

North West Rail Link Windsor Road Bridge, Rouse Hill Modification Report

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1 Introduction

The North West Rail Link (NWRL) is a key priority railway transport infrastructure project for the NSW Government. The NWRL will comprise an electrified railway with services operating between Chatswood and Cudgegong Road, Rouse Hill. It will include the construction of a new two-track alignment from Epping to Rouse Hill, 23 km in length with eight new stations and associated services.

Stations are to be built at Cherrybrook, Castle Hill, Showground, Norwest, Bella Vista, Kellyville, Rouse Hill and Cudgegong Road. A stabling and maintenance facility is to be built beyond the Cudgegong Road station site at Tallawong Road, Rouse Hill. Bus, pedestrian and cycling access facilities are proposed for all stations. A total of 4,000 park and ride spaces are to be provided at five of the stations being Cherrybrook, Showground, Bella Vista, Kellyville and Cudgegong Road stations.

The NWRL has been declared Critical State Significant Infrastructure (SSI) through clause 16 and Schedule 5, clause 2 of State Environmental Planning Policy (State and Regional Development) 2011. Two major planning approvals have been granted by the Minister for Planning and Infrastructure under Part 5.1 of the *Environmental Planning and Assessment Act, 1979* (EP&A Act). Stage 1 - Major Civil Construction Works (SSI-5100), including tunnelling, was approved on 25 September 2012; and Stage 2 - Stations, Rail Infrastructure and Systems (SSI-5414) was approved on 8 May 2013. In addition, a separate approval for the Rapid Transit Rail Facility was granted on 15 January 2014.

Transport for NSW (TfNSW) is seeking approval from the Minister for Planning and Infrastructure to modify the Stage 2 State Significant Infrastructure approval (SSI-5414). The proposed modification is to replace the approved viaduct structure with a cable stayed bridge over Windsor Road, Rouse Hill. The modification relates to the crossing of Windsor Road, Rouse Hill as identified in the Environmental Impact Statement for Stage 2 - Stations, Rail Infrastructure and Systems (EIS 2).

The proposed modification offers significant benefits to the NWRL in terms of simplifying the rapid transit infrastructure's crossing over Windsor Road. The bridge would also offer a unique opportunity to create an urban marker on the approach to the Rouse Hill Town Centre.

2 Strategic Context

2.1 Plans and Policies

NSW 2021

NSW 2021: A Plan to Make NSW Number One (NSW Government, 2011) outlines the NSW Government's principal strategies for the State over the next decade. It is the primary document guiding the direction of development in NSW and Sydney.

NSW 2021 identifies the NWRL as a key project to help deliver the NSW Government's policy goals including increasing public transport patronage by making it a more attractive choice. The proposed modification would be compatible with the policy goals of NSW 2021.

NSW Long Term Transport Master Plan

The *NSW Long Term Transport Master Plan* was released in December 2012. Sydney's Rail Future is an integral element of the *NSW Long Term Transport Master Plan*.

The Plan defines the direction for transport and policy decisions to enable the NSW Government to deliver an integrated, modern transport system that puts the customer first. The Plan confirms NWRL as a priority transport project. The modification is an integral element of the NWRL.

Draft Metropolitan Plan for Sydney 2031

The draft Metropolitan Plan for Sydney 2031 establishes the vision for the Sydney metropolitan area over the period to 2031. The draft Strategy was prepared in conjunction with the *Long Term Transport Master Plan*.

The Plan prioritises housing and jobs growth across Sydney, and recognises the importance of changes that will influence city form. The NWRL is one of nine 'city shapers' that will play an important role in shaping future growth across Sydney. The proposed modification is consistent with the city-shaping role of the NWRL transport infrastructure.

NWRL Corridor Strategy

The NWRL Corridor Strategy has been prepared to guide development around the new NWRL stations over the next 20-25 years. The Corridor Strategy identifies a vision for precincts around the new stations with the objective of maximising the opportunities for the NWRL to support positive changes in travel behaviour as a result of the transport modal shift from road to rail. The proposed modification is consistent with the Corridor Strategy.

2.2 Justification

The NWRL is one of nine 'city shapers' that will play an important role in shaping future growth across Sydney. The proposed Windsor Road Bridge offers significant benefits to the NWRL in terms of simplifying the rapid transit infrastructure's crossing over Windsor Road. The bridge would also offer a unique opportunity to create an urban marker on the approach to the Rouse Hill Town Centre.

Simplifying the road crossing

Windsor Road is a major four lane main road carrying approximately 48,000 vehicles per day in the vicinity of Rouse Hill.

The viaduct structure would have required at least two piers in Windsor Road. This would have resulted in multiple changes to the location of traffic lanes to construct piers in the roadway and permanent changes to the road configuration.

The single bridge span over Windsor Road would remove the need for permanent piers in Windsor Road. This would improve safety outcomes for road users and deliver significant benefits during construction from the reduced period of disruption to traffic.

Creating a visual marker

The proposed bridge would be likely to become a recognisable structure in the landscape, a marker of the rapid transit infrastructure in the immediate and wider context. The bridge would reinforce the Rouse Hill Town Centre and subsequently its importance as a major centre.

3 Statutory context

3.1 Legislation

The Environmental Planning and Assessment (EP&A) Act, 1979 provides the statutory framework for the NWRL planning approvals. The NWRL has been declared Critical State Significant Infrastructure under Part 5.1 of the EP&A Act and accompanying Regulations.

Pursuant to Section 115ZI of the EP&A Act, TfNSW is seeking approval for the modification of the State Significant Infrastructure approval (SSI-5414) granted on 8 May 2013.

Section 115ZI of the EP&A Act states:

(1) *In this section:*

Minister's approval means an approval to carry out State significant infrastructure under this Part, and includes an approval granted on the determination of a staged infrastructure application.

modification of an approval means changing the terms of the approval, including revoking or varying a condition of the approval or imposing an additional condition on the approval.

(2) *The proponent may request the Minister to modify the Minister's approval for State significant infrastructure. The Minister's approval for a modification is not required if the infrastructure as modified will be consistent with the existing approval under this Part.*

(3) *The request for the Minister's approval is to be lodged with the Director-General. The Director-General may notify the proponent of environmental assessment requirements with respect to the proposed modification that the proponent must comply with before the matter will be considered by the Minister.*

(4) *The Minister may modify the approval (with or without conditions) or disapprove of the modification.*

3.2 NWRL Project Approvals

The NWRL is subject to Part 5.1 (State Significant Infrastructure) of the EP&A Act. Concept approval for the NWRL was granted by the then Minister for Planning on 6 May 2008. The concept approval is taken to be a Staged Infrastructure Approval under Part 5.1 of the EP&A Act.

Two separate planning approvals have subsequently been granted for the project:

- Stage 1 – Major Civil Construction Works (EIS 1) approved on 25 September 2012 (SSI-5100);
- Stage 2 – Stations, Rail Infrastructure and Systems (EIS 2) approved on 8 May 2013 (SSI-5414).

The EIS 1 approval provides for the major civil construction works including 15.5km rail tunnels between Epping and Bella Vista, linking directly into the Epping to Chatswood Rail Line tunnels. The Stage 1 works also include excavation for underground railway station construction and construction of the 4.2km skytrain viaduct structure between Bella Vista and Rouse Hill.

The EIS 2 approval provides for the operation of the railway as well as the construction of those elements of NWRL not approved under EIS 1. This includes design principles for the skytrain,

additional land take for station precinct works (such as road works, pedestrian/cycle facilities, landscaping), and construction of the stations and station precincts.

Ancillary planning approvals are required for the Rapid Transit Rail Facility at Tallawong Road, Rouse Hill, and conversion works within the Epping to Chatswood Rail Line tunnels. The Rapid Transit Rail Facility, which provides stabling and maintenance for the new rapid transit trains, was approved on 15 January 2014. Conversion works within the Epping to Chatswood Rail Line tunnels are still to be fully defined.

An overview of the key elements of the NWRL is shown in Figure 1.

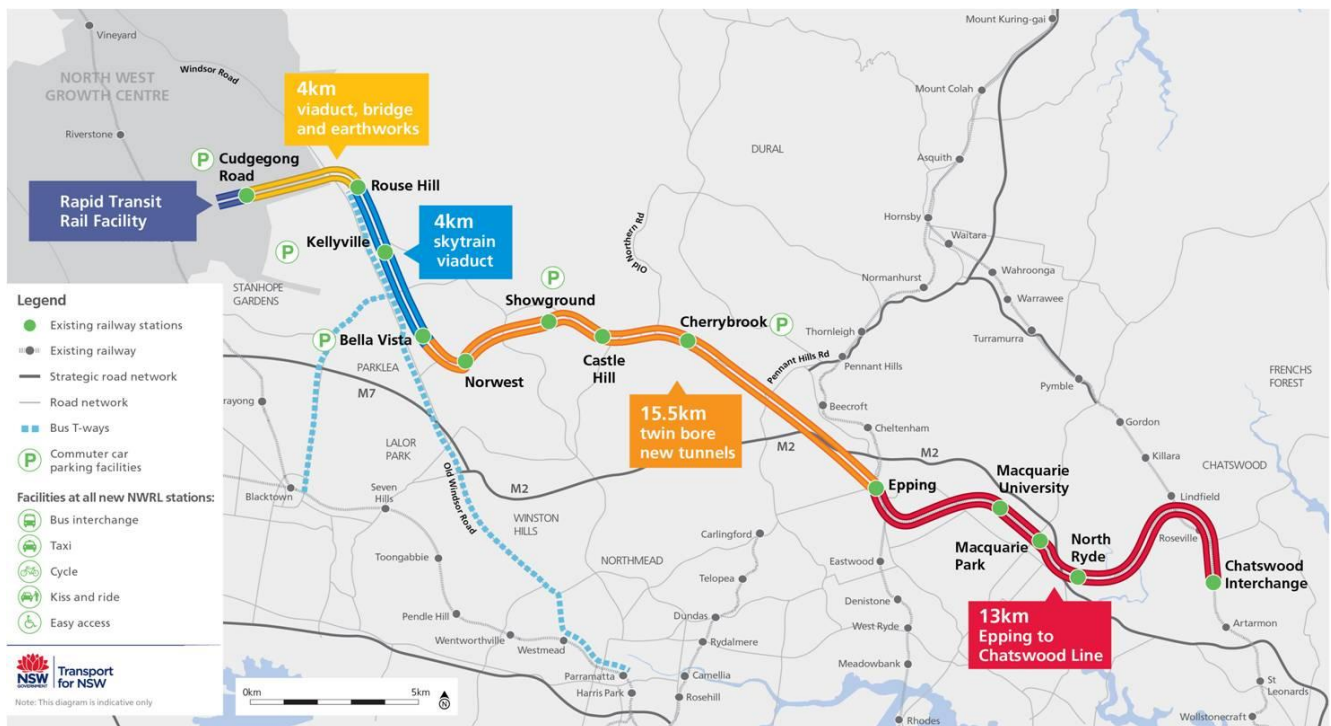


Figure 1 - NWRL project

4 Existing Approval (SSI-5414)

4.1 Director General's Requirements

The Director General's requirements for SSI-5414 are included in Table 1. This modification report responds to these requirements, where relevant, as indicated in the table. It is considered that the Director General's requirements cover all relevant impacts associated with the proposed modification.

Table 1 - Summary of Director General's requirements for NWRL EIS 2 (SSI-5414)

Requirement	Reference (as relevant)
Environmental Planning and Assessment Regulation EIS to be prepared in accordance with, and meet the requirements of, Part 3 of Schedule 2 of the Environmental Planning and Assessment Regulation 2000	Not applicable
Land use integration Integration with current and future land use plans and studies, and precinct/structure planning, in consultation with the Department (Strategies and Land Release and Plan Making and Urban Renewal) and relevant Councils, including: • Impacts on land use as a result of the change in design to a viaduct, the proposed Cudgegong Station and Tallawong Stabling Facility • Potential land severance and connectivity to and across the rail corridor; • Impacts associated with ancillary and services facility; and • Consideration of the Land Use and Rail Integration Study for Area 20 (CFA, 2011).	Section 7.2
Historic heritage Potential visual and cultural landscape impacts on historic heritage items.	Section 7.4
Noise The assessment of construction and operational noise and vibration shall have consideration of the relevant components of <i>Assessing Vibration: a technical guideline</i> (DECCW, 2008), <i>Interim Construction Noise Guideline</i> (DECC, 2009), <i>NSW Industrial Noise Policy</i> (EPA, 2000), <i>Interim Guideline for the Assessment of Noise from Rail Infrastructure Projects</i> (DECC, 2008) and <i>NSW Road Noise Policy</i> (DECCW, 2011).	Section 7.3

Requirement	Reference (as relevant)
Traffic and access	
As per the Concept Plan, the Proponent shall detail mode-of-access arrangements at Epping and each new station, with consideration to (but not necessarily limited to) the following matters:	Section 7.2
• At Bella Vista Station – details of park and ride provisions, road access arrangements (including the feasibility of provision of a signalised intersection replacing the Lexington Drive/Celebration Drive roundabout) and pedestrian and cycle linkages between the station and residential areas (including west of the station across Old Windsor Road) and • At Cudgegong Road Station – details of park and ride provisions, road access arrangements, and cycle and pedestrian linkages with the Area 20 residential catchment, including a potential connection between Tallawong Road and Cudgegong Roads.	
Groundwater	
Details of groundwater management during operation, particularly with regard to:	Section 7.7
• Details of the groundwater management • Proposed water discharge locations • Volume of water to be discharged at each location • Discharge water quality commitments and • Details of any ongoing treatment (if required).	
Soils	
Soil erosion and associated water course impacts, soil salinity and potential acid sulphate soils.	Section 7.7
Hydrology	
A detailed hydrological and hydraulic assessment for mainstreams and overland paths associated with major drainage lines.	Section 7.7
Cumulative impacts	
Assessment of cumulative impacts of the project on key environmental impact issues, particularly with regard to Stage 1 and 2 construction and interaction with other projects in the surrounding area.	Section 7.7
Consultation	
The EIS shall document consultation undertaken with relevant government agencies, local government and the community in its preparation and how matters raised during consultation have been considered.	Section 6

4.2 Detailed Elements

Skytrain

The key features of the NWRL skytrain and surface tracks, as described in EIS 2, include:

- A viaduct structure approximately 11m to 14m wide incorporating two railway lines plus signalling, overhead wiring, acoustic treatment and maintenance walkways for rail workers
- Anticipated construction from cast in-situ concrete piers with concrete box section girders between the piers
- Typical spans between 36m and 48m with longer spans possible where the viaduct passes over key infrastructure or watercourses.

Recognising that the skytrain will be an important design element in the visual landscape, EIS 2 sets out nine design principles to establish the focus for future detailed design:

1. The skytrain must contribute to a high quality experience for customers by, for example, providing for views from the train.
2. The skytrain must be an elegant architecturally and structurally engineered designed solution that represents value for money.
3. The proportions of the skytrain (such as width/depth ratios, edge design, column supports and underside treatments) must be well considered when viewed visually at human scale.
4. All of the rail infrastructure elements of the skytrain (such as services, catenary, acoustic sound walls, downpipes, lighting) must be integrated into the design holistically, and be able to be maintained.
5. The skytrain must be minimised in width and, in particular, minimised as far as practicable in the depth/thickness of the structure.
6. The support for the skytrain (i.e. column layout, spacing and design) must respond and/or facilitate uses below (such as local access, active and passive public spaces, landscaping and car parking).
7. Materials and finishes must be robust and easily maintainable considering graffiti protection and the effects of dust and rain.
8. The skytrain must incorporate feasible and reasonable noise mitigation (addressing both airborne and structural noise).
9. The skytrain must incorporate sustainability initiatives (such as water collection from the viaduct and energy harvesting), minimise the use of resources and materials and have a low carbon footprint.

An indicative cross section of the skytrain viaduct is shown in Figure 2. EIS 2 noted that there would be potential for design variations, particularly where there may be an opportunity to treat parts of the skytrain as individual elements to create urban markers.

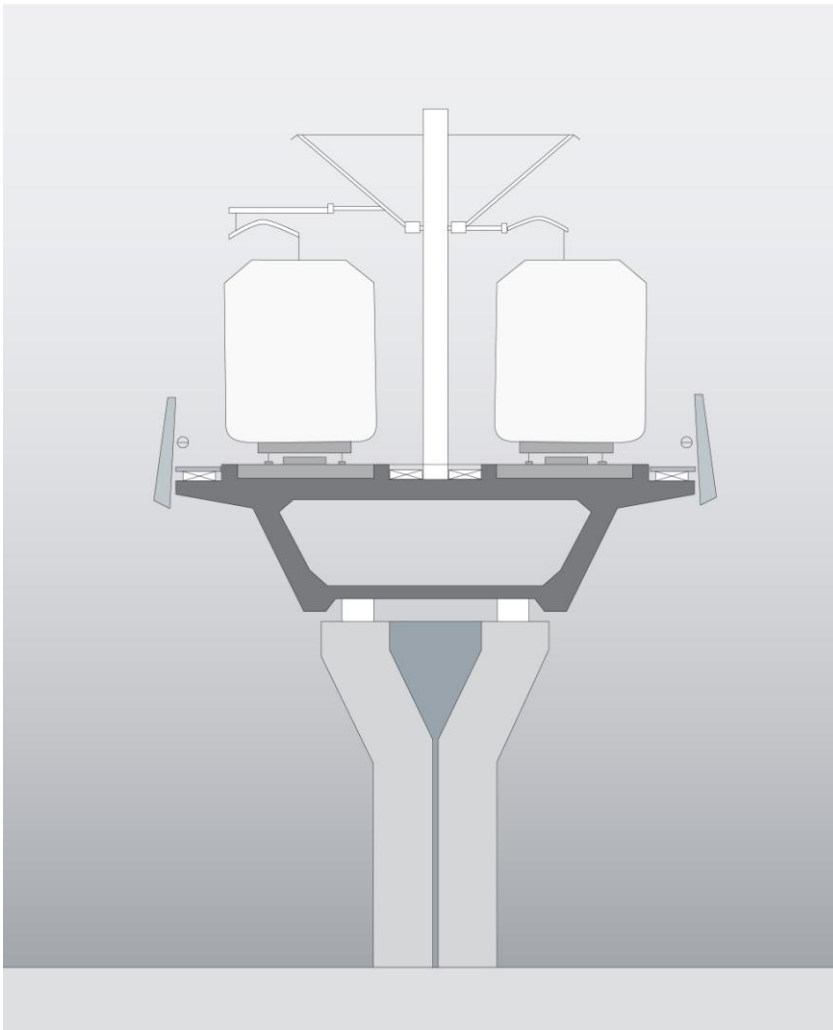


Figure 2 - Indicative cross section of preferred skytrain structure as described in EIS 2

Bridge structures

EIS 2 anticipated bridge structures along the viaduct where key infrastructure or watercourses crossings occur. The crossing over Windsor Road, Rouse Hill was described as a rail bridge with approximate spans of 40 m.

4.3 Relationship to EIS 1 Approval (SSI-5100)

Approval for EIS 1 (SSI-5100) was granted on 25 September 2012. The approval enables Construction Site 15 to be established between Windsor Road, Schofields Road and Rouse Hill Drive intersections.

The indicative layout of the construction site is shown in Figure 3 below. The construction site includes a temporary construction site in the Windsor Road central median strip for foundation and bridge piers. The approval allows for access to the Site 15 Construction Site from Rouse Hill Drive and Commercial Road to the north eastern side and Windsor Road to the north western side.

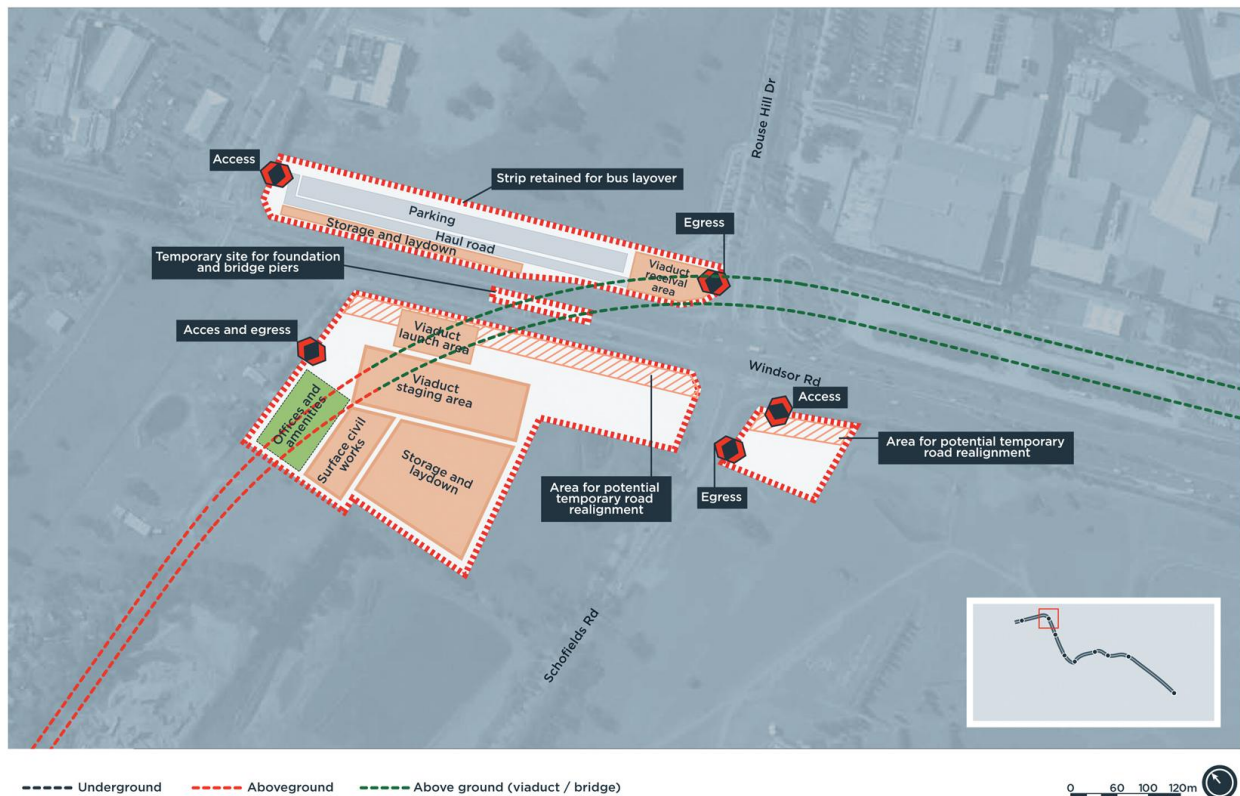


Figure 3 - Windsor Road Construction Site 15 as shown in EIS 1

This modification does not seek change the EIS 1 approval. The central/median temporary construction site would still be utilised, but no permanent structures would remain following construction. Construction of the proposed bridge would occur consistent with, and within the extent of, Construction Site 15 as described in EIS 1.

Importantly, the Minister's Conditions of Approval for EIS 1 related to minimising traffic impacts during construction (C27), establishment of a Traffic and Transport Liaison Group (C28), and the preparation of detailed Construction Traffic Management Plans (E46(c)) will be implemented.

5 Proposed Modification

5.1 Proposed Modification

5.1.1 Overview

The proposed modification is to provide a cable stayed bridge over Windsor Road, Rouse Hill. The bridge would cross Windsor Road near the intersection with Schofields Road / Rouse Hill Drive.

The design intention leading to the proposed modification was to complement the structural form of the viaduct over Windsor Road. The bridge would have a single span and would require additional support in the form of towers. The intent was to minimise the height of any towers and allow the bridge to sit comfortably and harmoniously within the existing surrounds.

A comparison of the approved elements of the EIS 2 and the proposed modification is set out in Table 2.

Table 2 - Summary of approved elements and proposed change

Component	Summary of Approved Component (EIS 2)	Proposed Modification
Bridge span	Viaduct or bridge structure between 11 m and 14m in width, approximately 15 m above ground level with approximately 40m spans across the roadway. Permanent piers to be placed in the central median strip of Windsor Road. No significant vertical elements over the roadway. No lighting.	Cable stayed bridge with two towers, a total length of approximately 270 m and three main spans. The indicative width of the bridge deck is similar to the viaduct as approved. Maximum height of the bridge towers above ground level is approximately 45 m. No permanent piers are required within the Windsor Road reserve. Vertical components (bridge towers) as described above. LED (light-emitting diode) lighting within towers with subtle illumination at night.
Integration with viaduct and Rouse Hill Station	No change to viaduct at station, support pylons at regular intervals.	Bridge structure integrates with viaduct at Rouse Hill Station.

The key elements of the proposed bridge are shown in Figure 4.

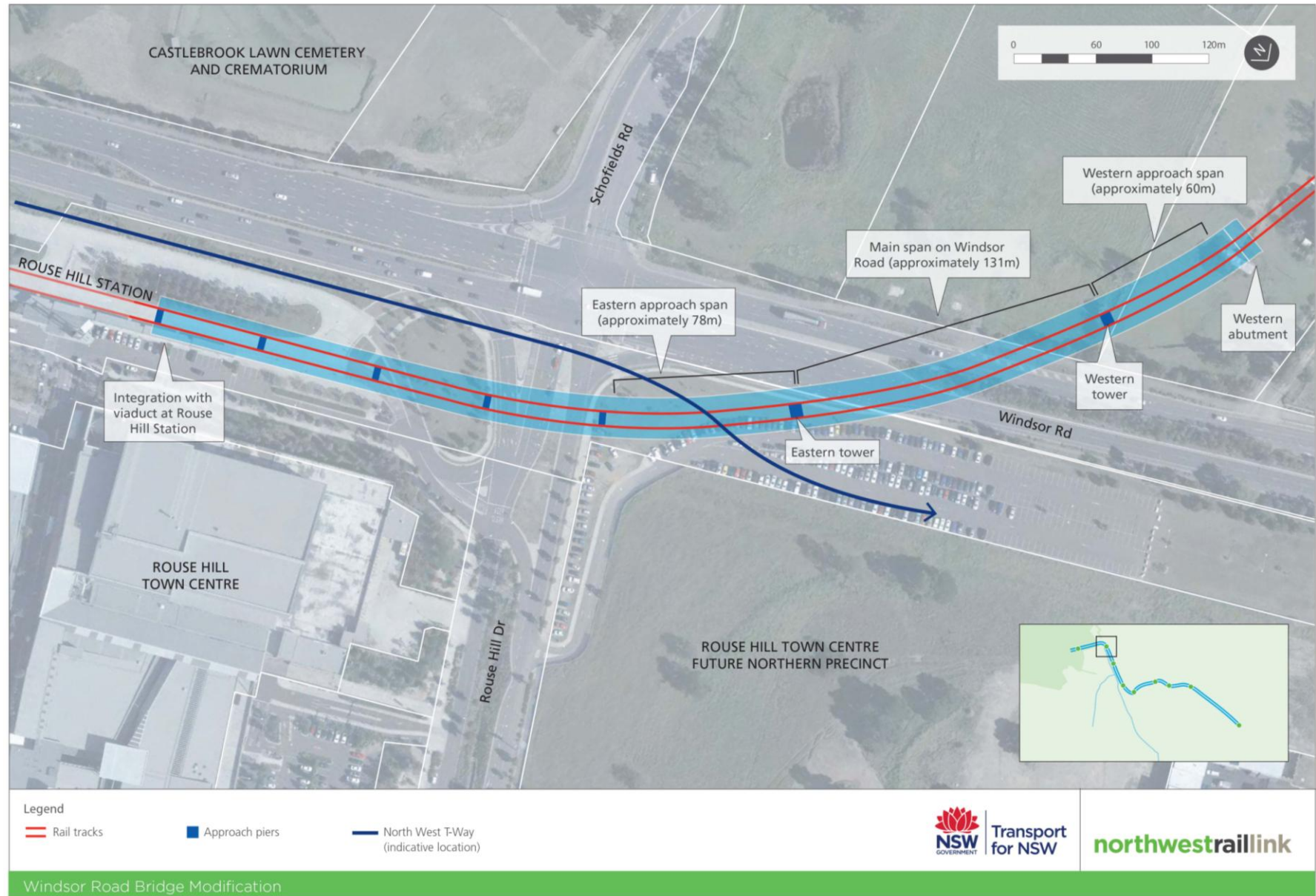


Figure 4 - Indicative layout
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5.1.2 Key details

Bridge span and towers

The new cable stayed bridge would span Windsor Road, Rouse Hill with an approximate length of 270 m. The continuous superstructure would have three spans of approximately 78 m (eastern approach), 131 m (main span) and 60 m (western approach). These spans would maximise the approach spans of the bridge and remove the need for permanent piers in the roadway below.

Two bridge towers would be located above the piers on either side of Windsor Road. The two piers supporting the bridge towers would not intrude on the road reserve and would therefore not require any permanent traffic diversions.

The towers would sit between the rail tracks on the bridge deck and would have a maximum height of up to approximately 45 m above ground level. The bridge deck would be approximately 15 m wide. Indicatively eight cable stays would project in each direction from both towers to support the bridge deck.

The bridge structure would be designed in accordance with loading from relevant Australian standards (AS5100, or where load sets are not mentioned in AS5100 then AS1170). In terms of required earthquake loadings, the bridge structure would be designed in accordance with AS5100.

A derailment kerb would be provided adjacent to each rail to contain a train in the unlikely event of a train derailment. Furthermore, a deflection wall would be located along the centreline of the bridge to protect the cables that support the bridge from impact should a train derail and not be contained by the derailment kerbs.

At the western end, an abutment approximately 15 m wide would be required to transition from the bridge deck to the embankment.

Indicative details of the bridge and towers are shown in Figures 5 and 6 below. Photomontages are provided in Appendix A.

Integration with viaduct and Rouse Hill Station

The bridge structure would have a larger box girder size than the viaduct. This would provide the structural capacity for the increased spans over the road. The depth, shaping and form of the bridge would continue to the northern side of Rouse Hill Drive where there would be a seamless transition to the viaduct.

Rouse Hill Station would remain in the same elevated location on the skytrain. The location of piers and abutments would not affect the operation of Rouse Hill Drive or the T-way.

Unauthorised access to the viaduct and bridge would be controlled through the implementation of a range of measures such as security fencing, CCTV surveillance, controlled lighting and other systems.

Lighting

The bridge would incorporate lighting within the mast tower to articulate the tower edges and cable stays with subtle illumination at night. Details of the lighting specification would be determined during documentation of the detailed design. The detailed design would ensure that potential light spill on surrounding existing and future residents would be minimised.

Navigational lights would be provided at the upper most point of the towers if required.

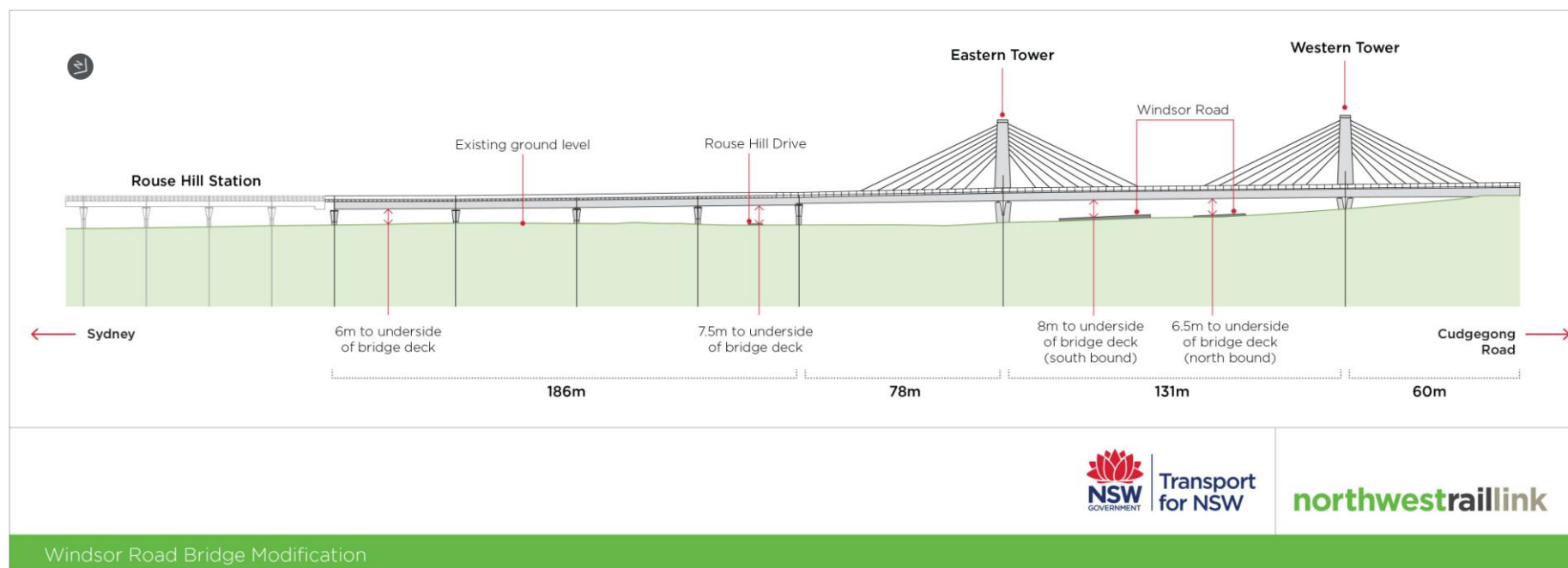


Figure 5 - Elevation of the proposed modification

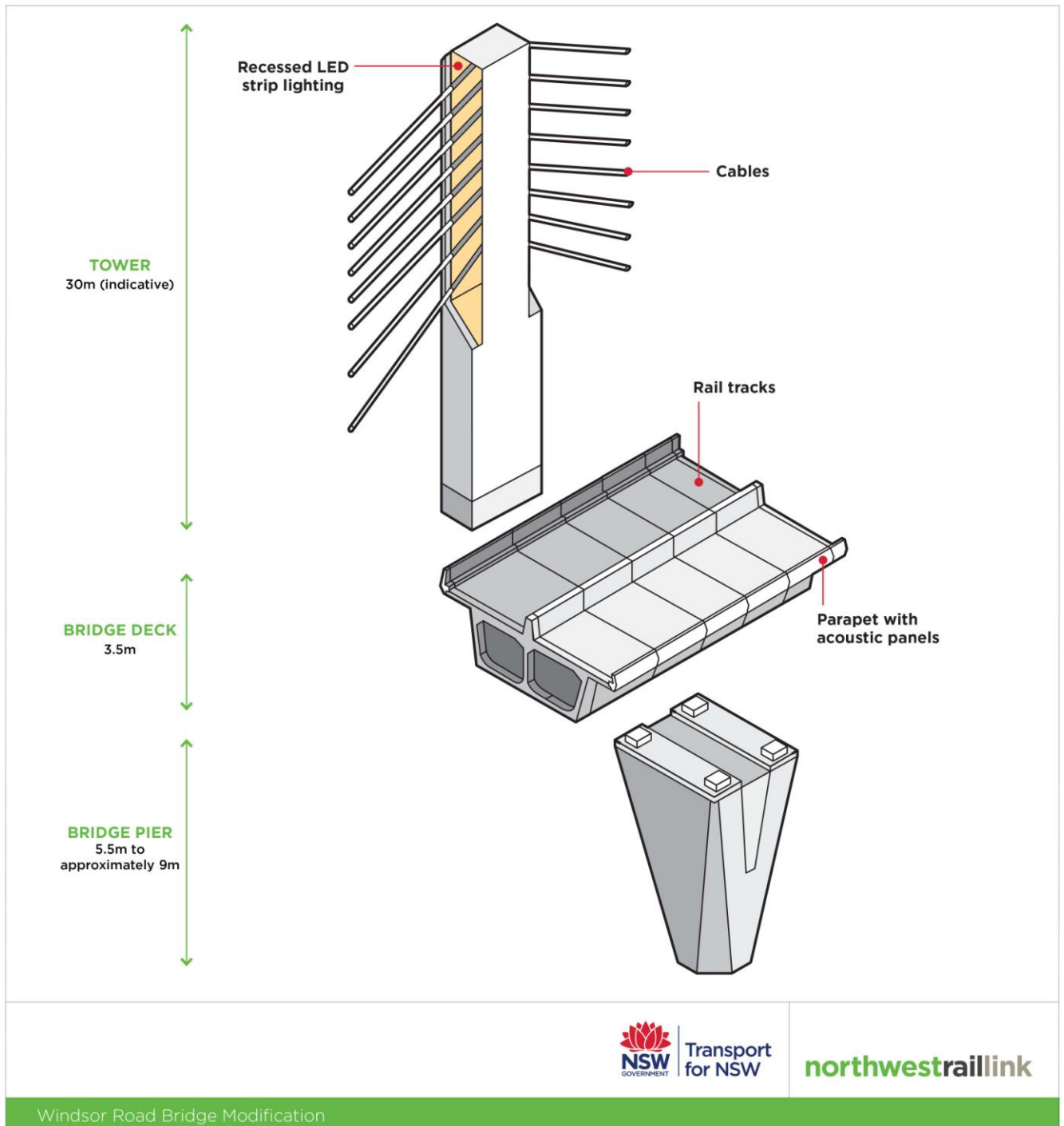


Figure 6 - Details of bridge tower, deck and piers

5.2 Alternatives Considered

The initial concepts for the proposed bridge focussed on a clear span over Windsor Road. The central span would need to be approximately 131 m. The total length, including approaches, would be approximately 400 m. A key design requirement was to minimise the height of any towers associated with the bridge. The limited land available for the location of bridge piers was also a key consideration.

Several alternative bridge options were considered before selecting a preferred solution. Relevant considerations included cost, safety, constructability, impact on traffic and visual amenity impacts.

Options that were considered and dismissed in preference to the preferred option included:

- Alternative cable stayed bridge designs that would have twin towers on either side of the road reserve (four in total) and cables on the outer sides of the bridge
- Alternative cable stayed bridge designs with a single tower. These design options were not preferred because the tower would be required to be significantly higher than the preferred option
- Designs featuring a deck suspended from an arch with side cables. These design options were not preferred because of the resulting height of the central arch
- A balanced cantilever bridge, being a bridge where the bridge deck would be supported by piers rather than towers with cables or the like. This type of bridge design would require very large piers and a significantly deeper deck structure at the piers and was not preferred because of the visual bulk.

The preferred cable supported bridge design was considered to have the following benefits over the other options:

- Elegant architectural solution
- Greater flexibility for aesthetics
- Reduced traffic and service impacts
- Potential to be an iconic structure (landmark qualities).

Variations on the preferred design concept were also considered. The design featuring centrally located towers with central line of cables was selected as the skewed alignment creates oblique views and the design would ensure the least cluttered appearance.

6 Consultation

The NWRL Project Office has undertaken the following consultation with agencies and stakeholders during the preparation of this Modification Application. Details are set out in Table 3.

Table 3 - Consultation during preparation of application

Stakeholder	Date	Issues raised
Roads and Maritime Services (RMS)	4 December 2013 21 January 2014	• Intersection performance • Traffic movements and management • Impacts on bus layover area north of Rouse Hill Drive • Construction staging and timing
NSW Heritage Office (including Office of Environment and Heritage)	8 January 2014 (via phone/email)	• No concerns provided there is no additional impact to known heritage items
Environment Protection Authority (EPA)	15 January 2014 (via email)	• No concerns raised
The Hills Shire Council	13 January 2014	• Residential areas within council area noted • No concerns raised provided appropriate statutory processes followed
Blacktown City Council	15 January 2014	• Visibility of structures from Rouse Hill House • Safeguarding for any requirement for future upgrades to Windsor Road • Consultation with other stakeholders (GPT, RMS, The Hills Shire Council)
UrbanGrowth NSW	22 January 2014	• Potential to act as an urban marker for the Town Centre • Relationship to future development of the Rouse Hill Town Centre Northern Precinct • Construction staging and timing • Provision for future pedestrian crossing to Area 20
Historic Houses Trust	10 January 2014	• Visibility of structures from publicly accessible areas of Rouse Hill House • Changing urban context of locality acknowledged

Stakeholder	Date	Issues raised
Castlebrook Lawn Cemetery and Crematorium	9 January 2014	• Visibility of structure from memorial gardens • Noise from train movements, particularly when memorial services are occurring
GPT	19 December 2013	• Reduced impacts to Windsor Road noted • Potential for the bridge to become an urban marker noted
Rouse Hill Heights Action Group	15 January 2014	• Operational noise, including from the curved bridge structure • Security on the viaduct and bridge to prevent trespass • Potential for drivers to be distracted by the movement of a train across the bridge • Design standards for earthquake protection • Design standards to mitigate impacts in the event of train derailment • Other operational issues (commuter parking, bus connections, rapid transit rail facility, land use change)
The Ponds Community Facilitators	15 January 2014 (via phone)	• No issues to date

As part of the ongoing community consultation, the project team will communicate the proposed change and potential impacts outlined in the modification to local residents and businesses via:

- Door knocking
- Letter box drops
- Community newsletters
- Maps and diagrams
- One-on-one meetings
- Community Information Session and
- The project website.

7 Changes to Environmental Impact

7.1 Assessment of Change in Environmental Impacts

The changed environmental impacts associated with the proposed modification of SSI-5414 (Stations, Rail Infrastructure and Systems) are identified in this section.

The process to determine the changed impacts has included:

- Consideration of each component of the modification against a list of environmental categories to identify whether there would be a potential change in environmental impact compared to the approved project;
- Response against relevant matters raised in the Director General's requirements for SSI-5414; and
- Determination of whether the identified change in environmental impact is potentially significant and warrants further assessment.

Changes in environmental impacts associated with the proposed modification are identified in Table 4. Further assessment has been undertaken for the following environmental areas where there is potential for a significant change in environmental impact:

- Traffic and transport
- Noise and vibration
- European heritage
- Local business impacts
- Land use and community facilities
- Visual amenity.

For each key environmental area, the approved impacts are compared with the impacts associated with the proposed modification. The outcomes of the further assessment are presented in the following sections.

A summary is provided in Section 7.7 for the environmental areas where the modification would not give rise to significant changes. This includes soils and groundwater, indigenous heritage, climate change and greenhouse gas, surface water and hydrology, general waste management or cumulative Impacts.

Table 4 - Change in environmental impacts

Proposed Modification	Soils & groundwater	Traffic and transport	Noise and vibration	European heritage	Indigenous heritage	Local business impacts	Land use and community	Ecology	Visual amenity	Climate change and greenhouse	Surface water and hydrology	Air quality	General waste management	Cumulative impacts
Bridge structure	X	✓	✓	✓	X	✓	X	X	✓	X	X	X	X	X
Integration with viaduct and Rouse Hill Station	X	✓	X	X	X	✓	X	X	✓	X	X	X	X	X

✓ = potential significant change, X = no potential significant change

7.2 Traffic and Transport

Approved impacts

Potential operational traffic impacts associated with the NWRL would arise primarily from the modification of existing transport infrastructure, the addition of new transport generating precincts and change to vehicle traffic, pedestrian use and cycling within precincts and on surrounding roadways.

Changes to the wider transport network (vehicle traffic, pedestrian use and cycling) were not associated with the rail infrastructure crossing Windsor Road.

However, changes to intersection arrangements were identified, including:

- The Windsor Road / Rouse Hill Drive / Schofields Road intersection would operate with a Level of Service (LoS) of F, irrespective of the NWRL, indicating unsatisfactory levels of delay. Both the Windsor Road northern approach and the right turn from Schofields Road are also predicted to have a degree of saturation (DoS) of over 0.9, again irrespective of whether the NWRL is completed
- The key contributing factor to this congestion is the predicted traffic growth for the Windsor Road corridor itself, and in particular the right turn movement from Schofields Road to Windsor Road
- A number of potential measures may be available to improve the capacity of the Windsor Road / Schofields Road intersection, such as converting a through lane on Schofields Road to a right turn lane, and possibly rationalising the intersection traffic signal phasing.

The viaduct structure would result in at least two piers and expanded medians located within Windsor Road requiring adjustment to the configuration of traffic lanes. However, the new piers would be designed to allow efficient and safe traffic flow. The piers would also allow a future grade separation of Windsor Road and Schofields / Rouse Hill Drive.

Within Area 20 the viaduct and embankment would allow for the implementation of Precinct planning, including the provision of a local road under the embankment.

Impacts as a result of the Modification

Potential operational traffic impacts associated with the modification would overall be beneficial. The new bridge structure would not affect the use of existing transport infrastructure, specifically Windsor Road and the intersection at Schofields Road / Rouse Hill Drive.

Changes to the wider transport network (vehicle traffic, pedestrian use and cycling) are unrelated to the Windsor Road crossing.

The bridge would result in an extended span length in the area north of Rouse Hill Station. This would reduce the number of piers needed in a congested area.

The modification would allow more efficient intersection arrangements to be implemented (less change to road geometry, lane configurations and at-grade pedestrian crossings) due to the removal of piers within Windsor Road and longer span over Rouse Hill Drive. The revised traffic model outputs for the Windsor Road and Schofields Road / Rouse Hill Drive intersection and adjacent intersections are shown in Table 5.

Table 5 – Rouse Hill End State (2021) Linsig Traffic Model Outputs, Jan 2014

	Scenario 10				Scenario 10a			
	AVD	LoS	DoS	Ave Que length (m)	AVD	LoS	DoS	Ave Que length (m)
AM Peak								
Windsor Rd / Commercial Rd								
North	60	E	96	154	58	E	95	149
South	43	D	94	177	42	C	94	177
East	50	D	27	17	50	D	27	17
West	198	F	112	49	198	F	112	49
Overall	65	E	112		64	E	112	
Windsor Rd / Rouse Hill Drive								
North	58	E	91	274	59	E	91	280
South	38	C	85	200	37	C	85	203
East	46	D	55	49	46	D	56	50
West	63	E	92	68	63	E	92	68
Overall	51	D	92		51	D	92	
Windsor Rd / White Hart Drive								
North	60	E	93	373	61	E	92	374
South	24	B	64	108	24	B	63	106
East	36	C	64	3	36	C	63	3
West	134	F	15	0	134	F	15	0
Overall	46	D	93		46	D	93	
PM Peak								
Windsor Rd / Commercial Rd								
North	32	C	78	133	29	C	68	106
South	33	C	88	235	29	C	84	219
East	89	F	92	65	80	F	87	51
West	97	F	90	35	88	F	83	36
Overall	43	D	92		38	C	87	
Windsor Rd / Rouse Hill Drive								
North	39	C	85	248	35	C	81	271
South	91	F	97	216	69	E	95	248
East	108	F	98	88	91	F	98	88
West	48	D	63	37	59	E	86	39
Overall	73	F	98		62	E	98	
Windsor Rd / White Hart Drive								
North	39	C	89	215	50	D	91	241
South	38	C	92	183	38	C	91	192
East	45	D	85	8	49	D	87	10
West	185	F	23	0	186	F	23	0
Overall	39	C	92		44	D	92	

Terms

AVD – Average Delay per Vehicle (AVD) in seconds that each vehicle incurs in waiting to pass through the intersection during the peak period

LoS – Level of service is a qualitative measure describing operational conditions within a traffic stream, and their perception by motorists and/or passengers. A level of service definition generally describes these conditions in terms of factors such as speed and travel time, freedom to manoeuvre, traffic interruptions, comfort and convenience, and safety. In general there are six levels of service, designated A to F, with a level of service A representing the best operating condition (i.e. free flow) and level of service F the worst (i.e. forced or breakdown flow).

DoS – Degree of Saturation is the ratio of arrival flow (demand) to the capacity of the intersection during the same period.

Notes:

1. Scenario 10 = dual right turn bays in Rouse Hill Drive.
2. Scenario 10a = triple right turn bays in Rouse Hill Drive.
3. All scenarios assume 140 second cycle time.

The bridge piers would be located outside the road reserve of Windsor Road, allowing efficient and safe traffic flow. The support structures would also allow any future grade separation of Windsor Road and Schofields Road / Rouse Hill Drive.

The bridge footing to the north of Rouse Hill Station would be designed to maintain functionality of the T-way, including the approved new bus layover between the future Northern Precinct development and Windsor Road.

The traffic analysis reaffirms that the revised intersection arrangements at the Windsor Road and Schofields Road / Rouse Hill Drive intersection will result in the same or better peak period intersection operation in 2021 compared to the approved impacts. This is also the case for the signalised intersections on Windsor Road to the north and south of Rouse Hill Drive. In this regard the proposed modification assists in mitigating peak period intersection operation at these locations.

The western abutment would not alter Precinct planning outcomes for Area 20.

Summary

Potential operational traffic impacts remain largely unchanged or slightly improved as a result of the modification. Importantly, the cable stayed bridge over Windsor Road would remove the requirement for permanent piers and other structures within the road reserve resulting in a more efficient, safe and legible journey for vehicular traffic and pedestrian movements along Windsor Road. In addition, construction of any future grade separation would be less complicated.

7.3 Noise and Vibration

Approved impacts

Potential noise and vibration impacts associated with operation of the NWRL would include airborne operational noise, ground-borne operational vibration and ground-borne operational noise.

Increased levels of noise emission can occur in areas where there are tight radius curves where flanging noise or curve squeal may occur. The viaduct crossing over Windsor Road would have the potential for increased noise emissions as a result of the (approximate) 400 metre radius curve.

Structure radiated noise from some types of rail bridges can increase overall levels of noise emission. The approved viaduct would comprise concrete box girder sections with concrete spans which are quieter than other construction methods. The viaduct would also include noise barriers 1 m above rail level to reduce airbourne noise; and resilient rail fasteners to minimise structure-radiated noise.

The closest residential receiver to the rail alignment over Windsor Road is 798 Windsor Road, Rouse Hill. There are also the commercial buildings along the western frontage of Rouse Hill Town Centre and the future Northern Precinct. Residential buildings are located within the Rouse Hill Town Centre (more than 200 m). Other sensitive receivers include the Castlebrook Lawn Cemetery and Crematorium.

Noise levels at the closest receiver (798 Windsor Road) were predicted to comply with the operational noise trigger levels.

Further noise modelling of future noise predictions at the Rouse Hill Town Centre future Northern Precinct were undertaken for information purposes in response to concerns raised by the landowner about impacts on future residential development. The modelling provides indicative noise levels for future buildings, which may be residential, to assist design of the development to meet the internal noise levels required by *State Environmental Planning Policy (Infrastructure) 2007*.

Impacts as a result of the Modification

The bridge would be designed to achieve compliance with the approved noise emissions based on a maximum radiated sound pressure level of 70dBA for a train speed of 80 km/h measured at a height of 1.5m above ground level. Relevant design considerations are:

- The bridge would comprise concrete box girder sections with concrete spans that would be comparable to the approved viaduct structure. The rail alignment, including the (approximate) 400 metre radius curve, would remain identical
- The bridge parapets would include acoustic treatment.

The bridge is predicted to comply with operational noise trigger levels at existing sensitive receivers.

The bridge would not be expected to alter the predicted indicative noise levels for future buildings along the western frontage of the Rouse Hill Town Centre Northern Precinct.

Summary

Potential operational noise impacts are largely unchanged as a result of the modification. The materials and design of the cable stayed bridge would be comparable to the approved viaduct. The bridge would include noise attenuation measures to ensure noise emissions would be consistent with the approved noise and vibration impacts. Relevant existing mitigation measures that would be applicable to the proposed modification are reproduced in Section 8.

7.4 European Heritage

Approved impacts

Heritage items in the vicinity of the site with potential to be impacted by the NWRL were identified as:

- Battle of Vinegar Hill (memorial), 712 Windsor Road (Blacktown LEP Heritage Schedule)
- Former Royal Oak Inn (now Mean Fiddler Hotel), 2 Commercial Road, Rouse Hill (State Heritage Register)
- Rouse Hill House and Farm, Windsor Road, Rouse Hill (State Heritage Register).

The assessment of potential impacts concluded that removal of trees in views south along Windsor Road from the Royal Oak Inn could result in an impact on the visual setting of the heritage item. However, the trees to be removed were assessed as being a substantial distance from the hotel, resulting in a neutral impact.

Analysis of the topography of the land that lies between Rouse Hill House and Rouse Hill Town Centre suggests that the potential impact of the NWRL upon the Rouse Hill House property or its extended visual curtilage would be negligible.

Impacts as a result of the Modification

Battle of Vinegar Hill (memorial)

The Battle of Vinegar Hill Memorial is located in an elevated position within the Castlebrook Cemetery at 712 Windsor Road, Rouse Hill. The memorial site is approximately 400 metres (south) away from the cable stayed bridge. However, the actual place where the event occurred has not been determined with certainty. Given that the memorial is a place of reflection, changes to the visual outlook from the memorial is not considered to have any adverse impact upon the Battle of Vinegar Hill Memorial.

Former Royal Oak Inn

The removal of trees in views south along Windsor Road from the Mean Fiddler Hotel could still result in an impact on the visual setting of the former Royal Oak Inn. However, the trees to be removed would remain a substantial distance from the hotel, and therefore this impact is considered to be neutral.

Any views of the bridge towers from the Mean Fiddler Hotel, which is set back from and lower than Windsor Road, would be filtered.

Rouse Hill House and Farm

Rouse Hill House is particularly sensitive due to its heritage significance. Although the property is 2.5 kilometres to the north, it is expected that the upper section of the bridge towers would be visible looking south from parts of the garden and around the outbuildings.

Visibility of the bridge would in part be reduced by topography, including a small hill that separates the heritage property from the bridge location. However, it is expected that there would be a moderate adverse visual impact upon the Rouse Hill House.

Summary

The introduction of a cable stayed bridge over Windsor Road would be noticeable from parts of the garden and around the outbuildings of Rouse Hill House. However, the bridge would be comparable with other elements of the changing urban landscape of the locality, and would be relatively minor against the skyline. Further details are contained in Appendix B.

Detailed design measures are recommended to further mitigate the reduction in visual amenity (refer Section 8 and Appendix B). Other potential heritage impacts as a result of the bridge remain negligible.

7.5 Local Business Impacts

Approved impacts

The NWRL transport infrastructure, and in particular Rouse Hill Station, would provide enhanced accessibility to businesses at the Rouse Hill Town Centre. In particular, a number of businesses in the locality would benefit from the increase in passing trade.

Impacts as a result of the Modification

Local business impacts associated with the modification would be unchanged. Local businesses within the locality would still benefit from enhanced accessibility and the increase in passing trade.

The iconic qualities of the bridge may offer additional benefits to businesses through association with an urban marker, providing a reminder for customers to the location of local businesses.

Summary

The introduction of a cable stayed bridge over Windsor Road would be visible from some local businesses providing a visual cue for drivers and passengers approaching the Rouse Hill Town Centre.

7.6 Visual Amenity

Approved impacts

Impacts on visual amenity as a result of the NWRL would range from a considerable reduction or improvement in visual amenity to a noticeable change or no perceived reduction or improvement in visual amenity. The significance of the visual impact would be relative to the visual sensitivity of the location.

The likely visual impacts of the viaduct crossing over Windsor Road ranged from moderate adverse for vehicles travelling along Windsor Road; to minor adverse on Rouse Hill Drive and from the Castlebrook Lawn Cemetery and Crematorium; to negligible in other locations.

Impacts as a result of the Modification

The proposed bridge would be located in an area of undulating topography. The topography, combined with established trees in the area, would obscure views of the bridge, especially from the west, north west and south east. Future development of the Rouse Hill Town Centre future Northern Precinct will also affect possible future views towards the bridge.

A summary assessment of the visual modification is provided in Table 6. Appendix B provides the full technical report.

Table 6 - Visual modification due to proposed bridge

View	EIS 2 Assessment (viaduct)	Visual modification due to proposed bridge
Windsor Road looking north	Moderate adverse impact	Considerable improvement with moderate beneficial impact as a result of the landmark characteristics of the bridge for the local area
Rouse Hill Drive looking west	Minor adverse impact	Negligible change, particularly in the context of likely future development of the Rouse Hill Town Centre Northern Precinct and the oblique view towards the bridge from this location.
Schofields Road looking east	Negligible impact	Negligible change, particularly in the context of likely future development of the Rouse Hill Town Centre Northern Precinct.
Windsor Road looking south	Moderate adverse impact	Considerable improvement with moderate beneficial impact as a result of the landmark characteristics of the bridge for the local area.
Castlebrook Lawn Cemetery and Crematorium looking north	Minor adverse impact	Noticeable reduction as the bridge towers would rise above the trees creating a noticeable structure against the skyline. The changed impact is assessed as moderate adverse particularly given the sensitivity of the site.

View	EIS 2 Assessment (viaduct)	Visual modification due to proposed bridge
Rouse Hill House and Farm looking south	Negligible impact	Noticeable reduction in visual amenity as the bridge towers would rise above the trees creating a noticeable structure against the skyline. The changed impact is assessed as moderate adverse particularly given the heritage significance of the site.
Withers Road looking east	N/A	Negligible visual impact.

Summary

The proposed bridge would create a local landmark at the Windsor Road crossing of the NWRL. The change would reinforce the location of the Rouse Hill Town Centre within the locality, an outcome consistent with its importance as a major centre. Possible future taller developments in the locality would reduce the contrast between the bridge and surrounding context, reducing the likely long term impact.

Impacts on wider regional views would be negligible as the bridge towers would be comparable with other elements in the changing urban landscape. Two detailed design opportunities have been identified to further improve any visual impact of the proposed bridge (refer Section 8).

7.7 Areas with No Significant Change

Issues considered to have no significant change to the approved impacts are summarised in Table 7.

Table 7 - Areas where no significant change is likely

Area	Approved impacts and known conditions	Proposed change
Soils and groundwater	The site is within the Blacktown Soil Landscape, Ashfield Shale geological region and an area of moderate soil salinity potential.	The potential impacts on soils and groundwater as a result of the change would be neutral.
Indigenous heritage	The site has a low level of previous impact (vegetation stripping and grazing). A potential archaeological deposit (NWRL PAD 11), identified on the western side of Windsor Road at Schofields Road, is expected to have a low level of archaeological potential.	Construction of the proposed bridge would not alter approved impacts on the western side of Windsor Road.
Ecology	Cumberland Plain Woodland vegetation in poor condition was recorded at the north western corner of the Windsor Road/Schofields Road intersection. Vegetation on the eastern side of Windsor Road comprises planted/exotic species.	No additional clearing would be undertaken. The proposed modification would not alter the approved impacts.
Climate change and greenhouse	A range of risks and adaptation responses would be incorporated into the NWRL stations, rail infrastructure and systems.	The proposed modification would not alter the approved risks or adaptation measures.
Surface water and hydrology	The site is within the catchment of Second Ponds Creek. The Windsor Road viaduct would have a negligible impact on local flooding characteristics.	The proposed modification would not alter the approved impacts.
Air quality	The NWRL would result in generally improved air emission impacts during operation through reduction in private vehicle trips on a region-wide scale.	The proposed modification would not alter the approved impacts.
General waste management	Operation of the NWRL would not generate significant adverse waste impacts. Mitigation measures are included to minimise impacts during construction.	The proposed modification would not alter the approved impacts.
Cumulative impacts	The NWRL would support transformation of the lands along the Schofields Road and along the NWRL corridor including improved travel conditions and connectivity.	The proposed modification would not change the approved impacts.

8 Mitigation of Environmental Impacts

Existing mitigation measures as identified in Section 9 of the Submissions Report for Stage 2: Stations, Rail infrastructure and Systems (March 2013) and the Minister's Conditions of Approval for SSI-5414 (on 8 May 2013) are considered appropriate to manage the potential impacts of the modification.

Condition C44 of the approval requires the preparation and implementation of an Urban Design and Corridor Landscape Plan for the NWRL permanent built works and landscaping. The condition requires, in part, the design details of built elements such as bridges to minimise impacts on adjoining residences, educational facilities, open space areas and heritage items and landscapes. Relevant design standards, including *Bridge Aesthetics Design guidelines to improve the appearance of bridges in NSW* (2012) are required to be considered.

All existing mitigation measures from the EIS 2 Submissions Report that apply to the approved crossing over Windsor Road are relevant to the proposed modification. Mitigation measures of particular relevance to the modification are reproduced in Table 8.

Table 8 - Existing mitigation measures of particular relevance to the proposed bridge

No.	Mitigation Measure
Noise and Vibration OpNV1	The implementation of feasible and reasonable noise and vibration mitigation measures such as: • One metre high noise barriers with absorptive facing between Bella Vista Station and Cudgegong Road Station, except where the track is in cutting. • For the viaduct section, noise barriers located on the outer edge of both sides of the structure. • For the surface track, noise barriers positioned as close as possible to the train taking into account access and safety requirements.
Noise and Vibration OpNV3	The implementation of feasible and reasonable noise and vibration mitigation measures such as: • Rail dampers provided between Kellyville Station and Cudgegong Road Station, except in the immediate vicinity of stations where train speeds are lower.
Noise and Vibration OpNV4	The implementation of feasible and reasonable noise and vibration mitigation measures such as: • Resilient rail fasteners provided on the viaduct and rail bridges.
Noise and Vibration OpNV4	During detailed design, options would be investigated to reduce airborne noise along the viaduct and surface track sections where exceedances have been predicted.

Ecology OpE6	To reduce disturbance to bats and nocturnal birds where reasonable and feasible, a range of measures would be undertaken, such as: • Artificial lighting would be directed to where it is needed and in a downwards orientation to avoid light spillage, Artificial light would be positioned to face away from areas of native vegetation. • Low-pressure sodium lamps would be used instead of high-pressure sodium or mercury lights. Where mercury lights are used, UV filters would be fitted. • The brightness of lights would be reduced to as low as legally possible, and in conformance with workplace health and safety standards.
Visual Amenity OpV2	Cut-off and directed lighting would be used to ensure glare and light spill on surrounding existing and future residents are minimised.
Visual Amenity OpV10	The design and ongoing maintenance of the project would adopt CPTED principles, including the maintenance of unobstructed views into and outside of underpasses, effective drainage and ventilation, wide corridors and appropriate lighting.

Two specific design opportunities have been identified in addition to further improve any visual impact of the proposed bridge (OpV11 and OpV12) as set out in Table 9.

Table 9 - New mitigation measures to be applicable to the proposed bridge

No.	Mitigation Measure
Visual Amenity OpV11	The design process for the Windsor Road bridge would consider opportunities to review the proportions of the bridge towers to ensure a proportionally elegant structure.
Visual Amenity OpV12	The Windsor Road bridge towers would be light and neutral in colour to minimise the contrast where they would be seen against the sky.

9 Conclusion

Pursuant to section 115ZI of the *Environmental Planning and Assessment Act 1979*, Transport for NSW is seeking the Minister for Planning and Infrastructure's approval to modify the NWRL Stage 2: Stations, Rail Infrastructure and Systems (SSI-5414) approval. The proposed modification is to provide a cable stayed bridge over Windsor Road incorporating the following elements:

- Bridge structure including cable-stays and associated vertical supports
- Integration with viaduct and Rouse Hill Station.

The modification does not result in consequential changes to the NWRL Stage 1: Major Civil Construction works approval.

The cable stayed bridge over Windsor Road provides a unique opportunity to create an urban marker on the approach to the Rouse Hill Town Centre. The bridge would provide an elegant design solution and avoid complex construction activities within the road reserve of Windsor Road. Importantly, the changes to environmental impacts are manageable through application of the existing mitigation measures and Conditions of Approval.

Two specific design opportunities have been identified in addition to further improve any visual impact of the proposed bridge.

Appendix A Photomontages



Windsor Road Bridge, Rouse Hill Modification Report



Windsor Road Bridge, Rouse Hill Modification Report



Windsor Road Bridge, Rouse Hill Modification Report

Appendix B Visual Impact Assessment

Appendix C Noise Impact Assessment