during standard daytime hours as works are not generally proposed outside of these hours. NML's for other sensitive land uses have been applied in accordance with the ICNG and apply when the property is being used.

As construction activities would also result in additional heavy vehicle movements on public roads, potential road traffic noise impacts have been identified using guidance from the RNP. Construction traffic noise management levels set at 2dB above the existing road traffic noise levels have been adopted to identify potential noise impacts.

Above ground construction activities would generally take place during standard daytime hours, being between the hours of 7am to 6pm, 8am to 1pm on Saturdays with no work on Sundays or Public Holidays. These activities would take place from Bella Vista to Rouse Hill predominantly on the viaduct and Rouse Hill to Tallawong TSF, mostly at grade or on bridge structures.

The Department has reviewed the Proponent's construction programs for Stages 1 and 2 and notes that there would be little overlap of construction activities proposed for Stages 1 and 2 since the works will generally be broken down into a number of discrete sub-stages, and that each construction site would only be handed over to the next appointed contractor once each work package has been completed. As such, there is unlikely to be any combined impacts associated with the overall construction of the NWRL project.

Below ground construction activities in tunnels from Epping to Bella Vista Station would take place 24 hours, 7 days a week but are not anticipated to cause adverse noise and vibration impacts. Similarly, ground-borne vibration and noise impacts associated with track construction and fit out of tunnels is not anticipated to be significant, would meet applicable criteria, and are much lower than the impacts associated with Stage 1 activities, which are

already subject to conditions of approval. Consequently, the Department has not considered these issues further in its assessment of Stage 2.

The level of construction noise was modelled and the resultant predictions were then compared against the applicable NML for each receiver area. It is important to note that it is often not possible for large-scale projects to meet NML's. As a result, they are not strictly applied but rather represent the point at which reasonable and feasible management and mitigation measures are to be implemented to minimise these impacts.

The assessment found that full compliance of the NMLs would be achieved at Norwest, Bella Vista and Rouse Hill Stations, the Cudgegong Road Station and Tallawong TSF and the bridgeworks proposed at Balmoral Road.

There would be some minor (≤ 10 dB) to moderate (10dB to ≤ 20 dB) exceedances of the NML's in some of the areas around the Epping and Cheltenham Service Facilities, at Castle Hill, Showground and Kellyville Stations from building construction and installation of rail systems and when the Bella Vista to Kellyville Station section of track is being laid.

Higher level exceedances (> 20 dB above the NML or > 75 dB) are predicted at Cherrybrook Station and along the sections of track to be constructed between Kellyville and Rouse Hill Stations and Rouse Hill to Cudgegong Road Stations.

At Cherrybrook Station, these higher level exceedances would be experienced in 2 of the 8 receiver areas assessed and are associated with the two car parks: a 2-level car park at the south eastern end of the station box and an at-grade car park in the north eastern corner of the station box. Minor exceedances of the NML's during construction of the station platform supporting structures and the station building and during installation of rail systems would also be experienced in some residential areas and at Kindalin childcare centre. Compliance is predicted at the remaining residential areas as well as at Tangara and Inala Schools.

Between Kellyville and Rouse Hill Stations, minor and moderate exceedances are predicted in several residential areas and a passive recreation area, together with a high level exceedance at 1 of the 8 receiver areas assessed to the east of Windsor Road from concrete pouring, installation of stanchions and track construction.

Similarly, between Rouse Hill and Cudgegong Road Stations, there would be a high level exceedance experienced by 1 of the 4 receiver areas assessed to the north of the site and west of Windsor Road, including the OK Caravan Park. This is also from concrete pouring, installation of stanchions and track construction, as well as overhead wiring installation. Some minor exceedances at some commercial sites east of Windsor Road and North of White Hart Drive are also predicted.

For each construction location and activity, a three tiered approach has been put forward by the Proponent to mitigate and manage noise and vibration impacts, comprising:

1. *site specific management and mitigation measures*, including the construction of 3 metre high noise barriers to mitigate airborne noise (6 metres in the case of Cherrybrook Station). The attenuation effect of these barriers on noise propagation has been taken into account in the modelling results, as outlined above.
2. *standard management and mitigation measures,* these include a series of mitigation measures in the form of source controls (e.g. imposing respite periods, using and siting of plant to minimise noise) and path controls (e.g. shielding stationary noise sources), community consultation and ongoing noise monitoring programs.
3. *additional management and mitigation measures,* to be implemented where construction noise and vibration exceed the NML's. These measures are primarily aimed at pro-active engagement with affected sensitive receivers, and range from specific notifications to respite offers and/or alternative accommodation depending on the nature and duration of the impact anticipated.

The second and third approaches are described in detail within a Construction Noise and Vibration Strategy (CNVS), which formed an Appendix to the Stage 2 EIS, and would be adopted by contractor staff to manage construction noise and vibration impacts.

The Proponent has identified a construction program including the activities to be carried out at each construction location and predicted the potential noise levels resulting from these activities. The Department has correlated this information in order to gain an understanding of the noise amenity of sensitive receivers during construction works and the duration of exposure to potential exceedances of NML's. This found that NML's would be met at 25 of the 83 noise catchment areas assessed but there would be some minor, moderate and high exceedances of the NML's in the remaining 58 noise catchment areas.

The Department's assessment notes that certain construction noise impacts are likely to be significant, where potential noise exposure for some receivers, including those in close proximity to Cherrybrook Station and some sections of track to be constructed from Kellyville to Cudgegong Road Station, are predicted to exceed 75dB(A). The ICNG identifies this as the point at which there may be a strong community reaction to noise.

It is understood that the predicted noise exceedances represent the worst-case maximum impact scenarios, where in actuality the duration of work and intensities of noise will be shorter and less intense. Nonetheless, the Department recognises that receivers will be subject to further noise amenity impacts once the major civil works have been completed and notes the concerns of the community and agencies raised in their submissions.

Blacktown, the Hills, Hornsby and Parramatta Council's raised construction noise (and vibration) impacts and highlighted the number of potential significant exceedances above the NML's in their respective LGA's. The management and mitigation measures proposed to address these exceedances were acknowledged and it was recommended that these measures be enforced, together with a requirement for ongoing noise (and vibration) monitoring, which the Department supports.

The EPA sought clarification that the predicted exceedances were predicted for daytime periods only, which was subsequently confirmed by the Proponent in its Submissions Report. The EPA also pointed out that since construction noise levels are predicted to exceed the highly noise affected level of 75dB(A) that appropriate mitigation measures must be implemented to reduce these impacts at these receivers, including provision of appropriate respite periods.

Based on its assessment, the Department considers the key issue relating to construction noise are the level of potential impact and how best to satisfactorily manage this and the potential for construction works to be carried out outside of standard daytime construction hours.

The Proponent has indicated that construction of Stage 2 is likely to take 4 years from 2016 (by which time most of the major civil works for Stage 1 will have been completed) to 2019. Whilst the Department acknowledges that the noisiest activities would not occur for the entire construction period, it notes that the NML's would be exceeded at certain locations at certain times.

It is recognised though that it is not possible to minimise construction noise levels to achieve the construction noise objective due to the nature and character of the construction works required, (i.e. linear infrastructure in an urban environment and in close proximity to residential receivers), which is why the approach of the ICNG is that when unavoidable noise impacts are to occur, they are required to be managed, rather than completely mitigated.

The Department supports the Proponent's threefold approach outlined above and is generally satisfied that its proposed management and mitigation measures represent current best practice. Further, it is aware that similar approaches adopted by the Proponent have proved effective in managing high levels of noise when other large scale infrastructure projects have been constructed in Sydney and other areas of NSW.

To ensure construction noise is appropriately managed, the Department has recommended a condition requiring the Proponent to prepare a Construction Noise and Vibration Management Plan (CNVMP) which requires detailed noise mitigation and management measures to be clearly articulated. Specifically, consideration is to be given to key noise generating construction activities, and the scheduling of works and respite periods. The Department has recommended conditions of approval that as part of the Plan, the Proponent must identify how the efficiency and efficacy of noise measures employed will be monitored and non compliances rectified.

The Proponent generally proposes construction activities to be carried out during standard construction hours but has identified that there would be a need for some works to be undertaken outside of these hours for technical, mandatory or unforseen reasons (e.g. where the delivery of materials outside of approved hours needs to occur because of the requirements of the Police or other authorities).

The Department recognises that there will be circumstances when flexibility in working hours is warranted, such as the circumstances outlined above. The Department has assessed the Proponent's justification for works to be undertaken out of standard hours, and the proposed management and mitigation measures. The Department considers the request to be generally justified to ensure the safe and efficient delivery of the project, provided that suitable management measures are implemented and the relevant affected community is properly consulted in accordance with the CNVMP.

On this basis, the Department recommends conditions of approval which generally restricts construction activities to standard construction hours, being 7:00am to 6:00pm, Monday to Friday, and 8:00am to 1:00pm on Saturdays, unless certain circumstances exist. In addition, to those outlined above, it is recommended that activities outside these hours are also permitted where the NML's set by the ICNG would be met, there is a negotiated agreement with affected receivers or the works are approved through an EPL.

In summary, the Department acknowledges that construction noise is a key concern for the community and that there would be some exceedances of the NML's as a result of the project. However, noise impacts associated with such significant infrastructure projects are unavoidable and need to be managed, rather than completely mitigated. Overall, the measures put forward by the Proponent represent best practice and are likely to prove effective in managing this issue.

Importantly, the EPA recommended that the majority of the construction noise and vibration conditions that were imposed in the Stage 1 approval be continued to manage impacts for Stage 2, and this is supported by the Department.

The EPA also raised the issue of cumulative construction impacts from both stages of the project and other large construction projects in the region including the Epping to Thornleigh Third Track, which is currently under assessment. As set out above, the Department notes that there would be little overlap between Stages 1 and 2 so the potential for combined impacts between the two stages are limited.

To address the potential for other construction projects to have concurrent impacts, the Department recommends that a condition be imposed that requires the Proponent to consult with Proponent's of other construction works in the vicinity of the project, and that reasonable steps are taken to coordinate works to minimise impacts on, and maximise respite for, affected sensitive receivers (e.g. scheduling of noisy activities, planned usage of certain routes etc).

Construction Vibration

Construction vibration impacts may be experienced by sensitive receivers at some construction locations from the use of large mobile and fixed plant and equipment, including vibrating rollers.

The recommended distances from vibration intensive plant, to address both potential building damage and human comfort impacts have been derived from *Assessing Vibration: a technical guideline (*DECCW, 2006*)* and for cosmetic impacts, from *British Standards BS 7385: Part 2 – 1993*. A conservative vibration damage screening level of 7.5 mm/s has been adopted for both stages of the NWRL project.

To minimise the risk of buildings being damaged by the proposed construction activities, the Proponent proposes the following control measures:

- if there is a risk that vibration levels will be greater than 7.5 mm/s and a building or structure may be damaged (including minor cosmetic damage), building condition surveys would be undertaken prior to and following construction to identify any change in building condition as a result of the construction activities;
- the safe working distances for cosmetic damage would be complied with at all times, unless otherwise approved by the relevant authority; and
- attended vibration measurements would be required at the commencement of vibration generating activities to confirm that vibration levels are within the acceptable range to prevent cosmetic building damage.

There is potential for human comfort vibration levels to be exceeded at some surrounding receivers. Under such circumstances, the Proponent has committed to manage impacts in accordance with its CNVS, including a commitment to undertake attended vibration monitoring to ensure vibration levels remain below safe and acceptable limits.

There is also the potential for ground-borne noise levels from the operation of vibrating equipment to be audible within the Castle Hill and Reading cinema complexes. To address this, the Proponent would conduct attended noise monitoring to evaluate potential impacts and would implement specific measures to manage this impact in conjunction with the operators.

The Department is satisfied that the Proponent's assessment has demonstrated that vibration generated during the construction period would have minimal impact on human comfort levels and, is highly unlikely to result in damage to buildings.

On this basis, the Department concludes that the assessment has demonstrated that vibration impacts are likely to be minor and can be adequately managed as part of the project. To ensure any residual impacts are managed, the Department, in consultation with the EPA, has recommended the following conditions:

- best practice vibration and blasting criteria to provide performance standards that must be achieved during construction works;
- the Proponent to conduct attended vibration monitoring at nearest residential and commercial buildings during high vibration activities to ensure vibration levels remain below these limits; and
- implementation of all reasonable and feasible mitigation measures with the aim of achieving the relevant construction vibration goals.

Construction Traffic Noise

As the project would increase the volume of traffic on the existing road network, primarily in the form of heavy construction vehicles, the assessment predicted the increase of this noise for residential receivers located on the proposed access route to each of the construction locations.

It was found that these increases would result in compliance with the 2dB allowance above existing road traffic noise levels or would meet the local road criteria of 55dB(A) $L_{Aeq(1\ hour)}$ at all construction locations.

To address the EPA and community concerns with this matter, the Department recommends that the CNVMP also be required to address road traffic noise.

Operational Noise and Vibration

Potential operational noise and vibration impact is a key issue in the Department's assessment of the project and was raised by Councils and by 27% of the public, including submissions from a number of special interest groups, including businesses, recreation and sporting clubs, schools, community interest groups, resident interest groups, and transport interest groups.

The submissions received were mostly concerned about the possibility for noise and vibration to affect existing amenity, disrupt local businesses and damage the structural integrity of buildings located above the tunnelled sections of the rail alignment.

Once the NWRL has been constructed, there would be three distinct sections of rail alignment, which would have different noise and vibration profiles:

- Epping to Bella Vista Station – predominantly within tunnel;
- Bella Vista Station to Rouse Hill Station – predominantly on viaduct; and
- Rouse Hill Station to Tallawong Road – predominantly at grade or on bridge structures.

To ensure that the calculated levels of vibration and noise from rail operation accurately reflected likely noise emissions, the noise modelling made a series of assumptions (many based on the operation of the existing ECRL), including the use of maximum speed profiles to ensure that the maximum, worst case levels of vibration and noise impact were predicted. To add further conservatism to the predictions, the model was adjusted to take into account several physical factors which could potentially increase noise and vibration emissions such as the location of turnouts (crossovers), the presence of tight radius curves (which can cause flanging noise or curve squeal) and track geometry in relation to adjacent terrain.

The Department and the EPA are satisfied that the assessment covers all relevant operational aspects of the NWRL project, that it has been carried out in accordance with relevant policies and guidelines, and that the modelling is sufficiently conservative.

The NWRL would generate ***ground-borne*** vibration and associated noise within the first 15.5 kilometres of twin underground train tunnels between Epping and Bella Vista and ***airborne*** noise from the 7.5 kilometres of surface track from the tunnel portal at Bella Vista to the entrance of the Tallawong TSF.

In addition to noise and vibration generated by the operation of the rail line itself, ***airborne* noise** would also be generated from the operation of the supporting stationary facilities, namely the Epping and Cheltenham Service Facilities, the train stations and the Tallawong TSF. Other ancillary services, such as noise from draught relief shafts, vent systems and electrical sub-stations and the like can cause nuisance and have also been modelled.

The Department has considered each of these potential operational noise impacts in turn in its assessment below.

Ground-borne Noise and Vibration – NWRL

Consistent with the IGANRIP, the Proponent has nominated ground-borne noise trigger levels for residential use of 40dB(A) during the daytime (7am to 10pm) and 35dB(A) at night (10pm to 7am) and between 40dB(A) and 45dB(A) for schools, educational institutions and places of worship when in use. These trigger levels are based on the $L_{Amax(slow),\ 95\%}$ noise metric descriptor, which refers to the noise levels not to be exceeded by 95% of train passby events. The IGANRIP does not provide guidance on acceptable levels for other receiver types, so the Proponent nominated a series of trigger levels based on the same noise metric.

The Department has reviewed these ground borne noise trigger levels and considers them to be sufficiently conservative and notes that they have been successfully adopted in similar rail assessments. IGANRIP requires the Proponent to assess and implement reasonable and feasible mitigation measures at locations where the trigger levels are exceeded.

Ground-borne vibration is generated at the interface of the rail head and train wheels and can be propagated into adjacent buildings via the tunnel structure and intervening ground. Uncontrolled, these effects can inconvenience or disturb occupants, especially at night, affect building contents (rattling, movement of loose objects etc) or could even affect the integrity of a building. Ground-borne vibration is also experienced as ground borne noise when the walls or floor vibrates and is characterised as audible, low frequency rumbling.

The Department notes that the NWRL alignment has, where practicable, been located below or near to major roads (including the M2 Motorway, Castle Hill Road, Old Northern Road, Showground Road and Norwest Boulevard) which is advantageous from a ground-borne vibration and noise perspective because the nearest sensitive receivers have existing exposure to road traffic noise that masks the effects of ground-borne vibration and noise. Plus, many receivers along main roads are often commercial or industrial in nature and are generally less sensitive to ground-borne vibration and noise emissions.

However, the proposed rail alignment runs under some suburban residential areas away from main roads where the ambient noise level environment is typically quieter and so the potential sensitivity to trains passing by is substantially increased.

Mitigation of ground-borne vibration and noise in buildings near rail lines is typically achieved through track form design, by the insertion of a resilient (rubber) layer between the rail and tunnel foundation. This layer may take the form of resilient rail fasteners, booted sleepers, floating slab track or a combination of these engineering design measures.

Modelling was used to identify the possible worst case ground-borne vibration and noise to determine the track form required to attenuate ground borne vibration and noise along the length of the NWRL to meet applicable criteria. It was found that for about 90% of the rail alignment, standard attenuation track is predicted to achieve compliance with the ground-borne vibration and noise criteria but for the remaining tunnel sections, high and very high attenuation track would be needed.

Based on this track form design, compliance with the ground-borne vibration objectives are predicted at all residential receivers and the majority of other sensitive receiver locations above or near the NWRL alignment (see Figure 5.10).

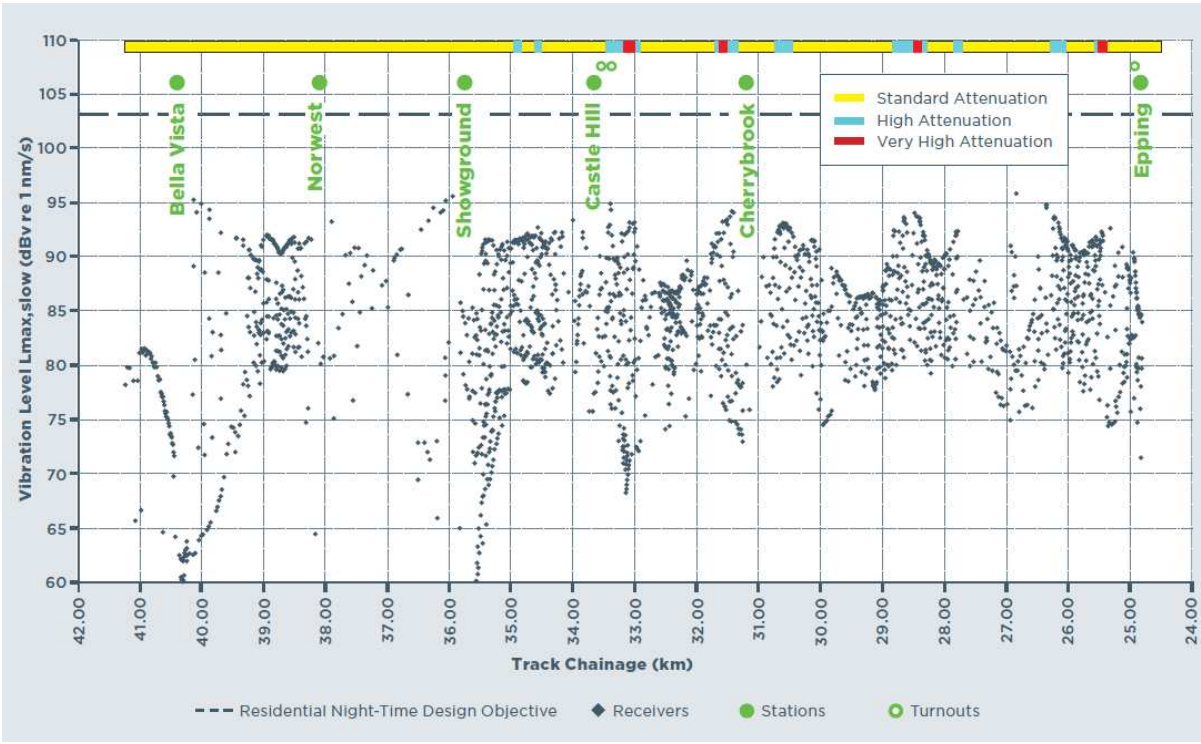

Figure 5.10: Predicted Ground-borne Vibration Levels and Indicative Track Form

However, three receivers have been identified that may contain highly sensitive equipment with an exceedance of the design objective predicted at an existing Medical Centre in Epping at Chainage 25.120km, a Veterinary Hospital in West Pennant Hills at Chainage 30.575km and Sydney Animal Hospital in Bella Vista at Chainage 40.130km.

The three minor exceedances are predicated on the assumption that these receivers contain highly vibration sensitive equipment that cannot be relocated (or are not already protected by on-site mitigation measures). This is a conservative assumption as detailed investigations of these localities have not been undertaken. Furthermore, the screening criterion which has been applied is appropriate for lithography and similar inspection equipment down to 1 micron detail size. Typical imaging equipment in the facilities identified would not contain this type of equipment.

In the event that highly vibration sensitive equipment was used by these receivers, it is likely that existing ambient vibration levels from adjacent major roads would already exceed the screening criterion.

Following detailed design investigations (including inspections of the above-mentioned sensitive receivers), in the event that ground-borne vibration from the NWRL operations was initially predicted to impact on any vibration sensitive equipment, a number of feasible and reasonable mitigation measures would be possible, including changes to track design. This would be addressed through the Operational Noise and Vibration Review (ONVR) process set out in more detail below.

With ground-borne noise, it is predicted that the IGANRIP criteria would be met at all residential and other sensitive receivers (see Figure 5.11).

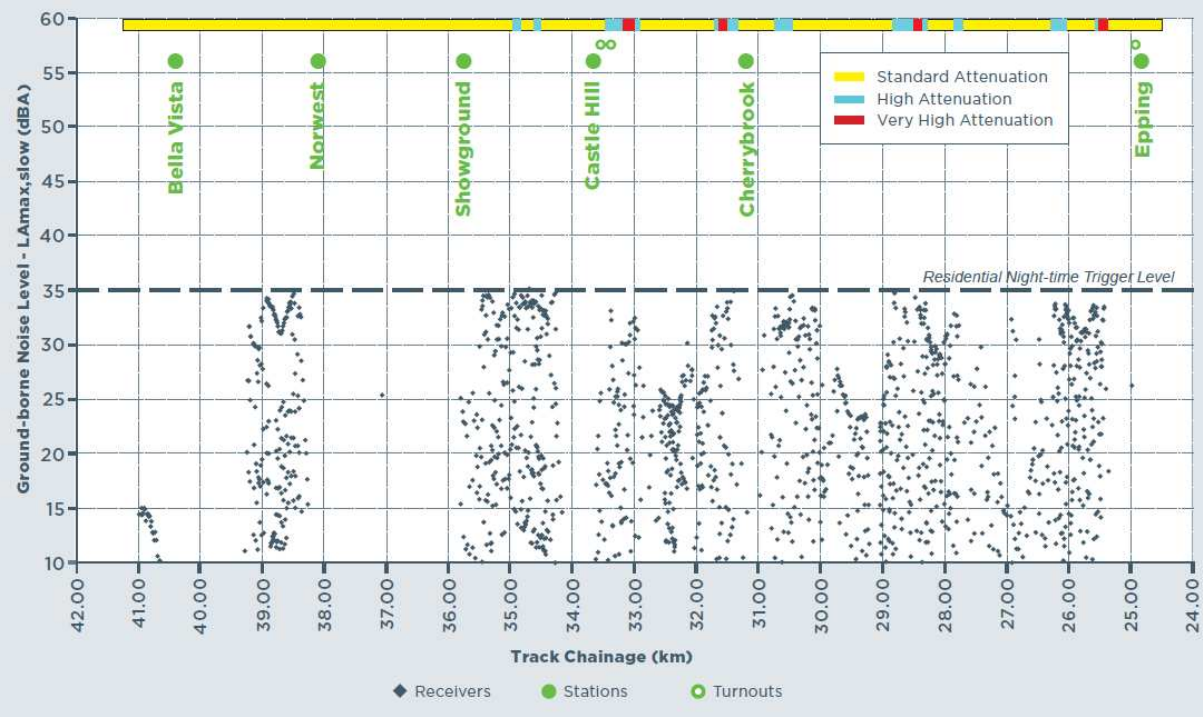

Figure 5.11: Predicted Ground-borne Noise Levels and Indicative Track Form

The Department is satisfied that the project can be designed and constructed to ensure that the level of ground borne vibration and noise would meet applicable criteria and not cause human discomfort or structural damage.

To ensure this is achieved, the Department and the EPA recommend that a condition be imposed which requires the Proponent to design and operate the rail line components of the project with the objective of not exceeding IGANRIP ground-borne vibration and noise trigger levels at all existing built development, as well as development approved prior to

determination of the project, in the vicinity of the rail corridor to the extent to where receivers are known.

As mentioned above, it is recommended that the Proponent be required to prepare an Operational Noise and Vibration Review (ONVR) in consultation with the Department (Land Release), the EPA and relevant Councils. The overall purpose of the ONVR will be to confirm the vibration and noise control measures that would be implemented in the detailed design of the project to meet these ground-borne vibration and noise trigger levels at all locations, including those receivers referred to above where highly sensitive equipment could be affected, and which would be independently verified by a noise and vibration expert.

Airborne Noise – NWRL

Consistent with the IGANRIP, the trigger levels for residential uses during the daytime period is 60dB(A) $L_{Aeq(15hour)}$ and is 55dB(A) $L_{Aeq(9hour)}$ at night with a train passby trigger level for both periods of 80dB(A) $L_{Amax(slow),\ 95\%}$. A similar approach has been adopted for other sensitive land uses, the main difference being that the noise metric is altered to be either the busiest 1 hour or 24 hour L_{Aeq} period depending on the nature of the use.

Airborne noise would be created by the operation of the 7.5 kilometres of surface track from the tunnel portal at Bella Vista to the entrance of the Tallawong facility. The chosen alignment runs through the open cut stations at Bella Vista, Kellyville, Rouse Hill and Cudgegong Road and has resulted in several at grade cuttings, which partly attenuates noise, and several viaducts and embankments where the track is in an exposed position and noise would be propagated.

Noise emissions from suburban electric passenger trains on surface tracks are caused by the rolling contact of steel wheels on steel rails. Other noise sources on these trains (such as air-conditioning plant and air compressors) are generally insignificant noise contributors when compared with wheel interaction, unless the train is travelling at a low speed or is stationery. Where track is located on bridges or viaducts, vibration is transmitted to the structure resulting in structure radiated noise.

The assessment modelled the noise impacts on surrounding receivers to develop an understanding of the balance between direct and structure related noise and to explore the effectiveness of a series of baseline mitigation measures, the residual noise impacts and the need for additional noise mitigation at existing receivers and future developments that could be affected by airborne noise.

It was found that when the project opens, with baseline mitigation measures in place in the form of noise barriers, rail dampners and resilient rail fasteners, noise levels are predicted to meet the IGANRIP noise trigger levels at the majority of existing receivers and all non-residential receivers with the exception of a relatively small number of residential properties between Kellyville and Rouse Hill Stations and a residence on Terry Road between Rouse Hill and Cudgegong Road Station. These exceedances are typically within 1dB(A) of the trigger levels and are considered negligible.

For the future operating scenario, the daytime $L_{Aeq(15hour)}$ and night time $L_{Aeq(9hour)}$ noise levels are predicted to increase by 1.6dB(A) and 0.8dB(A) respectively as a result of additional trains operating on the rail line, which means that the number of L_{Aeq} noise trigger level exceedances increases to 30 detached houses and the upper levels of 5 apartment buildings. Notwithstanding, exceedances would be within 2dB(A) of noise trigger levels, which are also not considered to be significant.

Overall, the Department is satisfied with the outcomes of the assessment and notes that the level of predicted impact is commensurate with other similar rail projects operating in NSW, including the existing Epping to Chatswood Rail Link. Further, it is noted that predicted airborne noise levels in previous rail modelling projects have shown good correlation with the values measured once operations have begun.

Whilst these exceedances are only marginal (≤ 2dB(A) in the future scenario), a series of additional feasible and reasonable noise mitigation measures (in the form of source, path and receiver control options) were nonetheless examined to ascertain what could be implemented to further reduce noise impacts at these receivers and thereby meet the criteria.

Of the options examined, several were considered reasonable and feasible. These measures include reducing train speeds to 100km/h between Kellyville and Rouse Hill Stations, designing the viaduct structure (shape, materials and track design) to minimise structure radiated noise, applying additional absorptive material and acoustic property treatments.

The Department notes the relatively minor nature of the exceedances predicted once the baseline mitigation measures have been implemented and that there are a number of additional feasible and reasonable noise control options that would be explored in more detail during detailed design. Further, it is noted that these sorts of controls have proved effective in mitigating rail noise and these types of mitigation measures for existing receivers can also provide acoustic benefits for future developments.

To ensure that airborne noise is managed during operation, the Department has recommended a condition requiring the Proponent to design and operate the rail line components of the project with the objective of not exceeding the airborne noise trigger levels at existing and approved developments. To achieve this outcome, the baseline mitigation measures would need to be implemented together with the additional mitigation measures set out above to address some minor exceedances. All of these measures would be would be implemented through the Operational Noise and Vibration (ONVR) process outlined above.

It is noted that with the mitigation measures assumed in the modelling, noise trigger level exceedances are only predicted at a number of receivers along part of the rail alignment from Kellyville to Cudgegong Stations. At these properties, further assessment of mitigation measures would be required and that these measures would be refined as part of the ONVR process (see above).

The noise assessment has also considered potential developments in the aboveground section of the rail corridor as identified in Council land use plans and Department of Planning master planning documentation, the key areas being around Bella Vista, Kellyville, Rouse Hill and Cudgegong Road Stations and the Area 20 Precinct of the NWGC. It was found that the noise impacts at future developments would be relatively minor and would only require noise mitigation controls to be implemented in some instances, much like those discussed above in relation to existing properties.

To help manage potential airborne noise impacts on future developments, a further condition is recommended which requires the Proponent to consult with the Department (Land Release) and relevant Councils during detailed design of the project to facilitate appropriate rail infrastructure and land use planning responses to potential airborne noise impacts within the NWGC and areas of new development adjacent to the rail line.

Noise and Vibration Impacts – ECRL

Once the NWRL project becomes operational in around 2020, the current mix of City Rail trains operating on the ECRL would be replaced by single deck, Rapid Transit operations. In addition, RailCorp data indicates that there are likely to be more trains operating on the existing line between now and 2031 as a result of natural growth and as existing systems are progressively upgraded.

The result of this is that train speeds and service frequency would increase which, in turn, has the potential to cause additional impacts on surrounding sensitive receivers in the form of airborne noise levels along the section of surface track between Chatswood Station and the ECRL tunnel portals and ground borne vibration and noise levels above the section of tunnel track between Epping and Chatswood.

The Proponent assessed these potential impacts and found that the associated increase in noise emissions is likely to be minor and of a magnitude that most would find difficult to detect. Whilst this conclusion is noted by the Department, changes to the noise and vibration profile of the ECRL does not form part of this project, and the ECRL is required to continue to operate under its existing approval and EPL licence conditions, including operational airborne noise criteria, which are required to be complied with.

Airborne Noise – Servicing Facilities, Stations and Ancillary Infrastructure

The following noise criteria apply in the assessment of these stationary facilities at surrounding receivers:

- intrusive criteria (RBL+5dB(A) LAeq(15 minute) and LAeq(period) amenity criteria (whichever the more stringent) and sleep disturbance screening criteria (RBL+15dB(A) LAeq(1minute) set by the INP for continuous mechanical and electrical services and stations and the proposed car parks;
- an LAmax(slow), 95% criteria from train passby noise emitted from draught relief shafts (at underground stations); and
- the RNP for the proposed new and upgraded roads. For new roads, criteria of 55dB LAeq(1hour) (daytime) and 50dB LAeq(1hour) (night time) apply at residential facades and, for land use developments with the potential to generate additional traffic on existing roads, the RNP requires an assessment of the increase in total traffic level which is limited to 2dB above existing levels of road traffic noise. Reasonable and feasible mitigation measures are to be implemented to address exceedances of the criteria.

The approach to the assessment of noise impacts from stations and ancillary equipment such as air conditioners, electrical substations and other mechanical plant was to calculate the maximum total allowable sound power level for all equipment at each of these locations (Epping, Cheltenham and Tallawong Servicing Facilities and Stations) to provide an indication of whether the INP criteria are able to achieved and to inform the detailed design of the project. The maximum allowable sound power levels emitted at each location have been calculated and range from around 73dB(A) to 106dB(A).

It was found that noise from these sources can be designed to achieve applicable INP criteria. Mitigation measures are likely to be required to achieve this for some station and tunnel ventilation equipment and locations, such as appropriate equipment selection, in-duct attenuators, noise barriers, acoustic enclosures and the strategic positioning of critical plant away from sensitive receivers.

For the proposed open cut and above ground areas, the main noise source is likely to be associated with announcements via the Public Address (PA) system, which would also be required to meet INP criteria, and can be achieved through loudspeaker selection and placement and the installation of ambient noise sensing microphones to reduce the volume of any announcements during periods with lower ambient noise levels.

Noise breakout through the draught ventilation shafts is predicted to comply with applicable noise criteria of 55dB(A) L_{Amax} for residential receivers and L_{Amax} 60dB(A) for commercial receivers at each underground station provided suitable in duct noise attenuation measures are installed.

For road traffic noise, the Proponent assessed the potential increase in noise from additional traffic generated from the proposed stations once operational. This included the overall increase in road traffic noise on existing roads surrounding the stations and from new and upgraded roads proposed at Cherrybrook, Showground, Bella Vista, Kellyville and Cudgegong Road Stations. For the new and upgraded roads proposed, compliance with the RNP criteria is predicted, except at Cherrybrook, Kellyville and Cudgegong Road Stations.

Based on the current bus strategy, vehicles travelling to and from Cherrybrook Station are expected to increase existing traffic volumes on the roads in the vicinity of the station,

particularly near the access points to the station precinct. Resultant road traffic noise levels on Castle Hill Road are predicted to increase by 1dB, which is below the RNP permitted increase of 2dB. However, during the morning peak period, $L_{Aeq(1hour)}$ traffic noise levels at building facades 10 metres from the edge of Franklin Road or Robert Road are predicted to be approximately 65dB(A), of which 59dB(A) and 63dB(A) are from light vehicles and buses respectively. As existing road traffic noise levels are expected to be at least 55dB(A), this represents a worst case increase of up to 10dB(A).

To address these possible exceedances, mitigation measures include the operation of quieter buses, the installation of noise barriers and property treatments. These and other mitigation measures would be investigated and implemented at detailed design stage through the ONVR process if required. The Department also notes that noise levels would reflect the future bus servicing strategy for the area.

At Kellyville Station, traffic noise levels are generally predicted to increase by less than 2dB at receivers. However, a possible 3dB exceedance of the RNP criteria is predicted at the nearest residences during the morning peak period. Several reasonable and feasible noise mitigation measures have been identified that would address this exceedance, which would be formalised during detailed design.

The Department is satisfied that through a combination of the measures outlined above, it is possible to ensure that existing and proposed road traffic noise from Cherrybrook and Kellyville Stations meets applicable RNP criteria at all surrounding receivers.

Traffic noise levels from proposed new roads at Cudgegong Road Station are not expected to exceed the RNP criteria but the $L_{Aeq(1hour)}$ on existing roads during the morning peak period is predicted to increase by up to 3dB at residences on Schofields Road. However, the areas around the proposed Cudegegong Road Station are part of the NWGC and traffic on Schofields Road is expected to double between 2011 and 2012, irrespective of the NWRL.

Of the five stations where park and ride arrangements are proposed, operational noise from car parks (including sleep disturbance from cars moving, starting or accelerating or door slamming) is predicted to comply with the criteria at Bella Vista, Kellyville and Cudgegong Stations, but not at Cherrybrook and Showground Stations.

At Cherrybrook Station, there are two car parks proposed, a 2-level car park at the south eastern end of the station, which is predicted to comply with intrusive and amenity criteria but at which a 4dB exceedance of the sleep disturbance criteria is predicted at the nearest residences on Castle Hill Road.

The second car park, an at grade car park in the north eastern corner of the station, is located closer to receivers in Kayla Way. Unmitigated, there could be exceedances of the intrusive criteria of up to 4dB during the day and night time periods, and between 11dB and 21dB above the sleep disturbance criteria, depending on whether the windows are left open at night or not. As a result, the Proponent has identified that specific measures are required to mitigate the possibility of sleep disturbance for occupants of the adjacent residences in Kayla Way. Mitigation measures that would be considered during detailed design include the construction of noise barriers along the north eastern boundary of the east car park or closing this car park between the hours of 10pm and 7am.

At the 3-level car park alongside Carrington Road at Showground Station there could be some exceedances of the intrusive night time criteria by up to 4dB at two receivers and the sleep disturbance criteria by up to 8dB at the nearest residences. This could be addressed by enclosing the south eastern corner or installing sound absorption panels on the roof of each car parking level near the southern end.

The Department is satisfied that the potential noise impacts from all stationary facilities, including servicing facilities, stations (including car parks) and ancillary infrastructure, can be designed to meet relevant INP criteria with the implementation of a series of management and mitigation measures, including those identified above. In the event that the above mitigation measures are not reasonable and feasible, and do not achieve the noise targets

derived for the project, the Proponent would be required to implement additional reasonable and feasible management and mitigation measures, which may include property treatment of nearby dwellings and other sensitive receivers. Final details of exactly what type of management and mitigation measures would be implemented would be addressed through the Operational Noise and Vibration Review (ONVR) process.

Airborne Noise – Tallawong TSF

The Tallawong TSF is also classified as a stationary facility so it has also been assessed in accordance with the INP. Intrusive, amenity and sleep disturbance screening criteria have been developed based on at opening and future scenarios, as shown in Table 5.2.

Table 5.2 – Stabling Facility Noise Criteria

Scenario	Period	Estimated RBL (dBA)	Operational Noise Criteria		
			$L_{Aeq(15minute)}$ Intrusive	$L_{Aeq(period)}$ Amenity	$L_{A1(1minute)}$ Sleep Disturbance Screening Level
At Opening and for Future Scenario	Early Morning (5am to 7am)	40	45	45	50
	Day (7am to 6pm)	45	50	55	-
	Evening (6pm to 10pm)	45	50	45	-
	Night (10pm to 5am)	35	40	40	50

As the Tallawong TSF could potentially operate 24 hours a day, seven days a week, it could affect the amenity of existing residential receivers including at night. At opening, it would service up to 20 single deck trains although there may be more train sets introduced as future train services increase.

The dominant noise sources associated with train stabling operations in this case are brake air noise release, air compressors, static inverters, air conditioners, general workshop noise and the train wash facility. Horn testing, an often problematic and significant noise source, would not be required here as an alternative warning system would be used to alert staff of impending vehicle movements in areas of the facility.

Other noise sources and activities that could generate noise include a work maintenance area, wheel lathe, alarm systems, internal train cleaning, a staff car park and a PA system. Emissions from these noise sources are either too low to pose a problem for surrounding receivers or can be addressed at the detailed design stage, much like the noise sources from servicing facilities, stations and ancillary infrastructure identified above.

During the morning (typically starting from about 4am), safety checks must be performed before the train can depart. All auxiliary equipment, including air conditioning, air compressors and static inverters, is operated for around 15 minutes before departure. Typically, when trains return to the Tallawong TSF, brakes are applied by exhausting the brake pipe, which releases compressed air to the atmosphere causing peak noise levels of short duration. After the parking brake is applied, the trains are stabled with all auxiliary equipment shut down and interiors cleaned. Some trains would also be cleaned in the train wash facility, passing through at a walking pace over several minutes.

Potential noise impacts were conservatively modelled at representative receivers surrounding the TSF for early morning, daytime, evening and night time periods for 'at opening' and 'future' scenarios based on a typical combination of operational configurations. The modelling assumed that no specific noise mitigation would be provided apart from natural shielding provided by the fact that the stabling facility would be partially located within a cutting. The results indicated that for the early morning, daytime and evening periods (5am

to 10pm), compliance would be achieved, except for a 2dB(A) exceedance at one sensitive receiver to the north but only during adverse weather conditions.

During the night time period (10pm to 5am), compliance is mostly predicted except at some receivers to the north, south east and north east where exceedances of up to 4dB(A) could be expected during adverse weather conditions for the 'at opening' scenario. For the 'future' scenario with adverse weather conditions, exceedances of the criteria of up to 5dB(A) are predicted at the nearest receivers to the south east with exceedances ranging from 1dB(A) to 4dB(A) predicted to the north east, east and south.

With the assumed unmitigated source levels, and under adverse meteorological conditions, brake air release noise could exceed the short-term sleep disturbance criteria by up to 6dB(A) at the nearest sensitive receivers adjacent to the TSF and warrants further consideration. It is noted that there would be some variation in noise levels from each of these events since brake air release is a variable source and impacts would be lower when trains entering the TSF later are shielded by other trains already stabled and under neutral weather conditions (noting that the predicted exceedances are largely during adverse meteorological conditions).

Further, the background noise measurements indicate that the existing L_{A1} and L_{Amax} noise levels in the area are higher than the predicted noise levels associated with brake air releases. This suggests that whilst noise associated with brake releases may be noticeable at the nearest receivers, the likelihood of sleep disturbance is low.

Notwithstanding this, a series of noise mitigation measures were examined by the Proponent to address the above exceedances. Since much of the noise would be generated at the top of the train, noise barriers or earth mounding is not considered to be viable in this case as it would need to be at least 5 metres high to provide effective attenuation for the southern receivers and would have a high cost and visual impact plus the performance of these barriers would reduce under adverse weather conditions when the highest noise impacts are predicted to occur. Options to mitigate noise in this case include source control by limiting the noise levels of rolling stock (via the procurement process), designing the Tallawong TSF to contain noise and implementing operational procedures to minimise noise impacts at nearby sensitive receivers, such as approved Rail Corp procedures, including the use of quakker style alarms.

Impacts from brake air release and air-compressor noise could be further reduced if required via the inclusion of silencers in the compressed air lines or by operational measures to maximise noise barrier effect from adjacent trains. Minimisation of all rolling stock auxiliary noise levels would be investigated during procurement of rolling stock. A condition has been recommended to this effect.

As with the other stationary facilities, the Department is satisfied that the potential noise impacts from Tallawong TSF can also be designed to meet relevant INP criteria provided appropriate mitigation measures are implemented, such as those set out above and/or through additional measures including possible treatment of dwellings if source controls do not prove reasonable and feasible. As set out above, final details of what management and mitigation measures would be implemented would be determined through the Operational Noise and Vibration Review and associated compliance assessment process as outlined above.

Finally, the Department also notes the difficulty and subsequent uncertainty over the future noise environment in setting definitive operational noise criteria for these stationary facilities in this case, given the evolving land uses adjacent to the corridor, particularly around the station precincts in the longer term as the *NWRL Corridor Strategy* is implemented over time (see Section 2.3), particularly in the area of the Tallawong TSF given the planned development and growth of the NWGC.

To address this uncertainty, and in the absence of fixed noise criteria for future development surrounding the stationary facilities, the Department has recommended a condition of

approval which takes account this uncertainty by requiring operational noise targets to be reviewed within 2 years of the date of any approval granted by the Director General for the ONVR and at any subsequent time as required by the Director General. These reviews shall have regard to the status of land use planning, any land use changes and the background noise environment within areas adjacent to the rail corridor at the time of the relevant review.

In summary, through a combination of management and mitigation measures being implemented by the Proponent and the Department's recommended conditions outlined above:

- there would be some further noise and vibration impacts in certain locations during the daytime as a result of construction activities proposed as part of the project but these impacts are able to be effectively mitigated and managed;
- ground-borne vibration and noise impacts along the tunnelled section of rail line from Epping to Bella Vista can be mitigated through track design at all sensitive receivers to meet relevant criteria so as not to cause human discomfort or structural damage;
- airborne noise criteria can be met at all receivers along the aboveground section of rail line from Bella Vista to Rouse Hill provided a combination of baseline and additional management and mitigation measures are implemented;
- airborne noise from all stationary facilities, including servicing facilities, stations (including car parks), ancillary infrastructure and the proposed stabling facility can be designed to meet relevant criteria, including at night and during adverse meteorological conditions;
- the final selection of management and mitigation measures to ensure the noise objectives set out above are achieved will be identified and implemented through the Operational Noise and Vibration Review for the project; and
- impacts at future developments would be relatively minor and would only require noise mitigation controls to be implemented in some instances.

5.3. Hydrology

The NWRL corridor crosses a number of named and unmanned tributaries of the Parramatta and Hawkesbury Rivers. There are eight main waterway catchments that are located in the vicinity of the project and traversed by construction sites, as outlined in Table 5.3.

Table 5.3 - Major Waterway Catchments and Construction Sites

Catchment	Construction Site
Devlins Creek	1. Epping Services Facility
	2. Cheltenham Services Facility
Pyes Creek	3. Cherrybrook Station
Cattai Creek	4. Castle Hill Station
	5. Showground Station
Strangers Creek	6. Norwest Station
Elizabeth Macarthur Creek	7. Bella Vista Station
	8. Balmoral Road
	9. Memorial Avenue
	10. Kellyville Station
Caddies Creek (including tributaries 3, 4 and 5)	11. Windsor Road/Old Windsor Road
	12. Old Windsor Road/Whitehart Drive
	13. Rouse Hill Station
	14. Windsor Road Viaduct

Second Ponds Creek	15. Windsor Road Viaduct to Cudgegong Road
First Ponds Creek	16. Cudgegong Road and Tallawong Stabling Facility

A 100 year ARI (average recurrence interval) flood standard was adopted for the design and assessment of permanent works, however, consideration was also given to the impacts of the full range of flood events up to and including the probable maximum flood (PMF). Flood risks in excess of the 100 year ARI were also assessed, particularly in relation to flood emergency evacuation and flooding to tunnels and below ground stations and other infrastructure due to the consequential risk to life and damage to critical services infrastructure. The assessment also considered the potential for floods to impact on critical infrastructure adjoining the NWRL including Windsor Road, Old Windsor Road, Schofields Road and the Tallawong Electricity Substation.

The hydrology modelling took into consideration the NSW Floodplain Development Manual and addressed existing and future catchment conditions, including the cumulative impacts of Stage 1 and Stage 2. The results of the assessment were used to assess the following:

- Flood risks to the rail infrastructure (above and below ground), station precincts and ancillary facilities including substations and tunnel service facilities;
- Flood impacts on the surrounding environment due to Stage 2 works; and
- Impacts on stormwater quantity during the operation of the NWRL.

Development within the catchment in the south east portion of the project (Epping to Bella Vista Station) is relatively well established and includes the suburbs of Epping, Cherrybrook, Castle Hill and Bella Vista. The catchments within the North West Growth Centre (including Strangers Creek, Caddies Creek and tributaries, Elizabeth Macarthur Creek, First and Second Ponds Creeks) are less developed, although significant future development has been identified including the Balmoral Release Area, Area 20 Precinct, Alex Avenue, Riverstone, The Ponds and Beaumont Hills. Water management strategies have been incorporated into the planning of these growth areas and include a range of detention regimes to manage potential increased runoff.

The rail alignment between Bella Vista Station and Kellyville Station runs parallel and close to Elizabeth Macarthur Creek and development in the upper catchment is well established and comprises a mix of residential and commercial development. The catchment which drains to Elizabeth Macarthur Creek between Celebration and Samantha Riley Drives is currently largely undeveloped, although significant development is underway and planned as part of the North West Growth Centres.

Of the construction activities proposed to be undertaken as part of Stage 2, works within the station precincts, service facilities and the stabling facility have the potential to result in flooding impacts. The assessment identified that the construction sites at Epping Services Facility, Showground and Bella Vista Stations have the greatest potential for flood affectation and the layout of the sites would require further development during detail design to consider the potential risk of flooding, duration of construction, the magnitude of inflows and the potential risks to the project, facilities and personal safety. There is also a risk that the tunnel section between Epping and Bella Vista Station and excavations for below ground stations could become inundated leading to potential damage, delays in the construction program and potential risks to personal safety. The EIS states that the potential for the ingress of floodwaters into underground sites would need to be managed and this would include specific measures at the entries to each of the sites. Tunnel entries have been designed at or above the PMF level (72m AHD) to minimise the entry of floodwaters. Temporary filling of the floodplain such as for haul roads or the placement of stockpiles for the construction of stations, precincts and ancillary facilities associated with Stage 2 would be minimal.

Notwithstanding, changes to the impervious area and catchment response times are expected but, impacts would be offset through the provision of erosion and sedimentation measures including basins and bunded swales designed to control the discharge and runoff

from each site and minimise offsite impacts. Railway stations are required to have 100 year ARI flood immunity, however, a higher level of protection is required where flows in excess of this level have the potential to cause significant damage or risk to life. For example, the PMF flood standard has been used for underground stations and tunnel portals. The flooding potential and proposed mitigation measures associated with each station and its precinct as well as the two rail service facilities are summarised in Table 5.4. Above ground traction stations and sectioning huts have been located a minimum of 500 mm above the 100 year ARI.

Table 5.4 – Flooding Potential to Station Precincts and Rail Service Facilities

Station Precinct and Type	Flooding Potential from/PMF Level (mAHD)	Potential Impact	Mitigation Measure
Cherrybrook – below ground open box	Local overland flow only.	This area is not affected by mainstream flooding however an overland flow path runs south to north across the site. The PMF overland flow is estimated at 1.7 m^3/s. Without appropriate grading and drainage measures, overflows from Castle Hill Road could enter the precinct and flood the station	Design site grading and local drainage system to divert overland flows around the station opening. Runoff draining to and through the site will be discharged to the natural depression at the north western corner.
Castle Hill – below ground	Local overland flow only.	Located at the top of the catchment with no flood impacts expected.	Station entries would be located 0.3 m above local ground level. No other measures are required or proposed for the station. Appropriate drainage design and surface grading for the broader precinct.
Showground – below ground	Cattai Creek/ 84.2m	Station located above the PMF level.	Station entries would be located 0.3 m above local ground level. No other measures are required or proposed.
Norwest – below ground	Strangers Creek/ 81m	Station located above the PMF level, however a minor tributary runs north along Brookhollow Ave (western boundary of station site). PMF flow along Brookhollow Ave is calculated as 9.1m^3/s with a depth of 0.6m.	Station located outside PMF for mainstream flooding. The western entry point to the station and buildings are proposed to be elevated 0.6m above road level to cater for overland flows.
Bella Vista – below ground open cut	Elizabeth Macarthur Creek/ 71m	The station and broader precinct is located above the PMF level for flooding.	Station entries would be located 0.3 m above local ground level. No other measures are required or proposed for the station. Appropriate drainage design and surface grading for the broader precinct.
Kellyville – above ground	Elizabeth Macarthur Creek/ 48.6m	The station is located above the PMF level for flooding. A small area of the broader precinct along the eastern edge is affected by 100 year ARI flooding. The area of car park north of Samantha Riley Drive is located within the PMF extent.	The filling associated with the construction of access roads and car parking will be designed to manage impacts of flooding on surrounding areas and Old Windsor Road up to the PMF.
Rouse Hill – above ground	Caddies Creek Tributary 3/ 49.5m	Rouse Hill Station forms part of the viaduct and is above the PMF level. The precinct would be subject to inundation from flows that overtop Windsor Road at the Tributary 3 culverts, however these culverts have in excess of 100 year ARI capacity.	Critical infrastructure within the facility to be designed above the PMF level and any precinct works would be designed to manage impacts to Windsor Road.

		The precinct is not expected to be affected by flooding up to 100 year ARI event. Access to the station off Windsor Road is outside PMF level. The rail line is located within the PMF extent.	
Cudgegong Road – above ground (in a cutting)	Second Ponds Creek/ 48.8m	The station is located above the PMF level for flooding. A number of drainage lines and depressions convey overland flows through the precinct.	Appropriate drainage design and surface grading for the broader precinct.
Rail Service Facility	**Flooding Potential from/PMF Level (m AHD)**	**Potential Impact**	**Mitigation Measure**
Epping	Devlins Creek Beecroft Road Tributary/ 78.8m	Facility entry points would be located above the PMF so the risk of mainstream flooding is low, however, flood levels could increase by 0.3m along the tributary between the facility and Raby Road.	Apart from appropriate drainage design, no additional measures are required.
Cheltenham	Local runoff only	Facility is located outside the floodplain	

The Tallawong TSF is located inside the First Ponds Creek floodplain and apart from appropriate drainage design, no additional flood mitigation measures are proposed. The stabling facility is required to have a 100 year ARI flood immunity however any critical service facilities located within the facility would require a higher standard, and would be located outside of the PMF.

The operation of the project would result in flooding impacts to the surrounding environment to varying degrees. While most of these impacts were already assessed as part of Stage 1 works, the EIS for Stage 2 assessed these elements with the added components of Stage 2 to identify cumulative flooding impacts. A summary of the main impacts for each creek system, is outlined as follows:

- Devlins Creek Tributary – Part of the proposed Epping Services Facility is located within the extent of the PMF which could increase flood levels by 0.3m between the facility and Raby Road, however, the increase in flood level is not considered to be significant and no new properties would be affected.
- Cattai Creek (Showground Station) – the station has been located above the PMF and the broader precinct above the 100 year ARI with the exception of a portion of western access road off Carrington Road which is within the PMF. The access road is not expected to have any impact provided it is set at or below Carrington Road.
- Strangers Creek (Norwest Station) – Subject to the management of local runoff and overland flowpaths, Norwest Station is not expected to have any adverse flooding impacts for the surrounding area.
- Elizabeth Macarthur Creek (Bella Vista to Kellyville Station) – the rail corridor and Bella Vista Station is clear of the PMF, however, part of the Kellyville Station precinct would be affected by flooding in the 100 year ARI. Modelling shows some localised impacts to properties to the east and south of the creek and in the PMF flood level impacts of up to 0.5m along the precinct boundary and immediately upstream of Samantha Riley Drive with the intersection of Old Windsor Road and Samantha Riley Drive also flooding. Peak flow velocities would also increase.
- Caddies Creek Confluence with Tributary 5 and Elizabeth Macarthur Creek (Kellyville Station to Windsor Road) – Kellyville Station Precinct includes an area north of Samantha Riley Drive that is outside the 100 year ARI but would be inundated in the PMF. Modelling indicates that there would be flood level impacts of up to 0.06m in the 100 year ARI around the columns of the viaduct, with increases of between 0.02

and 0.04m in the residential areas. Impacts could be offset by local flood mitigation works however this would depend on the final location, size and spacing of piers to be determined during detailed design. Modelled precinct layout indicates flood level impacts of up to 0.5m in the PMF at Old Windsor Road and the Transitway near the intersection of Samantha Riley Drive and for sections of Samantha Riley Drive which are currently flood-free. Peak flow velocities would also increase however the relative change would not be significant.

- Caddies Creek Tributary 4 – potential impacts are considered to be negligible for both 100 year ARI and the PMF. Localised increases in velocity around piers would require scour protection.
- Caddies Creek Tributary 3 – No impacts are expected for flooding up to the 100 year ARI. The precinct would be susceptible to inundation from flows that overtop Windsor Road. The area affected comprises a carpark, the Transitway interchange and local access roads for the Rouse Hill town centre, however flood impacts are not envisaged to be significant.
- Second Ponds Creek – Flood impacts in the vicinity of Schofields Road would be 0.03m or less for both the 100 ARI and PMF events.
- First Ponds Creek – the stabling facility is located outside the extent of the PMF and therefore no flood impacts are expected.

The proposed stations and rail infrastructure would alter the percentage of impervious area within the catchments that the rail link traverses, leading to increased volumes of runoff and catchment response times. The hydrologic modelling results indicated that it would not be feasible to raise the level of the precincts completely above existing flood levels without adverse impacts to the surrounding environment and therefore it would be necessary to provide a balance of cut and fill up to the 100 year ARI flood level to minimise impacts on floodplain storage. Measures such as on site detention facilities and/or water sensitive urban design features (such as grassed swales, bio-retention systems and the use of rain harvesting at buildings) would also be provided to mitigate stormwater and flood impacts.

The Department considers that the construction of a project of this nature requires careful construction management to prevent flooding. This includes the matters identified by the Hills Council in relation to construction drainage and stormwater management. The Department notes, however, that the majority of construction flooding impacts associated with the project was assessed as part of Stage 1. The Department notes that while Stage 2 works also have the potential to result in flooding impacts, the Proponent has outlined a number of measures that would be developed further during the detailed design stage such that flooding impacts from Stage 2 works would be minimised. Notwithstanding and to reinforce these measures the Department recommends the continuation of a Stage 1 condition relating to flood risk management.

The Department notes that a conservative assessment has been undertaken and acknowledges that the identified impacts can be mitigated or reduced through design measures. Accordingly, the specific design of many elements of the project would be further developed during the detailed design stage. The Department does acknowledge, however, that the project has the potential to increase flooding impacts in limited circumstances to the surrounding environment in terms of both increases in flood levels and flood velocities and therefore the project will need to be carefully designed to ensure that, where feasible and reasonable, flooding impacts on receivers are manageable and acceptable. The Department considers that the project should be designed in a manner with the objective that it does not exacerbate the flooding characteristics of the surrounding area and minimises the flood risk to the project.

To ensure that flood impacts from the project are minimised, the Department has recommended similar conditions in relation to flooding as it did for Stage 1 as it considers that they are also relevant for Stage 2 works. In this regard, the Department has

recommended that impacts from the project be limited, where feasible and reasonable to a maximum increase in flood levels of 50 mm in a 100 year ARI flood event, a maximum increase in the time of inundation of one hour in a 100 year ARI flood event and that any increase in flow velocity does not increase the potential for soil erosion and scouring.

The Department has also recommended a condition of approval requiring the Proponent to prepare a Stormwater and Flooding Management Plan. This Plan is to be prepared during the detailed design stage of the project and prior to construction of Stage 2 infrastructure in consultation with the Department (Strategies and Land Release), OEH and relevant Councils and be based on the entire project (Stage 1 and Stage 2). The Plan should include the identification of flood risks to the project and adjoining areas, the performance criteria identified above and mitigation measures that are proposed to be implemented to protect proposed works and not exacerbate existing flooding. The Department considers that this plan should form part of the Operation Environmental Management Plan.

In relation to operation, the Department notes that the OEH stated that the EIS for Stage 2 appeared to follow acceptable floodplain risk management practice, however, considered that the potential increase in the flood level of 0.5m for the PMF along Old Windsor Road and the Transitway near Samantha Riley Drive may lead to public safety impacts in relation to vehicle stability issues during larger flood events and therefore an emergency response plan should be prepared in consultation with the State Emergency Services. The Department notes that the Hills Shire Council also referred to the preparation of an evacuation plan for flooding events. The Department considers that public safety is paramount and while it notes that the Proponent has committed to the preparation of Emergency Response Plans to address residual flooding impacts, it has also specifically recommended that this matter be addressed as part of the Operational Environmental Management Plan in order to strengthen this commitment.

A number of other submissions made comments regarding flooding, with Blacktown City Council specifically stating that the location of the Tallawong Stabling Facility should be coordinated with the proposed Schofields Road extension and upgrade and that stormwater detention should be provided to service the entire site such that post development flows are no higher than pre-development flows for the full range of ARI from a 1 in 1 year to a 1 in 100 year event. The Department notes that the Proponent has committed to consulting RMS on this issue and that the Proponent is required to develop stormwater and flooding management plans in consultation with Councils.

The Department also notes that the potential impacts of climate change were considered as part of the hydrology assessment and included adopting a 10 percent increase in design rainfall intensities for events up to the 100 year ARI and undertaking sensitivity analysis in relation to increases in rainfall intensity. The Department notes that flooding impacts from climate change are not expected to be significant and therefore it does not consider that there is any need to include specific conditions in relation to this matter.

5.4. Surface Water Quality

The Stage 2 construction works have the potential to impact on the surface water quality through land disturbance and exposure of soils which can lead to increased erosion and sediment transport. Potential water quality impacts could also result from the management of spoil stockpiles and from spills.

The assessment identified that construction works associated with Stage 2 would include the construction of rail stations and associated precincts, temporary and permanent roads, spoil handling and the construction of ancillary facilities and therefore detailed and careful management would be required to minimise potential adverse impacts to surface water quality. Each construction site would involve various activities and would pose the greatest risk to water quality where they occur in proximity to waterways, on steep slopes or on land subject to flooding or overland flow.

The EIS states that preliminary soil risk maps have been prepared to identify which areas are more likely to be prone to erosion due to construction works. These maps would be developed further during the detailed design stage and included in the Construction Environmental Management Plan prepared for the project. A number of procedural and physical management measures would be implemented during the construction stage to retain sediment at work locations and would include the use of sediment basins, or bunded vegetated swales. In relation to spills, the EIS states measures would be developed and implemented to minimise the risk of spills at construction sites and spill response procedures would also be developed.

During the operational stage, increased impervious surfaces associated with building rooves and paved areas could result in changes to the hydrological regime in relation to increased runoff volumes and peak flows. The EIS states that the project would incorporate Water Sensitive Urban Design Principles into the design to minimise these impacts. Measures would include:

- managing total runoff volumes through the use of rainwater tanks at stations and the stabling facility buildings and implementing measures that promote stormwater infiltration;
- minimising peak flows through the use of detention measures such as water quality ponds;
- implementing natural vegetated measures instead of concrete channels; and
- treating stormwater through a range of at source and end point measures within the urban landscape including rain gardens, bioretention swales and water quality ponds.

Runoff from station precincts would be treated prior to discharge to the receiving drainage system and this would reduce pollutants from these areas. Water quality treatment measures to be implemented include a combination of swales, water quality basins and gross pollutant traps. In addition, at the Tallawong Stabling Facility, a separate drainage system is proposed to be provided to collect, store and treat wash down waters and other runoff prior to it being discharged from the site.

During the operational phase, the rail track could also generate pollutants from brake dust particulate matter. The EIS states that the design would implement measures such as the use of vegetated swales where space is available instead of concrete or bitumen lining and incorporate absorption trenches with slotted pipes in lieu of unslotted pipes and collection pits to provide natural filtering of runoff and minimising sediment deposition in downstream waterways.

The Department is satisfied with the level of assessment undertaken in relation to surface water and considers that with the implementation of various mitigation measures, potential impacts on downstream water quality can be effectively managed. As with the construction of any large infrastructure project, the potential to impact surrounding water quality is high if it is not managed appropriately. In this respect, the Department notes that there are a range of standard and tested management mechanisms available to ensure that watercourse systems are not impacted and would require the Proponent to implement appropriate sediment and erosion control devices to ensure the protection and maintenance of existing downstream water quality.

In order to manage water quality impacts, the Department has recommended a condition of approval that requires that any water discharged must be suitable for the receiving environment and that it comply with section 120 of the *Protection of the Environment Operations Act 1997*. All water leaving the site during both construction and operation is required to comply with this requirement. The Department has also recommended that the Proponent undertake a detailed water quality monitoring program, as required for Stage 1 works, and that the program should continue for a three year period following the completion of construction activities. In this regard, the Department notes that the Proponent has committed to undertake a surface water quality monitoring program post construction for the

station precincts, service facilities and the stabling depot to monitor water quality upstream and downstream of the works. The Proponent has indicated that monitoring procedures and performance criteria would be established in consultation with local Council and relevant government agencies. The Department supports this level of consultation.

The Proponent has also committed to the preparation of a Soil and Water Management Plan (SWMP) as part of the overall Construction Environmental Management Plan for the project. The SWMP would incorporate the most appropriate or best practice controls and measures in accordance "The Blue Book", would consider the sensitivity of the surrounding environment and would be regularly revised to suit the changing needs of the project as works progress. The Department supports the preparation of this Plan and has recommended it as a condition of approval, to strengthen the Proponent's commitment and to include specific requirements that need to be addressed.

5.5. Other Issues

Ecology

The study area provides a variety of habitat features for a range of threatened fauna species and contains threatened flora, endangered ecological communities, groundwater dependent ecosystems and riparian and aquatic environments within the creek systems associated with the sub-catchments of the Lane Cove River, Hawkesbury and Parramatta Rivers. On 21 May 2012, SEWPaC determined that the NWRL is a Controlled Action and therefore the project also requires assessment and approval under the EPBC Act. An approval under the EPBC Act was granted on 11 April 2013 (EPBC 2012/6360).

Stage 2 works would not result in any additional bushland clearance compared to what was previously been assessed as part of Stage 1 major civil construction works. The EIS states that Stage 2 works would only result in the clearing of five additional street trees located on a road island on Castle Howard Road to enable access to be provided to the Cheltenham Services Facility construction site and to allow for maintenance and emergency services access during operations. Apart from the proposed removal of these street trees, no other direct flora or fauna impacts are envisaged during either construction or operation of Stage 2 of the NWRL.

The construction of Stage 2 stations, rail infrastructure and systems construction works however, has the potential to result in indirect impacts to threatened flora and fauna, including Endangered Ecological Communities (EECs), riparian and aquatic environments and groundwater dependent ecosystems (GDEs). The study area assessed as part of the current EIS includes an extended construction area footprint to take into account a buffer area of approximately 100 metres. The following provides a summary of the potential indirect impacts to flora and fauna that could be associated with the construction phase of Stage 2 of the project:

- weed invasion of adjacent retained vegetation;
- habitat loss and fragmentation, although much of the impacted area already comprises small patches of native vegetation within a fragmented landscape;
- hydrological changes from runoff including potential elevated levels of sediment, nutrients, hydrocarbons, and other pollutants;
- increased noise levels which can disturb fauna, change movement patterns and alter fauna behaviour, however, the EIS clearly states that little is known on the impact thresholds of noise disturbance on fauna; and
- increased artificial light.

Mitigation measures to limit impacts from construction have been developed and include:

- ensuring site inductions address ecological information including the sensitivity of surrounding vegetation, threatened fauna species (particularly birds and bats), site

environmental management procedures (vegetation management, sediment and erosion control, protective fencing and weed control), emergency and incident response (chemical spills, fire, injured fauna);

- undertaking pre-clearing surveys for the presence of hollows or threatened fauna for the street trees proposed to be removed;
- storing and reusing weed free topsoil and felled trees on site;
- ensuring site office, stockpiles, machinery washdown areas and plant storage areas are located outside of ecologically sensitive areas;
- ensuring fuel and other chemicals are stored outside all riparian zones and at least 10 metres from any retained ecologically sensitive area on site;
- revegetation of construction sites using endemic native plant species where appropriate;
- minimising the spread of weeds by ensuring machinery is cleaned before entering work sites, the removal of weeds where they occur within 10 metres from the edge of the construction footprint, and disposing of any cleared weed material at a site licensed to receive green waste;
- directing artificial light away from areas of native vegetation, only to areas where it is required and reducing the brightness to as low as functionally possible;
- maintenance of waterway crossings and structures in accordance with relevant guidelines; and
- maintaining protective fencing implemented as part of Stage 1 works in accordance with Australian Standard 4970-2009 Protection of Trees;

The operation of the project is not expected to result in any direct impacts to threatened flora and fauna. The ecological assessment undertaken for Stage 2 also states that due to the implementation of mitigation measures such as sediment and erosion controls and an active weed management and removal program, indirect impacts on threatened flora are expected to be avoided. In relation to threatened fauna, indirect operational impacts would comprise edge effects, increased noise, vibration and artificial light along the above ground sections of the project which include the railway, stations, service facilities and stabling yards. These impacts are particularly prevalent for a range of bird species. The EIS also states that moving trains could potentially present a collision hazard to some fauna.

An impact assessment for each of the threatened fauna species listed under the *Threatened Species Act 1999* and likely to occur in the area of the project was undertaken, however, no significant indirect impacts are envisaged to result from the operation of the project. A number of mitigation measures have been proposed to be implemented to further reduce potential impacts from the project on ecology. These include:

- controlling noxious and environmental weeds within the operational site boundary;
- following *Best Practice Guidelines – Green and Golden Bell Frog Habitat* (DECC, 2008) to protect and maintain ephemeral breeding habitat established as a result of the project;
- visually inspecting creeks above tunnel sections to monitor water level decreases and if evident, discussion of possible mitigation measures and implementation as appropriate, in consultation with NOW;
- directing artificial light away from areas of native vegetation, only to areas where it is required and reducing the brightness to as low as legally and functionally possible;
- utilising low-pressure sodium lamps instead of high-pressure lamps or mercury lights (where these lights are used they would be fitted with a UV filter) and the brightness

of lights would be reduced to as low as possible while also meeting workplace health and safety standards;

- directing amplified speakers downwards and away from areas of native vegetation;
- maintenance of waterway crossings and structures in accordance with relevant guidelines; and
- monitoring of groundwater to protect likely or potential GDEs.

Of the submissions received, the issues raised in relation to ecology were generally concerned with the amount of clearing that would result from the project (note that the impacts from clearing were previously addressed as part of the assessment of Stage 1), increased traffic around stations and the impacts this could have on threatened fauna (this was specifically raised in relation to Franklin Street traffic and Cherrybrook Station), termite infestations to properties in Kayla Way and general noise impacts to fauna.

The Department considers that with the implementation of the proposed mitigation measures the construction and operation of Stage 2 is not expected to result in adverse ecological impacts. While there were a number of submissions made on the Stage 2 EIS in relation to ecology, many of the issues raised were concerned with the clearing of vegetation and resultant impacts. These issues are not relevant to Stage 2 works as no additional clearing is proposed to occur, apart from the removal of five street trees. Clearing of native vegetation and the resultant impact to threatened flora and fauna were previously assessed and addressed as part of the approval of Stage 1 works and therefore have not been considered further in this assessment.

The Department notes that noise disturbance to fauna was raised as an issue of concern and it agrees with the Proponent's response that noise from the operation of the rail tunnel is unlikely to result in impacts to local fauna and that noise from aboveground activities would be similar to other noise sources such as major roads. Notwithstanding, the operation of the rail line would be required to address noise impacts and the Department has recommended that the project operate in accordance with prescribed noise limits. This condition would ensure that surrounding residential areas are protected from adverse noise impacts and this would also ensure that noise emissions and resultant impacts to areas of ecological sensitivity would be managed. No further specific conditions for the protection of flora and fauna are considered to be required as part of the project approval as the previous approval addressed this issue through the development and implementation of a Biodiversity Offset Package to offset the ecological values that would be lost as a result of the construction and operation of the project.

Notwithstanding, the Department considers that the rehabilitation of construction sites that are not required to be utilised for operational purposes should be undertaken in consultation with the relevant Council and has recommended a condition of project approval to this effect.

Visual Impact, Landscaping and Urban Design

There are two distinctive visual landscapes that exist along the length of the NWRL corridor, the Hills District to the east and the Cumberland Plain in the west, which vary in topography, character and include a mix of low and medium density residential, commercial development and rural lots.

Table 5.5: Visual Impacts during Construction

Area	*Visual Environment*	*Consideration*
Hills District	Includes high density residential and commercial town centre uses around Epping Station, and predominantly low density residential uses with heavily vegetated streetscapes and nature reserves between Epping and the Norwest Business Park. Also within	The NWRL in this area is completely underground, therefore visual impacts are limited to surface sites.

Area	*Visual Environment*	*Consideration*
	this area are the Castle Hill Towers Shopping Centre, the Hills Centre, and the Norwest Business Park.	
Cumberland Plain landscape	The character of the area is generally low density residential and commercial uses, sitting within open space and rural character landscapes.	In this area, the NWRL alignment rises to the surface at Bella Vista Station and runs parallel to Old Windsor Road, which is up to six lanes across in some areas, as well as the North-West T-Way, a dedicated two lane bus way. The alignment crosses the centre of a broad floodplain, with hills on both sides of the line visually enclosing it from surrounding areas. Visual impacts will occur along the alignment once the viaduct and bridge sections between Bella Vista and Rouse Hill have been constructed.
Cudgegong	The landscape character changes to a more rural setting.	The NWRL alignment remains on the surface in this area, however no longer on a viaduct, therefore visual impacts would occur along the alignment, and at Cudgegong Road Station, and the Tallawong Stabling Facility.

To assess potential visual impacts, a matrix was developed based on a combination of visual modification (positive and negative) and the level of visual sensitivity of existing views. The relative level of visual impact at each location was then categorised into 1 of 7 categories: minor, moderate and high beneficial, negligible or minor, moderate and high adverse.

The assessment also considered the likely visual impacts at night from sky glow, glare and light spill by replacing the visual sensitivity parameter of the matrix with 4 night time landscape settings: E1: intrinsically dark landscapes; E2: low district brightness; E3: medium district brightness and E4: high district brightness.

A series of 3D-modelled photo montages were prepared in support of the assessment based on concept level site layouts, typical design drawings for station buildings, viaduct sections, services buildings and landscape plans to illustrate the location, scale and relationship of key visual elements in the surrounding landscape.

At each location, the assessment focussed on the construction and operational impacts on views from major routes, public open space and viewpoints, residential areas and commercial areas, including at night.

Table 5.6 provides a summary of the range of visual impacts identified at each location.

Table 5.6 – Summary of Visual Impacts

Location	Visual Impact during Stage 2 Construction	Visual Impact During Operation	Visual Impact At Night
Epping Services Facility	Negligible to Moderate Adverse	Negligible to Moderate Adverse	Negligible
Cheltenham Services Facility	Negligible to Moderate Adverse	Negligible to Minor Adverse	Minor Adverse
Cherrybrook Station	Negligible to Minor Adverse	Negligible to Moderate Adverse	Minor Adverse to Moderate Adverse
Castle Hill Station	Minor Adverse to Moderate Adverse	Minor Adverse to Moderate Adverse	Minor Adverse
Showground Station	Minor Adverse to High Adverse	Minor Adverse to High Adverse	Moderate Adverse

Location	Visual Impact during Stage 2 Construction	Visual Impact During Operation	Visual Impact At Night
Norwest Station	Negligible to Minor Adverse	Negligible to Minor Adverse	Negligible to Minor Adverse
Bella Vista Station	Negligible to Minor Adverse	Negligible to Minor Adverse	Negligible
Balmoral Road & Memorial Avenue	Negligible to Moderate Adverse	Negligible to Moderate Adverse	Minor Adverse
Memorial Avenue to Kellyville Station	Negligible to Moderate Adverse	Negligible to Moderate Adverse	Moderate Adverse
Samantha Riley Drive to Windsor Road & Old Windsor Road to White Hart Drive	Negligible to High Adverse	Negligible to High Adverse	Negligible
Rouse Hill Station	Negligible to Minor Adverse	Minor Beneficial to Minor Adverse	Negligible
Windsor Road Viaduct to Cudgegong Road	Negligible to Minor Adverse	Negligible to Minor Adverse	Negligible
Cudgegong Road Station	Negligible to Moderate Adverse	Negligible to Moderate Adverse	Moderate Adverse
Tallawong Train Stabling Yard	Negligible to High Adverse	Negligible to High Adverse	Moderate Adverse

The construction of the project would cause temporary adverse visual amenity impacts for surrounding land uses and occupants of vehicles using nearby roads from vegetation clearing, earthworks, construction compounds, access roads and the like. Construction of significant engineering elements such as the viaduct and bridge sections is also anticipated to be highly visible. Light spill from construction sites may also affect the visual amenity of adjacent land uses at night.

The visual impact of the operation of the rail line would be highly variable, and dependant on location and the available vistas to and from the railway line, stations and ancillary facilities. The proposed viaduct and bridge sections of the aboveground rail line and the supporting stationary facilities have the potential to impact on adjoining properties and neighbouring communities, particularly at locations where receivers have an unscreened view of the structures and where high levels of additional lighting are proposed, especially in low lit areas.

Of these impacts, the Department considers moderate and high adverse visual impacts to be particularly significant especially where views from public open spaces and viewpoints and residential (and other sensitive receivers) areas would be adversely affected.

At the Epping servicing facility, there would be moderate adverse impact due to a reduction in the amenity of views of local sensitivity from Epping Baptist Church. At the Cheltenham servicing facility, there would also be a moderate visual impact experienced from Cheltenham Oval.

At Cherrybrook Station, the most significant impact would be a considerable reduction in visual amenity at night from the introduction of additional light from the station, plaza spaces, internal access roads, park and ride areas and pedestrian linkages into existing low lit areas. From existing residential receivers, minor adverse impacts would be experienced from a reduction in amenity for views from surrounding neighbourhoods around the station precinct and associated development.

At Castle Hill Station, moderate adverse impacts are expected due to a considerable reduction in visual amenity to views from major routes (Old Northern Road, Old Castle Hill Road and McMullen Avenue) and from entries to Castle Towers Shopping Centre.

At Showground Station, there would be a high adverse visual impact because of the prominence of views from the showground, which is considered to be of regional visual

sensitivity. There would also be moderate adverse impacts to views from the childcare centre on Carrington Road and minor adverse views from surrounding residential areas.

Along the above ground sections of the NWRL from Bella Vista to Rouse Hill, including the open cut stations, there would be moderate adverse impacts, mostly along major transport routes since the elevated viaduct (and trains using it) would run next to a number of major roads. These impacts have been identified at a number of locations along Old Windsor Road and the T-Way and Windsor Road, including in the vicinity of Kellyville Station (see Figures 5.12 and 5.13 below).

Figure 5.12: Kellyville Station from the corner of Old Windsor Road and Samantha Riley Drive – before development

Figure 5.13: Kellyville Station from the corner of Old Windsor Road and Samantha Riley Drive – after development (showing general form and scale of development only)

A high adverse visual impact has also been identified at Mungerie House, a locally listed heritage building near the proposed Rouse Hill Station as it would have views of the viaduct, albeit filtered by intervening trees (see Figures 5.14 and 5.15 below).

Figure 5.14: Viaduct from Mungerie House – before development

Figure 5.15: Viaduct from Mungerie House – after development (showing general form and scale of development only)

The Proponent has proposed a series of measures to reduce the visual impact of the project on Mungerie House through a combination of viaduct design and buffer tree planting, which are discussed in more detail in the Historic Heritage sub-section.

Residential properties in the vicinity of Sanctuary Drive, particularly looking towards the intersection of Sanctuary Drive and Old Windsor Road, would experience a considerable visual change as the viaduct crosses the landscaped view. As this is an area of local visual

sensitivity and neighbourhood visual sensitivity to the west, it is considered that there would be moderate adverse impact in this area.

The viaduct and supporting structures would also be visible from John XXIII Catholic School and Church, with a moderate level of impact predicted.

At Tallawong TSF, there would be high adverse impacts from Schofields Road as the facility would be located on embankments rising up to 5 metres above the adjacent road level, thereby increasing the visibility and prominence of these structures. There would also be a moderate adverse visual impact at night as the facility would introduce light into an area visually dominated by a relatively dark landscape, from sky glow effects.

The Department recognises that the project would inevitably result in some level of visual impact temporarily, during construction and permanently, once it becomes operational, but that the level of visual impact of the project on the vast majority of residential and other sensitive receivers are negligible or low. Most of the moderate to high adverse impacts highlighted above are in the vicinity of the proposed viaduct and would mostly be in the form of glancing views by motorists travelling along major transport routes with adjoining commercial area. Further, once the project has been fully constructed and becomes operational, the NWRL would gradually blend into the existing visual context, particularly as landscaping matures over time.

To manage the visual impact from Stage 2 construction activities, similar measures are proposed to those that are being implemented for Stage 1. These include retention of existing vegetation around the perimeter of construction sites, the use and regular maintenance of site hoardings and acoustic sheds (designed to visually recede in more rural or bushland areas) and setting particular equipment and structures back from site boundaries to minimise their visual impact. These, and other measures, would be set out in more detail and implemented as part of a Construction Environmental Management Plan for the project, and are supported by the Department.

Once constructed, a range of mitigation measures have been committed to by the Proponent at all sites, including vegetation screening, materials selection, colour and treatment of structures and adjustments to the location of certain elements, the use of cut off and directed lighting to minimise glare and light spill on surrounding existing and future residents, street tree planting to visually soften road and car parking areas, earth mounding to improve the effectiveness of buffer planting areas where vegetation is to be lost and design and the adoption of CPTED principles in the design and ongoing maintenance of the project.

The Proponent's design solution for the rail corridor itself, including for bridge and viaduct structures, retaining walls, and noise mitigation would include solutions to minimise the bulk and scale of the structures and opportunities for graffiti. The viaduct between Rouse Hill and Cudgegong Station would be treated to maximise visual integration with surrounding landscape in views from Rouse Hill House, which may include the use of dark colours, landform mounding and buffer planting. In this regard, the Department is satisfied with the corridor landscaping, and notes the objective to create a variety of landscape characteristics, including plantings to screen infrastructure in some areas, and allowing views out of the rail corridor at key locations.

All of the abovementioned measures would be set out in more detail and implemented as part of a wider Operational Environmental Management Plan (OEMP) for the project, which has been stipulated as a recommended condition of approval.

At the proposed stations, a much higher level of urban design and landscape treatment would be adopted. At stations and service facilities, landform would be used to conceal certain buildings and the colour and materials of service facility buildings would be selected so as to blend into the adjacent bushland setting. In the case of Castle Hill Station, large specimen trees would be incorporated into the plaza at Castle Hill to soften the visual impact of the aboveground structures next to Arthur Whitling Park.

Overall, the Department is generally satisfied that the Proponent has sought to minimise the visual intrusiveness of the project as much as possible. It is recognised that further work would need to be undertaken by the Proponent before the final design of the stations, car parking and ancillary facilities can be determined, including consultation with the community and local Councils.

In this regard, the Proponent has established a Design Review Panel comprised of independent experts and chaired by the NSW Government Architect to provide independent advice on a range of issues in relation to station design, transport and precinct works, including master planning, public domain design, architecture, design of structures including viaducts and bridges, internal station design and sustainability. The Department supports this approach and notes that the Panel would be engaged for the duration of the project, including the assessment of tender proposals by contractors to ensure a high quality urban design outcome is achieved when each work package is subject to detailed design.

A small number of submissions received made reference to the detailed design of the station precincts. Of these, issues were raised in relation to the design of certain aspects of the station precincts, particularly Cherrybrook and Castle Hill, and a series of suggestions were made in relation to the internal and external design of these station precincts. The Department notes that since each station precinct is indicative at this stage, it would be subject to a detailed design process once each contractor is appointed, and that the local community will have the opportunity to have further input into the evolving design process.

To ensure that the station designs reflect best practice and are prepared in consultation with the local community, relevant Government agencies and Council's, the Department recommends the preparation of a comprehensive Urban Design and Corridor Landscape Plan. The Plan will include final design plans for the servicing facilities, train station precincts and other built elements, including retaining walls, embankments and the viaduct sections, Tallawong TSF and substations, as well as final landscaping arrangements and maintenance regimes.

The independent Design Review Panel would endorse the Plan which would be required to detail the urban and station design initiatives to integrate stations into the existing area and landscaping measures to minimise, mitigate and/or offset the impacts of the project (including acoustic barriers and embankments/cuttings) on property and other land uses (such as open space), visual amenity and local vistas and heritage values and include:

- identification of design objectives and standards based on local environmental and heritage values, strategic and statutory planning, future land release form and function, sustainable design and maintenance, transport and land use integration, passenger and community safety and security, community amenity and privacy, and relevant design standards and guidelines;
- details on the plans to provide, mitigate and/or augment landscaped areas and elements, with landscaping works to enhance ecological values, including riparian areas and fauna corridors, the provision of water sensitive urban design initiatives and to mitigate impacts to heritage landscapes;
- design details of the built elements of the SSI, including retaining walls, embankments, viaducts, culverts, bridges and underpasses, noise barriers, train stabling facility, and substations, and the measures to minimise the impact of these elements, particularly with respect to the impacts on adjoining residences, educational facilities, open space areas and heritage items and landscapes, including the recommendations of the Visual Impact Strategy (see historic heritage section below);
- specific plans for station precincts to provide high quality sustainable stations that enhance the public domain and provide for active uses, ensure intermodal integration and equitable and safe access, including connectivity of the stations to surrounding precincts and integration into strategic planning directions for these areas consistent with Station Access Plan(s);

- details on pedestrian and cycle access elements and fixtures, including crossings, secure cycle facilities, and other fixtures such as seating, lighting, fencing and signs etc, to enhance connectivity and the provision of a safe and secure environment consistent with the Pedestrian and Cyclist Network Facilities Strategy;
- details on parking elements and how commuter parking areas at stations shall be designed to minimise amenity impacts and so as not to preclude or prejudice the future functionality of town centres consistent with the Parking Management Strategy (see;
- details on public art and heritage (indigenous and non-indigenous) interpretation installations;
- implementation, management and monitoring strategies to ensure the establishment and ongoing maintenance of built elements and landscaped areas, including performance standards; and
- consideration of relevant design standards.

In conclusion, the Department recognises that even with the implementation of the Proponent's mitigation measures, together with the conditions that have been recommended, that there would be some level of visual impact with the project but that these impacts need to be considered in the context of the existing urban area and the proposed NWGC and the benefit delivered to the community by provision of a high quality rail line and new stations.

Historic Heritage

The NWRL passes through a landscape which contains a number of State and locally listed European heritage items and potential archaeological sites.

Since Stage 1 covered the major civil construction works for the rail line, above ground station boxes and service facilities, viaduct spans and bridges, the Department has already assessed the temporary and permanent impacts these works will have on existing heritage values.

The Department's assessment concluded that it was satisfied that, subject to a combination of commitments made by the Proponent and conditions being imposed in the approval, that the direct and indirect impacts of the project on these heritage values can be avoided and minimised to within acceptable levels and that the overall heritage landscape would not be significantly affected by the project.

Two conditions were imposed in the Stage 1 approval, in consultation with the NSW Heritage Office. Firstly, heritage impacts are to be avoided and minimised but, where impacts are unavoidable, works are to be carried out in accordance with a Construction Heritage Management Plan (CHMP) for the project.

Secondly, an archaeological excavation program is to be implemented for the historical archaeological sites identified in the Stage 1 EIS prior to commencement of construction-related activities that will impact these sites and, within two years of completing this work, a report is to be submitted to the Director-General containing the outcomes of the excavations, including artefact analysis and the final repository for any finds.

By the time construction of Stage 2 commences, it is expected that excavation of these sites will have been carried out in accordance with the terms of an approved methodology and archaeological excavation program. There could nonetheless be some residual construction and operational impacts to some extant sites that were not excavated and/or archivally recorded under Stage 1. The potential impacts to these sites are set out below, together with a summary of the measures proposed to minimise and mitigate these impacts.

Table 5.7: Potentially impacted historic heritage items and archaeological sites

Location / Item	Significance	Construction	Operational	Mitigation Measures
Epping Services Facility				
Stone causeway over Devlin's Creek	Local	Indirect: erosion and sedimentation	None	• implementation of standard erosion and sediment control measures (see Section 5.6).
Cherrybrook Station				
Glenhope	State	Moderate adverse: temporary and permanent visual impacts on visual setting and outlook from Glenhope House from clearing of vegetation on the northern side of Castel Road		• screening of the visual impacts of the station construction site in the northern outlook from the Glenhope property; and • where reasonable and feasible, retain and/or a vegetative buffer along the northern side of the road opposite the Glenhope property to preserve the character of its setting.
Castle Hill Station				
Arthur Whitling Park	Local	No additional impact	Additional pedestrian activity and visual impact from aboveground station infrastructure	• if feasible, the existing mature plantings along the Old Northern Road edge of Arthur Whitling Park would be retained and protected during construction; and • key elements of Arthur Whitling Park would be reinstated following completion of construction in consultation with the Hills Shire Council, the Hills District Historical Society and the Castle Hill sub branch of the RSL, where reasonable and feasible.
Inala School	Local	No additional impact	Minor adverse: some permanent visual impact upon the visual setting of Inala School	• an adequate buffer of vegetation along the western side of Franklin Road would be retained and/or reinstated.
Showground Station				
Castle Hill Showground	Local	No additional impact	Moderate adverse: some permanent visual impact upon the setting of Castle Hill Showground and increased pedestrian and vehicular activity	• reinstate or rejuvenate areas of the Showground disturbed by construction works following completion of works; and • retention, maintenance and instatement of vegetation.
Kellyville Station				
Windsor Road and Old Windsor Road Heritage Precincts (Stanhope Farm Alignment)	State	Minor adverse: there may be some impacts however due to recent physical changes to this part of Old Windsor Road, these would be relatively minor		• no mitigation measures considered necessary.
Windsor Road and Old Windsor Road Heritage Precincts (Caddies Creek	State	Minor adverse: there may be some impacts however due to recent physical changes to this part of Windsor Road, these would be relatively minor		• no mitigation measures considered necessary.

Alignment)				
Mungerie House	Local	No additional impact	Moderate adverse: the proposed rail corridor cuts across the original entrance driveway into the Mungerie property and the viaduct structure would dominate views to the west and interrupt important traditional links between the main road and this 1890's house (see Photomontage at Figures 5 and 6).	• The area of the Mungerie carriage drive that would be removed during construction works would be reinstated; • planted vegetation along the eastern side of the North West T-way would be reinstated following completion of construction works; • the existing buffer of trees between Mungerie and the rail corridor would be maintained; and • the viaduct to be designed and constructed to be as visually light and streamlined as possible. At Mungerie, the viaduct piers would be spaced widely and, where reasonable and feasible, symmetrically on either side of the carriage loop from Old Windsor Road.
Old Windsor Road to White Hart Drive				
Former Swan Inn	Local	No additional impact	Moderate adverse: some permanent visual impact as the viaduct would dominate views to the west	• see mitigation measures for Mungerie House above.
Battle of Vinegar Hill Memorial	Local	The Battle of Vinegar Hill Memorial is located in an elevated position within Castlebrook Cemetery although the actual place where the skirmish occurred has not been determined with certainty. Although construction works and operations may be visible in views from the Memorial it is considered that these impacts would be of a relatively minor nature.		• no mitigation measures considered necessary.
Cudgegong Road Station and Tallawong TSF				
Rouse Hill Estate, including Rouse Hill House and Farm	State	As the Rouse Hill Estate is located some distance from the Cudgegong Road Station and Tallawong TSF sites and is separated by an undulating landscape and forested areas, the construction and operation of the NWRL would barely be noticeable from Rouse Hill Estate and there is a low possibility that works proposed at these sites would result in any appreciable negative heritage impacts on this historic property or associated curtilage.		• no mitigation measures considered necessary.

The Department is satisfied that the scope of proposed construction works (i.e. construction and fitting out of building and structures in existing excavated areas) introduces limited additional impact on those heritage values that will not have been excavated and/or archivally recorded as part of Stage 1, and that many of these impacts are a continuation of

those that were assessed and approved as part of Stage 1 (i.e. in the form of ongoing visual impact).

In its original submission, the NSW Heritage Council raised issues in relation to a number of historic heritage sites that would be affected by the project. In its Submissions Report, the Proponent addressed most of these issues and highlighted that many of these issues have already been addressed by conditions imposed in the Stage 1 approval. At the Department's request, the NSW Heritage Council subsequently wrote to the Department again and indicated that it was generally satisfied with the Proponent's response and was able to recommend conditions for the project, which have been incorporated into the recommended conditions of approval.

The Department recommends that the requirement in the Stage 1 approval to prepare and implement a CHMP also be required for Stage 2 to ensure ongoing protection and management of historic heritage items.

Once the NWRL becomes operational, there would be some ongoing visual impact to certain State and locally significant sites, as set out above. The Department has considered these impacts and is satisfied that the mitigation measures put forward by the Proponent are commensurate with the level of impact anticipated.

To ensure that these impacts are appropriately managed and mitigated, the Department recommends that the Proponent be required to prepare and implement a Visual Impact Strategy, in consultation with the Department and the NSW Heritage Council, to detail and minimise the visual impacts of the project on heritage items, including Glenhope, Inala School, Castle Hill Showground, Mungerie House and the former Swann Inn. This strategy would be incorporated into the recommended Urban Design and Corridor Landscape Plan.

Overall, the Department is satisfied that the residual impacts to historic heritage values are low and are able to be managed through the Proponent's management and mitigation commitments and the Department's recommended conditions, as outlined above.

Aboriginal Heritage

The Aboriginal heritage assessment for the NWRL identified 35 Aboriginal sites that could be impacted by the project. These sites include stone artefact concentrations, isolated finds, open artefact scatters, and potential archaeological deposits (PADs), ranging from low to high level archaeological potential. In particular, sites and/or PADs of moderate to high archaeological potential are located at Balmoral Road, Memorial Avenue, and between the Windsor Road Viaduct and the Tallawong TSF.

Stage 1 of the project involves the removal of top soil horizons and, in some places, deep excavation through bedrock. Accordingly, there is no potential to retain original intact soil horizons within any of the construction sites. The Department recognised this in its assessment of Stage 1 and whilst a handful of sites outside the boundaries of the construction sites are able to be avoided, the majority of these sites will be impacted.

Mitigation measures developed to reduce and manage identified potential impacts, include minimising harm, developing an Aboriginal Heritage Management Plan, educating site workers, undertaking archaeological excavations, and public interpretation. Where extant Aboriginal sites are present they are to be conserved by prohibiting works (such as vehicle access, earthworks and stockpiling of materials) in these areas. These management measures were reinforced by a condition requiring the preparation of a Construction Heritage Management Plan.

To manage and mitigate the Aboriginal heritage impacts of the project, a condition was also stipulated in the Stage 1 approval requiring the Proponent to prepare archaeological research designs for the excavation of the known sites and PADs, in consultation with registered Aboriginal stakeholders and to the satisfaction of the Director General, which includes requirements for final reporting and storage of any objects recovered.

When construction of Stage 2 commences, all but nine of the sites will have been fully excavated and salvaged in accordance with the conditions outlined above.

These nine sites are all stone artefact concentrations (SAC's) with areas of archaeological potential that are located next to construction sites at Cheltenham Services Facility, Cherrybrook Station, Castle Hill Station, and between Bella Vista Station and the Tallawong TSF. These sites could result in additional impacts because some Stage 2 construction activities (e.g. road works) would extend beyond the boundary of the Stage 1 construction site footprint.

As the heritage values associated with these sites would already have been impacted from Stage 1 construction activities, the Proponent considers that any additional loss of heritage value can be minimised provided the following mitigation measures are implemented:

- fencing of construction sites to prevent construction personnel entering a PAD or known site outside the construction footprint;
- the Aboriginal heritage component of the site induction would need to include information on Aboriginal heritage conservation areas and/or no go areas for each construction site with legislation and penalties for impacting Aboriginal heritage objects conveyed to construction managers and personnel;
- consideration of public interpretation within at least one of the new railway stations if an extensive and high value archaeological deposit is recovered during site excavation; and
- consideration of the results and recommendations of archaeological excavations.

However, the Department does not consider that these mitigation measures go far enough in addressing the impacts to these sites. As such, specific additional conditions are recommended to ensure that any heritage values impacted by Stage 2 is appropriately managed and mitigated. In particular and like with Stage 1, the Proponent would be required to prepare archaeological research designs for the excavation of these sites, in consultation with registered Aboriginal stakeholders and to the satisfaction of the Director General, which includes requirements for final reporting and storage of any objects recovered.

Local Business Impacts

The EIS included a qualitative assessment of the impacts that Stage 2 of the project could have on local businesses. The assessment examined the economic profiles of each LGA, conducted a visual survey for businesses along the NWRL corridor, classified these businesses by employment, turnover and size and identified the effects that the project could have on these businesses. A series of management and mitigation measures were then formulated to alleviate identified negative impacts.

The assessment identified positive and negative sources and implications of the project on local businesses at each construction location. Positive sources and implications include:

- increased trade (increased demand for goods and services resulting from a higher workforce in the areas);
- increased income (increased value of wages paid to workers as a result of increased demand for labour); and
- increased employment (more demand for workforce).

The negative sources and implications include:

- reduced accessibility (impacts from construction traffic, parking and changes to existing road conditions);
- poorer visibility (considering visual obstruction and access resulting from worksite locations and activities associated with worksites; and

- reduced quality in operating amenity (due to increased noise, dust, reduced aesthetics and increased construction traffic).

To manage the impacts to local businesses during construction, the Proponent has committed to:

- forming a business group comprised of representatives from local Council's and the NSW Chamber of Commerce and Industry to monitor, consider and provide advice to businesses on how to manage impacts on their businesses during construction;
- employing specialist Place Managers to act as a single, identifiable and direct point of contact for local residents, business people and community groups with the project during construction, which would work closely with all affected local businesses to help ensure timely responses to queries;
- developing a business register to identify, rate and manage the specific impacts associated with construction related works for individual businesses; and
- setting up a toll free number and website for the duration of the construction works to enable business owners and operators to receive prompt responses to their concerns, access information and view assistance measures in place during construction related works.

The Department supports these management and mitigation measures and to reinforce them, it recommends that the same condition that was imposed in the Stage 1 approval be imposed in the Stage 2 approval. That is, a requirement to prepare and implement a Business Management Strategy to minimise impacts on business adjacent to construction locations, including measures to reduce business related impacts, maintain vehicular and pedestrian access during business hours, and maintain the visibility of local businesses. In addition, conditions are recommended which require the Proponent to rectify or provide compensation of any damage caused by the project to property.

More generic community information, consultation and involvement related conditions that are of relevance to local business owners include requirements to prepare and implement a Stakeholder and Community Involvement Plan, establish a Complaints and Enquiries Procedure, including a Construction Complaints Management System and make all relevant information publicly available.

Whilst there is the potential for negative impacts to be experienced by local businesses during construction of stations, rail infrastructure and systems over an extended 4 year period, there would also be a number of positive impacts as referred to above. Overall, it is estimated that the project would support more than 16,200 jobs and inject $25 billion (directly and indirectly) during construction into the economy.

Once the NWRL becomes operational, it would have a number of mostly positive impacts in the form of increased business opportunities in and around the station precincts due to increased population growth and vehicular and pedestrian traffic, increased accessibility for consumers, a growth in visitors and employees to suburbs previously only serviced by car and increased connectivity to strategic employment centres like Macquarie Park, Chatswood, North Sydney and Sydney CBD, from improved network opportunities and industry clustering.

The only impacts that could be perceived as negative would be in the form of increased competition and rents in the area but overall, the positive impacts above are expected to outweigh these impacts and the project overall is expected to positively contribute to the well being of local businesses within local areas, and more broadly, enhance the productive capacity of the NSW economy.

Land use and community facilities

The NWRL alignment spans a variety of land uses, including residential, commercial, industrial, open space and community facilities. The North West region of Sydney has

experienced significant growth over the last decade which is set to continue once the NWRL becomes operational and residential land releases are developed over time. Station locations have been chosen to service as many of these existing and future land uses and areas of growth as possible. At a strategic level, the vision for each station precinct and surrounding area is set out in the NWRL Corridor Strategy, which will be used to inform future development controls and policy.

The assessment considered the construction of the project, in reference to the period following the completion of Stage 1 works, on existing and future land uses, community facilities and land use and community impacts. The impacts of the NWRL on land use and community facilities was raised in 4% of submissions with concerns primarily being raised by the community over the temporary and permanent acquisition of land which will result in the loss of amenity to local residents at some locations. These sites are required to establish facilities and stations and other infrastructure in the most effective location, and in some circumstances, will be returned to the community once operations commence.

In assessing the operation of the project, consideration was given to existing and future land uses, existing natural and built form, strategic planning policies, movement constraints and opportunities for future transit oriented development. The project will integrate a number of high growth residential and employment areas and serve many community facilities resulting in a range of benefits to each station location including, improved access for local residents and businesses, stimulation of local markets, and opportunities for intensification of land use close to stations.

A summary of the key issues and impacts by station and facility is provided in Table 5.8.

Table 5.8: Key impacts to land use and community facilities

Work site	***Issues***	***Impacts***
Epping Services Facility	- Permanent land acquisition - Amenity - Strategic plan conflict	- Acquisition of Emmaus Bible College. - Reduced amenity to surrounding community facilities during construction period. - Facility is located within the Epping Town Centre Study which proposes revised controls. The Project may have implications for the study. Further consultation between Hornsby Shire Council and Parramatta City Council to be undertaken.
Cheltenham Services Facility	- Amenity - Temporary land acquisition - Access issues	- Reduced amenity to surrounding community facilities during construction period. - Temporary acquisition of the netball courts, cricket nets and playground at Cheltenham Oval and parts of Beecroft Reserve (impacting vegetation, walking trails and bike tracks) will limit community and resident use. These facilities will be reinstated during the operation phase.
Cherrybrook Station	- Improved access - Future development	- Improved accessibility for local key attractors (educational establishments, commercial properties, open space and community facilities such as the Anglican Retirement Village) and for pedestrians. - May stimulate future development and increase population densities.
Castle Hill Station	- Permanent land acquisition - Access issues - Increased access - Future development	- Construction works would require temporary acquisition and use of Arthur Whitling Park and permanent acquisition of two buildings. Arthur Whitling Park currently contains a war memorial and has European heritage value (these would be removed as part of the project). - Whitling Park will be inaccessible for public use during construction. The park will be transformed into an open civic area during the operation phase. - Cumulative impacts associated with the extension of Castle Towers Shopping precinct. - Increased accessibility to local key attractors. - Opportunities for intensified land uses.
Showground Station	- Increased access - Future development	- Increased accessibility for local key attractors including the Castle Hill Showground.

Work site	Issues	Impacts
		- Opportunities for intensified land uses
Norwest Station	- Increased access - Future development	- Increased access to Norwest Business Park, Hillsong Church, local facilities and future higher density zoned residential land. - Opportunities for intensified land uses and future economic investment.
Bella Vista Station	- Increased access - Future development	- Increased accessibility to local attractors. - Opportunities for new centre, land use integration and Transit Oriented Design.
Kellyville Station	- Improved access - Future development	- Improved access for local residents. - Opportunities for new centre, Transit Oriented Design and land use integration.
Rouse Hill Station	- Improved access - Future development	- Increased access to Rouse Hill Town Centre. - Opportunities for intensified land uses.
Cudgegong Road Station and Tallawong Stabling Facility	- Improved access	- Will provide improved access for future residential land development.

In terms of construction, the Department's assessment of Stage 1 found that whilst there would be a substantial level of disruption, this type of impact is often unavoidable for a large infrastructure project of this scale and nature, and is capable of being satisfactorily addressed primarily through consultation with Council's, community groups and other key stakeholder groups to determine viable and acceptable options for alternative arrangements during construction and through the implementation of a series of site specific management and mitigation measures.

Construction of Stage 2 would see a continuation of some of these impacts (e.g. certain community facilities and recreational grounds would continue to be unavailable in some locations) but the Department notes that it would not have such a significant level of impact on land use and community facilities as is the case for Stage 1.

The Department supports the Proponent's commitment to continue to consult with local stakeholders regarding the provision of alternative locations and facilities to be utilised during the construction period. These sites will be returned to their original uses by the time operations commence. Notwithstanding, the Department has included the same conditions from Stage 1 requiring the identification and implementation of mitigation and management measures where community facilities are affected.

The Department notes the Proponent's ongoing commitment to consultation with key community groups and stakeholders to mitigate disruption during construction. It is recommended that the conditions imposed in the Stage 1 approval requiring the preparation and implementation of a Stakeholder and Community Involvement Plan to provide mechanisms to facilitate communication between the Proponent, the relevant Council and community stakeholders (particularly adjoining landowners) be imposed in the Stage 2 approval.

The Proponent has committed to developing an Operational Environmental Management Plan to manage relevant environmental impacts that are ongoing during the operation of the project. This is supported by the Department and a condition has been recommended to strengthen and provide a detailed framework around this commitment.

In relation to operation impacts on land use and community facilities, some concerns have been raised in submissions over the impact of development on future land use at station locations. The Department is satisfied with the Proponent's commitment to consult with Councils, government agencies, land owners and community groups in developing integrated land use outcomes around the stations. I t is important to ensure that future land use development in and around the proposed stations is appropriately planned. As set out in Section 2.3, the Proponent is firmly committed to working with the Department to ensure this occurs within and surrounding each station precinct. It is however acknowledged that the

type of land use and scale of development is subject to a separate process and does not form part of this assessment.

The Proponent will continue to carry out ongoing consultation with land owners and developers within the strategic planning context for the Rouse Hill Town Centre Northern Frame works, the Epping Town Centre, Balmoral Road Release Area and the Castle Towers expansion within the Castle Hill Town Centre. As such, the Proponent has committed to continued consultation with key stakeholders such as Councils, land owners and developers, the Department (Land Release) and other relevant agencies regarding Precinct Planning and zoning impacts.

The Department is satisfied that the Proponent has adequately demonstrated that the negative impacts of the project on land use and community facilities can be mitigated and managed through a series of management and mitigation measures made by the Proponent and recommended conditions.

Finally, it is also important to point out that there would be a number of positive benefits from the project on land use and community facilities including increased accessibility for local residents and attractors, stimulation of development close to stations and opportunities for intensified land uses and transit orientated design.

Soils and Groundwater

The proposed construction of Stage 2 would include earthmoving and excavation activities associated with the construction of roads and overall precinct development. This has the potential to result in potential impacts from soil erosion and disturbance, stockpiling of spoil and land remediation on completion.

The Proponent undertook a field and laboratory testing program to assess identified areas of environmental concern (AEC) and contaminants of potential concern (CoPC), utilising 21 geotechnical test pits and 57 boreholes across the study area. In addition, two rounds of groundwater sampling were undertaken, the first round from 35 monitoring wells between January and February 2012 and the second round from 57 monitoring wells between March and April 2012. Potential areas of soil salinity were also considered across the study area as construction in areas of known salinity can lead to soil and water contamination through leaching or from changes to groundwater levels.

An assessment of contamination conditions and potential constraints to construction of Stage 2 was undertaken and soil and groundwater contamination, to varying degrees, was identified at a number of proposed station sites, often associated with former petrol station sites in the study area. Traces of various types of hydrocarbons were detected in either soil or groundwater samples (and sometimes both) at Castle Hill Station, Showground Station, Norwest Station, Bella Vista Station and in the area between Rouse Hill and the Tallawong Stabling facility. The EIS stated that further investigations would be required during the detailed construction planning stage of the project and at this stage, impacts on construction workers as well as disposal management would need to be further assessed and mitigation and management measures further developed. This includes defined investigations at the Tallawong TSF of existing structures, including the identification of asbestos.

Construction activities associated with Stage 2 could result in various impacts to groundwater. These include:

- the need to dispose of turbid, saline or contaminated water collected within excavations and stations boxes or from dewatering activities;
- disturbance to contaminated land or groundwater;
- leakage to the water table of contaminants such as oil and chemicals from construction excavations or from accidental spills; and
- lowering of the water table.

The EIS detailed the mitigation measures that would be implemented to reduce potential soil and groundwater impacts from the construction of the project. Specific measures are outlined for contamination of soils and groundwater, groundwater management and treatment and soil salinity.

Potential operational impacts of groundwater drawdown was assessed as part of Stage 1, and it is expected that drawdown from the construction or operation of Stage 2 stations, rail infrastructure and systems would be negligible.

The Proponent has calculated, through hydraulic modelling, that the proposed tunnel and station designs would result in an estimated inflow of groundwater from rock of 0.35 megalitres per day (ML/day) following the completion of the first stage (Cherrybrook to Epping) tunnelling and increasing to 0.6 ML/day at the completion of tunnelling. This rate is estimated to decrease to 0.5 ML/day during construction of Stage 2 and for the long term. Actual inflow may vary and would depend on the local climate with groundwater inflow increasing during periods of rainfall.

Groundwater flows collected from below ground stations and groundwater seepage into the tunnel could potentially be of low quality and therefore it is proposed to be collected and pumped to the existing water treatment facility at Lady Game Drive, Lindfield, which forms part of the operation of the Epping to Chatswood Rail Link project. The treatment plant at this location is designed to treat up to 33 L/s or 2.9 ML/day, however, the Proponent understands that it is currently treating an average of 1 ML/day and therefore it has capacity to accommodate and treat the groundwater inflows collected from the project. Groundwater is proposed to be transferred to the treatment plant via gravity flow or pumped from within the tunnel, as required. The treatment plant is required to meet discharge criteria for a range of analytes prior to the water being discharged to the Lane Cover River. These discharge criteria would also apply to the water treated and discharged from the NWRL project.

The EIS outlines mitigation measures that would be implemented to avoid, reduce and manage identified impacts to soils and groundwater during the project's operation. Mitigation measures to reduce operational impacts to soils and therefore impacts to surrounding water quality were previously assessed in Section 5.4. Operational measures to mitigate groundwater impacts are summarised as follows:

- a post construction monitoring program for ground movement and groundwater levels would be established for the land slip area near Cherrybrook Station;
- procedures to address accidental spills or contaminants would be developed and implemented during the operation of the station sites;
- groundwater quality would be subject to testing and where it does not meet license requirements would be treated prior to discharge;
- all feasible and reasonable opportunities would be identified for the reuse of captured groundwater; and
- captured groundwater from the tunnel would be collected and transferred to the Lady Game Water Treatment Plant for treatment and discharge provided the discharge criteria are met.

The Department considers that while there could be construction and operational impacts to soils and groundwater from the project, the Proponent has committed to a large number of specific mitigation measures to ensure that potential impacts are avoided where possible or if they occur, that impacts can be managed to acceptable standards. The Department notes that the Hills Shire Council stated that the mitigation measures proposed for operational impacts for groundwater and construction impacts for soil erosion are considered satisfactory.

Very few submissions raised issues with respect to potential soil and groundwater impacts arising from the construction and operation of Stage 2. Of the agencies that made submissions, the EPA was concerned that the Proponent had not committed to the

construction of undrained tunnels as part of the project to minimise groundwater inflows. The Department notes that the Proponent proposes to construct undrained tunnels and that this issue was addressed as part of Stage 1. The EPA also stated that a condition similar to E34 for the Stage 1 approval should be recommended for Stage 2 which states that water of suitable quality should be reused in preference to potable water. The Department agrees with the statement made by the EPA and has recommended that condition E34 of the Stage 1 approval also apply to Stage 2.

Notwithstanding the mitigation measures developed by the Proponent, the Department considers that soil salinity is still an issue for Stage 2 given that construction of the stations and their associated precincts would be undertaken in an area which is known to be moderately saline. The Department has therefore recommended a condition of approval that the Proponent be required to prepare a Soil Salinity Report, similar to that required for Stage 1. This report would detail the outcome of further geotechnical investigations and groundwater monitoring in order to determine the presence, extent and severity of soil salinity and its potential impact to groundwater resources and hydrology. The Department considers that such a study should be undertaken in consultation with various agencies, specifically OEH and NOW, and be submitted to the Director General prior to the commencement of construction activities associated with Stage 2 and that it detail measures to mitigate impacts on local/regional salinity processes, groundwater systems and receiving environments.

The Department understands that soil and groundwater contamination would need to be further investigated as part of Stage 2 works and that this may lead to additional mitigation measures being developed to reduce or manage potential impacts. The Department notes that the majority of station sites were identified as having either soil or groundwater contamination issues and therefore has strengthened the Proponent's commitment to undertake further investigations by recommending a number of conditions of approval on this matter. These conditions require endorsement and certifications to be undertaken by a qualified Site Auditor to ensure that contaminated soil, groundwater and building materials (including asbestos) are appropriately managed and/or remediated and that the site is suitable for the proposed use.

In addition, dewatering activities have the potential to result in impacts to the surrounding environment and the Department considers that the Environmental Representative should be present on site when these activities occur to ensure that each construction contractor undertakes dewatering such that it avoids or minimises adverse impacts to surrounding lands and waterways. The Department has therefore recommended that part of the ER's role be amended to be present for on-site activities that involve higher environmental risk such as dewatering and discharge of extracted groundwater.

Air Quality

The ambient air quality in the vicinity of the project is typical of a primary developed and developing residential and commercial area, with no significant industrial activities. Ambient air quality generally meets air quality criteria, except in relation to ozone and PM_{10}, which can be influenced by regional factors such as bushfires. Accordingly the Proponent undertook a qualitative assessment that reflects the relatively good air quality in the region and that operational air quality impacts would generally be minimal through the operation of electric vehicles.

Construction activities related to the project have the potential to impact surrounding air quality in relation to station construction, minor earthworks, and exhaust emissions from construction equipment and vehicles. However, the impacts associated with this stage will be less than for Stage 1.

Dust impacts would largely be confined to areas surrounding stations and service facilities caused by earthworks, spoil storage and transport. Impacts would be temporary and are expected to be minor with the implementation of mitigation measures (which are consistent with Stage 1).

Emissions are expected to be generated as a result of construction vehicles, construction equipment and other plant activity. The main sources of emissions would be from diesel combustion from heavy vehicles, mobile excavation machinery and combustion plants. Emission quantities would depend on the type of fuel used and hours of operation of equipment. However, particulate and gaseous emissions from vehicle movements, construction equipment and plant are not expected to significantly impact on the local air quality.

Impacts to air quality as a result of the operation of the NWRL are expected to be widely dispersed and generally not confined to specific sites. As the NWRL is powered by electricity, emissions will be minimal with indirect emissions created through off-site generation of electricity. The community has raised concerns over dust released from the ventilation system, however emissions from ventilation shafts are expected to be negligible with small amounts of particulate matter created by maintenance vehicles and breaking trains, with small volumes of emissions expected to be released.

Vented air from the ventilation shafts is likely to comprise minor concentrations of CO_2, Volatile Organic Compounds and NO_x, ash and soot particulates. Due to the large volumes of exhaust air released from the ventilation system, small volumes of particulates and low concentrations, the ventilation system is not expected to impact on surrounding air quality.

The NWRL is expected to change motor vehicle use and emissions as a result of changes to availability and access to rail services. The community has raised concerns that increased traffic and associated parking at stations will impact on local air quality and may have health impacts. While station precincts may experience a minor decrease in air quality due to higher concentrations of traffic and vehicle emissions, overall there is expected to be a decrease in traffic volumes as modes shift from road to rail. This will result in improved air quality, particularly around roads used by potential users.

Overall the Department is satisfied with the measures the Proponent has put in place to mitigate the impact to air quality resulting from the construction and operation of the project. The Proponent has developed mitigation measures to avoid, reduce and manage potential impacts to air quality as a result of construction of the project. Dust and exhaust emissions generated as a result of construction works can be largely controlled through routine measures adopted and refined during similar construction projects. The Department notes that the EPA has requested the continuance of relevant Stage 1 conditions and the Department supports this request, which will ensure the active management of these risks.

In relation to operational air quality impacts, the Department notes that maintenance activities (including operations at the TSF) will be minimal and consistent with emissions generated by the broader road network. In relation to impacts associated with increased traffic around station and ventilation, the Department accepts the Proponent's conclusions and supports its commitment to locate air ventilation and parking facilities to avoid air quality impacts on sensitive receivers wherever practicable.

Waste Generation

The construction of the NWRL has the potential to generate a number of different types of waste including building and excavation works, office and crib room waste and green waste from the clearing of vegetation. Potential construction waste impacts resulting from the project include:

- spoil and waste directed to landfill;
- contamination of soil, surface and ground water;
- an increase in vermin from the incorrect storage, handling and disposal of waste; and
- lack of identification of feasible options for recycling or reuse of resources.

A variety of solid and liquid waste is expected to be generated due to the operation of the NWRL including cleaning activities at train stations, underground rail corridor infrastructure

maintenance and waste materials generated from the Tallawong Stabling Facility. The waste generated at these sites is incidental to the operation of the NWRL; however, waste has the potential to cause adverse impacts if not correctly collected, stored and disposed of.

The Proponent has committed to the objectives of responsible waste management including complying with the waste management hierarchy and legislation relevant to waste management including the Protection of the Environment Operations Act 1997. It has also committed to a range of mitigation measures that are consistent with Stage 1.

The management of waste during operation is not considered to be a key issue due to the low level of waste generated and the ability to reduce this waste through standard measures. No significant adverse waste impacts are expected to occur during the operation of the NWRL. Notwithstanding the Proponent has committed to preparing an Operational Waste and Resource Recovery Management Plan.

The Department notes that waste generation from the construction of the project would have environmental risks similar to Stage 1 and that the Proponent has proposed a similar management framework as that approved under Stage 1. The Department also notes that the EPA has recommended a condition of approval requiring the Proponent to investigate reuse options, in accordance with the Waste and Resource Recovery Act 2001, and to carry over conditions in relation to land contamination from the Stage 1 approval. In relation to waste reuse options, the Department notes that the Proponent has committed to this action. The management of land contamination is addressed in the Soils and Groundwater section of this Report.

Hornsby Shire Council has raised concerns over the protocols for the assessment of contaminated water and disposal of waste water at authorised sites. The Department notes that any stormwater to be released to local waterways would occur after treatment and the Proponent has committed to meeting discharge criteria under Environmental Protection Licences associated with each major contract.

In relation to the operation of the project the Department is satisfied that potential waste sources can be adequately managed through standard design and management measures and supports the Proponent's commitment on this issue.

As no significant waste impacts are expected to result from the construction and operation of the NWRL, the Department is generally satisfied that the Proponent has provided a suitable framework to identify and manage any potential impacts. Standard waste management requirements have also been included by the Department as recommended conditions of approval.

Climate Change and Greenhouse Gases

The climate change assessment of construction and operational risks has identified a range of climatic variables that may impact the NWRL. These include annual average rainfall, extreme rainfall, drought, extreme temperature, extreme wind, storms, groundwater, ground stability and fire danger index.

Increased frequency, severity and duration of extreme temperatures (days exceeding 35˚C) may result in the failure of signalling and communication systems, failure of air conditioning units, track buckling and interruptions to mains power. These are considered to be of medium (tolerable) risk.

Increased rainfall intensity may cause issues with ground stability of embankments, malfunction of power supplies and flooding of rail infrastructure and stations. These risks are considered medium (tolerable). The risk of flooding to rail infrastructure and stations however in 2030 is considered low (acceptable).

There are also risks associated with reduced rainfall, storms, bushfires and solar radiation which are considered medium (tolerable). The Department also notes that there are no extreme (unacceptable) risks.

Climate change resilience is a key objective of the projects sustainability strategy which has been used to guide the project planning, implementation and design. Accordingly, the Proponent has responded to climate change risks to the NWRL with a range of adaption responses which are to be addressed in the design, construction and operation of the project, including the following:

- failure of air-conditioning units on trains - procure future rolling stock capable of handling the increased higher temperature and duration of events; and
- flood risks to infrastructure - design of rail infrastructure to account for one in a hundred year flood events, plus an additional 10 percent allowance for climate change impacts.

The project will be subject to review and response by designers and constructors on an ongoing basis against the latest climate change projections. It is estimated that the construction and operation of the NWRL stations, rail infrastructure and systems would generate a total of approximately 650,063 tCO_2-e Greenhouse Gas Emissions (GHG), and include the following:

- 260,180 tCO_2-e of direct scope 1 emissions – emissions generated directly by the project including fuel used on site by construction equipment (40 per cent of construction, 1.8 per cent of annual operational emissions)
- 50,360 tCO_2-e of indirect scope 2 emissions – emissions generated outside the project boundaries including power supply for site infrastructure and train traction, stations, stabling yards and services facilities (eight per cent of construction, 79.8 per cent of annual operational emissions); and
- 339,523 tCO_2-e of indirect upstream scope 3 emissions – emissions associated with the extraction, production and transport of construction materials (52 per cent of construction, 18.4 per cent of annual operational emissions).

The Proponent has identified mitigation measures to avoid, reduce and manage identified potential impacts regarding climate change and GHG emissions. These include:

- reducing the quantity of electricity used at the stations, stabling yards and maintenance facility through design which maximises natural ventilation, natural lighting and selection of more efficient cooling equipment;
- reducing the quantity of materials for stations, rail infrastructure and systems through better design and selection of materials which expend less energy in their life cycle; and
- reducing energy during operations through efficient design and incorporating a traction system designed for receptivity to regenerative breaking which returns break energy to the overhead wiring system.

The Proponent has also identified onsite renewable and low carbon generation of energy and carbon offsets as a means of achieving objectives of the NWRL Sustainability Policy. This includes the potential to source five percent of operational electricity demand from onsite renewable or low carbon sources.

In noting that the project has the potential to reduce GHG emissions by providing a low GHG intensive alternative to car travel, being approximately 6,860 tCO_2-e/yr, the Department is generally satisfied that the Proponent has provided a framework to ensure construction of the project is undertaken to avoid, reduce and manage identified potential impacts. Notwithstanding, and whilst the Department acknowledges that operating emissions from the project over time will decrease as the carbon intensity of grid sourced electricity declines, it considers the Proponent's commitment to offset carbon emissions should be conditioned to recognise the potential of the project to offset GHG emissions where reasonable and feasible.

6. RECOMMENDATION

With Sydney's population expected to increase by 1.3 million, to approximately 5.6 million people by 2031, the NWRL corridor will play a key role in accommodating Sydney's future residents.

Currently, the outer north western suburbs of Sydney are heavily reliant on private vehicles and bus services for transport options. With increased demand on road networks, it is vital that transport networks and services are expanded to the region to support ongoing development and to connect centres within the NWRL corridor to existing centres, services and employment. The provision of an efficient and reliable public transport system is, therefore, key to the sustainable development of the outer north western suburbs of Sydney.

The NWRL project, including alignment and stations has already been approved in a conceptual form. Stage 1 of the project has also been approved by the Minister and includes sixteen construction sites along the alignment from which excavation of tunnels and underground station boxes, construction of above ground infrastructure including viaduct spans and bridges, and earthworks will be carried out. Stage 2 of the project relates to construction works for the NWRL and operation of the railway, including stations and wider precincts, services facilities, and a stabling facility at Tallawong Road, and rail infrastructure and systems.

The Department considers that Stage 2 of the project is justified and is in the public interest because it is necessary to deliver a vital piece of public infrastructure which is key to the sustainable development of the outer north western suburbs of Sydney. The adverse consequences of not proceeding with the project would be significant in the long term, in terms of the capacity of the rail network and road network congestion, and poor level of accessibility between homes and jobs.

Following a detailed assessment of the Proponent's EIS and Submissions Report, and the submissions received from agencies, local Councils and the public during the exhibition period for the project, the Department is satisfied that the residual impacts of the project can be appropriately mitigated or managed to within acceptable levels. The Department therefore recommends that the project be approved subject to the recommended conditions of approval.

The recommended conditions of approval for the project provide for the mitigation and management of key impacts associated with the project. These include specific environmental performance and construction environmental management conditions for traffic and transport, noise and vibration, ecology, heritage, soil, water quality and hydrology, urban design, air quality, visual amenity, biodiversity and rehabilitation, business impacts and land use and community facilities. The Department has also recommended conditions of approval for construction environmental management planning, including the requirement for a Construction Compound and Ancillary Facilities Management Plan, a Construction Noise and Vibration Management Plan, a Construction Traffic Management Plan, a Construction Soil and Water Management Plan, a Construction Heritage Management Plan, a Construction Flora and Fauna Management Plan and a Construction Air Quality Management Plan. Conditions have also been included to provide for the environmental management of ongoing operational issues.

The Department believes that these requirements would provide for the implementation of best management practices during design, construction and operation of the project, and would ensure that the impacts of the project on the surrounding environment and the amenity of local residents and rail commuters are managed to acceptable levels.

The project represents a vital infrastructure asset which will provide significant benefits and is in the public interest. Consequently, the Department recommends that the Minister for Planning and Infrastructure approve Stage 2 of the NWRL project, subject to the recommended conditions of approval.

Felicity Greenway 24/4/13

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7.5.13

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Development Assessment Systems and Approvals

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APPENDIX A ENVIRONMENTAL IMPACT STATEMENT

See the Department's website at
http://majorprojects.planning.nsw.gov.au/index.pl?action=view_job&job_id=5414

APPENDIX B SUBMISSIONS

See the Department's website at
http://majorprojects.planning.nsw.gov.au/index.pl?action=view_job&job_id=5414

APPENDIX C PROPONENT'S RESPONSE TO SUBMISSIONS

See the Department's website at
http://majorprojects.planning.nsw.gov.au/index.pl?action=view_job&job_id=5414

APPENDIX D RECOMMENDED CONDITIONS OF APPROVAL