THE HILLS Sydney's Garden Shire

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28 May 2012

Ms Diane Sarkies
A/Manager - Rail and Ports
Infrastructure Projects
NSW Planning & Infrastructure
GPO Box 39
SYDNEY NSW 2001

Your Ref: SSI-5100
Our Ref: 98500591

Dear Ms Sarkies

North West Rail Link - Notice of Exhibition
Staged State Significant Infrastructure Modification (MP 06_0157)
State Significant Infrastructure Application – Major Civil Constructions Works (SSI-5100)

I refer to your letter dated 3 April 2012 inviting Council to make a written submission on the Environmental Impact Statement (EIS) as well as Council's responses dated 2 May and 21 May 2012.

A report on Council's response to EIS1 was considered by Council at its Ordinary Meeting of 22 May 2012 and a copy of this report, together with a copy of Council's Resolution, is attached for your information.

Please note that item 8.3 of the report refers to Old Castle Hill Road, this should read "Castle Hill Road".

Should you require any further information please do not hesitate to phone me on 9843 0105.

Yours faithfully

Michael Edgar
GROUP MANAGER - STRATEGIC PLANNING

English:

This letter contains important information. If you do not speak English and require a translation/interpreter you can either:

- *Come to Council's Administration Centre where we will be happy to assist*
- *Contact the Telephone Interpreter Service on 13 14 50 and ask them to call Council on 9843-0555 and enquire on your behalf.*

Arabic

هذه الرسالة تحتوي على معلومات هامة. إذا كنت لا تتكلم الإنجليزية وتحتاج الى ترجمة/مترجم فيمكنك أن:

- تأتي إلى مركز إدارة المجلس حيث يساعدنا أن نساعدك
- تتصل بخدمة الترجمة الهاتفية على ١٣١-٤٥٠ واطلب منهم الإتصال بالمجلس على ٩٨٤٣-٠٥٥٥ ويقوموا بالإستفسار بالنيابة عنك.

Korean

이 편지는 중요한 정보를 포함하고 있습니다. 만일 영어를 몰라서 번역이나 통역이 필요하시면 다음 중 한 가지를 하십시오:

- 카운슬의 행정 센터로 오시면 저희가 기꺼히 도와 드립니다.
- 전화 13 14 50 로 전화 통역 서비스에 연락해서 통역에게 9843-0555로 카운슬에 전화하여 당신 대신에 문의해 달라고 부탁하십시오.

Italian

Questa lettera contiene informazioni importanti. Se non parli inglese e hai bisogno di una traduzione o di un interprete puoi:

- o venire all'ufficio amministrativo centrale del municipio *(Council's Administration Centre)* dove saremo ben lieti di aiutarti.
- o contattare il servizio telefonico d'interpretariato *(Telephone Interpreter Service)* al numero 13 14 50 e chiedere loro di chiamare il municipio al numero 9843-0555 e chiedere ragguagli per te.

Chinese

這封信包含有重要的訊息，如果您不會說英語和要求一個翻譯員／傳譯員，您可以：

- 來市議會的行政中心，我們很樂意幫助您。
- 打電話 13 14 50 到電話傳譯服務處，請他們打電話9843-0555到市議會幫您諮詢有關詳情。

Greek

Το γράμμα αυτό περιλαμβάνει σημαντικές πληροφορίες. Αν δεν μιλάς Αγγλικά και χρειάζεσε μετάφραση/διερμηνέα μπορείς να:

- Έλθεις στο Δοιηκηπκό Κέντρο της Δημαρχείας όπου ευχαρίστως θα σε βοηθήσουμε, η
- Τηλεφώνησε στη Τηλεφωνική Υπηρεσία Διερμηνέων στο 13 14 50 και πες τους να τηλεφωνήσουν στη Δημαρχεία στο 9843-0555 και να ζητήσουν πληροφορίες εκ μέρους σου.

ITEM	**NORTH WEST RAIL LINK - ENVIRONMENTAL IMPACT STATEMENT 1**
THEME:	Balanced Urban Growth
HILLS 2026 OUTCOME/S:	BUG 1 I can get where I need to go.
COUNCIL STRATEGY/S:	BUG 1.1 Facilitate the provision of integrated transport alternatives that link residents to their home, places of work and services and facilities.
GROUP:	**STRATEGIC PLANNING**
AUTHOR:	**GROUP MANAGER – STRATEGIC PLANNING** MICHAEL EDGAR **MANAGER – OPERATIONS** MICHAEL LATHLEAN
RESPONSIBLE OFFICER:	**GENERAL MANAGER** DAVE WALKER

EXECUTIVE SUMMARY

The Environmental Impact Statement 1 (EIS 1) for the construction of the Northwest Rail Link (NWRL) has been placed on public exhibition. Comments close on the 21st May 2012. The purpose of this report is to assess EIS1 and consider the impacts arising from the construction of the NWRL and to form a submission on behalf of The Hills Shire Council.

EIS1 does bring home the magnitude of the NWRL project. It also makes obvious that a project of this scale will have impacts on the existing established community that will be difficult to ameliorate let alone eliminate. Nevertheless, the economic and social benefits this project will deliver to our current and future residents and our region cannot be underestimated.

The EIS has been assessed by a number of Council's Officers during the exhibition period and this report outlines the issues, provides some assessment and gives recommendations for Council to consider. Critically, issues surrounding the impacts of noise, vibration, ecology, traffic, heritage and geology have been identified in this report.

It is essential that the project delivery incorporate engagement activities that allow the community to be involved in the projects actual delivery. This will help manage the impacts on residents by providing an opportunity for them to influence and feel part of the project. Community liaison or reference groups that include key staff would provide a successful model.

HISTORY

Nov. 1998 Action for Transport 2010 published which identified a proposed railway from Epping to Castle Hill (by 2010) and Rouse Hill (post 2010).

03.03.2001 Council considered a report on the Balmoral Road Release Area and resolved (in part) that:

5. *In view of the importance of the Rouse Hill Regional Centre and the Balmoral Road Release Area, a formal request be made to the Minister for Transport to publicly release the consultant's report relating to the proposed heavy rail link from Castle Hill to Mungerie Park Regional Centre.*

07.08.2001 Council considered a status report on the Balmoral Road Release Area and resolved (in part) that:

2. *The Department of Transport be advised that the preferred alignment for the rail corridor is located adjoining Old Windsor Road north of the Norwest Business Park and the corridor be either "cut and cover" or underground.*

3. *The Department of Transport be requested to finalise and publicly release the alignment of the rail corridor from Castle Hill to Mungerie Park and specifically through the Balmoral Road Release Area.*

24.10.2001 Council received a letter from the Department of Transport stating that the Overview Report for the North West Rail Link, which will include the preferred alignment of the rail line, *"...is expected to be released towards the end of 2001"*.

10.03.2002 The Minister for Transport released the Overview Report for the North West Rail Link. The report was on exhibition until 3 May 2002 and submissions closed on the same day.

13.03.2002 Copies of the Overview Report obtained and circulated to Councillors.

16.04. 2002 Briefing to Councillors by Department of Transport.

23.04. 2002 Report to Council including a formal submission to State Government.

2003 to 2005 Economic Feasibility and projected patronage studies completed by State Government.

20.07.2006 Status Report to Council on North West Rail Link.

30.11.2006 North West Rail Link Environmental Assessment referred to Council.

18.01.2007 Preliminary Precinct Planning Workshops for each station held at Council with Transport Infrastructure Development Corporation (TIDC) representatives.

30.01.2007 Council considered a report at its Extraordinary meeting on 30 January 2007 on the exhibited Environmental Assessment and resolved to forward a submission in support of the project subject to all of the alignment being underground and the project being undertaken in a single stage.

31.01.2007 Council submission to the Department of Planning.

01.06.2007 Letter received from TIDC advising of exhibition of the Preferred Project Report. Report addresses issues raised in submissions to the Environmental Assessment and describes modifications to the project. It still does not address Council's objection to the elevated viaduct between the proposed Balmoral Station and Rouse Hill Station or the objection to the delivery of the project in two stages.

06.06.2007 Exhibition of preferred Project Report.

17.07.2007 Council considered a report on the preferred Project Report at its Ordinary meeting on 17 July 2007 and resolved:

1. *Council objects to the two staged delivery proposal and prefers to have the rail link between the Main Northern Line and Rouse Hill constructed as a single project with the Burns Road Station being the commencement point for construction. Council requests that the Final Statement of Commitments for the project be amended to reflect Council's preference.*
2. *Council endorses and supports the proposed lead tunnel extensions to facilitate connections to Parramatta via Carlingford. Such rail access via Carlingford supports Council's initiatives to increase population densities around the existing Carlingford rail station and encouraging transport orientated urban renewal of Carlingford.*
3. *The resources that Council will require for involvement during the construction and planning phase of the project will be significant. It is considered appropriate that the State Government provide financial assistance to Council to ensure a smooth delivery and gain maximum benefit from the investment in the North West Rail Link. Accordingly, Commitment No.6 should be amended to insert at the end of the paragraph "Grant funding opportunities will be explored with local council's to ensure local land use planning provisions reflect an integrated planning outcome within the vicinity of stations".*
4. *Council maintain its opposition to the proposed viaduct on social, economic and visual grounds and TIDC be requested to formulate alternate options to address Council's concerns.*
5. *Council requests that the railway be extended beyond Rouse Hill to establish a connection to the existing Richmond Line as part of the current concept plan providing an alternate route for rail movements and increased level of service to the population of the North West.*

25.07.2007 Council submission to the Department of Planning in accordance with resolution.

18.03.2008 NSW Government reaffirms its commitment to build a new rail line to the North West of Sydney but in the form of a Metro linking Rouse Hill to Epping and then following an alignment through Top Ryde, Gladesville, Drummoyne, Rozelle and Pyrmont.

31.03.2008 In response to the submissions on the Preferred Project Report, a Supplementary Submissions Report prepared by TIDC was submitted to Department of Planning.

08.04.2008 Mayoral Minute 10/2008 considered by Council at its Ordinary meeting on 10 April 2008. Council resolved:

1. *Council re-affirm its previous requests to the State Government for it to commit to a secure and permanent future for the Castle Hill Showground in view of its value to the Baulkham Hills Shire community as a recreational and cultural asset.*
2. *Council objects to construction of the North West Metro Link from the Hills Centre and prefers instead to have the link constructed in a single project from Burns Road where land has been appropriately zoned for this purpose and is close to major transport links.*
3. *The North West Metro Link should incorporate connection from Carlingford to Epping to support the planned increased housing*

densities in this location.

4 *Council maintain its opposition on any of the Metro Link being located above the ground surface on viaducts on social, economic and visual grounds.*

21.04.2008 Correspondence forwarded to TIDC advising of Council's resolution.

06.05.2008 Western portion of the Metro Link from Rouse Hill to Epping approved by Minister for Planning under Part 3A of the EP & A Act.

13.5.2008 Mayoral Minute 14/2008 considered by Council at its Ordinary meeting on 13 May 2008. The Mayoral Minute provided details on the outcome of a meeting with the then Deputy Premier and Minister for Transport to discuss the proposed North West Metro Rail Link and Council's previous submission. Council resolved that the Mayoral Minute be received.

31.10.2008 NSW Government announces North West Metro Link project deferred indefinitely.

March 2011 Incoming NSW Government announces its intention to fast track the North West Rail project.

June 2011 Castle Hill Community Information Centre opened.

July 2011 Project Overview Report released.

July 2011 Community and business consultation about Project Overview Report commences.

14.12.2011 Application submitted to Department of Planning and Infrastructure (DP & I) to modify the previous staged infrastructure approval. Proposed modifications to include:

- Change the North West Rail Link definition as a result of the proposed modifications.
- Relocate Kellyville Station from the vicinity of Burns Road, Kellyville to the vicinity of Samantha Riley Drive, Kellyville.
- Provide additional stations at Bella Vista and Cudgegong Road.
- Minor changes to the location of The Hills Centre Station.
- Change the Area 20 route alignment with a route alignment parallel to Schofields Road and through the Area 20 Precinct as shown in the Area 20 Draft Precinct Planning Package (Department of Planning and Infrastructure, May 2011).
- Vertical alignment changes between Bella Vista and Rouse Hill.

Application identifies that two State Significant Infrastructure Applications will also be submitted for Stage 1 (major civil construction works) and Stage 2 (construction and operation of stations, rail infrastructure and systems). Each application is to include its own Environmental Impact Statement (EIS).

03.02.2012 DP & I Director General's assessment requirements under Sections 115ZI and 115Y of the EP & A Act released.

02.04.2012 Advice received from Transport for NSW (TfNSW) that EIS Stage 1 will be on public exhibition from 4 April until 21 May 2012.

30.04.2012 Update briefing to Councillors from North West Rail Link Project Team.

REPORT

INTRODUCTION

The North West Rail Link (NWRL) is a key priority railway transport infrastructure project for the NSW Government. The NWRL is a key part of the NSW Government's strategic transport and land use plan for Sydney. The project extends the connectivity of the existing rail network and improves the availability of public transport access to existing residential areas as well as future growth centres in the north west.

Since the Concept Plan Approval was granted for the project in 2008, further strategic planning and project development has occurred. Rather than a Metro line, the project is now proposed to be integrated with the existing City Rail heavy rail network and reach further into the North West Growth Centre (NWGC).

The project proponent is Transport for New South Wales (TfNSW) which is the lead agency of the NSW Transport portfolio. A specialised Project Team has been established within TfNSW to coordinate and expedite the work.

The key features of the project include:

- Connection with City Rail lines in existing tunnels immediately north of the underground Epping to Chatswood link platforms at Epping Station.
- 15 km rail line between Epping and Bella Vista in twin underground tunnels.
- 1.2 km rail line in cutting from Bella Vista tunnel portal near Celebration Drive to Memorial Drive.
- 4 km above ground 'Skytrain' viaduct between Memorial Drive and Rouse Hill.
- Final part of the alignment between Rouse Hill and the proposed Tallawong stabling facility to be a combination of viaduct, embankments, cuttings and at ground level.
- Underground stations at Cherrybrook (Franklin Road), Castle Hill (Arthur Whitling Park), The Hills Centre and Norwest (Norwest Boulevarde).
- Station at Bella Vista within a cutting north of the Celebration Drive tunnel portal.
- Stations at Kellyville (Samantha Riley Drive) and Rouse Hill (Rouse Hill Town Centre) to be elevated.
- Station at Cudgegong Road within a cutting.
- Tallawong stabling facility immediately west of Tallawong Road and parallel to Schofields Road.
- Services facilities at Epping and Cheltenham to provide for ventilation plant and equipment, as well as emergency access and equipment.

A plan of the route of the NWRL is shown in Figure 1.

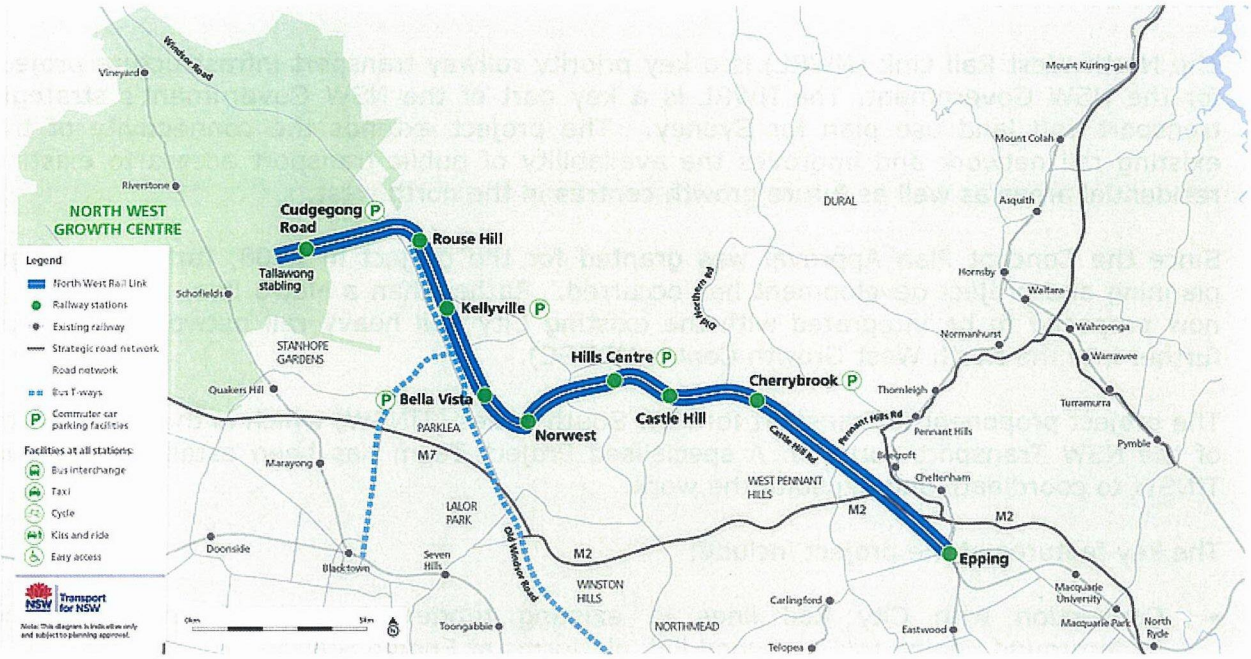

Figure 1

The project is subject to an environmental assessment and approval process under the *Environmental Planning and Assessment Act 1979* (EP & A Act) and is classified as Critical State Significant Infrastructure. With recent amendments to the EP & A Act, the 2008 Concept Plan Approval for the project is taken to be a Staged Infrastructure Approval under Part 5.1 of the EP & A Act.

In accordance with section 115ZI of the EP & A Act, an application to modify the Concept Plan Approval/Staged Infrastructure Approval was submitted to the Department of Planning and Infrastructure (DP & I) on 14 December 2011. The application seeks to:

- Change the NWRL project definition.
- Relocate Kellyville station from Burns Road, Kellyville to Samantha Riley Drive, Kellyville.
- Provide for additional stations at Bella Vista and Cudgegong Road, Rouse Hill.
- Make changes to the location of The Hills Centre station.
- Change the NWRL alignment within Area 20 of the NWGC to a route parallel to Schofields Road.
- Incorporate the 'Skytrain' viaduct between Bella Vista and Rouse Hill.
- Locate a train stabling facility in the vicinity of Tallawong Road.

Before major work can commence on the project, a detailed environmental impact assessment must be undertaken and approved by the Minister for Planning and Infrastructure in conjunction with the final project approval. In this regard TfNSW is proposing a two staged environmental impact assessment process.

Environmental Impact Statement (EIS) 1 is for major civil construction works with the focus being on the tunnel work along the route, excavation of the station boxes, as well as construction of a twin elevated rail viaduct, referred to as the 'Skytrain', from just north of Bella Vista to Rouse Hill.

A second EIS for station design and precinct planning, station construction and operation, rail infrastructure and systems will be released later in 2012. The principal reason for two EISs is to allow tunnelling work to commence more quickly than would have occurred if a single EIS had been prepared.

Subject to receipt of the necessary approvals, major civil construction work is to commence in mid 2013 and be completed by the third quarter of 2016, with the entire project scheduled for completion in 2019.

EIS 1 examines the following issues and includes strategies to avoid, mitigate and manage potential impacts:

- Major civil construction, including tunnelling and construction of the above ground 'Skytrain' viaduct.
- Soils and geology.
- Construction traffic.
- Construction noise and vibration.
- Local business impacts during construction.
- Land use and community facilities.
- Indigenous and no-indigenous heritage.
- Ecology.
- Visual impacts during construction.
- Climate change and greenhouse gas assessment.
- Surface water and flooding.
- Air quality and waste and spoil management.
- Waste water management and disposal.
- Cumulative impacts.

Public exhibition of EIS 1 commenced on 4 April 2012 and concluded on 21 May 2012. Full copies of the document have been available for viewing on the Department of Planning and Infrastructure (DP & I) website, with hard copies also available for viewing at a number of locations including Council's Administration Centre. In addition, the Project Team have conducted five community information sessions as well as three sessions on specialised topics including noise and vibration, construction traffic and construction methods. The Project Team also briefed senior Council officers on 17 April 2012 and Councillors at the Councillor Workshop on 30 April 2012.

The purpose of this report is to provide a description of the first stage of the NWRL project, identify and assess the potential impacts and highlight any issues of concern that could then form the basis of a submission from Council.

EIS 1 ISSUES IDENTIFIED AND PROJECT DESCRIPTION

1. ALIGNMENT

The project description is based on a direction of travel from Epping to Rouse Hill.

The NWRL would join the City Rail network at the existing tunnel stubs located immediately north of the underground Epping to Chatswood Rail Link (ECRL) Epping station platform. This connection is located at what is referred to as the Epping Decline

construction site and will be used for a number of construction activities. Two new tunnels stubs would be provided to safeguard a future Parramatta to Epping Rail Link. From this connection the twin tunnels would turn north-west onto a long straight section and descend to pass beneath Devlins Creek and the M2 Motorway before rising on a long and comparatively steep grade beneath Pennant Hills Road and toward Cherrybrook Station.

From Cherrybrook station the tunnels would run to the west beneath Castle Hill Road descending on a long moderate grade before turning to the south west at the location of Castle Hill station beneath Arthur Whitling Park. West of Castle Hill station they descend and curve north westerly onto a straight section of route below Showground Road before turning west on the approaches to The Hills Centre station which would be located to the south of the Showground and adjacent to Carrington Road.

Leaving the Hills Centre Station and moving west, the tunnels would pass below Cattai Creek before traversing to the south and falling gradually as it passes under the Castle Hill Trading Zone on a long straight section in a south westerly direction. Just beyond Windsor Road the twin tunnels would curve to bring the corridor directly below the southern edge of Norwest Boulevarde. Norwest Station would be located directly below Norwest Boulevarde between Strangers Creek and Brookhollow Avenue.

From Norwest station the twin tunnels would continue to follow Norwest Boulevarde in a south westerly direction up to the intersection with Solent Circuit. Past this point of the alignment it would begin to diverge from Norwest Boulevarde taking a more westerly route on a long curved section which eventually turns the alignment around to the north-west and parallel to Old Windsor Road. This route would continue in tunnel to a portal located immediately to the north of Celebration Drive with the Bella Vista station located a little further to the north.

This alignment would continue to follow a route located roughly parallel to the eastern side of Old Windsor Road and would begin to climb to become more elevated at a point some distance north of Balmoral Road. This elevated section of the route would at first be located on an earthwork embankment but this would soon become an elevated 'Skytrain' rail viaduct as the route passes over an area of local floodplain in the vicinity of Samantha Riley Drive. The Kellyville station would be located immediately to the south of Samantha Riley Drive.

The twin 'Skytrain' rail viaduct structure would continue to the north west, crossing and then following the eastern side of Windsor Road with Rouse Hill station located on a straight section of elevated track between the Rouse Hill Town Centre and Windsor Road, above the existing North West T-Way interchange.

From Rouse Hill Station the alignment would curve westward to pass over Windsor Road to run towards the south west, parallel and to the north of Schofields Road. The two tracks would cross Second Ponds Creek and pass beneath Cudgegong Road which would be located on a new bridge and the terminus station would be sited just beyond in a shallow cutting.

On the far side of the platforms, beyond a new bridge carrying Tallawong Road, the two track alignment would broaden into the stabling facility with provision made for future extension of the line to the west.

2. BELOW GROUND WORKS CONSTRUCTION

The major civil construction works would include excavation and lining of the tunnels only. The two bored tunnels would have a circular cross section and a total diameter of approximately 7.4m, with the internal lined diameter being approximately 6.7m. Generally the centrelines of the twin tunnels would be about 13m apart although this could vary depending on construction methodology and geotechnical conditions. The depth of the tunnels will depend on the vertical alignment of the rail line and the natural topography of the ground surface within the corridor, with a broad range of depths from 5m to 70m.

In addition to the twin tunnels, connecting cross passages would be provided at regular intervals of approximately 240m to facilitate emergency access between tunnels. Two train cross-over caverns would also be provided in the tunnel section, one at Epping and one at Castle Hill.

Most of the tunnelling would be undertaken by tunnel boring machines (TBM) with road headers used for irregular shaped tunnels such as stub tunnels and cross-over caverns. It is anticipated that TBM tunnelling operations would occur from west to east in three sections:

- Bella Vista Station – TBM launch site and support site
- The Hills Centre Station – TBM support site
- Cherrybrook Station – TBM launch and support site

The launch sites for roadheader activities are anticipated to be the Epping Decline site and the Castle Hill Station.

3. ABOVE GROUND WORKS CONSTRUCTION

To the north of Balmoral Road the alignment would reach the existing ground level and continue to climb as the rail corridor transitions onto the 'Skytrain' viaduct structure.

It is anticipated that the viaduct would be constructed from cast-in-situ concrete piles, columns and headstocks, with concrete box section girders between the columns. The viaduct would be typically 13m in width and have box section spans of between 36m to 48m. Two wider sections of viaduct would be constructed in association with the proposed Kellyville and Rouse Hill stations.

In addition to the viaduct, several bridges would also be constructed where the alignment crosses key infrastructure and watercourses.

Earthworks comprising fill embankments and cuttings would also be provided at a number of locations along the alignment.

Eight stations are proposed to be provided along the alignment with five being along the tunnelled section, two located on the 'Skytrain' viaduct structure and one within an area of earthworks to the west of the viaduct.

The stations associated with the tunnelled section would be constructed using either an open cut or cut-and-cover methodology.

For the open cut methodology proposed for Cherrybrook and Bella Vista stations, the completed structure would be covered with an above ground roof type structure. For the Castle Hill, The Hills Centre and Norwest Stations the cut and cover methodology would be used whereby the completed structure would be covered with a roof slab and backfilled leaving only discreet entrance and exit points.

4. MAJOR CONSTRUCTION SITES

A number of major construction sites would be required as part of the major civil construction works. This would include locations for TBM and roadheader launch, TBM and roadheader retrieval, TBM support, viaduct and earthworks support, station construction, services facilities construction, and concrete batching and pre-cast concrete manufacturing facilities.

Figure 2 shows the proposed construction sites and their uses during the major civil construction works.

Site	Area (m^2)	TBM Launch	TBM Support	TBM Retrieval	Spoil Removal	Roadheader Launch / Support	Station Construction	Services Facility Construction	Viaduct Launch / Support	General Civil Works	Concrete Batch Plant / Pre-cast Facility
Epping Services Facility	3,400			•	•			•			
Epping Decline	4,500				•	•					
Cheltenham Services Facility	12,000				•			•			
Cherrybrook Station	75,000	•	•	•	•		•				
Castle Hill Station	18,000				•	•	•				
Hills Centre Station	65,000		•		•		•				
Norwest Station	21,000				•		•				
Bella Vista Station	63,000	•	•		•		•			•	
Balmoral Road	190,000				•					•	•
Memorial Avenue	120,000								•	•	•
Kellyville Station	100,000						•		•	•	
Samantha Riley Drive to Windsor Road	50,000								•		
Old Windsor Road to White Hart Drive	97,000								•		
Rouse Hill Station	18,000						•		•		
Windsor Road Viaduct	61,000								•		
Windsor Road Viaduct to Cudgegong Road	83,000									•	
Cudgegong Road Station to Tallawong Stabling Facility	590,000				•		•			•	

Figure 2

5. SPOIL MANAGEMENT AND DISPOSAL

Based on the concept design, it is envisaged that project excavation will generate around 2.4 million m^3 (equivalent in-situ volume) of spoil resulting in approximately 190,000 by 30 tonne capacity truck movements. Although some spoil material will be used on site, the vast majority will must be taken off-site for disposal. The project will however be targeting 100% beneficial reuse of the spoil based on a hierarchy of spoil management options.

Tables 1, 2 and 3 show the approximate volumes of spoil, number of truckloads, spoil generation timeframe and average daily spoil truck movements.

Table 1: Station Excavation

Site	Approximate Volume of Spoil (m3)	Approximate Truck Loads	Spoil Generation Timeframe (months)	Average Daily Spoil Truck Movements
Cherrybrook Station	60,000	4,800	10	100
Castle Hill Station	135,000	10,800	19	110
Hills Centre Station	85,000	6,800	14	100
Norwest Station	65,000	5,200	14	80
Bella Vista Station	65,000	5,200	10	110
Total	410,000	32,800		

Table 2: Tunnelling

Site	Approximate Volume of Spoil (m3)	Approximate Truck Loads	Spoil Generation Timeframe (months)	Average Daily Spoil Truck Movements
Epping (Services Facility and Decline)	100,000	8,000	12	140
Cheltenham Services Facility	12,000	960	12	16
Cherrybrook Station	370,000	29,600	12	320
Castle Hill Station	30,000	2,400	5	40
Hills Centre Station	390,000	31,200	12	320
Bella Vista Station	365,000	29,200	12	320
Total	1,267,000	101,360		

Table 3: Above Ground Civil Works

Site	Approximate Volume of Spoil (m3)	Approximate Truck Loads	Spoil Generation Timeframe (months)	Average Daily Spoil Truck Movements (one way)
Cudgegong Station	120,000	9,600	7	114
Tallawong Stabling Facility	560,000	44,800	13	288
Other Civil Works (various sites)	31,600	2,528	0.5 - 10	10 per site
Total	711,600	56,928		

EIS 1 identifies a number of beneficial re-use options including use as a construction material and the rehabilitation of former extractive industry sites in western Sydney and Hornsby. The final re-use options for spoil material, as well as truck movement destination/s, would not be determined until closer to the commencement of construction.

6. UTILITY ADJUSTMENTS AND PROTECTION

Existing public utility services would need to be adjusted, relocated and/or protected where they may be impacted by construction. Where such utilities conflict with the proposed design, it may be necessary to:

- Provide physical protection for the utility where it is not directly affected by construction but may be indirectly affected by vibration or accidental impact.
- Modify construction methods to avoid impacting a nearby utility.
- Wrap and support utility services to provide mechanical protection.
- Divert the utility around the construction site.

Various utility relocations and/or protection works are proposed to be undertaken as early enabling works in order to allow construction activities to proceed at each individual construction site.

7. TRAFFIC MANAGEMENT

Table 4 provides details of proposed access to and from construction sites along with anticipated daily heavy vehicle and light vehicle movements associated with spoil and waste removal, material deliveries and the arrival and departure of construction workers.

Wherever possible access is to be gained from major arterial road ways. Traffic management plans for each site would be submitted to Roads and Maritime Services (RMS) and the relevant Council/s for review prior to the commencement of any works.

Table 4: Construction Site Access

Construction Site	Proposed Access Route	Daily Heavy Vehicle Movements	Daily Light Vehicle Movements
Epping Services Facility	▪ Beecroft Road (left in, left out)	80	34
Epping Decline Site	▪ Beecroft Road (left in, left out)	80	34
Cheltenham Services Facility	▪ M2 Motorway (left in, left out) ▪ Kirkham Street (left in, right out) ▪ Murray Road and Castle Howard Road (light vehicles only)	68	34
Cherrybrook Station	▪ Castle Hill Road (All movements) ▪ Franklin Road (left in, left out, right out) ▪ Robert Road (left in, left out)	550	330
Castle Hill Station	▪ Old Northern Road and Terminus Street (all movements) ▪ McMullen Avenue (left in, left out)	120	34
Hills Centre Station	▪ Showground Road (all movements) ▪ Carrington Road (all movements)	550	336
Norwest Station	▪ Norwest Boulevard ▪ Brookhollow Avenue	90	36
Bella Vista Station	▪ Celebration Drive (all movements) ▪ Balmoral Road (right in, left out)	250	1400
Balmoral Road	▪ Balmoral Road (left in, right out)	50	0
Memorial Avenue	▪ Memorial Avenue (all movements)	50	330
Kellyville Station	▪ Samantha Riley Drive (all movements)	50	300
Samantha Riley Drive to Windsor Road	▪ Samantha Riley Drive (all movements) ▪ Windsor Road (left in, left out)	50	0

Old Windsor Road to White Hart Drive	▪ Windsor Road (left in, left out) ▪ Sanctuary Drive south (right in, left out) ▪ Sanctuary Drive north (left in, right out)	50	310
Rouse Hill Station	▪ White Hart Drive (left in) ▪ Rouse Hill Drive (all movements)	60	92
Windsor Road Viaduct	▪ Rouse Hill Drive (left in, right out) ▪ Commercial Road (right in, left out) ▪ Windsor Road (left in, left out)	26	120
Windsor Road Viaduct to Cudgegong Road	▪ Schofields Road at the future Terry Road alignment (all movements) ▪ Cudgegong Road (all movements)	26	120
Cudgegong Road Station and Tallowing Stabling Facility	▪ Cudgegong Road (all movements) ▪ Tallawong Road (all movements) ▪ Schofields Road (all movements)	700	200

The major civil construction works would require a number of significant road modifications, either to provide access and/or egress to or from the construction sites, or to allow the proposed construction works to take place. Details are provided in Table 5.

Table 5: Proposed Road Modifications

Construction Site	Proposed Road Modifications
Epping Services Facility	▪ Beecroft Road. ▪ Access to adjacent commercial buildings from Beecroft Road.
Cheltenham Services Facility	▪ M2 Motorway on and off ramps. ▪ Potential localised widening and a new signalised intersection at Kirkham Street. ▪ New intersection with Castle Howard Road to access construction site.
Cherrybrook Station	▪ New signalised intersections where Glenhope and Franklin Roads meet Castle Hill Road.
Castle Hill Station	▪ Temporary partial occupation of Old Northern Road reserve. ▪ Adjustment to the phasing of existing signals on Old Northern Road and establishment of a new intersection.

Hills Centre Station	▪ New intersection on Showground Road and an internal access road.
Norwest Station	▪ Temporary realignment of Norwest Boulevard. ▪ Alteration of Norwest Boulevard / Brookhollow Avenue intersection from a roundabout to traffic signals.
Bella Vista Station	▪ Alteration of Celebration Drive / Lexington Drive intersection from a roundabout to traffic signals.
Balmoral Road	▪ T-way road works.
Memorial Avenue	▪ T-way road works. ▪ Potential adjustment to existing Memorial Avenue / Old Windsor Road intersection.
Kellyville Station	▪ T-way road works. ▪ Potential adjustment to the existing intersection at Memorial Avenue to accommodate construction access and viaduct piers.
Windsor Road / Old Windsor Road	▪ T-way road works.
Rouse Hill Station	▪ T-way road works.
Windsor Road Viaduct	▪ Potential adjustment to existing intersection between Windsor Road and Schofields Road to accommodate construction access and viaduct piers.
Cudgegong Road Station and Tallowing Stabling Facility	▪ Diversion of Cudgegong Road ▪ Diversion of Tallawong Road

8. PUBLIC TRANSPORT MODIFICATIONS

The major civil construction works would require a number of modifications to existing public transport facilities where they would interface with the construction works. Modifications would be necessary in order to allow existing public transport to remain functional and safe during the construction works.

a) Castle Hill Station

- Temporary relocation of bus interchange and layover on Old Northern Road.
- Potential adjustment to bus facilities on Old Castle Hill Road.

b) Memorial Avenue

- Temporary relocation of bus T-Way car parking.

c) Kellyville Station

- Relocation of bus T-Way car parking.

d) Rouse Hill Station

- Relocation of bus T-Way and interchange facilities.

Additional modifications to those listed may be required depending on the requirements of the construction contractor(s) and public transport providers.

9. CONSTRUCTION POWER

Power supply would be required during major civil construction works at the majority of the construction sites. In particular, high voltage power supply would be required for the operation of the TBMs, road headers and pre-cast concrete manufacturing facilities. The power supply for each site would need to be brought in from a source outside the project corridor, most likely along an underground route.

The provision of power supply to the worksites is proposed to be undertaken as enabling works in order to allow construction activities to proceed at the site. These works will be completed before substantial construction commences.

10. MATERIALS AND WATER USAGE

The major civil construction works would require the use of a variety of construction materials. The major items and indicative quantities would be:

- Concrete – 380,000 m^3
- Steel reinforcement – 51,580 tonnes

In addition, the tunnelling works require significant volumes of water for TBM and roadheader excavation. These volumes will be up to 1,728,000 litres per day at each of the TBM sites, and up to 864,000 litres per day at each of the roadheader sites. This water would require treatment before being discharged into the local waterway systems. In addition there would be water requirements for the pre-cast concrete manufacturing facility and dust suppression associated with earthworks. Recycled water for dust suppression would be maximised.

11. CONSTRUCTION HOURS

The proposed construction hours for the underground and aboveground activities are outlined in Table 6. The majority of the station and aboveground construction activities would be undertaken between the following hours:

- 7am to 6pm Monday to Friday
- 8am to 1pm Saturdays
- No works on Sundays or public holidays

As indicated in Table 6, there will still be substantive activities undertaken outside these hours. As the TBMs operate continuously, the tunnelling works and associated support activities would be undertaken up to 24 hours per day, seven days per week.

Table 6: Proposed Construction Hours

Activity	Construction Hours	Comments or Exceptions
Underground Construction Activities		
Tunnelling works by TBM, roadheader or excavator with rock hammer.	24 hours per day, seven days per week	Activities that support tunnelling works may need to occur 24 hours per day, up to seven days per week. Rock hammering in the tunnel between 10pm and 7am would be precluded except where there would be no impact on sensitive receivers or appropriate approvals are in place.
Above ground Construction Activities		
Construction sites for works other than tunnelling.	▪ 7am – 6pm Monday to Friday ▪ 8am – 1pm Saturdays ▪ No works on Sundays or Public Holidays	The following activities would be expected to be required 24 hours per day, up to seven days per-week where noise impact management measures have been established: ▪ Surface works supporting underground construction (eg concrete pumping, truck loading). ▪ Excavation and spoil removal from station entry shafts over two shifts. Non-disruptive preparatory work, repairs or maintenance may be carried out on Saturday afternoons between 1pm and 5pm or Sundays between 8am and 5pm. Activities requiring the temporary possession of roads may need to be undertaken outside the standard daytime construction hours during periods of low demand to minimise safety impacts and inconvenience to commuters. Activities requiring rail possessions may need to be undertaken outside the standard construction hours up to 24 hours per day, seven days per week.
Construction traffic for material supply to and spoil removal from tunnelling sites.	24 hours per day, seven days per week	Restrictions would be in place during peak hours and during special events. At locations where sensitive noise receivers are close to construction sites, significant construction vehicle movements are likely to be restricted during evening and night-time periods.

12. WORKFORCE

During the major civil construction works approximately 1,300 jobs are expected to be directly created during the peak construction period. Further jobs would be indirectly created by the project.

13. BUILDING DEMOLITION

The major civil construction works would require the acquisition and demolition of 92 buildings that lie within the footprint of the various construction sites. To ensure site readiness and reduce the potential for vandalism, it is likely that demolition works would occur early in the construction program, once the acquired properties have been vacated.

An indicative list of the number of buildings to be demolished at each site is provided in Table 7.

Table 7: Building Demolition

Construction site	Existing Use			
	Commercial	Residential	Other	Subtotal
Epping Services Facility	1	0	0	1
Epping Decline	0	0	0	0
Cheltenham Services Facility	0	0	0	0
Cherrybrook Station	1	28	0	29
Castle Hill Station	1	0	1	2
Hills Centre Station	11	0	0	11
Norwest Station	5	0	0	5
Bella Vista Station	3	0	0	3
Balmoral Road	0	4	0	4
Old Windsor Road - East	1	4	0	5
Kellyville Station	0	0	0	0
Old Windsor Road - West	0	0	0	0
Windsor Road	7	2	1	10
Rouse Hill Station	0	0	0	0
Cudgegong Station	0	8	0	8
Tallawong Stabling Facility	0	14	0	14
TOTALS	30	60	2	92

DISCUSSION OF IDENTIFIED SPECIFIC IMPACT AREAS

1. GENERAL

Council has long advocated and supported the NWRL. Our region is a significant contributor to the growth of Sydney and is relied upon to provide new homes and new jobs for our growing population. The region is not served adequately by rail and this project will facilitate a shift from road transport to help free up capacity on our local and regional road networks. Without the NWRL, our region's roads will experience increased congestion, increasing travel times for our residents with a corresponding affect on quality of life. The NWRL is a necessary alternative and complimentary option to our road network.

A project of this size and scale will cause significant impacts during its construction especially given it is amongst an existing established population. The EIS rightly points out significant impacts in terms of:

- Noise and vibration.
- Traffic, access and wear and tear on regional and local roads.
- Ecology.
- Heritage.
- Business.

While the impacts will be significant, the EIS has identified strategies to help ameliorate those impacts to a large extent but not completely. This report will identify some gaps and offer some further suggestions however what will be of paramount importance is for the project to allow continued meaningful involvement of the community. If our residents feel that they are part of the delivery of this very significant project, a greater acceptance of the construction impacts is more likely. It is therefore recommended that the project delivery team arrange community reference groups that meet regularly, are attended by key decision makers and allow our community to be meaningfully involved. In much the same way as community liaison groups successfully engaged in the M7 construction, a similar strategy for community involvement will help provide ownership to our community and will provide a vehicle for concerns and solutions to be raised and dealt with in a positive and collaborative way.

The alignment as outlined in the EIS is largely as previously exhibited and has addressed Council's wish for an additional station to serve the Norwest Business Park and maintain the potential connection for the Parramatta to Epping rail link. The alignment does however ignore some of the advice previously given by Council including an increase in the length of the viaduct now known as the "Skytrain", the diversion of the corridor away from Box Hill and the connection to the Richmond rail line at Vineyard.

On 12 March 2012 the NSW Premier and the Minister for Transport announced the NSW Government will secure an additional public transport corridor through the North West Growth Centre. A discussion paper outlines two potential corridors and is on public exhibition until 18 May 2012. A Public Forum was held at Rouse Hill Town Centre on 31 March. Two options have been identified for extension of the rail link:-

Option A — Cudgegong Road to Schofields and Marsden Park: from the end of the North West Rail Link heading west to Schofields Station then further on to Marsden Park, about 6.8km.

Option B — Cudgegong Road to Riverstone: from the end of the North West Rail Link heading northwest to the Richmond Line south of Riverstone Station, a distance of about 3.3km.

Both of the options proposed in the discussion paper would divert the Northwest Rail Link away from the route previously shown on the Growth Centre Structure Plan 2006 where the future rail corridor linked to the Richmond Line at Vineyard and serviced the Box Hill and Box Hill Industrial precincts. This alteration means that these precincts will no longer be serviced by the previously exhibited rail route.

Council has been consistent in seeking Government commitment to the construction of the extension of the rail line from Rouse Hill to Vineyard to service the future employment and residential areas in the Box Hill and Box Hill Industrial Precincts. It is also essential that the NWRL connect to the Richmond line especially given the potential at some stage for Richmond RAAF base to be used more widely than the current military use. It is anticipated that when fully developed, Box Hill and Box Hill Industrial Precincts will provide for a resident population of approximately 30,000 people, plus a future anticipated workforce. Beyond the 2036 timeframe, it could reasonably be expected that future housing growth could occur further north than the current growth centre boundary. To cater for this future growth in The Hills, it is vital that this rail infrastructure project is provided alongside a range of strategic transport options, including the NWRL.

The depth of the NWRL has reduced under the current alignment. Cost has been a driver for this decision but as a consequence more of the NWRL is now above ground on a elevated viaduct referred to as a "Skytrain". While being elevated is preferable to constructing the rail link on embankments that have obvious visual impacts and tend to be divisive, in the longer term it is considered more prudent to construct the entire line underground as it will avoid visual and noise impacts that will arise from the Skytrain. Given the decision has been made to decrease the depth of the alignment, the Skytrain is inevitable however it will need to be carefully treated to address the operational noise impact and will need to incorporate sufficient design features to make the construction more visually attractive and contribute positively to the setting.

RECOMMENDATIONS:

In its submission Council includes the following recommendations:-

1.1 Overall, Council supports the delivery of the NWRL project.

1.2 The NWRL Project Delivery team should include a meaningful community reference and liaison group that will help to build collaboration to help manage the inevitable impacts of construction a project of this scale amongst an established community.

1.3 The retention of the tunnel stubs to support a future Parramatta to Epping linkage at Epping is supported.

1.4 It remains Council's preference for the entire NWRL to be constructed entirely below ground.

1.5 It is essential that any construction and operation of a Skytrain ensures sufficient acoustic treatment is provided so as to not cause offensive noise pollution to surrounding areas. Further, the design of the elevated viaduct that supports the Skytrain must incorporate design elements including artistic features, to make the construction more visually attractive to contribute positively to the setting.

1.6 The route of the NWRL should be as exhibited in the 2006 growth centres structure plan so as to serve future population north of Windsor road at Box Hill.

2. SOILS AND GROUNDWATER

a) EXISTING ENVIRONMENT

The route of the proposed NWRL is located along the northern edge of the Cumberland Plain. Surface elevations along the route range from approximately RL42m in the area of Caddies Creek to around RL180 in the Old Northern Road/Castle Hill Road area between the Castle Hill and Cherrybrook stations. The steeper flanking slopes of the Castle Hill ridgeline between West Pennant Hills and Castle Hill are subject to well documented landslide mass movement.

The eastern half of the route is within elevated ridgeline terrain that is incised by creeks at several locations along the proposed route. The western half of the route traverses undulating terrain with meandering watercourses.

The tunnels will be constructed within Ashfield Shale and Hawkesbury Sandstone which is overlain in places by residual soils. The quality of the rock profile normally improves with depth and the permeability of the intact shale and sandstone is expected to be generally low with some areas of higher permeability associated with isolated major defects in the rock.

Groundwater levels have been assessed at 74 locations along the route and generally, the measurements show that the tunnels will sit below the water table. However experience in the Sydney area is that long term groundwater inflows into drained tunnels are relatively low except for locations where there are adverse structural features in the rock.

Groundwater quality has also been monitored in 38 monitoring wells with the results showing that the groundwater is not impacted by contamination except for two monitoring wells where there are minor hydrocarbon impacts. Water quality testing will continue on selected standpipes with testing for aggressivity, heavy metals and hydrocarbons.

Acid sulphate soil risk mapping has been undertaken by the former Department of Land and water Conservation (DLWC). These maps show that the project lies within areas designated as 'no known risk' of acid sulphate soil or potential acid sulphate soil.

Soil contamination investigations along the route have been undertaken using a combination of:

- Desktop study of previous site investigation reports, a review of the NSW Environmental Protection Authority's contaminated land public register, interviews with people familiar with historical changes in the area and limited brief site visits.
- Limited field and laboratory program to assess the identified areas of environmental concern (AEC) and contaminants of potential concern (COPC).

AECs include current and former petrol station sites, Council's Operations Centre and several sites of former farm paddocks and market gardens.

Soil samples for contamination assessment have been collected from 45 boreholes and 24 test pits. These samples have been subject to laboratory analysis for contaminants including:

- Total Petroleum Hydrocarbons (TPH)
- Benzene, Toluene, Ethylbenzene, Xylene (BTEX)
- Polycylic Aromatic Hydrocarbon (PAH)
- Organochloric Pesticide (OCP)
- Polychlorinated Biphenyl (PCB)

- Heavy metals
- Asbestos

Although the testing program is yet to be fully concluded, widespread significant soil contamination has not been identified in any of the test locations.

b) POTENTIAL IMPACTS

i) Settlement

The geology of the NWRL alignment is generally favourable for construction. However ground movements can occur as a result of:

- Tunnel induced movement primarily caused by stress relief from tunnelling through intact rock.
- Excavation induced movement due to 'relaxation' of unsupported ground adjacent to deep cuttings and basement excavations.
- Drawdown induced movement where dewatering to provide a dry working area below the water table may result in significant settlement of the ground surface.
- Tunnel failure.

Preliminary ground movement assessment indicate potential impacts of between 5mm to 20mm of settlement in immediate areas surrounding station locations and above some sections of shallow tunnels or tunnels through poorer ground conditions. No built structures are estimated to incur ground settlement of greater than 20mm, with the maximum rates of settlement to occur adjacent to station box excavations.

Damage criteria in relation to potential ground movements have been developed for the project as part of an Existing Buildings and Structures (EBS) risk assessment and are detailed in Table 8.

Table 8: Ground Movement Damage Criteria

Control Parameters (Damage Criteria)		Degree of Damage	Risk Category[1]	Risk Rating
Maximum Settlement	Angular Distortion (degrees)			
<10 mm	<1/750	Negligible to Slight	0-2 (Aesthetic)	Low
10-20 mm	1/300-1/750	Moderate	3 (Functional)	Medium
>20 mm	>1/300	Severe to Very Severe	4-5 (Serviceability/ Structural)	High

Based on the EBS risk assessment, the numbers of land parcels potentially affected by ground movement are:

- Low – 113
- Medium – 51
- High - 35

A Stage 2 EBS risk assessment would be undertaken to further refine the medium and high risk land parcels. The purpose of the second stage is to identify the actual buildings, structures and utilities within affected land parcels and apply a risk assessment to each.

While ground settlement would be small and unlikely to cause major distress to existing nearby surface and underground structures along the route, appropriate design requirements and management measures would be required to avoid unacceptable impacts.

ii) Soil Salinity

Soil salinity has been identified as a growing problem in the western Sydney region. Based on maps prepared by the former Department of Infrastructure, Planning and Natural Resources (DIPNR), areas along the alignment of the NWRL near Caddies Creek, First Ponds Creek and Second Ponds Creek show high salinity potential or known salinity.

iii) Hydrogeology

The regional water table within Hawkesbury Sandstone is affected by beds of low lying permanently flowing streams in the Beecroft/Castle Hill area. The water table rises away from these watercourses following the topography.

Potential impacts that could arise during construction include:

- Lowering of the water table due to water loss during construction and operation.
- Turbid, saline or contaminated water collected within the tunnel requiring disposal.
- Contaminants such as oils and chemicals from construction activities leaking into the water table where the tunnel is above the water table.
- A change in water table levels during unusually wet periods could ingress into previously dry sections of the tunnel invert.
- Lowering of the water table could result in the loss of output from any wells or bores in the vicinity of the rail line.
- Tunnelling and deep excavations are likely to require localised dewatering during construction and operation of the NWRL.
- Dewatering programs would likely involve construction of extraction bores, gravity drainage systems and/or pumping to extract groundwater. Discharge of the extracted groundwater would depend on the groundwater quality but options would include discharge to local creeks or temporary storage in detention basins to reduce turbidity prior to discharge.

iv) Contamination

As previously indicated, a number of sites along the route have been identified where there is potential for existing environmental contamination. The nature and extent of contamination at these sites would be subject to ongoing investigations prior to construction.

In addition to potential existing land contamination, contamination could also occur from some construction activities including the disposal of contaminated water, contaminants leaking onto the ground surface, and accidents or spills involving construction equipment.

v) Mineral resources

A range of on-line data has been accessed in order to assess the impacts of the NWRL on mineral resources. That data shows that the potential impacts to existing or proposed mineral or petroleum tenures is small to negligible, mainly because they cover the entire Sydney basin of which the alignment of the NWRL occupies only a relatively small area.

There are no known mine subsidence issues in the area of the NWRL and the potential for mine subsidence impacts as a consequence of the project are considered to be small.

Mitigation measures have been developed to avoid, reduce and manage potential soil and groundwater impacts. These mitigation measures and their impacts to the individual construction sites are presented in EIS 1 (Attachment 1).

While constructed underground, the alignment of the NWRL passes under land that is known to be affected by geotechnical hazards (landslip). The EIS does not contain information as to the extent of geotechnical investigation in relation to the potential for land slip.

RECOMMENDATIONS:

2.1 Council's LEP maps indicating the extent of the geotechnical assessment area be included in Council's submission and that the geotechnical experts investigate the potential risk to land in that area as a result of the construction and operation of the NWRL.

2.2 The mitigation measure of conducting before and after dilapidation surveys of buildings in the vicinity of stations, works and construction sites is supported.

3. CONSTRUCTION TRAFFIC

EIS 1 primarily deals with traffic impacts during the construction of the NWRL. Broader traffic and transport issues surrounding the operation of the completed rail project will be considered in EIS 2.

a) ASSESSMENT METHODOLOGY AND INPUTS

The methodology for the assessment of construction traffic impacts included:

- Traffic count information was collected for key intersections in the vicinity of the proposed construction sites during the peak periods. These were supplemented with seven day counts along selected roads in the area.
- The results of the traffic counts were utilised to undertake intersection modelling using the SIDRA Intersection modelling program. Predicted intersection performance was determined as both the Degree of Saturation (DOS) and the Level of Service (LOS).

The DOS value indicates the ratio of arrival volumes to capacity. Values above 1.0 represent over-saturated conditions where arrival volumes exceed capacity whereas degrees of saturation below 1.0 represent under-saturated conditions where arrival volumes are below intersection capacity.

The LOS refers to an overall indication of the operational performance of traffic on any given intersection, traffic lane or roadway. The LOS criteria for intersections are detailed in Table 9.

Table 9: LOS Criteria for Intersections

LOS	Average Delay (seconds per vehicle)	Traffic Signals & Roundabouts	Give Way & 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	43-56	Operating near capacity	Near capacity and accident study required
E	56-70	At capacity; at signals, incidents will cause excessive delays	At capacity, requires other control mode
F	> 70	Over capacity, unstable operation	Over capacity, unstable operation

Construction of the NWRL would require a range of vehicle movements involving light vehicles, heavy vehicles and specialised vehicles. Apart from the removal of spoil from each of the construction sites, there would also be truck movements for the delivery of materials to most sites for the construction of infrastructure.

The site truck movements would normally be uniformly distributed between approximately 7am to 6pm on most weekdays. However this could vary on certain days depending on the nature of construction work being undertaken.

Spoil removal activities at TBM sites (Cherrybrook, The Hills Centre and Bella Vista) would occur on a 24 hour, seven day per week basis.

Table 10 provides a summary of the proposed access route and anticipated daily heavy vehicle and light vehicle movements associated with construction activities at construction sites within or immediately adjacent to The Hills Shire.

Table 10: Access Routes and Daily Vehicle Movement

Construction Site	Proposed Access Route	Heavy Vehicle Movements	Light Vehicle Movements
Cherrybrook Station	▪ Castle Hill Road at Glenhope Road (all movements) ▪ Franklin Road (left in, left out, right out) ▪ Robert Road (left in, left out)	550	330
Castle Hill Station	▪ Old Northern Road and Terminus Street (all movements) ▪ McMullen Avenue (left in, left out) ▪ Crane Road (left out only)	120	34
Hills Centre Station	▪ Showground Road (all movements) ▪ Carrington Road (all movements)	550	336
Norwest Station	▪ Norwest Boulevard ▪ Brookhollow Avenue	90	36
Bella Vista Station	▪ Celebration Drive (all movements) ▪ Balmoral Road (right in, left out)	250	1400
Balmoral Road	▪ Balmoral Road (left in, right out)	50	0
Memorial Avenue	▪ Memorial Avenue (all movements)	50	330
Kellyville Station	▪ Samantha Riley Drive (all movements)	50	300
Samantha Riley Drive to Windsor Road	▪ Samantha Riley Drive (all movements) ▪ Windsor Road (left in, left out)	50	0
Old Windsor Road to White Hart Drive	▪ Windsor Road (left in, left out) ▪ Sanctuary Drive south (right in, left out) ▪ Sanctuary Drive north (left in, right out)	50	310
Rouse Hill Station	▪ White Hart Drive (left in) ▪ Rouse Hill Drive (all movements)	60	92
Windsor Road Viaduct	▪ Rouse Hill Drive (left in, right out) Commercial Road (right in, left out) Windsor Road (left in, left out)	26	120

b) POTENTIAL IMPACTS

i) General impacts

Section 9.3.3 and 9.4 of the EIS identify vehicle movement forecasts, access routes and potential impacts on the performance of traffic. The Director-General's Requirements (DGRs) do not contain specific requirements in relation to construction traffic. Table 9.1 of EIS 1 sets out the Conditions of Approval (CoA) and Statement of Commitments (SoCs).

Item 3.5 of this table states that the proponent shall confirm the construction traffic impacts associated with the project identifying haulage routes, congestion and intersection performance, construction options to help minimise traffic disruptions and alternative travel arrangements. There are no conditions relating to potential impacts associated with the condition of the road network during construction.

Given that EIS 1 is silent on the potential impact to the local and arterial road network it is recommended that a dilapidation report be prepared prior to work commencing to ascertain the current condition of the affected local roads and a form of Contributions Plan be established to collect contributions which will assist with the cost of maintenance, repair and reconstruction as a result of damage caused by trucks. This approach will address the accelerated wear and tear that will occur due to the haulage of materials and spoil from the NWRL. A model that could be used as a template is the $0.90 per tonne contribution as levied via the extractive industries Contribution Plan. A similar funding model should be established.

Council has an extensive network of weight restricted roads that control the through movement of heavy vehicles and generally keeps these vehicles on arterial roads. Restricted truck access on Council's local roads will be enforced in accordance with weight restrictions within the Shire. The weight restricted routes that are near the station construction precincts include Gilbert Road, Highs Road, Taylor St, Aiken Road, Oakes Road, Jenkins Road, Glenhaven Road, Commercial Road, Withers Road, Hezlett Road, Annangrove Road and Kenthurst Road.

Council also has several sub-arterial roads near the station construction sites that do not have weight restrictions. These roads include Samantha Riley Drive, Green Road, Sanctuary Drive, Carrington Road and Victoria Avenue. These unrestricted sub-arterial roads should not be used for truck movements to and from the station construction areas - Any conditions of consent issued for the construction of the NWRL by the NSW Government should restrict truck access on these roads.

Street lighting issues are likely to arise at each construction site because of the extensive excavations. Interrupted power supply and light pole relocations will occur at various stages and the construction management plans will need to detail how these issues are continuously monitored and resolved. This issue will be critical at Castle Hill and Norwest Stations in particular because of pedestrian movements, and site modifications will be required for street lighting at each area to ensure continued operation.

ii) Cumulative Construction Traffic Impacts

There are a number of major developments that are proposed to be undertaken with the potential to coincide with the NWRL construction. These include further expansion of Castle Towers, development of the Northern Freight corridor, expansion of the Rouse Hill Town Centre and residential land development and housing construction in the Balmoral Road and North Kellyville release areas.

Most of these developments are still in the early planning stages and little information is available on construction programming.

Identification and management of the cumulative impacts of these projects would be undertaken during the development of Traffic Management Plans (TMPs) as the NWRL construction program develops.

iii) Cherrybrook Station Construction Site (Site 4)

Castle Hill Road is already performing at level of service "F" along most it's length during the morning peak – there is little or no spare capacity, and there are no RMS plans for upgrade or a widening scheme for either general traffic or for bus priority along the road.

The key intersections surrounding the Cherrybrook Station construction site are:

- Castle Hill Road/County Drive/Highs Road (signalised)
- Castle Hill Road/Robert Road
- Castle Hill Road/Glenhope Road
- Castle Hill Road/Franklin Road
- Castle Hill Road/Coonara Avenue/Edward Bennett Drive (signalised)

No changes to the existing signalised intersections are proposed.

Table 11 details the existing intersection performance and anticipated intersection performance during construction. It shows that there would be a minor increase in the DOS, but no change to the LOS, at the existing Castle Hill Road/Coonara Avenue/Edward Bennett Drive and Castle Hill Road/County Drive/Highs Road intersections in the peak periods.

Table 11: Cherrybrook Station Construction Site – Intersection Performance

Intersection	Existing				During Construction			
	LOS (AM)	DOS (AM)	LOS (PM)	DOS (PM)	LOS (AM)	DOS (AM)	LOS (PM)	DOS (PM)
Castle Hill Road / Coonara Avenue / Edward Bennett Drive	D	0.75	C	0.85	D	0.76	C	0.85
Castle Hill Road / County Drive / Highs Road	E	1.01	E	1.01	E	1.01	E	1.01
Castle Hill Road / Glenhope Road	NA	1.00	NA	1.00	B	0.78	C	0.89

The primary access to the Cherrybrook Station construction site is proposed as a new signalised intersection on Castle Hill Road at Glenhope Road. This would involve converting the existing T-intersection into a four-way intersection with a new leg to the north. The design of the intersection would require the provision of new right turn bays from Castle Hill Road into both Glenhope Road and the site entrance to maintain the two traffic lanes in each direction along Castle Hill Road. These right turn lanes will require private property acquisition – possibly affecting the southern side of the road.

The proposed traffic signals will improve vehicle and pedestrian access for West Pennant Hills Valley residents, but there will be at least twice the existing volume of 2000 movements per day in Glenhope Road as a result – the road will therefore be over its environmental capacity of 250 movements in peak hour, and LATM treatment will be needed along the full length of the connection to Coonara Avenue. Public consultation and funding of any LATM Scheme along Glenhope Road and Glenridge Avenue will be the responsibility of NWRL. The northern footpath on Castle Hill Road adjacent to the construction site would be maintained, together with the crossing of the new site access road opposite Glenhope Road. The LATM scheme will need to include parking restrictions in Glenhope Road to control contractors vehicles during construction and these restrictions will remain to control commuter parking.

A supplementary access to Castle Hill Road at Franklin Road would be required to accommodate light vehicles and the possibility of some daytime spoil truck movements at peak production times. This would be signalised and limited to left in, left out and right out only.

Bus routes in the immediate vicinity of the worksite are confined to Castle Hill Road and Franklin Road (school services). None of these services would be required to be rerouted during the construction period. However, future bus access to the station will be critical and, as mentioned above, Castle Hill Road has no bus priority schemes to assist in the future demand. The West Pennant Hills Bus Link may be needed as an alternative to Castle Hill Road as buses are likely to use Glenhope Road as a major connection between the residential areas and Cherrybrook station. The proposed Bus Link will need to be re-evaluated as part of a general review of bus services integrating with the Station precinct.

The proposal includes minimal on-site parking for workers at the Cherrybrook station construction site. Although it is proposed to provide worker parking off-site and transfer them to and from the site by shuttle buses, there would still be some requirements for staff to park near the site and this would most likely occur on Robert Road, Franklin Road or Glenhope Road. Measures may need to be put in place to ensure that local residents are not inconvenienced by this additional street parking

iv) Castle Hill Station Construction Site (Site 5)

The key intersections surrounding the Castle Hill station construction site are:

- Old Northern Road/McMullen Avenue (signalised).
- Old Northern Road/Crane Road/Castle St/Old Castle Hill Road (signalised).
- Crane Road/Terminus St (signalised).

Table 12 details the existing intersection performance and anticipated intersection performance during construction. It shows that the additional traffic would result in:

- No significant change to the DOS or LOS at the existing Old Northern Road/McMullen Avenue and Terminus St/Crane Road intersections
- A small increase in the DOS but no change to the LOS at the modified Old Northern Road/Crane Road/Castle St intersection.

Table 12: Castle Hill Station Construction Site – Intersection Performance

Intersection	Existing				During Construction			
	LOS (AM)	DOS (AM)	LOS (PM)	DOS (PM)	LOS (AM)	DOS (AM)	LOS (PM)	DOS (PM)
Old Northern Road / McMullen Avenue	C	0.89	C	0.74	C	0.90	C	0.74
Old Northern Road / Crane Road / Castle Street	B	0.44	B	0.46	B	0.50	B	0.47
Terminus Street / Crane Road	D	0.88	C	0.68	C	0.88	C	0.68

The proposed worksite location within Arthur Whitling Park and adjoining section of Old Northern Road will require the relocation of the existing bus stops from that section of Old Northern Road for the duration of the project. Alternative sites for these stops are currently under investigation however it is expected that the bus stops would be relocated to Old Castle Hill Road on the western side of the worksite and utilising both sides of the road.

Buses would require two-way access along the section of Old Castle Hill Road between the former Eric Felton St and the Castle St/Crane Road/Old Northern Road intersection. Some minor changes to bus routes would be required. Relocation of bus interchange to Old Castle Hill Road will be complicated by the re-introduction of two way traffic movement in the full length of that street. If Castle Towers Stage 3 commences during the station construction, the construction activity will conflict heavily on customer access to the Shopping Centre.
Closure of bus interchange area is critical because pedestrian access will be restricted through and across the site. Buses, and pedestrian traffic using those buses, will all revert to Old Castle Hill Road resulting in severe congestion. A new bus layover area is needed to reduce demand for bus parking – options include unused QIC overflow parking areas, or Council land in Brisbane Road.
New traffic signals are to be provided off Terminus St at the northern end of the bus interchange – these signals are in accordance with Council's long term strategy for the interchange. Stage 2 of the Mainstreet development will be delayed until 2018 at the earliest, but it is expected that NWRL will fund most of the work at that time rather than Council.

There are currently significant volumes of pedestrian activity around the worksite. Appropriate alternative pedestrian routes would be provided during construction to accommodate this high level of pedestrian movement.

During construction the following temporary pedestrian and cyclist impacts would occur:

- The footpath on the northern side of Old Northern Road, between the Terminus St/Old Northern Road intersection and Old Castle Hill Road would be closed to pedestrian movement. The southern footpath along this section of road would remain open during construction work.
- The pedestrian and cycle routes through Arthur Whitling Park would be temporarily closed during the construction period.

The worksite is not expected to affect any existing off street parking although the relocation of buses to Old Castle Hill Road may result in the loss of approximately 10 kerbside parking spaces on Old Castle Hill Road. Taxi and 'kiss and drop' users would be largely unaffected during construction.

v) The Hills Centre Station Construction Site (Site 6)

The key intersections surrounding The Hills Centre station construction site are:

- Showground Road/Carrington Road (signalised).
- Showground Road/Gilbert Road (signalised).
- Victoria Avenue/Carrington Road (roundabout).

It is proposed that heavy vehicle construction traffic would be concentrated on a new signalised access off Showground Road near the bridge over Cattai Creek.

Table 13 details the existing intersection performance and anticipated intersection performance during construction. It shows that the additional traffic would result in:

- An increase in the DOS of 4% at the existing Showground Road/Carrington Road intersection in both the AM and PM peaks with no change in the LOS.
- An increase in the DOS of up to 3% at the existing Victoria Avenue/Carrington Road roundabout.

The new Showground Road/site access road intersection with provision for all turning movements is forecast to operate at an acceptable DOS and LOS.

Table 13: The Hills Centre Station Construction Site – Intersection Performance

Intersection	Existing				During Construction			
	LOS (AM)	DOS (AM)	LOS (PM)	DOS (PM)	LOS (AM)	DOS (AM)	LOS (PM)	DOS (PM)
Showground Road / Carrington Road	C	0.75	D	0.92	C	0.79	D	0.96
Victoria Avenue / Carrington Road	A	0.42	A	0.57	A	0.45	A	0.59
Showground Road / Gilbert Road	C	0.80	B	0.66	C	0.82	B	0.67
Showground Road / Site Access	N/A				B	0.83	B	0.81

Existing bus routes operating along Showground Road, Carrington Road and Victoria Avenue will not need to be re-routed during the construction period, with negligible impacts on travel times anticipated. An alternative carpark and bus rank location for Sydney Olympic Park/Royal Easter Show bus services would need to be determined. This is currently under investigation.

An existing pedestrian route from Carrington Road via Doran Drive and through the Showground to Showground Road would be closed during construction. However the existing cycleway that runs alongside Cattai Creek and under Showground Road into Fred Caterson Reserve would remain unaffected during construction.

Approximately 200 off-street parking spaces contained in The Hills Centre carpark would be lost during construction. Alternate parking could be provided within the Showground however this will be subject to further negotiation between Council, the Agricultural Society and the lessee of The Hills Centre.

The proposed major truck access for this station goes direct to Showground Road through the dog show area adjacent to the Cattai Creek bridge. It is unlikely that this proposed access arrangement will be approved on safety grounds because of the steep gradients of Showground Road. RMS agrees with Councils position on this truck access – a better location is through the Showground upper precinct at the existing signals for Gilbert Road. A fourth leg of this intersection would provide for construction access as well as supporting functions at the Showground during construction of the station. This issue will be of acute concern for each March when the Castle Hill Show is operating, but there are other civic events that will also benefit from this proposed access change.

No truck movements will be permitted onto Carrington Road. Secondary access for contractors is from Carrington Road at Doran Drive. No improvements are proposed but some form of intersection control such as a roundabout or traffic signals will be needed. Cycleway and pedestrian access to the station precinct will need to conform with the adopted Council Strategic plans.

The Upgrade of Showground Road to a four lane carriageway between Carrington Road and Old Northern Road is part of the Development Consent issued for the expansion of Castle Towers. Council understands that an agreement between the RMS and QIC is expected by the end of May 2012 and it is expected that the road will be needed to both facilitate the construction of QIC's development and to assist the construction of the NWRL.

vi) Norwest Station Construction Site (Site 7)

The key intersections surrounding the Norwest station construction site are:

- Norwest Boulevarde/Windsor Road (signalised).
- Norwest Boulevarde/Columbia Cir/Brookhollow Avenue (East) (roundabout).
- Norwest Boulevarde/Solent Cir (East).
- Norwest Boulevarde/Brookhollow Avenue (West)/Century Cir (roundabout).
- Norwest Boulevarde/Reston Grange/Solent Cir (West) (roundabout).
- Norwest Boulevarde/Old Windsor Road (signalised).

Table 14: Norwest Station Construction Site – Intersection Performance

Intersection	Existing				During Construction			
	LOS (AM)	DOS (AM)	LOS (PM)	DOS (PM)	LOS (AM)	DOS (AM)	LOS (PM)	DOS (PM)
Norwest Boulevard / Windsor Road	C	0.90	D	0.92	C	0.92	D	0.92
Norwest Boulevard / Brookhollow Avenue (East) / Columbia Circuit	A	0.77	B	1.04	A	0.77	B	1.04
Norwest Boulevard / Brookhollow Avenue (West) / Century Circuit	A	0.60	A	0.57	A	0.61	A	0.57

The Norwest station construction site would require the closure of the westbound indented bus bay on Norwest Boulevarde, east of Century Cir. Investigations into an alternate bus stop would be investigated as part of the TMP with the objective of retaining the stop close to its current location. No other bus stops would be affected by the station works.

The southern footpath on Norwest Boulevarde in the vicinity of the worksite would be closed for the duration of the project. Pedestrians would be directed to use the northern footpath via the underpass located to the east of the worksite.

RMS is currently reviewing its operational needs for Norwest Boulevarde and this may result in the intersection of Norwest Boulevarde and Brookhollow Avenue being signalised. This would facilitate pedestrians crossing Norwest Boulevarde to access the shopping centre from the western end of Brookhollow Avenue.

Some existing on-street parking in Brookhollow Avenue may need to be restricted during the station site works.

Peak travel time access through the Business Park must not be affected by the station construction. As a result, four traffic lanes must be available every work day from 7am to 9am and 4.30pm to 6.30pm. Brookhollow Avenue must not become a defacto bypass for Norwest Boulevarde.

Most truck movements will head to the west (Old Windsor Road). This will place a further burden on the roundabout at Lexington Avenue which performs at level of service "F" every morning and afternoon. Either a signalized intersection to replace the roundabout is needed ($8M) or the roundabout itself must be signalized ($0.3M).

No trucks will be permitted to exit/enter the Business Park except via the eastern end of Norwest Boulevarde at Windsor Road, or via Celebration Drive at the western end of the Business Park at Old Windsor Road. None of the local roads leading off Norwest Boulevarde will be used for truck traffic.

vii) Bella Vista Station Construction Site (Site 8)

The key intersections surrounding the Bella Vista station construction site are:

- Old Windsor Road/Celebration Drive (signalised).

- Lexington Drive/Celebration Drive (roundabout).

Celebration Drive is a collector road within Bella Vista serving both retail and commercial land uses. The road has two traffic lanes with heavily used on-street parking and significant pedestrian volumes. The road has a cul-de-sac at its north-eastern end and an all-movement signalised intersection providing access to Old Windsor Road.

At this location the North West T-Way is located on the western side of Old Windsor Road. An underpass immediately north of Celebration Drive transfers the T-Way from the western to the eastern side of Old Windsor Road. None of the T-Way bus routes would need to be re-routed during the construction period.

Table 15 details the existing intersection performance and the anticipated intersection performance during construction. It shows that the additional traffic would result in:

- An increase in the AM peak DOS at the Old Windsor Road/Celebration Drive intersection but with no change to the LOS. In the PM peak the LOS at the intersection would drop from C to D.
- A drop in the LOS in both peak periods at the Lexington Drive/Celebration Drive roundabout, from C to F in the AM peak and from B to E in the PM peak. The provision of two eastbound lanes on the approach to the intersection and replacement of the roundabout with traffic signals would be required as part of the construction works.

Table 15: Bella Vista Station Construction Site – Intersection Performance

Intersection	Existing				During Construction			
	LOS (AM)	DOS (AM)	LOS (PM)	DOS (PM)	LOS (AM)	DOS (AM)	LOS (PM)	DOS (PM)
Old Windsor Road / Celebration Drive	B	0.82	C	0.83	C	0.89	D	1.00
Lexington Drive / Celebration Drive	C	1.02	B	0.95	F	1.32	E	1.26

Bus routes surrounding the proposed construction site are largely confined to the T-Way. However there are two services that connect from Norwest Boulevarde to Lexington Drive and Brighton Drive adjacent to the construction site. There would be no need to re-route these services during the station construction.

The area surrounding the proposed construction site has high levels of pedestrian activity due to the various commercial land uses. However pedestrian and cycle routes surrounding the site would remain unaffected during construction. During construction the Old Windsor Road/Celebration Drive intersection may be upgraded to include a pedestrian crossing on the northern leg of the intersection which would improve pedestrian accessibility in the area.

Parking in the vicinity of the construction site is in the form of unrestricted, on-street parking in the residential areas to the west and the east of the construction

site and private parking in commercial buildings to the south of the site. Most existing on-street parking would not be affected by construction activities.

The 522 off-street car parking spaces in the Totally Home Centre would be lost as a result of the construction however this would no longer be required for customer or staff parking when the Centre closes after acquisition by TfNSW.

The Roundabout at the intersection of Lexington Avenue and Celebration Drive will need to be replaced with traffic signals. Celebration Drive will also need to be upgraded to a four lane carriageway between Lexington Avenue and Old Windsor Road and the dual right turn lanes in Old Windsor Road at Celebration Drive will need to be extended.

No truck movements are to be permitted from the construction site along Lexington Avenue or through the residential area to the east.

viii) Balmoral Road and Memorial Avenue Construction Sites (Sites 9 and 10)

The key intersections surrounding the Balmoral Road and Memorial Avenue construction sites are:

- Old Windsor Road/Balmoral Road (signalised).
- Old Windsor Road/Memorial Avenue/Sunnyholt Road (signalised).

Table 16 details the existing intersection performance and the anticipated intersection performance during construction. It shows that the additional traffic would result in:

- An increase of 2% in the AM peak DOS at the Old Windsor Road/Balmoral Road intersection but with no change to the LOS.
- No significant change to the already congested Old Windsor Road/Memorial Avenue/Sunnyholt Road intersection, although peak period truck movements would need to be avoided.

Table 16: Balmoral Road and Memorial Avenue Construction Sites – Intersection Performance

Intersection	Existing				During Construction			
	LOS (AM)	DOS (AM)	LOS (PM)	DOS (PM)	LOS (AM)	DOS (AM)	LOS (PM)	DOS (PM)
Old Windsor Road / Balmoral Road	C	0.67	B	0.89	C	0.69	B	0.89
Old Windsor Road / Sunnyholt Road / Memorial Avenue	E	1.15	E	1.02	E	1.06	F	1.04

Existing bus services in the vicinity of the construction sites are confined to the T-Way which would remain fully operational during the construction period. This includes the 'Burns' T-Way station. There may however be the need for periodic closures of the T-Way around the 'Burns' station and these would need to be managed to minimise the impact on services.

The 'Balmoral' T-way station would be unaffected by the NWRL construction as it is located outside the construction site compounds.

There are no intensive land uses in the area immediately surrounding the construction sites. Therefore the majority of pedestrian traffic is related to the T-Way station. The regional cycleway is on the western side of Old Windsor Road at this location however the pedestrian/cycle path located on the eastern side of Old Windsor Road between Memorial Avenue and Celebration Drive would be required to be closed for the duration of the construction works. Cyclists and pedestrians can be directed to the regional cycleway on the western side of Old Windsor Road at the Memorial Avenue and Celebration Drive signalised intersections.

The only parking to be affected by the construction is the 'Burns' T-way station carpark. This has 159 spaces and it is expected that these would be displaced and an alternate carpark would need to be provided during construction.

Balmoral Road is likely to be closed to through traffic at some stage of the construction. There is limited access available back through the Balmoral Road Residential Release Area when the closure will be in place, and the intersection conditions onto Memorial Avenue are a great concern. The planned traffic signals at Memorial Avenue and Balmoral Road may need to be brought forward in the program. Right turns are not permitted from Old Windsor Road into Balmoral Road. This access may need to be upgraded to reduce the load on right turns at Memorial Avenue.

ix) Kellyville Station Construction Site (Site 11)

The key intersection surrounding the Kellyville station construction site is:

- Old Windsor Road/Samantha Riley Drive/Newbury Avenue (signalised).

Table 17 details the existing intersection performance and the anticipated intersection performance during construction. It shows that the additional traffic would result in an increase of 3% in the AM peak and 5% in the PM peak DOS at the intersection. The LOS would drop from D to E in the PM peak.

Table 17: Kellyville Station Construction Site – Intersection Performance

Intersection	Existing				During Construction			
	LOS (AM)	DOS (AM)	LOS (PM)	DOS (PM)	LOS (AM)	DOS (AM)	LOS (PM)	DOS (PM)
Old Windsor Road / Samantha Riley Drive	E	1.00	D	0.94	E	1.03	E	0.99

Existing bus services in the vicinity of the construction site are confined to the T-Way and along Samantha Riley Drive. It is expected that the T-Way would remain fully operational during the construction period including the 'Riley' T-Way station. No services would need to be re-routed.

The main impact on the T-Way at this location will be on the car parking and access from the car parks to the T-Way station. It will be necessary to temporarily relocate some of the carparking spaces to accommodate the station construction

works. The proposed location for the temporary carpark is to the south of the existing access road, with access provided to and from the roundabout located on Samantha Riley Drive.

There are no intensive land uses in the area immediately surrounding the construction site with the majority of the pedestrian traffic related to the T-Way bus stop. Some modification to pedestrian paths around the bus stop and along Samantha Riley Drive would occur.

The existing roundabout in Samantha Riley Drive may need to be removed to allow for new signalized access from the station construction area, but this intersection is not at the same location as the roundabout. Access to the T-Way car park will need to be maintained at all times, regardless of whether the roundabout is in place.

All truck movements must be to Old Windsor Road. No trucks will be permitted to travel east along Samantha Riley Drive to Windsor Road or beyond Windsor Road.

x) Old Windsor Road to White Hart Drive Construction Site (Site 13)

The key intersection surrounding the Windsor Road construction site from Old Windsor Road to White Hart Drive is the Old Windsor Road/Windsor Road signalised intersection.

Table 18 details the existing intersection performance and the anticipated intersection performance during construction. It shows that the additional traffic would result in no significant change to the operation of the intersection.

Table 18: Old Windsor Road to White Hart Drive Construction Site

Intersection	Existing				During Construction			
	LOS (AM)	DOS (AM)	LOS (PM)	DOS (PM)	LOS (AM)	DOS (AM)	LOS (PM)	DOS (PM)
Old Windsor Road / Windsor Road	B	0.46	C	0.54	B	0.47	C	0.56

The construction site will have no impact on bus services, pedestrian and bicycle routes or carparking.

xi) Rouse Hill Station and Windsor Road Viaduct Construction Sites (Sites 14 and 15)

The key intersections surrounding the Rouse Hill station construction site are:

- Windsor Road/White Hart Drive (signalised).
- Windsor Road/Rouse Hill Drive/Schofields Road (signalised).

Table 19 details the existing intersection performance and the anticipated intersection performance during construction. It shows that the additional traffic would result in:

- A small increase in the DOS at the Windsor Road/White Hart Drive intersection but no change to the LOS.
- An increase of 6% in the AM peak and 4% in the PM peak DOS at the Windsor Road/Rouse Hill Drive/Schofields Road intersection but no change to the LOS.

Table 19: Rouse Hill Station and Windsor Road Viaduct Construction Site

Intersection	Existing				During Construction			
	LOS (AM)	DOS (AM)	LOS (PM)	DOS (PM)	LOS (AM)	DOS (AM)	LOS (PM)	DOS (PM)
Windsor Road / White Hart Drive	B	0.65	B	0.66	B	0.68	B	0.70
Windsor Road / Schofields Road / Rouse Hill Drive	D	0.95	D	0.93	D	1.01	D	0.97

As the Rouse Hill Station construction site would occupy the existing bus interchange, it will be necessary to relocate all bus stops and layover areas for the duration of the construction work. It is anticipated that the bus stops would be relocated to the adjoining service road, Tempus St, with new bus stops established on the eastern side of the road.

This would require some change to bus operations in and around the interchange including approach and departure routes and connections to the T-Way.

As a town centre station, the area surrounding the construction site will generate a higher level of pedestrian activity relative to most other sites. Therefore maintaining pedestrian and cycle connections during construction would be important.

Informal east-west pedestrian routes through the interchange will be lost during the construction period and pedestrians would be redirected via either Rouse Hill Drive or White Hart Drive, a diversion of approximately 200m. However as the key desire line for pedestrian movements from the interchange area are east through the town centre to the carparks and residential areas rather than west to Windsor Road, the impact on these pedestrian routes is considered minimal.

The construction site is likely to displace all of the existing parking between Windsor Road and the town centre. There are approximately 170 spaces around Tempus St that are either time restricted or restricted access. There are a further 240 spaces located to the north of Rouse Hill Drive adjacent to Windsor Road that are mainly used for staff and overflow parking.

Some of the affected parking could be relocated to other vacant parts of the town centre, possibly as part of any future re-development.

Mitigation measures have been developed to avoid, reduce and manage potential construction traffic impacts. These mitigation measures and their impacts to the individual construction sites are presented in EIS 1 (Attachment 2).

RECOMMENDATIONS:

3.1 A dilapidation report is to be prepared prior to work commencing to ascertain the current condition of the affected local roads and a form of Contributions Plan must be established to collect contributions which will assist with the cost of maintenance, repair and reconstruction as a result of damage caused by trucks.

3.2 Restricted truck access on Council's local roads will be enforced in accordance with weight restrictions within the Shire. The weight restricted routes that are near the station construction precincts include Gilbert Road, Highs Road, Taylor St, Aiken Road, Oakes Road, Jenkins Road, Glenhaven Road, Commercial Road, Withers Road, Hezlett Road, Annangrove Road and Kenthurst Road.

3.3 Council also has several sub-arterial roads near the station construction sites that do not have weight restrictions. These roads include Samantha Riley Drive, Green Road, Sanctuary Drive, Carrington Road and Victoria Avenue. These unrestricted sub-arterial roads should not be used for truck movements to and from the station construction areas - Any conditions of consent issued for the construction of the NWRL by the NSW Government should restrict truck access on these roads.

3.4 Street lighting issues are likely to arise at each construction site because of the extensive excavations. Interrupted power supply and light pole relocations will occur at various stages and the construction management plans will need to detail how these issues are continuously monitored and resolved. This issue will be critical at Castle Hill and Norwest Stations in particular because of pedestrian movements, and site modifications will be required for street lighting at each area to ensure continued operation.

3.5 Traffic volumes along Glenhope Road and Glenridge Avenue will be over their environmental capacity of 250 movements in peak hour, and LATM treatment will be needed along the full length of the connection to Coonara Avenue. Public consultation and funding of any LATM Scheme along Glenhope Road and Glenridge Avenue will be the responsibility of NWRL. The LATM scheme will need to include Parking restrictions in Glenhope Road to control contractors vehicles during construction and these restrictions will remain to control commuter parking.

3.6 The West Pennant Hills Bus Link may be needed as an alternative to Castle Hill Road as buses are likely to use Glenhope Road as a major connection between the residential areas and Cherrybrook station. The proposed Bus Link will need to be re-evaluated as part of a general review of bus services integrating with the Station precinct.

3.7 Relocation of the Castle Hill bus interchange area is critical because pedestrian access will be restricted through and across the site. Buses and pedestrian traffic using those buses, will all revert to Old Castle Hill Road resulting in severe congestion. NWRL will need to show how bus and pedestrian traffic will operate in the temporary location in conjunction with the re-introduction of two way traffic flow along the full length of that road.

3.8 A new bus layover area is needed to reduce demand for bus parking – options include unused Castle Towers overflow parking areas, or Council land in Brisbane Road. The State Government must identify where that layover area is, and clearly show how it will operate to reduce traffic issues in Old Castle Hill Road.

3.9 The proposed major truck access for The Hills Centre Station station goes direct to Showground Road through the dog show area adjacent to the

Cattai Creek bridge. It is unlikely that this proposed access arrangement will be approved on safety grounds because of the steep gradients of Showground Road. A better location is through the Showground upper precinct at the existing signals for Gilbert Road. A fourth leg of this intersection would provide for construction access as well as supporting functions at the Showground during construction of the station.

3.10 No truck movements will be permitted onto Carrington Road. Secondary access for contractors is from Carrington Road at Doran Drive. No improvements are proposed but some form of intersection control such as a roundabout or traffic signals will be needed.

3.11 Peak travel time access through the Business Park must not be affected by the Norwest Station construction. As a result, four traffic lanes must be available in Norwest Boulevarde every work day from 7am to 9am, and 4.30pm to 6.30pm. Brookhollow Avenue must not become a defacto bypass for Norwest Boulevarde.

3.12 Most truck movements will head to the west along Norwest Boulevarde (Old Windsor Road) This will place a further burden on the roundabout at Lexington Avenue which performs at level of service "F" every morning and afternoon. Either a signalized intersection to replace the roundabout is needed ($8M) or the roundabout itself must be signalized ($0.3M).

3.13 No trucks will be permitted to exit/enter the Business Park except via the eastern end of Norwest Boulevarde at Windsor Road, or via Celebration Drive at the western end of the Business Park at Old Windsor Road. None of the local roads leading off Norwest Boulevarde will be used for truck traffic.

3.14 The Roundabout at the intersection of Lexington Avenue and Celebration Drive will need to be replaced with traffic signals. Celebration Drive will also need to be upgraded to a four lane carriageway between Lexington Avenue and Old Windsor Road and the dual right turn lanes in Old Windsor Road at Celebration Drive will need to be extended.

3.15 No truck movements are to be permitted from the construction site along Lexington Avenue or through the residential area to the east.

4. CONSTRUCTION NOISE AND VIBRATION

a) EXISTING ENVIRONMENTAL CONDITIONS

The existing noise environment varies along the length of the proposed alignment due to the wide range of commercial, urban, residential and industrial land uses. Ambient noise measurements were subsequently undertaken at 10 locations along the proposed alignment, supplemented with attended measurements to confirm the major noise sources influencing the measurements. This information was supplemented with ambient noise data collated during the previous NWRL proposal and other recent projects, resulting in a total of 25 representative locations.

The results of the ambient noise surveys are used to establish baseline noise levels upon which the Construction Noise Management Levels (NMLs) are based. The noise parameters most relevant to construction noise are described below and evaluated during the daytime (7am to 6pm), evening (6pm to 10pm) and night time (10pm to 7am) periods:

- RBL

Rating background level (RBL) is the background noise level in the absence of construction activities. This parameter represents the average minimum noise level during the daytime, evening and night time periods and is used to set the NML for residential receivers.

- LAeq (period)

  The Energy Average Noise Level (LAeq) is evaluated over a defined measurement period (usually 15 minutes for construction noise) or the relevant daytime, evening or night time period for ambient noise monitoring.

- LAmax or LA1 (1 min)

  The 'typical maximum noise level' for an event, used in the assessment of potential sleep disturbance during night time periods

A review of the existing and proposed land uses within an area approximately100m either side of the proposed alignment and construction sites was undertaken to identify the nature and location of sensitive receivers.

For the construction noise and vibration assessment, all residential receivers are considered to be of a sensitive nature. Other sensitive receivers include commercial premises, educational facilities, schools, childcare centres, places of worship and hospitals. In addition, some facilities such as sound recording studios, performance spaces and precision laboratories have an increased sensitivity to noise and vibration. Adjacent to the NWRL proposed alignment, such facilities include:

- The Hills Centre for Performing Arts.
- Hillsong Church and its recording studio (HUB building).

b) AIRBORNE CONSTRUCTION NOISE

Airborne noise would occur at all construction sites and would be primarily associated with surface activities or underground activities where there is an airborne noise path between the source and the receiver.

For the purpose of EIS 1, Construction NMLs are based on the 'Interim Construction Noise Guideline' 2009 (ICNG) administered by the Office of Environment and Heritage (OEH).

The ICNG contains airborne NMLs for sensitive land uses including residential, commercial and industrial receivers. These are detailed in Table 20 (Residential Receivers) and Table 21 (Sensitive Land Uses).

Table 20: Airborne NMLs for Residential Receivers

Time of Day	Noise Management Level (NML) LAeq(15minute)	How to Apply
Recommended standard hours: Monday to Friday 7.00 am to 6.00 pm Saturday 8.00 am to 1.00 pm No work on Sundays or public holidays	Noise affected RBL + 10 dB	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured $L_{Aeq(15minute)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to minimise noise. The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dBA	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the proponent should consider very carefully if there is any other feasible and reasonable way to reduce noise to below this level. If no quieter work method is feasible and reasonable, and the works proceed, the proponent should communicate with the impacted residents by clearly explaining the duration and noise level of the works, and by describing any respite periods that will be provided.
Outside recommended standard hours	Noise affected RBL + 5 dB	A strong justification would typically be required for works outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5 dB above the noise affected level, the proponent should negotiate with the community. For guidance on negotiating agreements see Section 7.2.2 of the ICNG.

Table 21: Airborne NMLs for Sensitive Land Uses

Land Use	Management Level, LAeq(15minute) (Applies when Land Use is being Utilised)
Classrooms at schools and other educational institutions	Internal noise level 45 dBA
Hospital wards and operating theatres	Internal noise level 45 dBA
Places of Worship	Internal noise level 45 dBA
Active recreation areas (characterised by sporting activities and activities which generate their own noise or focus for participants, making them less sensitive to external noise intrusion)	External noise level 65 dBA
Passive recreation areas (characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion, for example, reading, meditation)	External noise level 60 dBA
Community Centres	Depends on the intended use of the centre. Refer to the recommended 'maximum' internal levels in AS2107 for specific uses.

c) GROUND-BORNE CONSTRUCTION NOISE

Ground-borne noise during construction may be experienced by sensitive receivers located close to tunnels or other underground excavations including stations, service facilities and crossover caverns.

Ground-borne NMLs for residential receivers are based on levels provided in the ICNG and reproduced in Table 22.

Table 22: Ground-borne NMLs for Residential Receivers

Time of Day	Ground-borne Noise Management Levels (NMLs) - $L_{Aeq(15minute)}$
Daytime 7am to 6pm	Human comfort vibration objectives only
Evening 6pm to 10pm	40 dBA – Internal
Night-time 10pm to 7am	35 dBA – Internal

Ground-borne noise is usually not a significant disturbance to building occupants during the day due to higher ambient levels that mask the audibility of ground-borne noise emissions. For daytime periods, the ICNG does not provide NMLs but instead specifies that the human comfort vibration guidelines are applicable.

During evening and night time periods however, when ambient noise levels are lower, ground-borne noise is more prominent and may result in adverse comment from building occupants.

d) GROUND-BORNE VIBRATION

The effects of vibration in buildings can be divided into three main categories:

- Those in which the occupants or users of the building are inconvenienced or possibly disturbed.
- Those where the building contents may be affected.
- Those in which the integrity of the building or structure itself may be prejudiced.

People are able to 'feel' vibration at levels lower than those required to cause even superficial damage to the most susceptible classes of building. As a guide, safe working distances for typical vibration intensive plant would be provided in a Construction Noise and Vibration Impact Statement (CNVIS) that would be prepared by the contractor for each major stage of works or activity, outlining the potential noise and vibration impacts, proposed mitigation measures, and community consultation process.

To ensure that buildings in close proximity to the proposed construction activities are not damaged, the following measures are proposed:

- If there is a risk that a building or structure may be damaged, building condition surveys would be undertaken prior to and following construction to identify any change in building condition as a result of the activities.
- The safe working distances for cosmetic damage would be complied with at all times, unless approved by an appropriate relevant authority.
- 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.

A conservative vibration damage screening level of 7.5 mm/s has been adopted for the NWRL project and has been established with reference to the minor damage criteria in British Standard BS 7385 Part 2 – 1993.

e) BLASTING

Blasting may be required if hard rock is encountered during the excavation works. Guidance in relation to acceptable overpressure and vibration from blasting is provided in the ICNG.

Should blasting be required, an assessment of the realistic worst-case noise and vibration levels would need to be undertaken and compared with noise and vibration criteria. Alternative construction methods may need to be considered if the predicted noise and vibration levels from blasting exceed the criteria.

f) CONSTRUCTION TRAFFIC NOISE

During construction, spoil removal and product deliveries would result in additional heavy vehicle movements on public roads. Whilst specific guidance on acceptable noise levels associated with construction traffic is not provided by OEH, potential impacts have been identified using guidance in the NSW Road Noise Policy (RNP) (DECCW,2011).

The RNP notes that a noise level increase of up to 2dBA represents a minor impact that is considered barely perceptible to the average person. On this basis, construction traffic NMLs set at 2dBA above the existing road traffic noise levels during both the daytime and night-time periods are considered appropriate to identify the onset of potential noise impacts. At locations where the predicted construction traffic noise levels are more than 2dBA above the existing levels, consideration has been given to identifying all feasible and reasonable work practices to minimise the potential impacts.

Another element of construction traffic noise that has been taken into consideration in EIS 1 is sleep disturbance, with the appropriate screening criteria determined as a maximum level of 15dBA above the RBL, normally during the night-time period (10pm to 7am).

The RNP concludes that maximum internal noise levels below 50 to 55dBAare unlikely to cause awakening reactions. It also concludes that one or two nights per week, with maximum internal noise levels of 65 to 70dBA are not likely to affect health and wellbeing significantly. On that basis, a sleep disturbance NML of 55dBA (internal) has been adopted which equates to an external noise level of 65dBA (assuming open windows).

g) POTENTIAL IMPACTS

Construction noise and vibration emissions have been assessed for each of the major worksites and proposed construction phases (including site establishment, excavation and construction). For each construction site and construction phase, a noise and vibration modelling scenario was developed to assist in predicting the noise and vibration levels within the nearest sensitive receiver areas.

EIS 1 includes details of all sensitive receivers for each construction site, as well as construction NMLs for each receiver. It also includes a table for each construction site of predicted noise level exceedances for each receiver and each type of construction activity.

As an example, the tables for the Norwest station construction site are detailed in Tables 23 and 24.

Table 23: Nearest sensitive receivers to Norwest Station

Receiver Area	Receiver Type	Location Relative to Works (m)[1]	Construction NMLs LAeq(15minute) (dBA)		
			Day	Evening	Night
A – Commercial adjoining South	Commercial	15	70	N/A	N/A
B – Residences to the South	Residential	70	57	50	43
C – Hillsong Church, including recording studio	Worship	115	65	65	-
D – Commercial adjoining North	Commercial	15	70	N/A	N/A

Table 24: Predicted Noise Level Exceedances at Norwest Station

Receiver Area		Noise Modelling Scenario				
		Earthworks and site establishment (daytime)	Excavation of the station box (daytime)	Roadheader operation and spoil removal with acoustic shed (night-time)	Station box construction (daytime)	Station box construction (evening)
A	Commercial adjoining South			N/A		N/A
B	Residences to the South					
C	Hillsong Church			N/A		
D	Commercial adjoining North			N/A		N/A

Compliance | ≤ 10 dB exceedance | 10 dB to ≤ 20 dB exceedance | > 20 dB exceedance or LAeq(15minute) > 70 dBA

Mitigation measures have been developed to avoid, reduce and manage potential noise and vibration traffic impacts. These mitigation measures and their impacts to the individual construction sites are presented in EIS 1 (Attachment 3).

It is acknowledged that a major construction project such as this one will create noise impacts on residents, the reasonableness of the magnitude and duration of the impacts must be considered.

In general, the criteria adopted to determine acceptable noise impacts and establish the Noise Management Levels (NMLs) of the proposal are considered satisfactory. However the number of predicted non-compliances with these criteria, the relatively few monitoring locations to establish background noise levels and the long duration of likely exposure of residential and sensitive receivers, particularly around the major construction sites, demonstrates that more investigation and implementation of noise mitigation measures is required.

It is noted that there is some latitude to amend and refine the construction methodologies subsequent to the detailed design stage and following the awarding of the construction contracts. Any amendment to construction methodologies and associated mitigation measures should be required to improve or maintain those impacts anticipated by this EIS as amended subject to community feedback.

Background Noise Level Assessment

It is noted in Technical Paper 2 attached to EIS 1 that, "the existing noise environment varies along the length of the proposed alignment, as would be expected from the wide range of commercial, urban, residential and industrial land uses within the study area."

Ten locations for background noise level measurement, with the addition of a further fifteen data sets collected from previous NWRL proposals is too few to establish accurate background levels along the entire corridor.

It is therefore suggested that further background measurements be undertaken to assure the accuracy of the background noise levels and resultant modelling of the impacts on receivers where the background noise is lower than that modelled. Particular concern is raised at the reliance of this small data set for sensitive and residential receivers around the major construction sites.

Site Establishment and Earthworks

It is acknowledged that significant site establishment and earthworks will be required prior to the implementation of acoustic mitigation measures such as the construction of the proposed acoustic sheds. While it is proposed to "primarily" conduct these works as daytime works only during these periods, the duration of these works and occasional evening and night time works during this period, will inevitably lead to some level of community dissatisfaction and complaints. Further consideration should be given to mitigation measures at individual receiver's premises to reduce these impacts.

Noise from vehicle movements

The maximum noise levels associated with truck movements are expected to exceed the background + 15 dB sleep disturbance screening criterion at most locations. While it is acknowledged that vehicle movements will be concentrated toward the arterial road network, the project will result in significant increase in traffic noise for sensitive and residential receivers particularly on those portions of the proposed traffic routes linking the construction sites to the arterial road network.

Particular concern is raised regarding the impacts of truck movements on Carrington Road and Norwest Boulevarde, where current night time utilisation by heavy vehicles is very low.

Further consideration and commitment to reducing truck movements to and from constructions sites during the night time hours should be included in the Construction Noise and Vibration Strategy for the project.

In relation to the prediction that on-site truck movements causing awakening reactions (or sleep disturbance) at nearby residences. At each of the underground station sites, including the Bella Vista TBM support site, during night time periods, further consideration of mitigation measures either at the construction site and/or at sensitive or residential receivers to reduce these impacts should be included.

Cumulative impacts of multiple noise sources

Careful consideration to the cumulative noise emission of multiple sources. Eg. Sites affected by Boring machine and work trains within the tunnel, fresh air ventilation system, Concrete plant & Water treatment facilities, internal and external truck movements, conveyors and/or electricity generators operating

concurrently should be modelled for each construction site when considering the appropriate level of noise mitigation measures to be implemented.

Blasting

Should blasting be required (presumably as a last resort), in addition to the proposed assessment of the realistic worst-case noise and vibration levels being undertaken and compared with noise and vibration criteria, a comprehensive community information program should be undertaken to advise potential receivers of; the need for the activity, the days and times proposed and the expected noise impacts associated with the activity.

Proposed Mitigation Measures

The proposal to displace residents from their homes during periods of high noise should be a last resort management option. Rather it is preferable to further commit to adopting mitigation measures to reduce the impacts of noise on residential receivers such as assuring such works are only conducted during daytime hours or in difficult locations mitigation measures at the receivers' properties.

Acoustic treatment should be offered for the dwellings of those residents most affected by the on-going construction noise. Such treatment measures may include additional acoustic insulation of walls and ceilings, installation of double glazing, installation of air conditioning units etc. These measures should be considered particularly around The Hills Centre, Castle Hill & Bella Vista stations. Particular residential receivers of concern include, Carrington Road, Showground Road, residents to the east of Bella Vista Station & Precast Yards including Celebration Drive, Sharrock Avenue,

A commitment to upgrade the acoustic treatment of the acoustic enclosure at the Bella Vista station and pre-cast yard acoustic sheds is required. The modelled impacts on residential receivers for the duration of this project are unreasonably high based on standard acoustic shed construction.

The construction methodology and proposed mitigation measures for the construction of the viaduct require review. The modelled impact of the construction of the viaduct are unacceptable as the prediction indicates significant exceedance of the NMLs for the entirety of the construction works on the residences described as:

1. "Residences East of Old Windsor Road from the North section of Arnold Avenue to the North border of the Celebration Drive shopping centre";
2. "Residences East of Old Windsor Road and South of Samantha Riley Drive";
3. "Residences East of Old Windsor Road, between the group of residences North East of Windsor Road/Old Windsor Road junction and Samantha Riley Drive"; and
4. "Residences East of Windsor Road, between Bellcast Road and Sanctuary Drive"

Limiting of works to daytime only hours would also be considered appropriate to allow evening respite to residents of the above areas.

Vibration Impacts

Building condition surveys should be undertaken prior to and following construction to measure any change in building condition as a result of the

construction activities for all properties within the affinity of the tunnelling works were property damage resulting from vibration is possible. These surveys should not be limited to those properties anticipated to be affected by vibration in order to address future claims by property owners that may otherwise be unable to substantiate.

Monitoring and Measurement Regime

Proactive monitoring at strategic sites along the rail corridor, correlating to the predicted high impact areas should be undertaken to demonstrate compliance and/or guide further mitigation measures.

Complaint handling and Response

It is recommended that a commitment be made to offer attended measurement at key sites in response to complaints. Attended measurements should be undertaken at locations and times identified by residents affected to assure noise concerns are appropriately dealt with and the magnitude of any impacts are accurately understood.

An on-going commitment to complaint management and community liaison is required to manage and resolve future issues.

RECOMMENDATIONS:

4.1 While the criteria used to determine acceptable noise impacts is supported, that criteria predicts that there will be significant noise impacts and more investigation around the major construction sites is required.

4.2 Any amendment to construction methodologies and associated mitigation measures should be required to improve or maintain those impacts anticipated by this EIS.

4.3 Further background measurements should be undertaken to assure the accuracy of the background noise levels and resultant modelling of the impacts on receivers where the background noise is lower than that modelled.

4.4 While it is proposed to "primarily" conduct site establishment works during the daytime, the duration of these works and occasional evening and night time works during this period will inevitably lead to some level of community dissatisfaction and complaints. Further consideration should be given to mitigation measures at individual receiver's premises to reduce these impacts.

4.5 Further consideration and commitment to reducing truck movements to and from constructions sites along Carrington Road and Norwest during the night time hours should be included in the Construction Noise and Vibration Strategy for the project.

4.6 In relation to the prediction that on-site truck movements causing awakening reactions (or sleep disturbance) at nearby residences. At each of the underground station sites, including the Bella Vista TBM support site, during night time periods, further consideration of mitigation measures either at the construction site and/or at sensitive or residential receivers to reduce these impacts should be included.

4.7 Where blasting is required (presumably as a last resort), in addition to the proposed assessment of the realistic worst-case noise and vibration levels being undertaken and compared with noise and vibration criteria, a comprehensive community information program should be undertaken to

advise potential receivers of; the need for the activity, the days and times proposed and the expected noise impacts associated with the activity.

4.8 Acoustic treatment should be offered for the dwellings of those residents most affected by the on-going construction noise. Such treatment measures may include additional acoustic insulation of walls and ceilings, installation of double glazing, installation of air conditioning units etc. These measures should be considered particularly around the Hills Centre, Castle Hill & Bella Vista stations. Particular residential receivers of concern include, Carrington Road, Showground Road, residents to the east of Bella Vista Station & Precast Yards including Celebration Drive, Sharrock Avenue,

4.9 A commitment to upgrade the acoustic treatment of the acoustic enclosure at the Bella Vista station and pre-cast yard acoustic sheds is required. The modelled impacts on residential receivers for the duration of this project are unreasonably high based on standard acoustic shed construction.

4.10 An on-going commitment to complaint management and community liaison is required to manage and resolve future issues.

4.11 The construction methodology and proposed mitigation measures for the construction of the viaduct require review. The modelled impact of the construction of the viaduct are unacceptable as the prediction indicates significant exceedance of the NMLs for the entirety of the construction works on the residences described as:

- "Residences East of Old Windsor Road from the North section of Arnold Avenue to the North border of the Celebration Drive shopping centre";
- "Residences East of Old Windsor Road and South of Samantha Riley Drive";
- "Residences East of Old Windsor Road, between the group of residences North East of Windsor Road/Old Windsor Road junction and Samantha Riley Drive" and
- "Residences East of Windsor Road, between Bellcast Road and Sanctuary Drive"

5. EUROPEAN HERITAGE

a) ASSESSMENT METHODOLOGY

A European Heritage Report was prepared to address impacts on European heritage from the major civil construction works that would occur as a result of demolition and clearing, removal of vegetation and site preparation activities.

The methodology for the Report included:

- A review of Heritage Reports previously prepared for the NWRL project,
- A review of statutory heritage lists including the State Heritage Register and heritage schedules on Local Environment Plans,
- A review of non-statutory heritage lists including the National Trust Register,
- A review of relevant archaeological assessments and zoning plans,
- Desktop research and historical research, including a review of relevant conservation management plans (CMPs) and Plans of management (PoM),
- Consultation with heritage advisers at Councils and State Agencies,

- Assessments of heritage significance for the assessed heritage items, including heritage curtilages and assessments of condition, based on the NSW heritage criteria, and
- Site inspections along the NWRL alignment.

b) EXISTING ENVIRONMENT

i) Cherrybrook Station Construction Site (Site 4)

The area around Cherrybrook station was predominantly rural until the 1960s. The station site on the Hornsby Shire side of Castle Hill Road consists of a number of residential properties, some areas of open space, as well as bushland and an electrical transmission line easement. Some large houses established during the late nineteenth century and early twentieth century, are located nearby. Inala School, located to the east of Franklin Road, is a good example of a large early Federation Bungalow style house.

Glenhope, a large two storey residence is situated within The Hills Shire on the southern side of Castle Hill Road, directly opposite the proposed station site. The house, which faces the road, is set back within a landscaped garden setting and extensive grounds.

ii) Castle Hill Station Construction Site (Site 5)

Arthur Whitling Park was established in the 1930s on the site of a former tramway terminal and later Castle Hill railway station, to perpetuate the memory of a former local Councillor and Shire President. An Anzac Memorial Hall was located at the southern end of the park until 2005 before being demolished. It was constructed for use as the first Castle Hill RSL and was later used as a cinema and community centre. A number of potentially significant items are located within the grounds of the park including a war memorial, several other memorials and commemorative trees, as well as some other mature trees.

iii) The Hills Centre Station Construction Site (Site 6)

Castle Hill Showground has hosted the annual Castle Hill Show since the 1890s and is regularly used by a number of local community groups. The showground has retained its rural character which is reinforced by the vernacular nature of the majority of sheds and pavilions located to the north and west of the show ring.

iv) Norwest Station Construction Site (Site 7)

Historically the area was characterised by large land grants made in the early years of the colony, the largest being to Foveaux and Grimes in 1799 and known as Bella Vista farm from 1821. The transformation of the area into residential and commercial has occurred over the past 20 years.

v) Bella Vista Station Construction Site (Site 8)

The designated site for Bella Vista station is located on the eastern side of Old Windsor Road and its historical character is similar to the Norwest station site. The connection of the area to Sydney by Old Windsor Road was established in 1794.

vi) Balmoral Road Construction Site (Site 9)

There are no known heritage items or potential heritage items within the proposed Balmoral Road construction work zone. No known archaeological sites have been identified.

vii) Memorial Avenue Construction Site (Site 10)

The area of the Memorial Avenue construction site has historically been rural, with the area sparsely developed and populated.

viii) Kellyville Station Construction Site (Site 11)

The site for Kellyville station on the eastern side of Old Windsor Road is located within an area along an original alignment of the road. The area of the station remained predominantly rural until the 1990s, when residential subdivisions and development occurred.

ix) Samantha Riley Drive to Windsor Road Construction Site (Site 12)

The area of this construction site has historically been rural and sparsely populated until comparatively recently when development has occurred.

x) Old Windsor Road to White Hart Drive Construction Site (Site 13)

The area of this construction site remained predominantly rural following European settlement in the area and the construction of Old Windsor Road/Windsor Road in the late eighteenth century. Residential subdivisions have occurred since the late twentieth century and are transforming the visual character of the area.

One heritage item is located in the vicinity of the construction site, Mungarie, a late nineteenth century house located on the eastern side of Windsor Road, south of White Hart Drive. The house is located within an allotment that has been landscaped to mimic the historical rural setting of the building. The house has been refurbished for use as the Rouse Hill Visitor Information Centre.

xi) Rouse Hill Station Construction Site (Site 14)

The proposed Rouse Hill station would be located in an area that includes a number of sites with historical associations with the colonial period including the site of the Battle of Vinegar Hill, Windsor Road and Rouse Hill farm.

xii) Windsor Road Viaduct Construction Site (Site 15)

This site is to occupy the north-east and north-west corners of the intersection of Windsor Road, Schofields Road and Rouse Hill Drive, plus a small zone in the median. No heritage context was identified for this area.

c) POTENTIAL IMPACTS

In order to assess the potential impacts of the proposed works, a ranking measuring their severity was developed and is detailed in Table 25.

Table 25: Ranking of Severity of Heritage Impact

Rating	Definition
Major adverse	Actions which will have a severe, long-term and possibly irreversible impact on a heritage item. Actions in this category would include partial or complete demolition of a heritage item or addition of new structures in its vicinity that destroy the visual setting of the item. These actions cannot be fully mitigated.
Moderate adverse	Actions which will have an adverse impact on a heritage item. Actions in this category would include removal of an important part of a heritage item's setting or temporary removal of significant elements of fabric. The impact of these actions could be reduced through appropriate mitigation measures.
Minor adverse	Actions which will have a minor impact on a heritage item. This may be the result of the action affecting only a small part of the place or a distant/small part of the setting of a heritage place. The action may also be temporary and/or reversible.
Neutral	Actions which will have no heritage impact.
Minor positive	Actions which will bring a minor benefit to a heritage item, such as an improvement in the item's visual setting.
Moderate positive	Actions which will bring a moderate benefit to a heritage item, such as removal of intrusive elements or fabric or a substantial improvement to the item's visual setting.
Major positive	Actions which will bring a major benefit to a heritage item, such as reconstruction of significant fabric, removal of substantial intrusive elements/fabric or reinstatement of an item's visual setting or curtilage.

i) Cherrybrook Station Construction Site (Site 4)

Based on the location of the heritage sites with respect to the proposed works, it was determined that there is potential for two heritage items to be affected by the NWRL project, Glenhope and Inala School. These impacts are assessed in Table 26.

Two potential archaeological sites were identified within the construction site, both within Hornsby Shire in Franklin Road. They are former house sites and include structural remains, wells/cisterns etc. As the sites are located within the perimeters of the proposed deep excavation for the station site, it would result in the removal of any potential archaeological resources that may have survived at the site. This has been assessed as having a moderate adverse impact.

Table 26: Cherrybrook Station Construction Site - Assessment of Heritage Impacts

Glenhope

Significance	State
Statement of Significance	Glenhope is an intact early Federation period mansion characteristic of its type. It is particularly important for its retained internal finishes and architectural features which heralded new trends in late nineteenth century interior decoration. Its prominent ridge-crest location, remnant garden features and mature trees provide Glenhope with an outstanding setting which is rare for this area. (Adapted from the Australian Heritage Places Inventory).
Heritage Impact	The construction works would have some temporary adverse impacts upon the setting of (and the outlook from) the heritage-listed Glenhope, which is directly opposite the access road to Cherrybrook Station construction site. Existing vegetation on the northern side of the road (within the construction site) forms part of the visual setting for Glenhope house. Much of this vegetation would be removed from the proposed civil construction works. The proposed construction woks would have a moderate adverse impact on the visual setting of Glenhope.

Inala

Significance	Local
Statement of Significance	Good example of a large early Federation Bungalow style house. Elegant design with distinctive tall chimney and pair of gablets. Integrity affected by some unsympathetic modifications. (State Heritage Inventory).
Heritage Impact	There may be some minor impact upon the setting of this property resulting from the station construction works if trees are to be removed from near Franklin Road. It is considered that the proposed construction works would have a minor adverse impact on Inala.

ii) Castle Hill Station Construction Site (Site 5)

There are two potential heritage items in the vicinity of the construction site that could be impacted, Arthur Whitling Park and The White House Gallery. The White House Gallery was recently demolished following a resolution by Council.

The potential heritage impacts on Arthur Whitling Park are detailed in Table 27.

The potential archaeological remains associated with the Parramatta to Castle Hill tramway and terminus are located within the perimeter of the proposed deep excavation for the construction works. Therefore any potential archaeological resource would be totally removed and has been determined to have a moderate adverse impact.

Table 27: Castle Hill Station Construction Site – Assessment of Heritage Impacts

Arthur Whitling Park	
Significance	**Local (potential)**
Statement of Significance	Arthur Whitling Park has significance at the local level for its historic use as the site of the Castle Hill railway station and terminus, and as the first site of the Castle Hill RSL, in the Anzac Memorial Hall (demolished 2005). The reserve land has a long history of community use, being the site of Castle Hill's first community hall in 1879. However, no physical evidence of these past significant uses remain within the reserve; rather, its history is reflected in the numerous plaques and memorials to local people that are scattered throughout the reserve and the construction of a new war memorial at its northeastern corner. The war memorial and commemorative elements have social value at a local level as places of remembrance and ceremony. Arthur Whitling Park has some aesthetic significance for its elegant arrangement of mature trees and planted beds.
Heritage Impact	The entire area of Arthur Whitling Park would be directly affected by the proposed works. This park is not a listed heritage item however it has existed since the mid-1930s, and it contains several monuments and memorials as well as numerous established mature trees. An existing war memorial including a central fountain occupies the northern section of the park. The memorials would be dismantled and placed within the station precinct or as agreed with the Returned and Services League (RSL). The removal of the park and all of its various components would adversely affect the existing aesthetic character of the space. The works would also have negative heritage impacts upon the existing historic and social values of the park. The works are considered to have a range of adverse impacts from minor to major, depending on the individual item.

iii) The Hills Centre Station Construction Site (Site 6)

The Castle Hill Showground is the only potential heritage item in the vicinity of the construction site that was assessed as having the potential to be impacted by the NWRL. Details are provided in Table 28.

Two potential archaeological sites were identified within the construction site. They are former pre-1920s buildings identified on historic plans and aerial photos and are within the area designated for earthworks construction of the station. The nature of the proposed earthworks would require that any archaeological remains in situ be removed prior to construction. It was determined that this would have a moderate adverse impact.

Table 28: The Hills Centre Station Construction Site – Assessment of Heritage Impacts

Castle Hill Showground	
Significance	**Local**
Statement of Significance	Castle Hill Showground has significance at the local level for its historic, rarity and representative values. The showground has been the home of the Castle Hill Show since 1890, which by the 1950s was the second largest show in Sydney region, after the Royal Agricultural Society's show at Moore Park. It provides evidence of the historical importance of agriculture to The Hills district and is a reminder of the vital role the area once played in providing produce for Sydney. Castle Hill Showground is a representative example of rural showgrounds in NSW, with a large show ring and pavilions arranged around it. While the shape of the show ring has changed over time, the layout of the showground, with the pavilions arranged around the north and western edges of the show ring, remains unchanged since at least 1930. The Showground is an important and much used cultural and recreational facility in The Hills Shire.
Heritage Impact	The designated construction zone would have potential adverse impacts upon parts of the Castle Hill Showground, which is a rare example of a rural-style showground within the Sydney metropolitan area. The showground facility has existed in this location since the 1890s and the place retains its rural character. However it is considered that very few of the existing showground pavilions and associated structures have high heritage values as individual built elements. The resulting impacts on the affected portion of the Showground and some component items in this region would be major. Whereas, other areas and component elements of the Showground well outside the construction zone would remain relatively unaffected by the works.

iv) Norwest Station Construction Site (Site 7)

No heritage items in the vicinity of the construction site were assessed as having the potential to be impacted by the NWRL. No known archaeological sites were identified within the proposed construction zone.

v) Bella Vista Station Construction Site (Site 8)

Bella Vista Farm Park is the only potential heritage item in the vicinity of the construction site that was assessed as having the potential to be impacted by the NWRL. Details are provided in Table 29.

As no archaeological potential was identified within the construction zone, the construction works are unlikely to result in any archaeological impacts.

Table 29: Bella Vista Station Construction Site – Assessment of Heritage Impacts

Bella Vista Farm	
Significance	**State**
Statement of Significance	Bella Vista Farm is of at least state significance to NSW as a rare example of an intact rural cultural landscape on the Cumberland Plain, continuously used for grazing since the 1790s: evidence of patterns of agricultural use of the farm over the last 200 years survive including field patterns, post and rail fences, vernacular slab farm buildings and evidence of the alignment of its traditional transport route, Old Windsor Road, as well as cultural plantings and remnant woodland trees.... Bella Vista Farm is one of the most intact and best examples on the Cumberland Plain of the summit model of homestead siting, where the house and plantings are sited high on a prominent hill in contrast with open fields around. Its driveway is intact and relates to the traditional transport route (Old Windsor Road). Its prominent siting allows views to and from the property from a wide area. Views to the 'summit' are also available from Old Windsor Road. (Adapted from the State Heritage Inventory)
Heritage Impact	It is considered that there would be few appreciable adverse impacts upon any known items of European heritage arising from the construction of Bella Vista Station. The station site is unlikely to be visible from anywhere within the State heritage listed property of Bella Vista Farm which is located approximately one km from the construction zone. Recent developments in the vicinity include the Norwest Business Park.

vi) Balmoral Road Construction Site (Site 9)

There was only one potential heritage item that may have been impacted by the NWRL project, a weatherboard house at 36 Old Windsor Road that was identified in the Windsor Road Old Windsor Road Conservation Management Plan 2005 (CMP). However, according to the EIS, the house has since been demolished.

No items of archaeological potential were identified in the construction zone.

vii) Memorial Avenue Construction Site (Site 10)

There are no known heritage items or potential heritage items within the proposed construction zone.

A number of old boundary stones along Old Windsor Road were identified in the 2005 CMP to the north of Memorial Avenue. However these boundary stones were most likely buried during construction of the North West T-Way during the past decade.

viii) Kellyville Station Construction Site (Site 11)

The Windsor Road and Old Windsor Road Heritage Precinct (Stanhope Farm Alignment) is the only potential heritage item in the vicinity of the construction

site that was assessed as having the potential to be impacted by the NWRL. Details are provided in Table 30.

Several archaeological sites were identified within construction site 11, including brick wells and boundary markers. There is potential for these to be disturbed or destroyed by any proposed earthworks associated with construction of the station. The magnitude of the impact will be determined by the depth of excavation required, and the

Table 30: Kellyville Station Construction Site – Assessment of Heritage Impacts

Old Windsor Road Heritage Precinct 1 (OWR 1) Stanhope Farm Alignment	
Significance	**State**
Statement of Significance	*Surviving section of the old alignment of Windsor Road showing early construction and design methods. Contains the largest group of alignment stones. Remnants of the early setting also remain. Named after original land grant.* (Windsor Road and Old Windsor Road CMP 2005) Assessed as having high historic, associative, aesthetic, research and rarity values in the Windsor Road and Old Windsor Road CMP 2005, this precinct was altered to some extent during the North-west T-way works. However, some elements of the precinct remain in situ.
Heritage Impact	As the proposed station site would be located adjacent to one of the identified historic precincts along Old Windsor Road, there may be some impacts upon this historic roadway precinct. Since there have been numerous physical changes to this part of Old Windsor Road in recent times, any negative heritage impacts are likely to be of a relatively *minor adverse* nature.

ix) Samantha Riley Drive to Windsor Road Construction Site (Site 12)

There are no known heritage items or potential heritage items within the proposed construction zone.

x) Windsor Road to White Hart Drive Construction Site (Site 13)

There are two heritage items in the vicinity of the proposed construction site that have the potential to be impacted by the NWRL project, the Windsor Road and Old Windsor Road Heritage Precinct and Mungerie House. One archaeological site, the former Swan Inn, was also identified as being within the construction site.

Details of the heritage impact assessment are included in Table 31.

The site of the former Swan Inn is located within the proposed construction site. Therefore the proposed works would result in a major adverse impact on this archaeological site.

Table 31: Construction Site 13 – Assessment of Heritage Impacts

Windsor Road Heritage Precinct 14 (WR 14) Caddies Creek Alignment	
Significance	**State**
Statement of Significance	*Surviving section of the old alignment of Windsor Road and approach to old bridge crossing at Caddies Creek. Remains of the old road alignment also exist on the eastern side of the creek.* (Windsor Road and Old Windsor Road CMP 2005) Assessed as having high historic, associative, research and rarity values in the Windsor Road and Old Windsor Road CMP 2005, this precinct was altered to some extent during the North-west T-way works. However, some elements of the precinct remain in situ, including the original alignment.
Heritage Impact	As the proposed construction works site is located adjacent to one of the identified historic precincts along Old Windsor Road, there may be some impacts upon this historic roadway precinct. Since there have been numerous physical changes to this part of Windsor Road in recent times, any negative heritage impacts are likely to be of a relatively *minor adverse* nature.

Mungerie	
Significance	**Local**
Statement of Significance	*Evidence of late nineteenth century farming. If a Pearce property, the place is also significant for its association with and evidence of the Pearce family as major graziers, orchardists and land dealers in this part of the Shire.* (The Hills Shire Council Heritage Inventory Sheet)
Heritage Impact	It is considered that there would be a *major adverse* impact upon the setting and curtilage of Mungerie. The proposed rail corridor cuts across the original entrance driveway into the Mungerie property and the viaduct structure would substantially reduce the remnant curtilage of the house, dominate views to the west and interrupt important traditional links between the main road and this 1890s house. The proposed work would therefore result in further erosion of the traditional setting of the house and would constitute a *major adverse* impact.

xi) Rouse Hill Station Construction Site (Site 14)

The Battle of Vinegar Hill memorial is the only heritage item in the vicinity of the site that has been assessed as having the potential to be impacted by the NWRL project. The potential impacts on this item are assessed in Table 32.

There are no known archaeological sites identified within the proposed Rouse Hill station site. Therefore the construction works are unlikely to result in any archaeological impacts.

Table 32: Rouse Hill Station Construction Site – Assessment of Heritage Impact

Battle of Vinegar Hill (memorial)	
Significance	**Local (potential state)**
Statement of Significance	*The position overlooks Windsor Road, the site of the first military battle to have taken place on Australian soil.* (State Heritage Inventory). This memorial commemorates a significant event in the early colonial history of New South Wales.
Heritage Impact	The Battle of Vinegar Hill Memorial is located in an elevated position within the Castlebrook Cemetery at 712 Windsor Road, Rouse Hill. However, the actual place where the skirmish occurred has not been determined with certainty. Although the proposed construction works may be visible in views from the Battle of Vinegar Hill Memorial it is considered that these impacts would be of a relatively minor and temporary nature.

xii) Windsor Road Viaduct Construction Site (Site 15)

There are three items in the vicinity of the viaduct construction site that have the potential to be impacted by the NWRL project, the Battle of Vinegar Hill memorial, the Royal Oak Inn (now mean Fiddler Hotel) and the Rouse Hill Farm House and farm. However based on the location of these items in relation to the construction site, only the Royal Oak Inn has the potential to be affected. The potential impacts on this item are assessed in Table 33.

No known archaeological sites were identified within the proposed viaduct construction site.

Table 33: Windsor Road Construction Site – Assessment of Heritage Impact

Royal Oak Inn (former) (now Mean Fiddler Hotel)	
Significance	**State**
Statement of Significance	The former Royal Oak Inn (now the Mean Fiddler Inn) is of historical and technological heritage significance because: It is an important survivor of an early colonial coaching inn of the 1820-40 periods with the main part of the original complex of buildings remaining intact. (Kremmer, 1991) It is probably the only inn along the main road between Parramatta and Windsor that is conserved and which continues its use today as a "watering hole" or "stop over" for the general public and travellers along the Windsor Road. Its Georgian sandstone frontage and elegant verandah facing Windsor Road is a vivid reminder of a roadside inn that once were plentiful along Windsor and Old Windsor Roads (Edds, 2003) It is the site of one of the earliest licensed premises in the colony dating to 1830. It was a simple, practical design for a coaching inn which allowed its use to continue until the advent of the railways, to be adapted for residential use and later to be restored as a restaurant. It is well built with dressed sandstone Georgian facade enhanced with a handsome Colonial verandah. Its structure and fabric have survived relatively well despite changes in ownership and use. The seven main rooms and road frontage have been well conserved internally with plaster walls, lath and plaster ceilings, Australian cedar joinery and traditional hardware. Although compromised and consumed within the Irish Tavern, the L shaped coaching inn remains extant and recognisable. Its structure and fabric have survived relatively well despite changes of ownership and use. (Kremmer, 1991). (State Heritage Inventory).
Heritage Impact	Removal of trees in views south along Windsor Road from the hotel could result in an impact on the visual setting of the former Royal Oak Inn. However, the trees to be removed are a substantial distance from the hotel, and therefore this impact is considered neutral.

Mitigation measures have been developed to avoid, reduce and manage identified potential impacts on European heritage items and archaeology. These mitigation measures and their application to individual construction sites are detailed in EIS 1 (Attachment 4 – European Heritage Mitigation Measures).

Heritage specialists would be involved in the design documentation phase and with the construction teams selected to carry out the civil construction works to ensure that the recommended mitigation measures are implemented and impacts on heritage items minimised. Such specialists would also be able to assist by identifying opportunities for enhancing the significance of heritage items and archaeological sites.

In the event that archaeological remains are encountered during excavation works in the areas of the designated alignment that have not already been

identified as archaeological sites or sites of archaeological potential, the Heritage Branch will be notified and the measures set out in the Heritage Act for the management of archaeological remains be implemented.

To determine the severity of construction impacts on the various heritage/archaeological items and items of unlisted historical significance in the vicinity of the railway, the EIS adopted an impact ranking system, ranging from 'major adverse' through to 'neutral' and 'major positive'. The impact on the majority of heritage and archaeological items, ranged from 'neutral' to 'minor adverse'.

The EIS has identified 'moderate adverse' or 'major adverse' impacts in relation to two heritage items within the Shire being 'Glenhope', West Pennant Hills and 'Mungerie', Rouse Hill.

In terms of archaeological impacts, 'moderate' to 'major adverse' impacts have been determined in relation to sites at Castle Hill Station, Hills Centre Station and Old Windsor Road to White Hart Lane. The impact on structural remains and brick wells (Site 11, Kellyville Station), which are not listed as heritage items and are identified as having low to medium archaeological potential, was not ranked since it would be determined by the depth of excavation required. However, mitigation measures require further investigation and assessment of a number of sites, and detailed recording and retention (if possible) of these wells in particular. These measures are considered appropriate.

Heritage impacts – Glenhope

A 'moderate adverse' impact has been identified for the visual setting of Glenhope, an intact early Federation period mansion located on the southern side of Castle Hill Road, directly opposite the proposed Cherrybrook station (Site 4). Existing vegetation on the northern side of the road, which forms an important part of the visual setting, would be removed. The proposed mitigation measures to retain or reinstate an adequate buffer of vegetation along the northern side of Castle Hill Road are considered sufficient to reduce the impact of the proposal.

Heritage impacts – Mungerie

A 'major adverse' impact has been identified for the setting and curtilage of Mungerie (c 1890s), adjacent to Site 13, which has recently been fully restored and is currently being used as a Visitors/Information centre. The proposed rail corridor cuts across the original entrance driveway into the property and the viaduct structure would substantially reduce the remnant curtilage of the house, dominate views to the west, and interrupt important links between the main road and the house.

It is clear that the rail construction will cause a major impact on the heritage item by further eroding its traditional setting. The visual impacts of the viaduct to and from Mungerie will be permanent and significant, however it will also be viewed within the context of existing major transport routes (Windsor Road and Transitway). The EIS focused only on views from the house, however views to the site, the siting of the house on a rise and its relationship with Windsor Road, the traditional entry point to the property, are also very important and should be considered.

The mitigation measures include re-establishing vegetation, special attention to the design of the viaduct and location of piers and reinstating the carriage drive. These measures are considered acceptable.

Archaeological impacts

There is potential for 'moderate adverse' to 'major adverse' archaeological impacts for the following locations:

- Castle Hill station (Site 5) – potential for remains of Parramatta to Castle Hill tramway;
- Hills Centre Station (Site 6) - two pre-1920s house sites off Carrington Road; and
- Old Windsor Road to White Hart Drive construction (Site 13) - former Swan Inn site.

The proposed mitigation measures include further research to assess archaeological potential and significance and archaeological excavation and recording of features and/or deposits if required. For the former Swan Inn the preparation of an interpretation plan and strategy may be required. The proposed mitigation measures in relation to archaeological impacts are considered appropriate.

RECOMMENDATIONS:

5.1 Views to Mungerie House from Windsor Road must also be considered in the design and placement of the viaduct and its piers.

5.2 During the detailed design of the viaduct and consideration of view corridors, Transport NSW should consult the Mungerie House Conservation Management Plan (2007) prepared for Lend Lease by Tanner Architects and endorsed by Council as it contains important information regarding view corridors and the setting of Mungerie House.

6. INDIGENOUS HERITAGE

a) ASSESSMENT METHODOLOGY

The methodology for the Indigenous Heritage Report (IHR) undertaken for the project (Godden Mackay Logan and Jo McDonald CHM, March 2012) involved a review of previous Aboriginal Archaeological Assessments that were prepared during the preliminary stages of the project. These included an initial impact assessment for the NWRL undertaken by Mills Archaeological and Heritage Services Pty Ltd in 2003, and a second preliminary assessment undertaken by Jo McDonald CHM Pty Ltd in 2006. These reports identified a number of Aboriginal sites associated with the proposed alignment of the NWRL project.

To prepare the IHR extensive consultation with relevant stakeholders and Registered Aboriginal Parties was undertaken, together with field surveys.

b) EXISTING ENVIRONMENT

The IHR assessed each construction site in terms of its physical setting, level of impact, existing Aboriginal sites and archaeological potential.

i) Cherrybrook Station Construction Site (Site 4)

This construction site contained a mixture of disturbed (from residential development) and undisturbed (containing dense vegetation) land. A registered Aboriginal site (45 – 6 – 2861, Stone Artefact Concentration (SAC)) was found to be located within the centre of this construction site. Therefore this area was

assessed as possessing a low to moderate potential for sub-surface Aboriginal objects and Potential Archaeological Deposits (PAD).

ii) Castle Hill Station Construction Site (Site 5)

This construction site is highly disturbed by landscaping, including gardens, lawns and exotic trees and the construction of the adjacent roads and bulk excavation around the buildings at the eastern end of the park. No Aboriginal objects and/or sites were observed within the construction site and therefore it was determined that there was a very low potential for intact Aboriginal sites to be present.

iii) The Hills Centre Station Construction Site (Site 6)

The eastern portion of this construction site has been heavily impacted by building and construction activities. Therefore it is considered to have no archaeological potential. However the western portion of the site has a moderate level archaeological potential for Aboriginal objects to be located within a subsurface context.

iv) Norwest Station Construction Site (Site 7)

This construction site is highly disturbed by modern buildings, cut and imported fills, roads and landscaping and was assessed as having low to no potential for intact Aboriginal sites.

v) Bella Vista Station Construction Site (Site 8)

Construction has already been highly impacted by development and the course of the creek bank along the northern end of Celebration Drive has been modified in the past. As such the site was assessed as having low to no potential for Aboriginal heritage sites.

vi) Balmoral Road Construction Site (Site 9)

This construction site was found to have been impacted by housing development and service installations. However despite this, Aboriginal objects have previously been recorded within this construction site, and a new site was also observed. As a result, construction site 9 was assessed as having archaeological potential associated with two properties within it at 2 and 12 Cumberlege Lane.

vii) Memorial Avenue Construction Site (Site 10)

In general this construction site was found to have been subject to a low level of disturbance, primarily through historical vegetation clearing. Site preparation for surrounding residential development and the Burns Road –T-Way station have resulted in significantly modified soil horizons.

A number of aboriginal sites have previously been recorded within and adjacent to the construction site with the most recent survey identifying that the ridge top, hill slope and flat landforms overlooking Elizabeth Macarthur Creek have the potential for relatively undisturbed archaeological deposits.

viii) Kellyville Station Construction Site (Site 11)

This construction site was found to have been impacted by the T-Way carpark, some residential development and historical vegetation clearing. Three aboriginal sites had previously been identified directly adjacent to this construction site and one (a stone artefact site with PAD) within its boundary. The assessment determined that this construction site has moderate archaeological potential for relatively undisturbed archaeological deposits.

ix) Samantha Riley Drive to Windsor Road Construction Site (Site 12)

Some disturbances were identified at this construction site, including earthworks adjacent to Elizabeth Macarthur Creek, stockpiling of gravels, fills and concrete dumping, and native vegetation clearing. An area of PAD covers the whole construction site due to its proximity to the creek and landforms suitable for Aboriginal occupation.

x) Windsor Road to White Hart Drive Construction Site (Site 13)

The northern areas of this construction site were found to contain several previously recorded Aboriginal sites, some of which have been subject to prior Aboriginal Heritage Impact Permits issued under Section 90 of the National Parks and Wildlife Act. However they could not be relocated due to limited ground surface visibility. Creek flat landforms 100m either side of the two creek lines were found to have archaeological potential for relatively undisturbed archaeological deposits.

xi) Rouse Hill Station Construction Site (Site 14)

The majority of this construction site has been cleared and subjected to extensive urban development. Section 90 permits have been previously granted for all lands in the Rouse Hill Town Centre and it was determined that there is no archaeological potential for intact Aboriginal sites to remain within the previously developed land. The Caddies Creek precinct was subject to archaeological salvage excavation in 2007, with the heritage outcome being the retention of all identified Aboriginal grinding grooves.

The south west portion of this construction site has not been developed. As such it was determined that the lower slope landforms closer to Caddies Creek, retain a potential for relatively undisturbed archaeological deposits.

xii) Windsor Road Viaduct Construction Site (Site 15)

This construction site has had a low level of previous impact, including vegetation stripping and grazing. The ridge top and ridge spur landforms in this site have potential to contain intact Aboriginal sites. These locations have provided good views to adjacent landforms and are located close to Caddies Creek and second Ponds Creek, both locations with significant archaeological deposits.

c) POTENTIAL IMPACTS

The proposed activity within each of these construction sites would result in complete removal of all top soil horizons and in most cases, deep excavation through the underlying bedrock. As such there is no potential for the retention of original intact soil horizons within any of the proposed construction sites.

Therefore there would be no opportunity within any of the construction sites for conservation of, or avoidance of impacts, to known Aboriginal sites or areas with archaeological potential.

Mitigation measures have been developed to avoid, reduce and manage identified potential impacts on Aboriginal heritage. Ground surface impacts within each of the construction sites are generally unavoidable. However impacts on a number of the sites that are partially outside the boundaries of the construction site could be avoided and thus preserved intact.

Mitigation measures are detailed in EIS 1 (Attachment 5 – Indigenous Heritage Mitigation Measures).

There are 27 known Aboriginal sites identified as being located within or in close proximity to the construction sites. There are also newly recorded Aboriginal sites as a result of the field survey which are included in the assessment. The EIS notes that within each of the 17 construction sites there will be no opportunity for conservation of, or avoidance of impacts, to known Aboriginal sites and areas with archaeological potential. In some cases Aboriginal heritage sites extend outside the boundaries of constructions sites, enabling conservation of portions of some sites. Mitigation measures are proposed including developing an Aboriginal Heritage Management Plan, educating site workers, undertaking archaeological test and salvage excavation and public interpretation.

The proposed mitigation measures in relation to indigenous heritage impacts are considered appropriate.

7. LOCAL BUSINESS IMPACTS

a) ASSESSMENT METHODOLOGY

A local business impact assessment was undertaken for the major civil construction works for the NWRL project. The purpose of the assessment was to identify and provide an assessment of the potential impacts on local businesses in the immediate vicinity of the project during the major civil construction works.

The assessment of local business impacts during the construction phase of the project comprised:

- An overview of the Local Government areas affected by the project with a focus on profiling key business characteristics including the number of businesses by employment and turnover.
- A survey of businesses visually identifiable along the NWRL corridor to identify and document the existing businesses at each construction site that may be affected by the construction work. Low rise commercial buildings were not included in the business surveys.
- Identification and assessment of the potential impacts (positive and negative) on businesses during the major civil construction works.
- Identification and discussion of mitigation measures (general and specific) that would assist in alleviating potential negative impacts associated with the major civil construction works

The NSW Government has appointed a Small Business Commissioner, Ms Yasmin King. The mall business commissioner is to provide an advocacy support role to the States 600 000 odd small businesses. Construction of the NWRL will have

unexpected consequences to some small business operators and it is essential that the Small Business Commissioner commence a study into the structural adjustment and support required for specific small businesses directly affected by the construction work.

b) EXISTING ENVIRONMENT

The survey revealed the following characteristics about the business environment of The Hills Shire:

- The dominant business type by employment size is small business (92.7%), mainly in construction, with the remaining 7.3% of businesses classed as medium size employers. It was noted that based on ABS data, no large employers were registered within The Hills Shire although there are a number of businesses such as Woolworths, Resmed and IBM that would be considered as such.
- Businesses with a small turnover comprise the largest share (53.9%) of businesses. Medium turnover businesses account for 36.2%, while large turnover businesses account for the remainder. Again, the top industry in turnover size is construction.

Based on the survey results the following observations have been made:

- Construction businesses comprise a large proportion of the business in both The Hills Shire and the two other affected Local Government areas. This provides a strong foundation for these businesses to support the construction of the project as demand for such services increases.
- Other businesses that support construction activity (e.g. equipment hire, hardware, material supplies etc) are likely to benefit from increased economic activity during construction.
- Although some industries in the region may potentially be negatively affected by construction works, the impacts are likely to be negligible because of the nature of their operations.
- Retail traders that service the daily needs of a construction related workforce such as food outlets will also experience an increasing demand for their goods and services.

c) POTENTIAL IMPACTS

The assessment of the potential impact on local businesses during the major construction works included the following:

- Identification of the potential impacts (positive and negative) on local businesses during the major civil construction phase of the project.
- Identification and classification of existing businesses in the immediate vicinity of the project that may be affected by the major civil construction works based on targeted site surveys at teach construction site.
- Assessment of the type, direction and magnitude of potential impacts by qualitatively discussing the impacts at each of the construction sites.

i) Negative Sources and Implications

The potential negative impacts on local businesses would vary depending on the location and type of business. In this regard a set of common negative sources of

impact were applied at each construction site to assess the type and magnitude of the impacts that would affect the operation of local businesses as follows:

- **Reduced accessibility**

  Accessibility to a business relates to the ease that customers and/or suppliers can gain access to the business within the proposed construction area. Reduced accessibility could be caused by street closures or increased traffic congestion due to heavy vehicle movements.

- **Poorer visibility**

  Visibility to passing traffic is important to some businesses, particularly those that rely on passing trade such as service stations and take-away food outlets. Poor visibility of businesses could result from a number of construction related activities including visual disruption from a number of construction related activities.

- **Reduced quality in operating amenity**

  The operating amenity of businesses located in close proximity to each construction site may be affected by construction activity resulting in noise, air and vibration disturbances.

  In summary, these negative sources of impacts may have the effect of reducing trade and commerce for such businesses unless managed appropriately. In some instances, where the impact is particularly severe, the displacement and/or relocation of businesses and their employees could also occur.

ii) Positive Sources and Implications

The key positive sources of impact relate to the expenditure made by government to construct the project. This economic stimulus will benefit many local businesses principally through expenditure made by construction businesses and associated workers to build and support the development of the project.

Principally, the positive sources of impact are expected to be reflected by:

- **Increased trade**

  Reflects an increase in the demand for goods and services due to construction activity.

- **Increased income**

  Reflects an increased value of wages paid to workers as a result of increased demand for labour resources to construct the project.

- **Increased employment**

  Reflects the increase in the number of workers engaged to construct the project.

iii) Cherrybrook Station Construction Site (Site 4)

Development immediately surrounding this construction site is predominantly residential, however several community and educational facilities are in close proximity.

The business survey identified four businesses that may be directly impacted by the construction works. Three are in the health and community services sector and one is an education facility.

The identified businesses may experience a minor reduction in operating amenity during the construction period due to the effects of noise, air and vibration disturbances which will be subject to mitigation measures.

Two clusters of local retail businesses are located within a radius of approximately two kilometres of the site. One is at Shepherds Drive in Cherrybrook and the other which is much closer, is in Coonara Avenue in West Pennant Hills. These businesses may experience increased patronage from workers during construction works.

The EIS does not recognise that the national headquarters of IBM Australia is also located in Coonara Avenue. It employs more than 2,000 people, most of whom would drive to work. Therefore increased truck movements and any resulting traffic delays around the construction site could have some impact on those employees travelling to and from work.

iv) Castle Hill Station Construction Site (Site 5)

The proposed construction site is located within the Castle Hill Town Centre and includes a major retail and commercial precinct.

Construction works and associated construction traffic movements would adversely affect the amenity, accessibility and visibility of some local businesses within the area immediately surrounding the construction site.

Those businesses that are most significantly affected are located within a number of commercial buildings bounded by the Old Northern Road bus interchange, Crane Road and Terminus St. It is understood that all of these properties are under the ownership of one family. Although all but one have vehicle access off Crane Road, any reliance on passing vehicular and pedestrian traffic that will be significantly impacted by the construction activities, could affect their commercial viability.

There may also be a reduction in available parking for staff and customers of the various businesses within the town centre should construction workers not adhere to parking arrangements proposed in EIS 1 and utilise any of the available parking in the Castle Towers, Castle Mall or Terminus St carparks during the construction period.

During construction works a small to moderate increase in the demand for goods and services may be expected, particularly the restaurant and take-away food outlets within Castle Towers, Castle Mall and on Old Northern Road within Main Street. Similarly, chemists and medical centres may also experience some increased demand from the flow-on effects associated with construction worker activity.

Overall, EIS 1 indicates that it expects that the construction related works will result in an increase in income for local businesses through spending by construction workers. This could also lead to the generation of additional employment opportunities.

v) The Hills Centre Station Construction Site (Site 6)

This construction site is located within a mixed land use area consisting of residential, industrial, civic and community uses. Again, construction works and associated construction traffic movements would adversely affect the amenity, accessibility and visibility of some local businesses within the area immediately surrounding the construction site. There may also be a reduction in available parking for staff and customers of the Council Administration Centre and The Hills Centre should construction workers not adhere to parking arrangements proposed to be located within an area of the construction site designated for such purposes.

The Carrington Pre-School Long Day Care Centre located directly opposite the construction site in Carrington Road may experience a minor reduction in operating amenity during the construction period due to the effects of noise, air and vibration disturbances which will be subject to mitigation measures. Similar problems may be experienced by the Council Administration Centre and The Hills Centre.

Some businesses within the vicinity of the construction site such as cafes, restaurants and take-away food outlets may also experience increased trade, as will any other businesses within the Castle Hill Trading Zone that directly and indirectly support construction activity.

vi) Norwest Station Construction Site (Site 7)

The construction site is located within the existing Norwest Specialist Centre located at the corner of Norwest Boulevarde and Brookhollow Avenue and opposite the Norwest Market Town shopping centre.

Construction works, temporary road changes and associated construction traffic movements would adversely affect the amenity, accessibility and visibility of some local businesses within the area immediately surrounding the construction site. Businesses particularly impacted would be those located within and adjoining the Norwest Market Town shopping centre, as well as the Shell Service Station which rely on passing trade. The Hillsong Church and various businesses located in commercial buildings surrounding the station construction site in the may also experience reduced accessibility and operating amenity resulting from construction noise, air and vibration disturbances.

Businesses that would most likely benefit from the construction are again those that service the direct needs of the workforce such as cafes, restaurants and take-away food outlets. EIS 1 predicts a small to moderate increase in demand and sales for these businesses.

vii) Bella Vista Station and Balmoral Road Construction Sites (Sites 8 and 9)

These construction sites are located on and adjacent to the Totally Home bulky goods shopping centre which will be acquired as part of the project and demolished. These businesses will be completely lost as part of the project. At this stage it is not known whether they will close down completely or try to re-establish in another location.

Accessibility to the McDonalds and BP service station, which partially rely on access through the Totally Home Centre, will be significantly impacted. Although these access points will be removed and relocated, there may be some reduction

in trade. They will also experience a significant reduction in operating amenity during the construction period due to the effects of noise, air and vibration disturbances which will be subject to mitigation measures.

Commercial businesses along Celebration Drive and Lexington Avenue may also experience a reduction in their operating amenity due to the construction works.

The close proximity of the McDonalds and BP service station, as well as a number of other cafes, restaurants and take-away food businesses, to the construction site may offset some of the negative impacts through an increase in business sales.

viii) Memorial Avenue, Kellyville Station and Samantha Riley Drive to Windsor Road Construction Sites (Sites 10,11 and 12)

These construction sites are predominantly in residential and rural areas with the only significant businesses being on the western side of Old Windsor Road within the Blacktown City Council area. These businesses may experience some minor traffic congestion and reduced operating amenity but the impacts are likely to be negligible. However they may also experience some increase in demand due to the presence of construction workers in the area.

ix) Windsor Road, Rouse Hill Station and Windsor Road Viaduct Construction Sites (Sites 13, 14 and 15)

The proposed construction sites are located in close proximity to the Rouse Hill Town Centre, a major retail and service centre servicing the North West Growth Centre.

A storage and laydown area is to be provided on the sites currently occupied by Baulkham Hills Landscaping Supplies and the White Hart Restaurant. Although no mention is made in this section of EIS 1, it must be assumed that these properties will be acquired for the project and closed down. It is not known whether the owners have any intention or re-opening in another location.

Accessibility to those businesses within the Rouse Hill Town Centre that are located adjacent to the station construction site is expected to be reduced due to the erection of construction fencing and heavy vehicle movements. The loss of visibility to passing traffic along Windsor Road may also have an impact, as will a loss of amenity due to construction noise, air and vibration disturbance. Some problems may also be experienced with the potential loss of staff and customer parking resulting from both the construction works themselves and the use of available on and off-street parking by construction workers.

As is the case with several of the other construction sites, some businesses may experience increased demand and sales due to the presence of the construction workers.

d) MITIGATION MEASURES

Mitigation measures have been developed to avoid, reduce and manage the potential impacts on businesses as a result of the construction activities at the various sites. These are detailed in Table 34.

Table 34: Local Business Mitigation Measures

No.	Mitigation Measure	Applicable Sites*
LB1	A business consultation group would be formed to monitor, consider and provide business specific advice to manage the impacts during construction. Members of the consultation group may include representatives from local councils, and the NSW chamber of commerce and industry.	1 – 17
LB2	The project has employed 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. Place Managers and/ or would work closely with all affected local business to help ensure timely responses to queries.	1 – 17
LB3	A business impact risk register would be developed to identify, rate and help manage the specific impacts associated with construction related works for individual businesses.	1 – 17
LB4	A toll free number and website would be maintained to enable business owners and/or operators to receive prompt responses to their concerns, access information and view assistance measures in place during construction related works.	1 –17

In addition to these mitigation measures, other measures described elsewhere within EIS 1 would assist in alleviating the potential negative sources of construction impact including accessibility, construction worker parking and operating amenity.

Cherrybrook Station

IBM is located nearby with some 2,000 plus workforce. Given the proximity to the construction site some delays maybe expected in accessing the site for the workforce and some of the customers who visit the site.

Castle Hill Station

There are 5,461 jobs (2006 census) in Castle Hill precinct adjacent to the Station. Castle Towers has 306 stores (2011) with turnover of $671m and Pedestrian traffic Estimate (pa) at 18.3 million. As this is a major truck access point, potential impacts will need to be managed.

The Mainstreet upgrade generated vocal complaints from retailers and media enquiries on a regular basis. This could be expected depending on the level of noise and vibration reaching the shops and restaurants. Council placed "business as usual" advertising in local newspapers as well as street signs. There were several requests for trade compensation. Access for businesses near the current bus interchange will need to be managed. Traffic will need to be managed in peak times.

The Hills Centre Station

There are 6,785 jobs (2006 census) located near the Hills Centre Station. Access to traders from Showground Road along Carrington Road is significant.

Congestion around the construction site in Carrington Road will need to be managed. Traffic will need to be managed in peak times.

Norwest Station

Access to the retail traders in Norwest Market Town which has 41 shops and over 500 parking bays will need to be managed. Some impact on trade might be expected. Hillsong also has a major presence in the area on weekends. Brookhollow Avenue Post Office generates traffic from all over Norwest and Bella Vista. Traffic will need to be managed in peak times.

Bella Vista Station

The location supports 4,830 jobs (2006 census). Due to the issues at the Norwest Boulevarde and Lexington Drive roundabout, access to Norwest Business Park for workers at the intersections adjacent to Bella Vista Station is significant. Traffic will need to be managed in peak times as it is a primary access point that is already congested.

Balmoral Road Station, Memorial Avenue Construction Zone and Kellyville Station

Impacts on local businesses expected to be minimal.

Rouse Hill Station

Turnover at Rouse Hill Shopping centre is $366 million. Impacts on traders would be minimal if access to the centre is managed. For all sites education for workers and their clients on how to access the various locations will be important.

RECOMMENDATIONS:

7.1 The Small Business Commissioner commence a study into the structural adjustment and support required for specific small businesses directly affected by the construction work.

7.2 The EIS does not recognise that the national headquarters of IBM Australia is also located in Coonara Avenue. It employs more than 2,000 people, most of whom would drive to work. Therefore increased truck movements and any resulting traffic delays around the construction site could have some impact on those employees travelling to and from work.

7.3 A community liaison group to cater and involve business operators in Castle Hill Town Centre should be established to help respond to issues relating to traffic, access and parking during construction.

8. LAND USE AND COMMUNITY FACILITIES

a) ASSESSMENT METHODOLOGY

The relationship between the NWRL and current and potential future land uses is primarily being addressed through a parallel master planning and land use integration process. These will be considered in EIS 2.

The assessment in EIS 1 considers the impact of the major civil construction works on existing land uses, known future land uses and community facilities.

The assessment of impacts from construction works on land use and community facilities for the project has been carried out by undertaking the following key tasks:

- Providing an overview of the existing character and land use in the immediate vicinity of the construction sites.
- Identifying key community facilities that would be either directly or indirectly impacted by the major civil construction works.
- Identifying the planned future development within the project area that may be impacted by the civil construction works.
- Identifying potential land use and community impacts associated with the civil construction works focussing on the direct impacts of the construction footprint.
- Compilation of mitigation measures (general and specific) that would assist in reducing the land use and community impacts.

b) EXISTNG ENVIRONMENTAL CONDITIONS

i) Cherrybrook Station Construction Site (Site 4)

The proposed Cherrybrook station would be located on the corner of Castle Hill Road, Franklin Road and Robert Road within the Hornsby Shire local government area. Castle Hill Road forms the local government boundary between Hornsby and The Hills Shires.

The construction footprint for the proposed construction site is currently residential blocks of land. Much of the location consists of low density housing surrounded by established vegetation, green open space and corridors, and an undulating topography. Some pockets of medium density townhouses also exist. A high voltage (132kV) transmission line crosses the site to the east with one of the transmission towers located within the construction footprint.

A number of educational establishments are located in close proximity to the construction site including Tangara Infants School, Tangara School for Girls and Inala Rudolf Steiner School. Other community facilities include two childcare centres (both within The Hills Shire on the western side of Castle Hill Road) and an adult day care service. A third childcare centre is located within the construction site and will be demolished.

Under Hornsby LEP 1994, the station construction site is zoned Residential A (Low Density). Under the Draft Hornsby LEP 2011, the site is proposed to be rezoned as R2 (Low Density Residential)

ii) Castle Hill Station Construction Site (Site 5)

The proposed Castle Hill station is situated in the core of the Castle Hill Town Centre. Most of the footprint of the construction site would be on land utilised as open space being Arthur Whitling Park. However it would also include part of the Old Northern Road Reserve at the existing bus interchange and a commercial property adjacent to the park in Old Castle Hill Road which will be demolished.

The construction site is located adjacent to both the Castle Towers and Castle Mall shopping centres, with a number of other retail and commercial office premises in close proximity.

The area is a major thoroughfare for traffic and public transport services. The bus interchange provides frequent bus services within the local government area, to neighbouring regions and to the city. The interchange also serves as a bus layover facility.

A number of community facilities are located in close proximity to the construction site including schools, churches, Senior Citizens Centre, library and Castle Hill Police Station.

Arthur Whitling Park is of particular importance as it provides a significant area of open space within the Town Centre. It also includes a war memorial incorporating a cenotaph and remembrance pool, as well as memorials to prominent local citizens. The war memorial area also includes a pine tree that was donated to Council by Legacy and is believed to have been grown from a seed from the original lone pine at Gallipoli. The pine tree was planted in the park in 1972.

Under Baulkham Hills LEP 2005, the construction site consists of a number of zones including Open Space 6 (a) (Existing and Proposed Public Recreation), Business 3 (b) (Commercial) and Special Uses 5 (b) (Existing and Proposed Roads).

Under the Draft The Hills LEP 2010, the construction site is to be rezoned as RE1 (Public Recreation), ER1 (General Residential), B4 (Mixed Use) and R4 (High Density Residential.

iii) The Hills Centre Station Construction Site (Site 6)

The proposed The Hills Centre station construction site has a diverse character influenced by its proximity to industrial, civic, residential and community use.

To the west of the site is the Castle Hill light industrial area accommodating factory units, motor vehicle dealers, bulky goods retailing and warehousing. The area also provides an urban support function including a number of indoor recreation facilities, accommodation facilities and a motor registry.

All of the residential development in the vicinity of the site is established low density on the southern side of Carrington Road.

The construction site is surrounded by a number of community facilities including Castle Hill Showground, Fred Caterson Reserve, the Council Administration Centre and Operations Centre, and The Hills Centre. It also includes a large carpark used for a variety of purposes including visitors to The Hills Centre and Council staff parking.

Under the Baulkham Hills LEP 2005, The Hills Centre station construction site is zoned as Open Space 6 (a) (Existing and Proposed Public Recreation) and Special Uses 5 (a) (Existing and Proposed).

Under the draft The Hills LEP 2010, the site is proposed to be rezoned as RE1 (Public Recreation), B2 (Local Centre), B6 (Enterprise Corridor) and R1 (General Residential).

iv) Norwest Station Construction Site (Site 7)

The proposed Norwest Station would be located in the existing Norwest Business Park. The construction footprint for the proposed station would be located on Norwest Boulevarde and two existing commercial buildings. The station would be

located adjacent to Norwest Market Town Shopping Centre and within close proximity to the Hillsong Church, as well as numerous commercial office and warehouse developments, retail outlets and residential properties.

The Norwest Business Park is highly accessible by road with direct access to the M7 motorway and the major regional roads of Windsor Road and Old Windsor Road. However peak hour traffic congestion on these roads is well documented.

While the vast majority of housing in the suburbs surrounding the Norwest Business Park is single detached dwellings, there are some medium density developments already constructed or under construction.

A number of community facilities are located in the immediate vicinity of the proposed station including Hillsong Church, convent of St Joseph and facilities such as childcare within the Norwest Market Town Shopping Centre.

Under the Baulkham Hills LEP 2005, the Norwest station construction site is zoned as Employment Area 10 (a) (Business Park).

Under the draft The Hills LEP 2010, the site is proposed to be rezoned as B7 (Business Park) and B2 (Local Centre).

v) Bella Vista Station, Balmoral Road and Memorial Avenue Construction Sites (Sites 8, 9 and 10)

The Bella Vista station site is characterised by large format commercial buildings which are generally newer and taller than the older parts of the Norwest Business Park to the east.

Residential land to the east of the proposed station is mostly low density residential with small pockets of medium density town house development. Land to the north and north east are currently rural in character and will be developed to low-medium density residential uses as part of the Balmoral Road Release Area. A few businesses and recently developed low density residential areas are located to the west of Old Windsor Road in the suburb of Glenwood within the Blacktown City Council area.

Community facilities in the immediate vicinity of the construction site include a number of churches, schools and childcare centres. All are located within the Blacktown City Council area.

Under the Baulkham Hills LEP 2005, the Norwest station construction site is zoned as Employment Area 10 (a) (Business Park), Special Uses 5(a) (Existing and Proposed) and Residential 2 (a4) (Rouse Hill Regional Centre).

Under the draft The Hills LEP 2010, the site is proposed to be rezoned as B5 (Business Development), SP2 (Infrastructure) and R1 (General Residential) and B2 (Local Centre).

Parts of the Balmoral Road release area have been identified and zoned as land for railway purposes in line with the original concept approval for the NWRL. Modifications to the horizontal alignment may require integration of the NWERL with the land release area.

vi) Kellyville Station, Samantha Riley Drive and Old Windsor Road Construction Sites (Sites 11, 12 and 13)

The proposed Kellyville station construction site is located on the southern side of Samantha Riley Drive at the intersection with Old Windsor Road. The site would encompass a T-Way carpark and bus station, open space and scattered residential properties.

The area to the east of Old Windsor Road is currently agricultural, with some residences located on large blocks of land. The land consists of open plains with some remnant Cumberland Plain woodland coverage and is bordered by the drainage gully of Elizabeth Macarthur creek. Mixed use low-medium residential and commercial areas are planned including the Balmoral Road Release Area to the east of Kellyville Station. The area to the north east of the station site has been developed as low density residential.

Recently developed low density residential areas are located within the Blacktown City Council area to the west of Old Windsor Road in the suburbs of Stanhope Gardens and Kellyville Ridge. These suburbs are connected by cycle and walking paths in open space areas and are bordered by Caddies Creek and its associated floodplain.

A very limited number of businesses are scattered along Windsor Road/Old Windsor Road.

A number of community facilities such as schools, childcare centres and the Castlebrook Lawn Cemetery are located on the western side of Old Windsor Road/Windsor Road, all within the Blacktown City Council area. Mungerie House Visitor Information Centre is located within The Hills Shire on the eastern side of Windsor Road near White Hart Drive.

Under the Baulkham Hills LEP 2005, this section of construction site traverses a number of zones including Employment Area 10 (a) (Business park), Special Uses 5 (a) (Existing and proposed), Special Uses 5 (b) (Existing and proposed Roads), Business 3 (b) (Commercial), Residential 2(a4) (Rouse Hill Regional Centre) and B6 (Enterprise Corridor).

Under the Draft The Hills LEP 2010, this section of construction site traverses a number of zones including B7 (Business Park), SP2 (Infrastructure), R1 (General Residential), R3 (Medium Density Residential) and B6 (Enterprise Corridor).

Parts of the Balmoral Road Release Area have been identified and zoned as land for railway purposes in line with the original concept approval for the NWRL. Modifications to the horizontal alignment may require integration of the proposed NWRL with the land release area.

vii) Rouse Hill Station and Windsor Road Viaduct Construction Site (Sites 14 and 15)

The proposed Rouse Hill station construction site is located directly west of the Rouse Hill Town Centre adjacent to Windsor Road. There is planned future development of the Town Centre with the northern Frame works immediately north of the existing commercial centre.

The area surrounding the Rouse Hill Town Centre on both sides of Windsor Road is currently being developed as part of the north-west Growth Centre.

A number of community facilities are located within and adjacent to the Rouse Hill Town Centre including a community centre, library, community college, schools

and childcare centres. Castlebrook Lawn Cemetery and Crematorium is located opposite the proposed station construction site.

Under the Baulkham Hills LEP 2005, the Rouse Hill station is zoned as Business 3 (a) (Retail). Under the Draft The Hills LEP 2010, Rouse Hill station is proposed to be zoned as B4 (Mixed Use)

c) PLANNED FUTURE DEVELOPMENT

Strong housing and employment growth is forecast in the North West Subregion covering the Hills Shire and Blacktown City local government areas, with more modest growth in the Northern Region covering the Hornsby local government area. There are a number of future planning projects in the vicinity of the EIS 1 study area, three of which are focussed on The Hills Shire – Castle Towers Expansion, Balmoral Road Release Area and the Rouse Hill Town Centre Northern Frame.

Consultation with all major stakeholders involved in these projects has been undertaken and will be ongoing during the development of EIS 2.

d) IDENTIFICATION OF IMPACTS

In EIS 1 the potential for land use and community impacts associated with the civil construction works is focussed on and around the construction sites along the proposed alignment.

Potential impacts on land use include:

- Direct land use changes at construction sites and the above ground alignment.
- Demolition of residential, commercial and other buildings that lie within the footprint of each construction site.
- Impact of construction works on known future land use planning developments.
- Land severance resulting from construction activities that can create physical barriers interrupting established social linkages, connections and travel patterns

The potential impacts on community facilities include:

- Loss of community facilities located within the construction footprint.
- Disruption to the access, use and amenity of community facilities in the immediate vicinity of the construction sites.
- Modifications to and /or relocation of existing public infrastructure such as roads, pedestrian access ways, bus stops and carparking.

A summary of the direct land use and community impacts at each construction site within and adjacent to The Hills Shire as a result of the major civil construction works is detailed in Table 35.

Table 35: Potential Land Use and Community Impacts

Site	Direct Impacts on existing land use and community facilities
Cherrybrook Station (Site 4)	**Land use and property:** ▪ Land at the proposed station would change from residential to a construction site for approximately 42 months, the duration of the construction period. ▪ The total land area required during construction would be approximately 75,000 m^2. ▪ Construction works would require permanent acquisition of 28 residential properties and one commercial property. ▪ There are no known future land use plans in the immediate vicinity of the proposed station. **Community:** ▪ The construction footprint would require acquisition and demolition of one childcare facility located at the corner of Castle Hill Road and Robert Street. ▪ Community facilities such as Tangara Infants School, Tangara School for Girls, Inala Rudolf Steiner School, Kindalin Early Childhood Learning, Playdays Pre-School and Inala Dilkara Adult Day Service may experience reduced amenity during the construction period. Assessments of these impacts are provided in the following chapters; Traffic (**Chapter 9**), Noise and Vibration (**Chapter 10**) and Air Quality (**Chapter 19**).
Castle Hill Station (Site 5)	**Land use and property:** ▪ Land at the proposed site would change from open space to a construction site for the duration of the construction works, approximately 39 months. ▪ The total land area required during construction would be approximately 18,000 m^2. ▪ Construction works would require the use of Arthur Whitling Park, part of the Old Northern Road reserve and demolition of two buildings. ▪ Potential interaction of the NWRL with the future expansion of the Castle Towers Shopping Centre. ▪ Cumulative impacts associated with the overlapping of construction works associated with the expansion of Castle Towers Shopping Centre are considered in **Chapter 20**. **Community:** ▪ Temporary loss of an open space area (Arthur Whitling Park) during construction within a predominantly retail environment which is used for a variety of passive recreation activities. ▪ Temporary impact on the local heritage of the area due to removal of war memorial and other monuments, structures and memorials located within Arthur Whitling Park. Events and ceremonies associated with these memorials would also be impacted during construction.

Site	Direct Impacts on existing land use and community facilities
	▪ Potential amenity impacts on community facilities in close proximity to the construction works including Castle Hill Senior Citizens Centre, Castle Hill Community Information Centre and St Bernadette's School. Assessments of these impacts are provided in the following chapters; Traffic (Chapter 9), Noise and Vibration (Chapter 10) and Air Quality (Chapter 19). ▪ Acquisition of the bus stop on Old Northern Road between Crane Road and Terminus Street during the construction works would have implications for commuter traffic.
Hills Centre Station (Site 6)	**Land use and property:** ▪ Land use would change from an open space and community area to a construction site for the duration of the construction works, approximately 36 months. ▪ The total land area required during construction would be approximately 65,000 m^2. ▪ Construction works would require temporary possession of areas associated with the Castle Hill showground complex and The Hills Shire Council Depot. ▪ Construction works would require the acquisition of 11 commercial properties. ▪ There are no known future land use plans in the immediate vicinity of the proposed station. **Community:** ▪ Temporary loss of parts of Castle Hill Showground with the removal of a small number of pavilions and other infrastructure during construction works. The majority of the showground would still be accessible by local residents. ▪ Acquisition of The Hills Council Depot during construction works. ▪ Disruption to the car parking facilities and amenity of The Hills Centre for Performing Arts and Carrington Road Pre-School. Amenity impacts are discussed in the following chapters; Traffic (**Chapter 9**), Noise and Vibration (**Chapter 10**) and Air Quality (**Chapter 19**).
Norwest Station (Site 7)	**Land use and property:** ▪ Land use would change from a commercial area to a construction site for the duration of the construction works, approximately 24 months. ▪ The total land area required during construction would be approximately 21,000 m^2. ▪ Construction works would require permanent acquisition of five commercial properties. ▪ There are no known future land use plans in the immediate vicinity of the proposed station. **Community:** ▪ No direct impacts on community facilities are anticipated. ▪ Surrounding community assets including Hillsong Church may experience reduced amenity during construction works. Assessments of these impacts are provided in the following chapters; Traffic (**Chapter 9**), Noise and Vibration (**Chapter 10**) and Air Quality (**Chapter 19**).

Site	Direct impacts on existing land use and community facilities
Bella Vista Station (Site 8)	**Land use and property:** ▪ Land use would change from a commercial area to a construction site for approximately 30 months, the duration of the construction works. ▪ The total land area required during construction would be approximately 63,000 m^2. ▪ Construction works would require the demolition of buildings and acquisition of the Totally Home Centre site. ▪ There are no known future land use plans in the immediate vicinity of the proposed station. **Community:** ▪ No direct impacts on community facilities are anticipated. ▪ Community facilities including Emmanuel Baptist Church and Anglican Technical College Western Sydney may experience reduced amenity during the construction works. Assessments of these impacts are provided in the following chapters; Traffic (**Chapter 9**), Noise and Vibration (**Chapter 10**) and Air Quality (**Chapter 19**).
Balmoral Road (Site 9)	**Land use and property:** ▪ The land would change from rural to a construction site for the duration of the construction works, approximately 30 months. ▪ The total land area required during construction would be approximately 190,000 m^2. ▪ Construction works would require the acquisition of four residential properties. **Community:** ▪ No direct or indirect impacts on community facilities are anticipated at this construction site.
Memorial Avenue (Site 10)	**Land use and property:** ▪ The land would change from rural to a construction site for the duration of the construction works, approximately 30 months. ▪ The total land area required during construction would be approximately 120,000 m^2. **Community** ▪ No direct impacts on community facilities are anticipated. ▪ Temporary relocation of T-way car park to the eastern side of the bus station during construction works would have implications for commuter traffic accessing the T-way.
Kellyville Station (Site 11)	**Land use and property:** ▪ The land would change to a construction site for the duration of the construction works, approximately 18 months. ▪ The total land area required during construction would be approximately 100,000 m^2.

Site	Direct Impacts on existing land use and community facilities
	Community ▪ No direct impacts on community facilities are anticipated ▪ Temporary relocation of bus T-way car park during construction works would have implications for commuter traffic accessing the T-way.
Samantha Riley Drive to Windsor Road (Site 12)	**Land use and property:** ▪ Land would change to a construction site for approximately 24 months. ▪ The total land area required during construction would be approximately 50,000 m^2. ▪ There are no known future land use plans in the immediate vicinity of the proposed alignment. **Community:** ▪ No direct impacts on community facilities are anticipated. ▪ Nearby community facilities, including John XXIII Catholic Primary School may experience reduced amenity during the construction period. Assessments of these impacts are provided in the following chapters; Traffic (**Chapter 9**), Noise and Vibration (**Chapter 10**) and Air Quality (**Chapter 19**).
Old Windsor Road to White Hart Drive (Site 13)	**Land use and property:** ▪ The land in this area would change to a construction site for the duration of construction works, approximately 24 months. ▪ The total land area required during construction would be approximately 97,000 m^2. ▪ There are no known future land use plans in the immediate vicinity of the proposed alignment. **Community:** ▪ No direct impacts on community facilities are anticipated. ▪ Nearby community facilities, including John XXIII Catholic Primary School and Mungerie House Rouse Hill Visitor Information Centre may experience reduced amenity during the construction period. Assessments of these impacts are provided in the following chapters; Traffic (**Chapter 9**), Noise and Vibration (**Chapter 10**) and Air Quality (**Chapter 19**).
Rouse Hill Station (Site 14)	**Land use and property:** ▪ Land would change from a commercial area to a construction site for approximately 18 months, the duration of the construction works. ▪ The total land area required during construction would be approximately 18,000 m^2. ▪ No residential or commercial properties would be acquired at this location. ▪ Mixed use development adjacent to existing Rouse Hill Town Centre is proposed. A proposed station at Rouse Hill would support this land use planning. ▪ Cumulative impacts associated with the overlapping of construction works from the Rouse Hill Town Centre Northern Frame are considered in **Chapter 20**.

Site	Direct Impacts on existing land use and community facilities
	Community: ▪ No direct impacts on community facilities are anticipated. ▪ Community facilities in close proximity to the construction works, including Castlebrook Lawn Cemetery and Crematorium and facilities within the Rouse Hill Town Centre, may have reduced amenity during the construction period. Assessments of these impacts are provided in the following chapters; Traffic (**Chapter 9**), Noise and Vibration (**Chapter 10**) and Air Quality (**Chapter 19**). ▪ Relocation of the bus station adjacent to Windsor Road at Rouse Hill Town Centre would have implications for commuter traffic.
Windsor Road Viaduct (Site 15)	**Land use and property:** ▪ Land in the area would change to a construction site for the duration of construction works, approximately 27 months. ▪ The total land area required during construction would be approximately 61,000 m^2. ▪ This section of the alignment is within the Area 20 precinct. Although the Project is generally consistent with land use planning in the precinct, the vertical alignment at the corner of Windsor Road and Schofields Road has been modified as part of the current Project. The main change is that Rouse Hill Station is now an elevated station and a viaduct passes over Windsor Road. Current zoning in the area assumes an underground rail tunnel with planned open space and residential development over the rail alignment (refer Section 14.4.5). **Community:** ▪ The construction footprint within the north east corner of Castlebrook Lawn Cemetery and Crematorium is not anticipated to have a significant impact on the community. ▪ Community facilities in close proximity to the construction works, including Castlebrook Lawn Cemetery and Crematorium and facilities within the Rouse Hill Town Centre may have reduced amenity during the construction period. Assessments of these impacts are provided in the following chapters; Traffic (**Chapter 9**), Noise and Vibration (**Chapter 10**) and Air Quality (**Chapter 19**).

Mitigation measures have been developed to avoid, reduce and manage identified potential impacts on land use and community facilities. These mitigation measures are detailed in EIS 1 (Attachment 6).

The relationship between NWRL and current and potential future land uses is primarily being addressed through a parallel master planning and land use integration process. These will be considered in EIS 2. The assessment in EIS 1 considers the impact of the major civil construction works on existing land uses and community facilities. Where impact has been identified Attachment 3 provides a summary of the potential impacts and proposed mitigation measures and comments on whether such measures are considered appropriate.

Overall the primary impacts identified for land use, property and community facilities include:

- Major changes in use from residential, commercial, rural and open space to construction sites.
- Impact on existing and future land uses including Castle Towers, Rouse Hill northern frame and Balmoral Road Release area.
- Loss of community facilities within the construction footprint including Arthur Whitling Park and facilities with Castle Hill Showground.
- Disruption to the use, access and amenity of community facilities.
- Modification or relocation of existing public utility infrastructure such as roads, bus stops, parking.

The temporary loss of the Arthur Whitling Park is one of the more notable impacts that will affect visitors and workers with respect to loss of open space in the town centre. However a new and improved open space area that is integrated with the rail station will be of benefit to all users of the town centre and will be planned in consultation with Council, and the RSL Sub-branch with respect to the war memorial.

Negotiations should also continue with Council and the RSL Sub-Branch with regard to the temporary relocation of the war memorial during construction of the Castle Hill station. Expert technical advice should also be obtained on the feasibility of transplanting the 'lone pine' located adjacent to the war memorial to an alternate site to the satisfaction of Council and the RSL sub-branch. Consideration should also be given to the collection of seeds or cuttings from the 'lone pine' to enable propagation should transplanting of the tree not be considered feasible or is unsuccessful.

The identified mitigation measures primarily indicate ongoing and comprehensive consultation with the community and key stakeholders and the appointment of place managers, an approach that is firmly supported. Transport NSW will be consulting with Council and the Department of Infrastructure and Planning with respect to land uses in the vicinity of the construction sites and rail corridor, and in particular the Balmoral Road Release Area. Particular consideration will also be given to the planned extensions of the Rouse Hill Town Centre and Castle Towers Shopping Centre. Other community groups and key stakeholders to be consulted include the RSL, Castle Hill & Hills District Agricultural Society Inc., various churches, businesses, schools etc. Place Managers will assist in the consultation process.

Transport NSW must also ensure consultation is carried out with residents and owners, including Kindalin Child Care Centre on The Hills Shire side of Old Castle Hill Road at West Pennant Hills (opposite Cherrybrook station). Consultation should also be carried out with landowners in the vicinity of the length of the tunnel. Transport NSW should consult with the Hills District Historical Society with regard to the railway heritage and monument within the Arthur Whitling Park and future inclusion of railway heritage into the future station and open space.

RECOMMENDATIONS:

8.1 Negotiations should also continue with Council and the RSL Sub-Branch with regard to the temporary relocation of the war memorial during construction of the Castle Hill station. Expert technical advice should also be obtained on the feasibility of transplanting the 'lone pine' located adjacent to the war memorial to an alternate site to the satisfaction of Council and the RSL sub-branch. Consideration should also be given to the collection of seeds or

cuttings from the 'lone pine' to enable propagation should transplanting of the tree not be considered feasible or is unsuccessful.

8.2 Transport NSW should consult with the Hills District Historical Society with regard to the railway heritage and monument within the Arthur Whitling Park and future inclusion of railway heritage into the future station and open space.

8.3 Transport NSW must also ensure consultation is carried out with residents and owners, including Kindalin Child Care Centre on The Hills Shire side of ~~Old~~ Castle Hill Road at West Pennant Hills (opposite Cherrybrook station).

9. ECOLOGY

a) ASSESSMENT METHODOLOGY

The study area for the ecology assessments is defined as the projects construction footprint, as well as any additional areas that are likely to be directly or indirectly impacted by the project.

Terrestrial, riparian, aquatic and groundwater dependent ecology within the study area were assessed by reviewing existing available information and conducting field surveys. These surveys included flora, fauna, riparian and aquatic ecology. Consultation with the OEH was carried out in October 2011 to inform the requirements and methodology of the ecology assessments.

The NSW Threatened Species Conservation Act 1995 (TSC) aims to protect and encourage the recovery of threatened species, populations and communities listed under the Act. An assessment of impacts on threatened species, populations, and ecological communities listed under the Act has been completed in accordance with the Draft Guidelines for Threatened Species Assessment (DEC and Department of Primary Industries 2005). The assessment process included:

- Desktop review of literature and database searches.
- Field surveys to 'ground truth' the presence of threatened species, populations and endangered ecological communities (EEC).
- Significance assessments to evaluate the potential impacts on threatened species, populations, habitats and EEC likely to be affected by the project.
- Identification of measures to avoid and minimise impacts, or offset strategies where impacts cannot be avoided or minimised.

The Commonwealth Environment Protection and Biodiversity Conservation Act (EPBC) aims to 'provide for the protection of the environment, especially those aspects of the environment that are listed under the Act as matters of national environmental significance'. Matters of national environmental significance relevant to the study area include nationally listed threatened species and ecological communities and listed migratory species. A referral under the EPBC Act will be submitted to the relevant commonwealth agency.

b) EXISTING ENVIRONMENTAL CONDITIONS

i) Context

The existing environment varies across the project area. Areas east of Castle Hill have well forested bush reserves across hilly terrain dominated by established

residential suburbs. The vegetation communities support impressive trees such as Sydney Red Gum, Sydney Blue Gum, Blackbutt and Turpentine.

To the west of Castle Hill, the topography is gentle and its long history of land use is transforming into dense suburbs and town centres. The creeks are dominated by Swamp She-Oak and scattered Forest Red gum, with a weedy understorey of Lantana, blackberry and Privet, as well as exotic grasses. The largest creeks are heavily modified from rural activities. Council's water monitoring programs of these creeks show a long history of high nutrient concentrations.

Centred between these two areas is Cattai Creek which bisects Castle Hill. Flowing north-west to the Hawkesbury River, the creek runs through a confined valley within a substantial bushland corridor. However the headwaters are heavily modified and disturbed by residential and light industrial land uses contributing to poor water quality downstream. The upper watercourses are dominated by smothering weeds and erosion from fast stormwater runoff.

ii) Terrestrial Flora

A total of 397 species from 118 plant families were recorded from across the study area. Of these 39% were exotic weeds and 65 were introduced plantings.

While potential habitat was present for a number of threatened flora species, targeted searches of the study area (during appropriate survey seasons) recorded only one threatened flora species – Epacris purpurascens var. purpurascens. The shrubs were recorded at a study site in Cheltenham within the Hornsby Shire area and were approximately 80m outside of the construction footprint. No threatened flora species listed under the EPBC Act were recorded during the field surveys.

Six native vegetation communities were mapped in the study area, including five communities listed under the EPBC Act and/or the TSC Act as EECs or Critically Endangered Ecological Communities (CEECs).

Table 36 provides a summary of the type and status of those native vegetation communities mapped within the study area.

Table 36: Native Vegetation Communities Mapped within the Study Area.

Vegetation Community	TSC Act Status	EPBC Act Status
Blue Gum High Forest	CEEC	CEEC
Sydney Turpentine-Ironbark Forest	EEC	CEEC
Shale/Sandstone Transition Forest	EEC	CEEC
Cumberland Plain Woodland	CEEC	CEEC
River-Flat Eucalypt Forest	EEC	Not listed
Coastal Shale - Sandstone Forest	Not listed	Not listed

Apart from Coastal Shale – Sandstone Forest, all other vegetation communities have been found in one or more locations along the NWRL project alignment within the Hills Shire.

iii) Terrestrial Fauna

The following species of fauna have been identified within the study area:

- 140 birds.
- 38 reptiles.
- 18 frogs.
- 11 flying mammals (bats).
- 16 non-flying mammals (including ten introduced species).
- 2 snail species (including one introduced species).
- 13 fish species (including three introduced species).

During the field survey two migratory bird species listed under the EPBC Act were identified – Cattle Egret and Latham's Snipe. Additional targeted field surveys were also undertaken for the Green and Golden Bell Frog and Cumberland Land Snail. Although neither species was found during targeted field surveys in areas of known habitat, this does not preclude the possibility of them using the habitats at these locations at other times.

EIS 1 identifies a total of 31 endangered or vulnerable species that have either been found, or have the potential to or likelihood of being found, in the study area.

Vegetation condition and the availability of fauna habitat varied widely across the study area. Vegetation within the eastern part of the study area contained dense patches of vegetation strongly influenced by sandstone/shale geology providing some reptile habitat and a more dense vegetation structure. A total of four native vegetation communities were represented within the eastern part of the study area.

In contrast, extensive vegetation clearing, grazing and weed infestation has resulted in much of the native vegetation within the western part of the study area (from Bella Vista station) being of poor condition.

The following provides a summary of fauna habitat along the project alignment within or adjacent to the Hills Shire:

- At the Cherrybrook station site native shrubs and groundcover species were poorly represented in areas of high weed infestation and mechanical disturbance. The Blue Gum High Forest within the site is in poor condition with sever weed infestation. The Blue Gum High Forest located outside of the site (to the north-east) is classified as in good condition and contains regenerating native species.
- The Hills Centre station site contained the only patch of Shale/Sandstone Transition Forest (EEC) with native shrubs and groundcover species poorly represented and areas of high weed infestation and disturbance. The area contains scattered Narrow-leaved Scribbly/Snappy Gum with several hollows of varying size and shape in each tree. Hollow dependent avian species were observed nesting in hollows and foraging in the tree canopy.

- The north-western portion of the study area (from Bella Vista station to Rouse Hill station) contains large tracts of exotic weed grasses and shrubs with low native species richness. Clearing of vegetation, under-scrubbing and grazing have led to the area having poor condition habitat. A few small pockets of Cumberland Plain Woodland (CEEC) in moderate condition were retained in private lots, as was some areas of River-Flat Eucalyptus Forest which were in poor to moderate condition. Some regenerating Cumberland Plain Woodland canopy trees were present which could provide foraging resources for winter migrant bird species. Occasional mature canopy trees were present with hollows.

Temporary and permanent water bodies are located within the north-western portion of the study area, including minor creeks, secondary drainage lines, farm dams and constructed wetlands. The general condition of these water bodies is poor, with nutrient enrichment and an absence of native vegetation cover. However they provide habitat to reptile, amphibian, fish and wading bird species.

The survey identified substantial areas of potential primary and secondary habitat for the Green and Golden Bell Frog, including potential breeding sites and movement corridors.

iv) Riparian and Aquatic Environment

The NWRL project crosses many sub-catchments of the Lane Cove River, Hawkesbury River and Parramatta River. Major creeks in and around the study area include:

- Devlins Creek (flows to Lane Cove River).
- Excelsior creek (flows to Darling Mills Creek and then to the Parramatta River).
- Cattai Creek (flows to Hawkesbury River).
- Strangers, Elizabeth Macarthur, Caddies, First Ponds and Second Ponds Creeks (all flowing to Cattai Creek).

These creeks are located in residential suburbs within the three local government areas. Further downstream, all creeks and rivers flow through at least one conservation reserve plus many regional reserves and parks. The riparian and aquatic conditions of most creeks within The Hills Shire have been assessed as moderate to degraded.

Literature and database searches were undertaken for any threatened aquatic species listed on the schedules of the Fisheries Management Act 1994. No threatened aquatic species or endangered aquatic populations were identified as likely to occur within the watercourses of the study area.

v) Groundwater Dependent Ecosystems

Groundwater Dependent Ecosystems (GDE) rely to a varying degree, on a supply of groundwater to function. Therefore if the supply or quality of groundwater is altered for a sufficient length of time, detrimental changes can occur to the functions of the GDEs. Table 37 provides a summary of the existing condition of the GDEs within the study area.

Table 37: Existing Condition of GDEs Located within the Study Area

Groundwater Dependent Ecosystem	Condition
Floodplains and wetlands communities (Caddies Creek and Elizabeth Macarthur Creek)	Good
Coastal Shale - Sandstone Forest around Devlins Creek and tributaries	Degraded to good
Sydney Turpentine- Ironbark Forest in Cattai Creek	Degraded
Sydney Turpentine- Ironbark Forest near Beecroft Road	Degraded
Instream ecosystems dependent on groundwater derived base flows	Predominately degraded
Riparian vegetation along creeks within the Study Area	Generally degraded

The current condition of GDEs is a reflection of encroaching urban development creating disturbances to ecosystems within the catchment, rather than any stress associated with changes to aquifers.

c) IDENTIFICATION OF IMPACTS

i) Terrestrial Flora

Threatened flora species

No threatened flora species have been identified within The Hills Shire portion of the study area. One threatened species, *Epacris purpurascens var. purpurascens* was found within the Hornsby Shire portion of the study area but was outside the construction footprint and should not be affected.

As no other threatened flora species were recorded during the field surveys, it is stated in EIS 1 that it is considered unlikely that additional threatened flora species would occur in the study area.

Vegetation communities including threatened vegetation communities

The total area of native vegetation to be cleared as part of the NWRL project is approximately 30.87 hectares. The existing condition of this vegetation is as follows:

- Good: 5.35 hectares (17.33%)
- Moderate: 10.17 hectares (32.95%)
- Poor: 15.35 hectares (49.72%)

Of the 30.87 hectares, 12.16 hectares is located within the North West Growth Centre in the Blacktown City area with the remaining 18.71 hectares within the Hornsby Shire and The Hills Shire areas.

A summary of the type and area of poor, moderate and good condition vegetation communities to be cleared within the Hornsby Shire and The Hills Shire areas is as follows:

- **Blue Gum High Forest:** 1.01 hectares in poor condition
- **Sydney Turpentine – Ironbark Forest:** 0.01 hectares in good condition, 0.31 hectares in poor condition
- **Shale/Sandstone Transition Forest:** 0.78 hectares in poor condition
- **Cumberland Plain Woodland:** 0.63 hectares in good condition, 8.32 hectares in moderate condition, 4.93 hectares in poor condition
- **River –Flat Eucalypt Forest:** 0.46 hectares in moderate condition, 0.93 hectares in poor condition
- **Coastal Shale-Sandstone Forest:** 0.88 hectares in good condition, 0.45 hectares in poor condition

Table 38 taken from EIS 1, provides information on the area of each threatened vegetation community which would be cleared in relation to the entire distribution of the community

Table 38: Proportional Loss of threatened Vegetation Community

Vegetation Community	Proportional loss (compared to entire distribution)
Blue Gum High Forest	0.86%
Sydney Turpentine-Ironbark Forest	0.02%
Shale/Sandstone Transition Forest	0.008%
Cumberland Plain Woodland	0.13%
River-Flat Eucalypt Forest	0.03%

The table does not include details on the proportional loss of coastal shale sandstone forest.

ii) Terrestrial Fauna

The study area provides a variety of habitat features for a range of threatened fauna species. The vegetation clearing outlined above would result in the loss of known or potential habitat, including primary habitat (e.g. breeding/roosting sites within the hollows of trees) and/or secondary habitat (e.g. foraging areas, movement corridors). In terms of a regional context however, EIS I indicates that the total loss of potential habitat is relatively small at 0.2% or less.

Details of the threatened fauna species identified within the study area are:

- Cumberland Plain Land Snail.
- Green and Golden Bell Frog.
- Glossy Black Cockatoo.
- Gang-gang Cockatoo.
- Swift Parrot.
- Powerful and Barking owls.
- Scarlet Robin.

- Varied Sittells.
- Brown Treecreeper.
- Woodland birds (e.g. Regent Honeyeater, Black-chinned Honeyeater, Super Fruit Dove).
- Bats – predominantly tree roosting (Yellow-bellied Sheathtail-bat, Eastern False Pipistrelle Bat, East Coast Freetail Bat, Greater Broad-nosed Bat).
- Bats – predominantly cave –roosting (Eastern Bent-wing Bat, Large-footed (Southern) Myotis and Large–eared Pied bat).
- Grey-headed Flying Fox.
- Spotted-tailed Quoll.

EIS 1 also considered the risk that the project would increase the injury/mortality rates of fauna due to collisions with construction equipment or static infrastructure. However this risk was considered to be low.

Indirect impacts considered in the environmental assessment include:

- Weed invasion.
- Habitat loss and fragmentation.
- Hydrological changes.
- Sediment, erosion and pollution.
- Increased noise.
- Increased light.

iii) Riparian and Aquatic Environment

Potential impacts on stream conditions due to the project include:

- Encroachment into riparian buffer.
- Creek crossing.
- Loss of riparian habitat.
- Groundwater discharge.
- Weed invasion.
- Polluted surface water runoff.
- Increased velocity of surface runoff.
- Surface erosion and sedimentation.
- Altered fluvial hydrology.
- Bedrock cracking.

The potential impacts to each watercourse within or immediately adjacent to the Hills Shire are outlined below:

Excelsior Creek Upstream of Highs Road

This section of creek is a minor headwater gully with no aquatic habitat and limited riparian value. Although tunnel boring under the creek is proposed, potential impacts such as substrate cracking would not impact on the creek as no aquatic habitat exists.

Cattai Creek upstream of Showground

Cattai Creek is a large tributary of the Hawkesbury River. Weeds dominate the riparian zone and it is considered to be in moderate condition, with pressures from surrounding urban/ semi-industrial land uses. The aquatic habitats vary, but overall the condition is poor to moderate. The creek is likely to be important for frogs, reptiles and birds, especially as the corridor links urban bushland upstream and larger bushland areas downstream.

Tunnel boring is proposed under the creek, which could potentially impact on its water-holding capacity. This would decrease the aquatic value to fauna dependent on permanent water, particularly frogs. However once the tunnel lining is installed, no long term impacts to the stream surface flows are expected. Tunnel boring operations could discharge groundwater under licence into the creek.

Tributary to Cattai Creek (Anella Avenue)

Both the downstream and upstream sections of this watercourse are piped underground, however the remaining central patch is surrounded by development but fenced off from public access. This provides a small but isolated patch of dense riparian habitat and variable rocky habitat, suitable for frogs and reptiles. The riparian vegetation has a dense canopy with a weedy understorey, suitable for an array of birds.

Tunnel boring is proposed under the creek, which could potentially impact on its water-holding capacity. This would decrease the aquatic value to fauna dependent on permanent water, particularly frogs. However once the tunnel lining is installed, no long term impacts to the stream surface flows are expected.

Strangers Creek (Norwest Boulevarde)

This creek is greatly modified from its original form with moderate riparian condition and poor aquatic condition. Upstream of Norwest Boulevarde the creek is piped beneath/adjacent to small landscaped ponds. Downstream of the road is a large artificial lake with some fringing reeds and riparian vegetation.

Tunnel boring is proposed under this creek. Potential impacts such as substrate fracturing from vibrations, could occur which would compromise the water holding capacity of the artificial lake and result in impacts on habitat viability. Tunnel boring operations could discharge groundwater under licence into the creek.

Tributary to Strangers Creek (Edgewater Drive)

This creek tributary is greatly modified from its original form with moderate riparian and aquatic condition. The stream bed is lined with concrete.

Tunnel boring is proposed under the creek, which could potentially impact on its water-holding capacity and result in impacts on habitat viability. Tunnel boring operations could discharge groundwater under licence into the creek.

Elizabeth Macarthur Creek (Norwest Boulevarde to Celebration Drive)

This section of Elizabeth Macarthur Creek from Norwest Boulevarde to Celebration Drive includes portions of a rehabilitated stream channel centred by a large

artificial lake. Both the creek and the lake have well established reeds, shrubs and trees and form the headwaters of Elizabeth Macarthur Creek.

At this site the project would include a bored tunnel, rising to open cut and the Bella Vista station site. The tunnel would have no surface impacts on the creek, however potential impacts such as substrate fracturing from vibrations could occur which would compromise the water holding capacity of the creek and result in impacts on habitat viability. Tunnel boring and station construction operations could also discharge groundwater under licence into the creek.

Elizabeth Macarthur Creek (Celebration Drive to Balmoral Road)

This section of Elizabeth Macarthur Creek from Celebration Drive to Balmoral Road has a mostly poor condition riparian zone, with clearing up to the bank and weed invasion common. However, small patches of good riparian vegetation do occur. Even in its mostly poor condition, the creek is still of value as it still contributes to a long green corridor that would eventually be constricted by development. Numerous small dams are scattered around the creek, which break the hydrological connectivity for fish movement. The aquatic habitat is in moderate condition.

At this location the project would include an open cut construction running adjacent to Old Windsor Road. A construction plant (to manufacture pre-cast tunnel linings) is proposed for the area near the creek. An area of this construction footprint would be located within the 50m buffer zone from the top of the bank. Therefore this plant would increase the risks of impacts to riparian and aquatic habitats.

Elizabeth Macarthur Creek (Balmoral Road to Memorial Avenue)

This section of Elizabeth Macarthur Creek has a mostly poor condition riparian zone, with clearing up to the bank and weed invasion common. Despite its poor condition, it is still of value as it contributes to a long corridor that would eventually be constricted by development. Numerous weedy swamps are scattered around the creek which breaks the hydrological connectivity for fish movement. The aquatic habitat is also in poor condition.

At this location the project would include a partly open cut and elevated viaduct, connected by a short embankment. A construction road would be created adjacent to the viaduct section. A construction plant (to manufacture pre-cast tunnel linings) is proposed for the area near the creek. A small area of this construction footprint would be located within the 50m buffer zone from the top of the bank which would increase the risks of impacts to riparian and aquatic habitats.

Other indirect t impacts include pollution of water runoff, increased runoff velocity and the spread of weeds, especially around the fringes of the footprint.

Elizabeth Macarthur Creek (Memorial Avenue to Samantha Riley Drive)

This section of Elizabeth Macarthur Creek is mostly in a moderate condition. The riparian zone is generally uncleared but with a weedy understorey common. This creek's area is of great value as it contributes to a long corridor that would eventually be constricted by development. In the southern portion of the area several dams and swamps break the hydrological connectivity for fish movement. The channel is mostly unmodified and has stable banks.

At this location the project would include an elevated viaduct adjacent to Old Windsor Road. A construction road would be created adjacent to the viaduct.

Kellyville station would be located at the northern end of the site and a small area of the construction footprint would be within the 50m buffer zone from the top of the bank. Therefore the project would increase the risk of impacts to riparian and aquatic habitats.

Other indirect impacts include pollution of water runoff, increased runoff velocity and the spread of weeds, especially around the fringes of the footprint.

Elizabeth Macarthur Creek (Samantha Riley Drive to Windsor Road)

The section of creek from Samantha Riley Drive to Windsor Road varies in condition, with a poor condition riparian zone to the south and a moderate riparian zone to the north. The bank has been cleared and weeds are abundant, except under areas with dense canopy cover. This creek's area is of great value as it contributes to a long corridor that would eventually be constricted by development. Aquatic habitat is in moderate condition. A large wetland exists to the west of the creek.

At this location the project would include an elevated viaduct running along the floodplain on the left bank and a construction road would also be created adjacent to the viaduct. The viaduct would enter the 50m buffer zone and cross the channel twice. Therefore he project would increase the risk of impacts to riparian and aquatic habitats. Due to the elevated nature of the viaduct, the crossings would not impact the riparian and aquatic connectivity values of the waterway. However some trees would be cleared at these crossings.

Caddies Creek (downstream of Windsor Road)

Caddies Creek downstream of Windsor Road is in moderate condition and understorey weeds are prevalent. The left bank is highly disturbed in parts, however the right bank is relatively intact with a good cover of riparian trees and adjacent woodland. The creek has high value as it contributes to a long green corridor that would eventually be constricted by development. Aquatic habitat is in moderate condition and during a field inspection, large carp were observed.

The project construction at this location (Construction Site 13) would include an elevated viaduct adjacent to Windsor Road. A construction road would be created adjacent to the viaduct and a support site (material storage and offices) would be located between Windsor Road and Caddies Creek. The footprint of this support site would be within the 50m buffer zone from the top of the bank, which increases the risk of impacts to riparian and aquatic habitats.

Tributaries to Caddies Creek

A small tributary to Caddies Creek opposite the Ettamogah Pub, is in poor to moderate condition. The sections that receive inflows from three culverts beneath Windsor Road are in poor condition, with no riparian vegetation and dense Typha and Blackberry stands within the channel. Further downstream the riparian zone is in moderate condition with occasional weeds and some regeneration. The connectivity of the riparian zone is important from a downstream perspective but from an upstream perspective, Windsor Road creates a significant break in the riparian connectivity.

Overall the aquatic habitat is in poor to moderate condition, with only small patches of valuable in-stream habitat.

The construction at this location would include an elevated viaduct with one crossing over the upper extent of the tributary. The alignment would enter the 30m buffer zone. This crossing would dissect the three channels inflowing from culverts beneath Windsor Road. Here the tributary is in poor condition and due to the close proximity of Windsor Road and the existing culverts upstream, potential impacts from this crossing would be indistinguishable from that already present. However mitigation measures to prevent disturbance downstream during construction are proposed.

Another small tributary to Caddies Creek located near White Hart Drive has a riparian zone in a moderate condition and appears to be establishing well after restoration works. The connectivity value of the riparian zone is moderate as it provides a link to larger woodland habitats downstream. Generally the aquatic habitat is in poor to moderate condition.

The project construction at this location would include an elevated viaduct with one crossing over the upper extent of this tributary into the proposed Rouse Hill station. The alignment would enter the 10m riparian buffer zone. This crossing would occur through a small basin immediately downstream of the culverts under Windsor Road, however due to existing disturbance, potential impacts from this crossing would be minor.

Second Ponds Creek

Second Ponds creek downstream of Schofields Road was assessed by Eco Logical Australia (2010) as part of the Area 20 Biodiversity assessment. The project construction at this location would include a 250m long elevated bridge similar to the viaduct design, with one creek crossing. The crossing site has been assessed as in poor condition.

Despite its current poor condition, Second Ponds Creek is an important riparian corridor and its value would increase as development encroaches in the future.

iv) Groundwater Dependent Ecosystems (GDEs)

Potential impacts to GDEs include:

- Loss of fauna habitat resources.
- Loss of aquatic habitat.
- Hydrological and groundwater level changes (to both groundwater and surface water).
- Contamination.
- Altered groundwater recharge.

The construction of tunnels and underground stations would influence the groundwater in the area as groundwater would flow into the constructed cavities and then be pumped out and discharged. There is also the risk that groundwater could become contaminated by the construction works.

The GDEs likely to occur are located in the western section of the proposed alignment, predominantly in the floodplain. The elevated viaduct would be constructed in this area.

A risk assessment framework has been used to assess the potential impacts to GDEs and any groundwater related aquatic environments. The risk assessment illustrated that the project is unlikely to change groundwater regimes such that GDEs would be significantly impacted.

Ecology mitigation measures have been developed to avoid, reduce and mange identified potential impacts. These mitigation measures and their application to the construction sites for the project are detailed in EIS 1 (Attachment 7).

An offset strategy has also been prepared to offset the loss of native vegetation (including endangered ecological communities) and threatened species habitat that cannot be avoided. A summary of the main elements of the proposed offset strategy is detailed below:

- Subject lands within the North West Growth Centre that have previously been offset by SEPP (Sydney Region Growth Centres) 2006 and therefore any impacts to subject lands as part of the project do not require additional offsets.
- Impacts to the area (0.50 hectares) of non-certified Existing Native Vegetation (ENV) within the North West Growth Centre would be offset as per the growth Centres Biodiversity Certification Order requirements.
- The offset ratios proposed for the EECs cleared by the project are:
  - 5:1 for vegetation and habitat in good condition
  - 4:1 for vegetation and habitat in moderate condition
  - 3:1 for vegetation and habitat in poor condition
- Cumberland Plain Woodland would require the largest offset at 51.22 hectares, followed by Coastal Shale-Sandstone Forest requiring 5.75 hectares.

In addition, the following performance measures are applicable to offsets for the project:

- Offset lands are to consist of viable, ecologically functioning native vegetation wherever possible or, if degraded, are to be improved with sufficient funding and long term management.
- Offsets are to be 'like for like' in terms of vegetation by meeting the minimum areas of offset vegetation.
- A management plan is to be prepared for each offset site which identifies the proposed in-perpetuity management actions.
- Funding is to be provided for the management of offsets in perpetuity via the Biobank Trust Fund, or another form of Trust Fund agreed to by OEH or SEWPaC.
- Offsets are to be provided within the Sydney Metropolitan Catchment Management Authority and Hawkesbury Nepean Catchment Management Authority areas of operation.
- Appropriate offset sites are to be secured following the commencement of major civil works. Management Plans for offset sites must be agreed with the OEH and SEWPaC prior to the completion of construction works.

While the objective of the principles for Biodiversity Certification "Improve and Maintain" have been adopted, the report does not identify where any ecological Offset sites might be. The issue of impact on Cumberland Plain Woodland will be particularly difficult to offset as there are so few sites with Cumberland Plain Woodland left.

Offset sites should be identified and procured prior to works commencing that involve the removal of ecology. It is requested that specific priority be given to securing offset sites as near to the location of the impact/loss as possible, to assist with the preservation of the specific endemic community of the area and assure that the ecological and amenity benefits of retaining endemic vegetation remain within the Local Government Area.

The management of off-set sites could be secured through the registration of land as Biobank Sites with the Biobank Trust funding the in perpetuity maintenance of the vegetation. This could be achieved without the need to purchase the land, rather the purchase and surrender of credits under the Biobanking scheme.

It is noted that 51.22ha of Cumberland Plain Woodland is required to offset the impacts on that community by the project. Council's vegetation communities mapping identifies a number of properties in the immediate vicinity of the Bella Vista station which contain Cumberland Plain Woodland. This land has recently been re-zoned for urban use in the release area known as the Balmoral Road Release Area, however these particular sites are limited in their development potential by the presence of this Critically Endangered Ecological Community and could be appropriate as Biobank or offset sites. Three distinct patches of vegetation within the release area seem particularly appropriate which are 21.6ha, 13.7ha & 6.1ha respectively located on Balmoral Road and Fairway Drive. Additional smaller patches are also mapped within the immediate area.

RECOMMENDATIONS:

9.1 Offset sites should be identified and procured prior to works commencing that involve the removal of ecology.

9.2 It is requested that specific priority be given to securing offset sites as near to the location of the impact/loss as possible, to assist with the preservation of the specific endemic community of the area and assure that the ecological and amenity benefits of retaining endemic vegetation remain within the Local Government Area.

9.3 The management of off-set sites could be secured through the registration of land as Biobank Sites with the Biobank Trust funding the in perpetuity maintenance of the vegetation. This could be achieved without the need to purchase the land, rather the purchase and surrender of credits under the Biobanking scheme.

9.4 Three distinct patches of Cumberland Plain vegetation within the Balmoral Road Release area seem particularly appropriate which are 21.6ha, 13.7ha & 6.1ha respectively located on Balmoral Road and Fairway Drive. Additional smaller patches are also mapped within the immediate area. Consideration should be given to securing these sites to offset the loss of vegetation.

10. VISUAL AMENITY

a) ASSESSMENT METHODOLGY

The assessment of visual impact is based on the identification of the level of visual modification created by the project, and the sensitivity of the viewer. When combined, these characteristics of the view are then considered to assign a level of likely visual impact.

The assessment begins with a description of the existing visual conditions of each construction site and surrounding area. This serves as the baseline for the visual assessment.

Visual modification refers to the change to the landscape that would occur as a result of development from a given viewpoint. This includes what has changed, and how it has changed. Visual modification can result in an improvement or reduction in visual amenity.

Visual sensitivity refers to the nature and duration of views. Locations from which a view would potentially be seen for a longer duration, where there are higher numbers of potential viewers and where visual amenity is important to viewers can be regarded as having a higher visual sensitivity. Generally, the greater the distance the less sensitive the viewpoint.

The visual impact for the construction sites has also been assessed for both daylight and night-time conditions.

b) VISUAL CHARACTER AND IMPACTS OF THE PROPOSAL

The construction of the project would include a number of activities and built elements that may be visible from the surrounding landscape. These activities include temporary elements include enabling works, acoustic sheds (up to 15m high), water treatment plants, sedimentation tanks and ponds, workshop and stores, site offices, concrete batching plants, concrete segment factory and storage, cranes, site hoardings and lighting to allow safe movement at night. In addition a number of permanent structures may be visible such as cuttings, embankments and viaducts.

Not all of these elements are common to each site, nor would they necessarily be visible. The common component to all sites is the plywood hoardings, three metres high at all sites except for Cherrybrook station where it would be six metres in height. This hoarding would generally enclose worksites and provide a visual screen to the construction within. Generally, many of the activities and elements would be less than the height of the hoardings. However the most visually prominent components of the sites would be those which rise above the hoarding including the acoustic sheds, cranes, substations, batching plants, as well as elements beyond the site boundary such as construction traffic and road realignments.

Lighting of each site would typically be designed to assist with site legibility at night and provide safe access routes to both pedestrians and vehicles. Light spill, shadowing or glare during construction would be minimised where possible, so as not to cause danger to drivers or cyclists, or nuisance to local residents.

The visual impacts of the project are determined by the following typical situations:

- Large scale of acoustic sheds (height, footprint, warehouse character) in contrast to the appearance of surrounding areas that are predominantly of residential or commercial landscape character.
- Tall elements visible and viewed against the sky, including batch plants, cranes and attenuation sheds.
- Linear nature of the worksites, within the Cumberland Plains so that the project influences a broad expanse of some views, often seen aligned across the view.
- Proximity to Windsor Road, Old Windsor Road and T-Way corridor character which have a similar linear and urbanised character, therefore less visual contrast.
- Construction traffic dispersed throughout the site, and therefore more visible, but not in great contrast to existing road traffic when using major roads.
- Mature framework of vegetation on existing sites which is highly visible and typical of the local character in both The Hills and Cumberland Plain character areas, requires removal along the project corridor.

The range of visual impacts identified from each worksite location is summarised in Table 39.

Table 39: Summary of Visual Effects

Location	Visual Impact - Daytime	Visual Impact - Night
1 Epping Services Facility	Negligible to Minor Adverse	Negligible
2 Epping Decline	Negligible to Minor Adverse	Negligible
3 Cheltenham Services Facility	Negligible to Moderate Adverse	Negligible
4 Cherrybrook Station	Negligible to Minor Adverse	Moderate Adverse

Location	Visual Impact - Daytime	Visual Impact - Night
5 Castle Hill Station	Moderate Adverse	Minor Adverse
6 Hills Centre Station	Negligible to High Adverse	Moderate Adverse
7 Norwest Station	Negligible to Moderate Adverse	Negligible
8 Bella Vista Station	Negligible to Moderate Adverse	Negligible
9 Balmoral Road and 10 Memorial Avenue	Negligible to Minor Adverse	Minor Adverse
11 Kellyville Station	Minor Adverse	Negligible
12 Samantha Riley Drive to Windsor Road and 13 Old Windsor Road to White Hart Drive	Negligible to Minor Adverse	Negligible
14 Rouse Hill Station and 15 Windsor Road Viaduct	Negligible to High Adverse	Negligible
16 Windsor Road Viaduct to Cudgegong Road	Minor Adverse	Negligible
17 Cudgegong Road Station and Tallawong Stabling Facility	Minor Adverse to Moderate Adverse	Negligible

Mitigation measures have been developed to avoid, reduce and manage identified potential impacts on visual amenity. These mitigation measures and their application to the construction sites for the project are detailed in EIS 1 (Attachment 8).

The assessment of visual impact is based on the identification of the level of visual modification (change to landscape) created by the project and the sensitivity of the viewer (based on the nature and duration of views). Combined, these characteristics of the view are then considered to assign a level of likely visual impact. Visual compatibility is also considered, that is, the impact of a construction site on a low density residential area will differ to that in an industrial or commercial area. There are no recognized visual impact standards to refer to, therefore the EIS has created a system of assessment in order to clearly and consistently measure visual impact with visual impact significance levels ranging from 'negligible' through to 'major adverse'.

EIS 1 deals mainly with the visual impacts of major construction works. Detailed urban design and landscaping works will be considered as part of EIS 2. Typical visual components of construction works include:

- Enabling works (clearing, services), acoustic sheds (up to 15m high), water treatment plants, workshops/stores, offices, substations, cranes (up to 20m high), concrete batching plants, hoarding, traffic realignment etc.
- Permanent features resulting from construction stage works will include viaducts, cuttings, bridges and embankments.

Proposed mitigation measures include:

- "Cut off" and directed lighting to minimize light spill.
- Existing vegetation on perimeter of sites to be retained where possible.
- Where possible, locating elements within the sites in locations to minimize visual impact.
- Regular maintenance of site hoarding and graffiti removal.
- Including incorporating artwork or information into hoarding and making a feature of acoustic sheds.

Mitigation measures are generally acceptable however there will be some adverse visual impacts despite their implementation. The reflectivity of acoustic sheds and site buildings is an additional measure that should be considered. If possible, 6m hoarding proposed on Castle Hill Road (Cherrybrook Station) should be reduced in height if it will not reduce the amenity of residents / child care centre on the opposite side of Castle Hill Road. For Castle Hill station the mitigation measures do not identify this site as a location for feature/informative hoarding, however it is identified as a location for hoarding that would be designed to visually recede into a bushland setting. This error should be rectified given the town centre is an ideal location for feature hoarding.

The viaduct structure at Rouse Hill will permanently alter the landscape and visual amenity of users of Windsor and Old Windsor Roads for several kilometres. Its size and scale will have adverse impacts in terms of size and scale in contrast to low-medium density residential areas and natural landscape in drainage corridors. However it will also be viewed in a context of the significant transport route.

Due to the visibility of the viaduct it is expected that the detailed design stage will give particular consideration to making the structure as streamlined as possible, and incorporate measures to reduce its visual impact. The possible use of the structure for advertising is an ongoing concern for Council and should be addressed in EIS2.

For EIS2 the urban design assessment process would be assisted by clearer documentation and more detailed photomontages to assist in understanding each sites development within the surrounding context.

RECOMMENDATIONS:

10.1 The reflectivity of acoustic sheds and site buildings is an additional measure that should be considered.

10.2 If possible, 6m hoarding proposed on Castle Hill Road (Cherrybrook Station) should be reduced in height if it will not reduce the amenity of residents / child care centre on the opposite side of Castle Hill Road.

10.3 Due to the visibility of the viaduct it is expected that the detailed design stage will give particular consideration to making the structure interesting and visually appealing is required. The ultimate design is to incorporate measures to reduce its visual impact and where possible use engineering art to decorate, provide visual interests where landscaping cannot be adequately provided.

10.4. The possible use of the viaduct structure for advertising is an ongoing concern for Council and should be addressed in EIS2.

11. CLIMATE CHANGE AND GREENHOUSE GAS (GHG) EMISSIONS

a) CLIMATE CHANGE RISK ASSESSMENT

Risks to the NWRL project associated with climate change need to be understood and mitigated where necessary, to avoid impacts on customers, service reliability, safety, and project capital and operating costs.

A climate change risk assessment identified those areas of the major civil construction stage of the project that may be at most risk from potential changes, and proposes mitigation measures (adaption options) that could be implemented to respond to these challenges.

In accordance with the NWRL Environment and Sustainability Policy and Sustainability Strategy, climate change risk assessment of the direct and indirect risks associated with the project has been undertaken.

That risk assessment process identified:

- No extreme risks
- No high risks (also referred to as an undesirable risk)
- Two medium risk ratings (also referred to as a 'tolerable' risk)

The medium risks are summarised in Table 40.

Table 40: Medium Climate Risks for NWRL major Civil Construction Works for 2030 and 2070

Risk Title	Risk Description	Risk Rating 2030	Risk Rating 2070
Flooding damage to infrastructure	Climate change causes increased frequency and severity of extreme rainfall events leading to flooding of tunnels and tunnel portals, viaducts and construction footprint.	Medium (tolerable) Consequence - major Likelihood - rare	Medium (tolerable) Consequence - severe Likelihood - rare
Extreme rainfall events causing failure of embankment	Climate change causes increased frequency and severity of extreme rainfall events leading to flooding or saturation of embankments and ground conditions.	Medium (tolerable) Consequence – moderate Likelihood - unlikely	Medium (tolerable) Consequence - moderate Likelihood - unlikely

Adaption options to respond to the climate change risks associated with the major civil construction works are outlined in Table 41.

Table 41: Adaption Options

Risk Title	Adaptation Options
Flooding damage to infrastructure	Design the drainage system to take account of increased rainfall events through flood modelling with a climate change margin (ie design can't be based on past flood levels of 1 in 100 return interval events). For example design elevation levels for tunnels, stations and transport interchange areas need to be based on future climatic conditions at least up to future climate projections for 2070.
Extreme rainfall events causing failure of embankment	Design embankment to take into account a changing climate such as structures to reduce water build up behind and under embankments to prevent lubrication and loss of stability.

The climate risks for EIS 1 would be addressed in the design, construction and operation of the project. All climate risks would also be entered into the project's Risk Register.

b) GREENHOUSE GAS ASSESSMENT

For the purpose of EIS 1, GHG emissions have been categorised into three different 'scopes' to help delineate between direct emissions from sources that are owned or controlled by the project, and upstream indirect emissions that are a consequence of project activities but occur at sources owned or controlled by another entity. The three GHG scopes include:

- Scope 1 emissions, also called 'direct emissions'. These emissions are generated directly by the project e.g. emissions generated by the use of diesel fuel by construction plant and equipment.
- Scope 2 emissions, also called 'indirect emissions'. These emissions are generated outside of the project's boundaries to provide energy to the project e.g. the use of electricity purchased from the grid.
- Scope 3 emissions are all indirect emissions due to upstream or downstream activities. For example indirect upstream emissions associated with the extraction, production and transport of purchased construction materials.

ESI 1 estimates that the major civil construction works for the project would generate approximately:

- 782,688 tCO2-e of direct Scope 1 emissions
- 1,087,314 tCO2-e of direct Scope 2 emissions
- 454,323 tCO2-e of indirect upstream Scope 3 emissions

The total (Scope 1) direct CHG emissions would be approximately equivalent to 0.4% of Australia's national annual GHG emissions and 1.2% of NSW's annual GHG emissions in 2010.

The GHG assessment associated with the operation of the NWRL is being undertaken as part of EIS 2. However it should be noted that once operational, the NWRL would provide a viable alternate mode of non-road based transport and has the potential to directly reduce CHG emissions associated with transport in the north west of the Sydney basin.

GHG mitigation measures for the major civil construction works that have been considered and applied in the design process include:

- Optimisation of the alignment, tunnel diameter, twin-bore tunnel arrangement, station size and elevation of the stabling facility to minimise the amount of excavation required, thereby reducing the quantities of fuel and electricity used in the construction process.
- Designing to prioritise the use of pre-cast elements in stations and viaduct sections. In general there is less waste of materials and energy expended in construction when pre-cast elements are used.
- Spoil use hierarchy developed and documented in the constructability report to maximise the re-use of spoil on the project.
- Design refinements and optimisation for minimising the quantities of steel and concrete used, including the evaluation of varying viaduct span sizes to identify the solution that will require the least amount of concrete to meet structural and durability requirements.
- The utilisation of materials with lower embodied GHG emissions e.g. low carbon concrete, recycled galls fines instead of sand, etc.

Mitigation measures have been developed to avoid, reduce and manage identified potential impacts on climate change and greenhouse gas emissions. These mitigation measures and their application to the project are detailed in EIS 1 (Attachment 9).

While it is acknowledged that large infrastructure projects such as this one will require significant natural resources to be utilised both in the materials forming the structures and in the energy consumed by construction and transport equipment, further opportunities to off-set these impacts should be incorporated into the project.

The 20% electricity offset target should be increased. Further offset options associated with revegetation projects and biodiversity offset requirements should also be included.

RECOMMENDATIONS:

11.1 The 20% electricity offset target should be increased.

11.2 Further offset options associated with revegetation projects and biodiversity offset requirements should also be included.

12. SURFACE WATER HYDROLOGY

a) ASSESSMENT METHODOLOGY

The 17 construction sites that form the extent of the EIS traverse eight main waterway catchments as detailed in Table 42.

Table 42: Major Waterways Catchments and Construction Sites

Catchment	Construction Site
Devlins Creek	1. Epping Services Facility
	2. Epping Decline
	3. Cheltenham Services Facility
Pyes Creek	4. Cherrybrook Station
Cattai Creek	5. Castle Hill Station
	6. Hills Centre Station
Strangers Creek	7. Norwest Station
Elizabeth Macarthur Creek	8. Bella Vista Station
	9. Balmoral Road
	10. Memorial Ave
	11. Kellyville Station
Caddies Creek (including Tributaries 3, 4 and 5)	12. Windsor Road/Old Windsor Road
	13. Old Windsor Road/Whitehart Drive
	14. Rouse Hill Station
	15. Windsor Rd Viaduct
Second Ponds Creek	16. Windsor Road Viaduct to Cudgegong Road
First Ponds Creek	17. Cudgegong Road and Tallawong Stabling Yard

Some of the surface water impacts are dependent on the specific characteristics of these catchments and their associated floodplains in the vicinity of the sites. Other impacts, particularly those relating to the management of site runoff, are more generic.

The assessment of the surface water catchments draining to and through the project corridor involved:

- Hydrologic modelling to determine peak flow estimates applicable for design and flood assessment.
- Hydraulic modelling to quantify flood behaviour (levels and velocities) as well as identify potential flood impacts and risks during construction.
- Quantification and assessment of flood impacts and risks associated with the major civil and construction works proposed.
- Identification of appropriate mitigation measures commensurate with the potential for, and consequences of, flood inundation to the proposed works and construction sites.

The assessment of surface water quality impacts from proposed construction works involved:

- Collation and review of available data on stream condition and water quality to define the existing environment within the creeks.
- Assessment of proposed construction activities for impacts on the water quality of receiving creeks.
- Identification of required mitigation measures, including types of controls and design criteria required to manage potential impacts.

b) POTENTIAL IMPACTS

i) Flooding

Flooding of creeks and waterways crossing the project has the potential to inundate the construction sites and lead to damage to the project works, delays in construction programming, pose a safety risk to construction workers and cause damage to the downstream waterway through the transport by floodwaters of sediments and construction materials.

In EIS 1 an assessment has been made of flood risks and impacts relating to the major civil construction works. Each key construction activity is described in the following sections in the context of potential flood impacts.

Tunnel Construction (Sites 1 to 8)

The operation of the tunnel boring machines will involve the use of a pump at the tunnel head to collect water generated for heat and dust suppression, groundwater ingress and runoff from tunnel openings. The tunnel pumping system would be designed to handle flows greater than normal operational flows to minimise the risk of drowning the header. Drainage sumps would also be provided along the tunnel to intercept runoff which would then be pumped to the surface.

While the tunnel excavation arrangement will be designed to accommodate a nominal amount of stormwater runoff, a significant amount of floodwater ingress into the tunnel excavations would flood the tunnel machines with potential risk to personal safety, damage to machinery and delays to the project. As a result the potential for ingress of floodwaters into the tunnel excavations would be appropriately managed at tunnel entries.

A summary of the flooding potential at each proposed tunnel entry site within or adjacent to The Hills Shire is provided in Table 43.

Table 43: Summary of Flooding Potential at Proposed Tunnel Entries within or Adjacent to The Hills Shire

Construction Site	Tunnel Access	Flooding Potential
4. Cherrybrook Station	TBM launch and support.	Site is not affected by mainstream flooding. However, local overland flowpath runs south to north across the site and proposed station portal.
5. Castle Hill Station	Road header launch and support.	Site is located at the top of catchment and is not affected by mainstream flooding.
6. Hills Centre Station	TBM support.	Part of the site spans Cattai Creek and is flood affected.
7. Norwest Station	Tunnel ventilation.	Site is not affected by mainstream flooding. However, local drainage runs west to east along Norwest Boulevard.
8. Bella Vista Station	TBM launch and support.	Small portion of site adjacent to Elizabeth Macarthur Creek is flood affected during the 20 year ARI event.

The flood assessment has identified that of the construction sites within The Hills Shire, The Hills Centre and Bella Vista stations have the greatest potential risk of flood affectation. These sites are to be used for tunnel support and consequently the tunnel openings at these locations could be substantial. Therefore the layout of the sites would need to be developed taking into consideration the nature and potential risk of flooding.

At all sites there would be potential for local runoff to enter the tunnels and this would be addresses through local stormwater management of the site.

Earthworks Fill Embankment and Cutting (Sites 8 to 11)

From immediately north of Bella Vista station through to Balmoral Road (Sites 8 and 9) the alignment is proposed to be in cutting. North of Balmoral Road (within Site 10) the alignment would involve a combination of cutting and fill embankment before joining the viaduct which commences just south of Memorial Avenue.

The rail corridor is located outside the floodplain between Sites 8 to 10 and apart from local drainage and overland flow, no flood impacts and risks are expected with regards to earthworks in these areas.

At Site 11 earthworks would be required to revise the existing road and carpark layout to integrate with Kellyville station. The western fringe of Site 11 is affected by flooding from Elizabeth Macarthur Creek.

Viaduct Construction (Sites 10 to 15)

The viaduct section of the alignment would extend from north of Balmoral Road to the western end of Windsor Road. Based on the current concept design, it is

anticipated that the viaduct would consist of box section spans, typically 36m in length, supported by columns and headstocks. Longer spans would be required to traverse key infrastructure such as road crossings. In order to construct the permanent viaduct structure it will be necessary to provide temporary access roads and working pads across the floodplain.

Through Sites 10 and 11 the viaduct alignment would run to the west and clear of the Elizabeth Macarthur Creek floodplain and consequently no flood impacts are expected from the proposed viaduct arrangement in this area.

At Site 12 the viaduct alignment crossed the broad floodplain at the confluence of Elizabeth Macarthur Creek and Caddies Creek.

Within Site 13 the viaduct runs close to Windsor Road and crossed the waterways of Caddies Creek Tributaries 3 and 4, immediately downstream of the Windsor Road culverts. From the crossing of Caddies Creek Tributary 3 the viaduct would run north through Site 14 and past the Rouse Hill Town Centre.

Through Site 15 the viaduct runs along the ridge of Caddies Creek catchment and is outside the floodplain.

Any works within the floodplain have the potential to alter flood behaviour and impact on the surrounding environment. Consequently detailed hydraulic modelling has been carried out to assess the potential impacts of the proposed viaduct arrangement, including temporary construction works, on the existing flood regime at Sites 12 and 13. Details of the hydraulic modelling and the results are included in a Technical Paper attached to EIS 1.

Generally, the modelling found relatively small increase increases in flood levels or flow velocities with Site 12 most affected. For a 100 year ARI event the increase in flood levels within the adjacent residential development would be up to 0.04m but typically less than 0.02m and for the PMF the increase would be up to 0.15m but generally less than 0.08m.

Stations and Services Facilities Construction (Sites 4 to 8, 11 and 14)

As noted previously, flood inundation of excavations for below ground stations and services facilities could lead to flooding of the tunnels and result in damage to works, delays in the construction program and a risk to personal safety.

The above ground station sites at Kellyville and Rouse Hill are located outside the 100 year ARI flood extent and therefore flooding is not expected to pose a significant risk during construction and operation.

Spoil Management and Stockpile Areas

The construction of the project will generate a significant quantity of spoil as a result of excavations for tunnels, below ground stations and services facilities, and above ground civil works.

Spoil generation is expected to be greatest from the tunnel excavation and as a result a significant area to stockpile spoil from the tunnelling operations would likely be required at the tunnelling support sites proposed at Cherrybrook, The Hills Centre and Bella Vista.

Stockpiles located in the floodplain have the potential to obstruct and alter flood behaviour. Changes to flow distributions and flood levels can have adverse

impacts on the surrounding environment. Furthermore flooding of stockpiles can lead to significant quantities of spoil being displaced by floodwaters into downstream waterways with associated impacts on stream ecology.

The stockpile site with the most potential for flooding is The Hills Centre.

Concrete Batch Plant and Pre-casting Facility (Sites 9 and 10)

A concrete batch plant and pre-casting facility is proposed at the Balmoral Road and Memorial Avenue sites (Sites 9 and 10) to manufacture the pre-cast concrete segments required for the tunnelling component of the project. The batch plant and pre-cast facility would be housed in an acoustic shed. The site would also be used for the storage of the pre-cast ring segments.

The location of the batching shed or storage of pre-cast units within the floodplain would have the potential to alter flooding patterns and impact on adjacent developments. The two sites are predominantly located outside of the 100 year flood extent, apart from a small section of the site along the eastern fringe which would be affected by flooding from Elizabeth Macarthur Creek. Consequently, subject to site planning and layout, flood impacts associated with the facilities on these sites could be appropriately managed.

ii) Stormwater Quantity

Proposed works during construction would alter the extent of impervious area and catchment response times. Potential impacts would be offset by the provision of erosion and sediment control measures which would be designed to control the discharge of runoff from the site.

Discharge of treated water from the tunnel excavations would be required at sites along the tunnel alignment. Discharge is expected to be greatest at the TBM support sites at Cherrybrook, The Hills Centre and Bella Vista stations.

Impacts on peak flow rates within the downstream drainage systems and watercourses would be managed through controlled discharge to ensure that peak instantaneous discharge rates did not coincide with significant rainfall events and did not exceed the capacity of the downstream system.

iii) Floodplain Storage

The major civil works proposed under EIS 1 west of Bella Vista station will involve a combination of at-grade (fill embankment and cutting), viaduct and bridge structures. The major waterways traversed or bordered by the rail alignment within this area will be spanned by viaduct or bridge structures with abutments located outside the 100 year ARI flood extents. Consequently impacts of the proposed works on floodplain storage are considered to be negligible.

Temporary filling of the floodplain will be required to form temporary haul roads and working pads to facilitate construction of the viaduct and bridge structures. The greatest extent of filling and therefore the greatest potential for impacts on floodplain storage is at Site 12 and to a lesser extent at Site 13.

iv) Potential impacts Due to Climate Change

Scientific research into the potential impacts of climate change has been rapidly evolving over recent years. Latest research indicates that climate change is likely to result in more frequent and intense storms, but lower annual rainfall.

The time periods of these potential climate change impacts relative to the time period for construction of the major civil works is such that they are not expected to have any significant effect on the civil construction works for the project. Potential impacts on the operational phase of the project will be addressed in EIS 2.

v) Water Quality

The construction phase of the project has the potential to impact on the water quality of the receiving environment. Construction works would involve excavation at many locations resulting in exposure of the underlying soils. This has the potential to lead to increased erosion and sediment transport, erosion and ultimately sedimentation in downstream water bodies. Construction activities can also result in the release of potentially harmful chemicals into receiving waters.

The following works involving excavation have the greatest potential to result in sediment transport and sedimentation issues:

- Tunnel and station excavation.
- Construction of viaduct columns and bridge piers.
- General civil works including temporary and permanent roads and ancillary station facilities.
- Stockpiling and handling of spoil.

A management framework and site specific controls would need to be developed and implemented during the construction phase of the project to reduce the risks of sedimentation to down gradient water bodies. Measures to be taken would include the use of sediment basins or bunded swales.

A preliminary assessment has been carried out to determine the sediment basin sizing that would be required to control runoff from each site. Details of the sediment basins to be provided on sites within or adjacent to The Hills Shire are provided in Table 44.

Table 44: Preliminary Sediment Basin Sizing

Construction Site	Site Area (hectares)	Preliminary Sediment Basin Volume (m3)
4. Cherrybrook Station	7.5	3100
5. Castle Hill Station	1.8	750
6. Hills Centre Station	6.5	2690
7. Norwest Station	2.1	870
8. Bella Vista Station	6.3	2600
9. Balmoral Road	19	7850
10. Memorial Avenue	12	3690
11. Kellyville Station	10	3080
12. Windsor Road/Old Windsor Road	5.0	1540
13. Old Windsor Road/Whitehart Drive	9.7	2980
14. Rouse Hill Station	1.8	560
15. Windsor Road Viaduct	6.1	1880

The construction of viaducts and bridges over major watercourses has the potential to impact upon water quality. Riparian vegetation would need to be cleared to create work areas at these locations. Temporary roads would need to be created through vegetated areas to access the proposed work locations to construct viaduct columns and bridge piers and support the transport of bridge spans. The removal of vegetation and the disturbance created when constructing the tracks and work areas would cause ground instability. The potential for sediment release from these areas would increase, particularly on sloped land.

Temporary waterway crossings would need to be designed to minimise significant increases in velocity. Where applicable, outlets to these structures would be designed with suitable scour protection to reduce the risk of scour at the culvert and sedimentation of the downstream receiving waters.

Mitigation measures have been developed to avoid, reduce and manage identified potential impacts on surface water hydrology. These mitigation measures and their application to the project are detailed in EIS 1 (Attachment 10).

13. NON-KEY ENVIRONMENTAL ISSUES

EIS 1 includes an assessment of what are referred to as 'Non-key' environmental issues, being air quality, waste and spoil management.

a) AIR QUALITY

i) Assessment Methodology

The emission sources associated with the major civil construction works are considered in EIS 1 to be fugitive in nature. Emissions would depend on a number of factors including meteorological conditions and construction methodologies employed. The sources are considered temporary in nature and would be confined to the construction period. As a consequence impacts have been assessed qualitatively with respect to the sources of emissions from the construction sites.

The assessment of potential air quality impacts of the major civil construction works addressed:

- Ambient air quality assessment criteria and air pollutants of concern during the construction works.
- Existing air quality in the vicinity of the study area.
- Emissions arising from the major civil construction works.

Mitigation measures were then derived to minimise air quality impacts during the civil construction works.

The air pollutants of concern during the civil construction works include particulate matter with diameter less than or equal to 10 microns (PM10), deposited dust, total suspended particles (TSP), sulphur dioxide (SO2), nitrogen dioxide (NO2) and carbon monoxide (CO). Deposited dust, TSP and PM10 are all measures of airborne particulates. Diesel combustion emits a number of particulate compounds including CO, SO2 and NO2.

ii) Existing Environmental Conditions

Ambient air in the vicinity of the study area is regarded as typical of a primarily developed and developing residential and commercial area. The ambient air quality is largely affected by motor vehicle emissions, commercial businesses, domestic activity, construction and event based emissions such as bushfires or dust storms. There is no notable heavy industry or extractive operations in the immediate vicinity of the study area.

The OEH monitors air quality at various locations throughout NSW. There are no air quality monitoring stations located within the study area, however data at Lindfield, Vineyard and Prospect have been used to provide an indicative description of air quality of the area.

A summary of air quality monitoring data and air quality criteria relevant to the assessment is provided in Table 45.

Table 45: OEH Air Quality Monitoring Data

Date	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
SO_2 maximum 1h average [pphm] Criterion - 20 pphm											
Lindfield	4.2	4.4	2.1	2.9	2	-	-	-	1.6	-	1.7
Vineyard	1.6	2.4	1.3	1.4	1.6	1.7	1.4	2.9	1.4	1.4	2
Prospect									1.4	1.7	1.8
NO_2 maximum 1h average [pphm] Criterion - 12 pphm											
Lindfield	5.4	5.4	5.1	4.4	4.6	-	-	-	3.3	5.3	3.8
Vineyard	3.5	4	4.9	3.4	4.1	4.1	4.8	3.7	3.2	4.8	2.9
Prospect	-	-	-	-	-	-	-	-	-	5.8	4.3
CO maximum 8h rolling average [ppm] Criterion - 9 ppm											
Lindfield	-	-	-	-	-	-	-	-	-	-	-
Vineyard	-	-	-	-	-	-	-	-	-	-	-
Prospect	-	-	-	-	-	-	-	2	1.5	2.3	1.9
OZONE maximum 1h average Criterion - 10 pphm											
Lindfield	9.3	16.1	13.3	8.1	10.4	-	-	-	7.5	10.9	8.2
Vineyard	10.9	11.1	14	13.6	10.4	11.7	10.4	12.7	8.1	10	9
Prospect									10.7	12.6	10.4
PM_{10} maximum 24h average [$\mu g/m^3$] Criterion - 50 $\mu g/m^3$											
Lindfield	40.1	103.9	93.2	132.4	-	-	-	-	38.8	1596.3	48.2
Vineyard	35.4	82.4	160.9	209.7	43.4	49.1	70	45.1	38	1698.9	39.7
Prospect	-	-	-	-	-	-	-	46.3	41.8	1680.3	40.1

Source: OEH (2011) and DEC (2005)
pphm – concentration in parts per hundred million
ppm – concentration in parts per million

The table shows that air quality in the vicinity of the project site is below the assessment criteria for CO, SO2 and NO2 at all sites for the data available. There are however some exceedances for ozone and PM10 in a number of years. The extremely high elevated levels of PM10 in 2009 are attributable to severe dust storms and extensive bushfires in the Sydney basin.

iii) Identification of Impacts

The NWRL project construction sites are located adjacent to various land uses including residential, commercial and recreational land uses. Sensitive receivers are regarded as locations where people are regularly present and include residential properties, educational facilities, health buildings and outdoor recreation areas.

EIS 1 identifies a number of sensitive receivers around each construction site. Activities which may impact on ambient air quality at each of the sites have also been confirmed.

Dust Generation

The main activities with the potential to generate dust emissions during construction works include:

- Work site establishment.
- Earthworks.
- Tunnelling activities.
- Spoil storage and transport.
- Concrete batch plants and pre-cast manufacturing facility activities.

The quantity of dust generated is dependent on the type of machinery used, the construction technique employed, the type, particle size and moisture content of material, size of the exposed area and meteorological conditions (in particular wind).

As the majority of the rail tunnel from Epping to Bella Vista would be constructed below ground, dust impacts would largely be confined to the areas where the proposed alignment is above ground, and in areas where station cavern excavation, spoil improvement and service facilities are proposed.

Vehicular and Plant Emissions

Activities generating exhaust emissions associated with the civil construction works include:

- Emissions from construction vehicles.
- Emissions from construction equipment, generators and other plant.

The main sources of emissions from heavy vehicles, mobile excavation machinery and stationary combustion plants would be related to diesel combustion. The quantity of emissions from construction vehicles and machinery is dependent on the type of fuel used and the hours of operation.

Dust and exhaust emissions generated during the construction works can largely be controlled through operational and physical mitigation measures, which are routinely adopted during similar construction projects.

Mitigation measures have been developed to avoid, reduce and manage identified potential impacts on air quality. These mitigation measures and their application to the project are detailed in EIS 1 (Attachment 11).

It is noted that air quality management should be a minor risk to the amenity of residents and that the predominant historical exceedances for air quality criteria coincide with bushfire and dust storm events.

The potential dust and air pollutant emitting activities have been adequately considered in the EIS and expected impacts from stockpiles, vehicles, erosion and transport of spoil should be adequately addressed by the proposed mitigation measures.

b) WASTE MANAGEMENT

i) Assessment Methodology

This section of EIS1 outlines the framework for general waste management that would apply to the project and identifies:

- Waste streams generated during the major civil construction works.
- Potential waste management related impacts associated with the civil construction works.
- Potential waste management related impacts associated with the civil construction works.
- Options for spoil reuse and disposal.
- Waste management procedures.

ii) Waste Generation

The project has the potential to generate a number of different types of waste during the civil construction works which would require management and disposal in accordance with relevant state legislation and government policies.

The key waste streams anticipated to be generated during the civil construction works include:

- Spoil from tunnelling, station excavations, cuttings and general earthwork activities:
  - ❖ Virgin excavated natural material (VENM)
  - ❖ Contaminated or acid sulphate soils (ASS)
- Wastewater from tunnel construction operations .

Other waste streams anticipated to be generated during the civil construction works include:

- Demolition waste from the demolition of residential and commercial buildings:
  - ❖ Concrete, bricks, tiles, timber, metals, plasterboard, carpets, electrical and plumbing fittings and furnishings
  - ❖ Hazardous waste including asbestos
- Green waste from the clearing and scrubbing of vegetation.
- General construction waste.
- General waste from construction site offices and amenity facilities.
- Waste from the operation and maintenance of vehicles and machinery.
- Wastewater from other sources including dust suppression and washdown, and sewerage/greywater from construction compounds.

The quantity and type of construction waste would be site specific, with the majority of construction waste classified as general waste.

iii) Potential Impacts

Potential waste management impacts associated with the civil construction works include:

- Excessive volumes of spoil directed to landfill due to inadequate recycling and beneficial re-use.
- Dust impacts from the incorrect storage, handling and disposal of spoil.
- Excessive volumes of waste directed to landfill from the inadequate collection, classification and disposal of waste.
- Contamination of soil, surface and/or groundwater from the inappropriate storage, transport and disposal of liquid and solid wastes.
- An increase in vermin from the incorrect storage, handling and disposal of putrescible waste from construction compounds.

Waste management activities associated with the construction works are not considered to pose a significant risk to the environment given that standard measures are available to address waste generation, storage, disposal and re-use in order to reduce impacts.

iv) Spoil Management

It is envisaged that the project would generate approximately 2,400,000 m3 of surplus spoil. The majority of spoil would be generated from excavation of tunnels and underground stations. Relatively smaller quantities would be generated by site preparation activities, excavation of vertical access shafts, dive structures and cut and fill activities for the above ground components of the project.

The majority of the excavated spoil material would be uncontaminated crushed sandstone and shale material classified as VENM.

The strategy for the re-use of spoil material from the project would follow a hierarchy of spoil management options. This hierarchy is detailed in Table 46.

Table 46: Waste Spoil Management Hierarchy

Rank	Re-use Options	Example of Option
1	Within the Project	▪ Reuse in the Project to fill embankments and mounds within short haulage distance of source. ▪ Restoration of any pre-existing contaminated sites within the Project boundaries. ▪ Reuse as a feed product in construction materials (eg concrete).
2	Environmental works	▪ Reuse in coastal protection works such as beach nourishment and land raise. ▪ Reuse in flood mitigation works.
3	Other development projects	▪ Reuse for fill embankments and mounds on projects within an economic transport distance from site. ▪ Reuse for land reclamation or remediation works. ▪ Reuse sand for manufacturing concrete and reuse shale for manufacturing bricks/ tiles.
4	Land restoration	▪ Reuse to fill dis-used facilities, eg mines and quarries, to enable either future development or ecological rehabilitation.
5	Landfill management	▪ Reuse to cap completed landfill cells. ▪ Reuse in daily covering of landfill waste.

The project would target 100% beneficial re-use of the usable spoil, recognising that a proportion of excavated material would not be a re-usable resource.

There would only be limited opportunities for on-site re-use of spoil as the project has very few requirements for fill and construction space is limited.

The spoil generated as part of the project would compromise the following categories of materials, and potential re-use opportunities:

- Clean granular fill is likely to be suitable for use as structural fill.
- Excavated moist clay and clayey sand material is likely to be suitable for use as general fill following moisture conditioning.
- Excavated weathered shale and sandstone could be suitable for use as structural fill following moisture conditioning to reduce reactivity.
- Medium strength or better quality shale is likely to be suitable for use as non-reactive fill.
- Medium to high strength sandstone may be suitable for use as structural fill.
- Wet clay and wet shale spoil is unlikely to be suitable for re-use on site without substantial moisture conditioning.

The geology of the spoil material as well as its consistency and quality would determine the re-use options. The options proposed for re-use of shale and sandstone are summarised in Table 47.

Table 47: Re-use Options for Shale and Sandstone

Sandstone	Shale
▪ Reuse as construction material e.g. concrete, aggregate, road base ▪ On site land rehabilitation ▪ Off site land rehabilitation ▪ Reclamation	▪ Manufacture of bricks, tiles and ceramics ▪ Off site land rehabilitation

There are a number of extractive industry voids in the Sydney Region. Former quarries and other sites that are potentially available for large scale VENM disposal are detailed in Table 48.

Table 48: Possible large Scale VENM Disposal Sites and Quarries in the Sydney Region

Company	Location	Comments	Capacity (million m^3)	Haulage Distances
Hornsby Shire Council	Hornsby Quarry	Hornsby Quarry, owned by Hornsby Shire Council, has capacity for large quantities of VENM. There is a possibility that the void space would be available for placing materials following environmental assessment and provision of a suitable access through a residential area.	3.5	Cherrybrook: 13km Hills Centre: 18km Bella Vist;a: 24km
Wallgrove Quarry	Archibald Road, Eastern Creek	Owned by Dial-a-Dump. May be willing to receive large quantities of VENM, to permit quicker redevelopment of the site.	11	Cherrybrook: 37km Hills Centre: 27km Bella Vista: 23km
CSR PGH Schofields Quarry	Meadows Road	Owned by CSR and with planning approval from Blacktown City Council to take non putrescible waste (including VENM) 24 hours a day, 7 days a week.	1 to 1.5	Cherrybrook: 28km Hills Centre: 18km Bella Vista: 14km

Company	Location	Comments	Capacity (million m^3)	Haulage Distances
CSR PGH Horsley Park	Old Wallgrove Road, Horsley Park	Currently comprises brickworks, clay shale extraction/open land. Site is approved as a Class 2 landfill and will accept sandstone and shale.	2	Cherrybrook: 38km Hills Centre: 28km Bella Vista: 24km
Lend Lease Australian Defence Industry Site	Werrington County and Werrington Downs	Owned by Delfin Lend Lease. The ADI site is rezoned to allow development. May be willing to receive large quantities of VENM, to permit quicker redevelopment of the site.	2	Cherrybrook: 37km Hills Centre: 27km Bella Vista: 23km
Austral Plant 3	Old Wallgrove Road, Horsley Park	The site currently has an active brickworks, and clay shale extraction activities. It is relatively small and would therefore not be ideal for landfilling. Hence filling with VENM may be a consideration.	1.5	Cherrybrook: 38km Hills Centre: 28km Bella Vista: 24km
Penrith Lakes Development Corporation	Penrith Lakes Scheme	Spoil has been used in the past for beneficial reuse as fill material in the Penrith Lakes scheme. Both shale and sandstone materials have been accepted. Future plans to receive large quantities of VENM (preferably sandstone or shale) for on-site use.	5	Cherrybrook: 56km Hills Centre: 47km Bella Vista: 42km

It is noted in EIS 1 that the locations above require separate planning approval and obtaining an EPL under the Protection of Environment Operations Act (POEO) from the EPA. A waste levy would be payable for each tonne of waste directed to landfill under the POEO Act.

The capacity of the listed spoil re-use locations suggest that adequate opportunity exists for spoil to be appropriately managed during the civil construction works. The actual spoil re-use sites for the project would need to be determined closer to the commencement of construction, as sites which may

accept spoil materials from 2013 through to completion of excavation may change.

Any spoil classified as contaminated in accordance with NSW Guidelines would be directed to a waste management facility to accept the waste. There are a number of solid waste landfills in Sydney which accept contaminated soils. As the potential volume of contaminated spoil is expected to be less than one percent of the total excavated volume, it is likely that adequate disposal sites exist to dispose of the contaminated waste. A waste levy would be payable for each tonne of waste directed to landfill.

In order to ensure that appropriate disposal sites are available from the commencement of construction to the completion of excavation, the following actions would be undertaken:

- The known VENM receiving locations and landowner contact details would be provided in the 'Information to Tenderers' issued during the procurement phase.
- During the balance of the definition design phase and the subsequent period leading up to procurement, further investigations would be made with land owners and Government Agencies on re-use and disposal opportunities.

Determination of the disposal sites would be the ultimate responsibility of the contractor.

Waste management in NSW is prioritised according to the principals of a resource management hierarchy embodied in the 'Waste Avoidance and Resource Recovery Act 2001'. The hierarchy is as follows:

- Avoidance if unnecessary resource consumption.
- Resource recovery including re-use, reprocessing, recycling and energy recovery.
- Disposal.

The project would target the following in regards to waste management:

- 100% beneficial re-use of usable spoil.
- 95% beneficial re-use of construction and demolition waste.

Mitigation measures have been developed to avoid, reduce and manage identified potential impacts on waste management. These mitigation measures and their application to the project are detailed in EIS 1 (Attachment 12).

14. CUMULATIVE IMPACTS

Cumulative impacts are incremental environmental impacts that are caused by past, present or reasonably foreseeable future activities which when combined may have a cumulative effect. When considered in isolation, the environmental impacts of any single project upon any single receiver or resource may not be significant. Significant effects may arise, however, when individual effects are considered in combination, either within the same project or together with other projects.

The cumulative impacts assessment addresses impacts under two categories:

- Interaction between impacts and activities associated with Stage 1 major civil construction works and other projects in the vicinity of NWRL (external cumulative impacts)
- Interaction between impacts and activities associated with Stage 1 major civil construction works and Stage 2 works which would be subject to detailed assessment in EIS 2

a) EXTERNAL CUMULATIVE IMPACTS

The assessment of external cumulative impacts is focussed on the known key environmental issues associated with the major civil construction works for the NWRL and their interaction with other projects in the vicinity.

Other projects were identified taking into account:

- **Location**

  Located in close proximity to the major civil construction works (i.e. located within suburbs intersected by or adjacent to the major civil construction works).

- **Project Timeframe**

  Only projects likely to be under construction concurrent with the major civil construction period were considered.

- **Project Size**

  Projects were identified by virtue of being listed on the DP & I Major Projects Register and through consultation with the NWRL project team.

The main projects identified were:

- Construction and operation of drinking water and wastewater infrastructure to service the North West Growth Centre second release precincts (The Hills Shire and Blacktown City).
- Parklea Markets redevelopment (Blacktown City).
- Northern Sydney Freight Corridor Epping to Thornleigh third track (Hornsby Shire).
- Castle Towers expansion and redevelopment (The Hills Shire).
- Showground Road upgrade (The Hills Shire).
- Schofields Road upgrade (Blacktown City).
- Rouse Hill Town Centre northern frame development (The Hills Shire).

The potential cumulative impacts of these projects with the NWRL major civil construction works are detailed, on a geographic basis, in Table 49.

Table 49: Cumulative Impacts by Geographic Area

Area	Projects
Beecroft Road area between Epping Station and M2 Motorway, Epping.	❖ NWRL Stage 1 major civil construction works ❖ Northern Sydney Freight Corridor Epping to Thornleigh Third Track
Old Windsor Road area between Samantha Riley Drive and Sunnyholt Road including the suburbs of Stanhope Gardens and Glenwood.	❖ NWRL Stage 1 major civil construction works ❖ Redevelopment of Parklea Markets ❖ Water related services for North West Growth Centre
Old Windsor Road/Windsor Road area between Samantha Riley Drive and White Hart Drive including the suburbs of Kellyville Ridge and Beaumont Hills.	❖ NWRL Stage 1 major civil construction works ❖ Water relates services for North West Growth Centre
Showground Road and Castle Towers area, Caste Hill	❖ NWRL Stage 1 major civil construction works ❖ Castle Towers Shopping Centre Upgrade ❖ Showground Road Upgrade
Rouse Hill area and area west of Windsor Road and north of Schofields Road incorporating Area 20 and parts of Riverstone Precinct.	❖ NWRL Stage 1 major civil construction works ❖ Water related services for North West Growth Centre ❖ Rouse Hill Town Centre Northern Frame ❖ Schofields Road Upgrade

Table 50 identifies the potential cumulative impacts in each of these areas that are within or immediately adjacent to The Hills Shire.

Table 50: Potential Cumulative Impacts with NWRL Major Civil Construction Work

Area	Potential Cumulative Impact with NWRL Major Civil Construction Works
Old Windsor Road Area between Samantha Riley Drive and Sunnyholt Road	❖ Noise and vibration impacts to receptors in the area bounded by Old Windsor Road, Sunnyholt Road and Cattai Creek as a result of construction and related traffic[1]. ❖ Disruption to traffic along Old Windsor Road and Sunnyholt Road as a result of construction related traffic. ❖ Visual impact due to construction hoarding, elevated building structures associated with Parklea Markets redevelopment as well as the NWRL viaduct structure. ❖ Water quality impacts on Cattai Creek as a result of potential pollution of stormwater run-off from construction activities. Cattai Creek runs through or alongside the Parklea Markets redevelopment and the Water Services project as well as the NWRL major civil construction works.
Old Windsor Road/ Windsor Road Area between Samantha Riley Drive and White Hart Drive	❖ Noise and vibration impacts to receptors alongside Windsor Road as a result of construction and related traffic[1]. ❖ Disruption to traffic along Windsor Road (and other local roads) as a result of construction related traffic.

Area	Potential Cumulative Impact with NWRL Major Civil Construction Works
	❖ Visual impact due to construction hoarding and the NWRL viaduct structure. ❖ Water quality impacts on Tributaries 3, 4 and 5 as a result of potential pollution of stormwater run-off from construction activities. Tributaries 3, 4 and 5 cross the construction of the Water Services project, which follows Old Windsor Road/Windsor Road, flowing to the east of Old Windsor Road/Windsor Road and crossing the construction sites for the major civil construction works.
Showground Road and Castle Towers Area	❖ Noise and vibration impacts to receptors along Showground Road and Old Northern Road particularly where they are in close proximity to the shopping centre and the major civil works construction sites[1]. ❖ Noise and vibration impacts to receptors along Showground Road and other local roads as a result of construction related traffic. ❖ Disruption to traffic along various roads as a result of construction related traffic. ❖ Visual impact due to construction hoarding and elevated building structures associated with the Castle Towers Shopping Centre Upgrade.
Rouse Hill area and area west of Windsor Road and north of Schofields Road incorporating Area 20 and parts of Riverstone Precinct	❖ Noise and vibration impacts to receptors throughout the area including those along Windsor Road, Schofields Road, Tallawong Road, Cudgegong Road, Rouse Road, Macquarie Road and Hambledon Road, as a result of construction and related traffic[1]. ❖ Disruption to traffic along various roads as a result of construction related traffic. ❖ Visual impact due to construction hoarding and construction activities as well as the NWRL viaduct structure. ❖ Water quality impacts on Second Ponds Creek and First Ponds Creek as a result of potential pollution of stormwater run-off from construction activities.

b) INTERNAL CUMULATIVE IMPACTS

Internal cumulative impacts refers to the potential cumulative impacts related to the construction of the stations, rail infrastructure and systems in addition to the major civil construction works, as well as the operation of the NWRL.

The internal cumulative impacts assessment is concerned with potential cumulative impacts on receptors which result from:

- Construction activities at similar locations and from both stages of the project undertaken concurrently, thereby intensifying potential impacts at any one location.

- Construction activities at similar locations and from both stages of the project undertaken concurrently, thereby prolonging potential impacts at any one location.
- Operational activities following on from construction activities which may prolong impacts at any one location.

The methodology focuses on providing the most up to date project description for stations, rail infrastructure and systems construction works and rail operations to allow an understanding of the potential environmental impacts associated with these activities and how they might interact with the major civil construction works to give rise to cumulative impacts.

Although EIS 1 identifies the main impacts that would be most likely associated with Stage 2 construction works and the operation of the railway, these are to be assessed in more detail in EIS 2.

c) MANAGEMENT AND MITIGATION MEASURES

Environmental impacts for major civil construction works and construction of stations, rail infrastructure and systems would be managed and mitigated through a project wide Environmental Management Framework (EMF). NWRKL contractors would be required to implement and adhere to the requirements of this management Framework when constructing the NWRL works.

The EMF, which is included as an appendix to EIS 1 would provide a linking document between the planning approval documentation and the Construction Environmental Management Plan (CEMP) to be developed by the construction contractors relevant to their scope of works.

The requirements of this EMF would be included as a contract document in all construction contracts related to the project.

The CEMP prepared by all contractors would be relevant to the scale and nature of the nominated scope of works and would be prepared consistent with the 'Guideline for the Preparation of Environmental Management Plans' (DIPNR, 2004).

The CEMP would cover the requirements of the relevant EIS/s, the project approval conditions, the conditions of all other permits and licences, the Contractor's corporate EMS, the environmental provisions of the contract documentation and the EMF.

The purpose of the CEMP would be to detail how the project would deliver the environmental requirements and how issues that arise are handled.

As part of the CEMP, TfNSW would identify all other significant developments occurring in the vicinity of the construction sites and identify environmental impacts to be monitored during construction that have the potential for cumulative effects to occur. TfNSW would review environmental impacts every six months during the construction phase. Any new impacts identified during construction would be addressed appropriately to reduce the cumulative effects and reported.

15. ENVIRONMENTAL RISK ANALYSIS

a) PURPOSE OF ENVIRONMENTAL RISK ANALYSIS

The purpose of the environmental risk analysis is to:

- Identify potential environmental risks and issues to be considered as part of EIS 1.
- Identify any issues not included in the Director General's Requirements, or the concept Plan Conditions of Approval and Statement of Commitments to enable appropriate assessment.
- Identify the residual environmental impacts after the implementation of the mitigation measures described in the EIS.

b) KEY ISSUES IDENTIFIED

Various environmental risk identification and analysis have been undertaken throughout the development of the project. These analysis, along with the assessments undertaken as part of EIS 1 identified the key environmental issues associated with the project as:

- Construction management (including spoil handling).
- Soils and groundwater.
- Construction traffic (including public transport, parking and access).
- Construction noise and vibration.
- European heritage.
- Indigenous heritage.
- Local business impacts.
- Land use and community facilities.
- Ecology.
- Visual amenity.
- Greenhouse gas and climate change.
- Surface water and hydrology.

EIS 1 includes a detailed assessment of all of these key issues as they relate to the proposed project, and the potential construction related impacts. Further the EIS proposes a suite of mitigation measures to reduce the identified potential impacts.

The risk analysis also includes the non-key issues identified by EIS 1 including air quality, waste management and resource use.

c) RISK ANALYSIS FRAMEWORK

The environmental risk analysis has been undertaken in accordance with the principals of AS/NZS ISO 31000:2009 Risk Management – Principles and Guidelines. The risk analysis involved:

- Ranking the risk of each identified potential impact by identifying the consequences of the impact and the likelihood of each impact occurring.
- Considering the probable effectiveness of the proposed mitigation measures to determine the likely residual risk of each impact.

The results of the risk analysis are presented in Attachment 13.

d) CONCLUSION – RISK ANALYSIS

The Environmental Risk Analysis identified the following key issues that would present a high or greater level of residual risk for NWRL after the incorporation of standard mitigation measures:

- Soils and groundwater.
- Construction noise and vibration.
- European heritage.
- Indigenous heritage.
- Ecology.
- Visual amenity.
- Surface water and hydrology.
- Resource use.

The identified environmental issues retaining a significant environmental risk (despite the application of mitigation measures) suggest that an increased focus would be required on these aspects throughout the construction of the project to meet an acceptable risk level.

Other issues that have a moderate risk include:

- Construction traffic.
- Local business impacts.
- Land use and community facilities.
- Greenhouse gas and climate change.
- Waste management.
- Resource use.
- Cumulative impacts.

The level of assessment undertaken for these issues has determined the likely extent of impacts and recommended appropriate mitigation required to ensure that the risk would be abated.

Air quality impacts have a low residual risk. It is expected that air quality issues can be routinely managed through detailed design and construction, and by the implementation of standard management measures aimed at ensuring that all necessary environmental criteria and guidelines would be achieved.

CONCLUSION

The NWRL project is one of, if not the largest, infrastructure projects ever undertaken by any NSW State Government. Its successful completion will provide a critically important public transport option for existing and future residents of The Hills Shire and the North West Growth Centre. Consequently the project has been, and will continue to be, strongly supported by both Council and the community.

In undertaking a project of this magnitude it is inevitable that there will be significant impacts from construction, particularly in terms of noise and heavy traffic generation.

EIS 1 for the major civil construction work utilises a risk management framework to identify a wide range of environmental risks that have been assessed in terms of their severity, likelihood and consequence with a range of mitigation measures developed.

Overall it is considered that the mitigation measures proposed in EIS 1 satisfactorily address those risks. However Council officers have identified in the report a number of concerns and comments which should be submitted to the Department of Planning.

Since the NWRL project was first announced in the early to mid 2000s, Council has consistently objected to proposals involving the section of the project west of Bella Vista, being above ground. Those objections have been based on the visual impacts of any above ground structures, the alienation of any land below those structures, and the potential noise impacts on existing and future residential properties from railway operations.

It is recommended that Council should maintain its position on the entire project being built underground. However should the State Government not accept Council's view, the officers comments included in the report incorporate recommendations to help address the impact of these above ground structures.

The other major concern that is not necessarily addressed in EIS 1 is the impact that construction activities, traffic management proposals and heavy vehicle traffic movements will have on Showground Road and Norwest Boulevarde. The need for upgrading of the section of Showground Road from Carrington Road to Old Northern Road and the upgrade of various intersections along Norwest Boulevarde are both well documented and are subject to the redevelopment of Castle Towers (Showground Road) and the allocation of State and/or Federal Government funding (Norwest Boulevarde). It is essential that the delivery of the NWRL provides active, meaningful engagement processes to help our residents be a part of the delivery. Significant construction impacts will arise and opportunities for affected residents to be informed, engaged and part of the solution will prove valuable.

IMPACTS

Financial

Construction of the NWRL project will have a wide range of both direct and indirect financial impacts on Council. Direct financial impacts include income received for the acquisition of Council property and expenditure involved in the relocation of Council's Operations Centre. These financial impacts will be provided in more detail as future reports are submitted to Council on these matters.

Indirect financial impacts will primarily involve the large amount of time that will be spent by officers from across the organisation liaising with the NWRL project Team on a wide variety of matters throughout the duration of the project. These indirect costs will be accommodated within Council's existing staff establishment and budget allocations.

Hills 2026

The NWRL is a significant State infrastructure project that addresses many of the factors identified by our community's strategic vision, that contributes to our quality of life.

RECOMMENDATION

This report and the following recommendations form the basis of The Hills Shire Council's response to EIS 1.

General

1.1 Overall, Council supports the delivery of the NWRL project.

1.2 The NWRL Project Delivery team should include a meaningful community reference and liaison group that will help to build collaboration to help manage the inevitable impacts of construction a project of this scale amongst an established community.

1.3 The retention of the tunnel stubs to support a future Parramatta to Epping linkage at Epping is supported.

1.4 It remains Council's preference for the entire NWRL to be constructed entirely below ground.

1.5 It is essential that any construction and operation of a Skytrain ensure sufficient acoustic treatment is provided so as to not cause offensive noise pollution to surrounding areas. Further, the design of the elevated viaduct that supports the Skytrain must incorporate design elements including artistic features, to make the construction more visually attractive to contribute positively to the setting.

1.6 The route of the NWRL should be as exhibited in the 2006 growth centres structure plan so as to serve future population north of Windsor road at Box Hill.

Soils and Groundwater

2.1 Council's LEP maps indicating the extent of the geotechnical assessment area be included in Council's submission and that the geotechnical experts investigate the potential risk to land in that area as a result of the construction and operation of the NWRL.

2.2 The mitigation measure of conducting before and after dilapidation surveys of buildings in the vicinity of stations, works and construction sites is supported.

Construction Traffic

3.1 A dilapidation report is to be prepared prior to work commencing to ascertain the current condition of the affected local roads and a form of Contributions Plan must be established to collect contributions which will assist with the cost of maintenance, repair and reconstruction as a result of damage caused by trucks.

3.2 Restricted truck access on Council's local roads will be enforced in accordance with weight restrictions within the Shire. The weight restricted routes that are near the station construction precincts include Gilbert Road, Highs Road, Taylor St, Aiken Road, Oakes Road, Jenkins Road, Glenhaven Road, Commercial Road, Withers Road, Hezlett Road, Annangrove Road and Kenthurst Road.

3.3 Council also has several sub-arterial roads near the station construction sites that do not have weight restrictions. These roads include Samantha Riley Drive, Green Road, Sanctuary Drive, Carrington Road and Victoria Avenue. These unrestricted sub-arterial roads should not be used for truck movements to and from the station construction areas - Any conditions of consent issued for the construction of the NWRL by the NSW Government should restrict truck access on these roads.

3.4 Street lighting issues are likely to arise at each construction site because of the extensive excavations. Interrupted power supply and light pole relocations will occur at various stages and the construction management plans will need to detail how these issues are continuously monitored and resolved. This issue will be critical at Castle Hill and Norwest Stations in particular because of pedestrian movements, and site modifications will be required for street lighting at each area to ensure continued operation.

3.5 Traffic volumes along Glenhope Road and Glenridge Avenue will be over their environmental capacity of 250 movements in peak hour, and LATM treatment will be needed along the full length of the connection to Coonara Avenue. Public consultation and funding of any LATM Scheme along Glenhope Road and Glenridge Avenue will be the responsibility of NWRL. The LATM scheme will need to include Parking restrictions in Glenhope Road to control contractors vehicles during construction and these restrictions will remain to control commuter parking.

3.6 The West Pennant Hills Bus Link may be needed as an alternative to Castle Hill Road as buses are likely to use Glenhope Road as a major connection between the residential areas and Cherrybrook station. The proposed Bus Link will need to be re-evaluated as part of a general review of bus services integrating with the Station precinct.

3.7 Relocation of the Castle Hill bus interchange area is critical because pedestrian access will be restricted through and across the site. Buses, and pedestrian traffic using those buses, will all revert to Old Castle Hill Road resulting in severe congestion. NWRL will need to show how bus and pedestrian traffic will operate in the temporary location in conjunction with the re-introduction of two way traffic flow along the full length of that road.

3.8 A new bus layover area is needed to reduce demand for bus parking – options include unused Castle Towers overflow parking areas, or Council land in Brisbane Road. The State Government must identify where that layover area is, and clearly show how it will operate to reduce traffic issues in Old Castle Hill Road.

3.9 The proposed major truck access for The Hills Centre Station station goes direct to Showground Road through the dog show area adjacent to the Cattai Creek bridge. It is unlikely that this proposed access arrangement will be approved on on safety grounds because of the steep gradients of Showground Road. A better location is through the Showground upper precinct at the existing signals for Gilbert Road. A fourth leg of this intersection would provide for construction access as well as supporting functions at the Showground during construction of the station.

3.10 No truck movements will be permitted onto Carrington Road. Secondary access for contractors is from Carrington Road at Doran Drive. No improvements are proposed but some form of intersection control such as a roundabout or traffic signals will be needed.

3.11 Peak travel time access through the Business Park must not be affected by the Norwest Station construction. As a result, four traffic lanes must be available in Norwest Boulevarde every work day from 7am to 9am, and 4.30pm to 6.30pm. Brookhollow Avenue must not become a defacto bypass for Norwest Boulevarde.

3.12 Most truck movements will head to the west along Norwest Boulevarde (Old Windsor Road) This will place a further burden on the roundabout at Lexington Avenue which performs at level of service "F" every morning and afternoon. Either a signalized intersection to replace the roundabout is needed ($8M) or the roundabout itself must be signalized ($0.3M).

3.13 No trucks will be permitted to exit/enter the Business Park except via the eastern end of Norwest Boulevarde at Windsor Road, or via Celebration Drive at the western end of the Business Park at Old Windsor Road. None of the local roads leading off Norwest Boulevarde will be used for truck traffic.

3.14 The Roundabout at the intersection of Lexington Avenue and Celebration Drive will need to be replaced with traffic signals. Celebration Drive will also need to be upgraded to a four lane carriageway between Lexington Avenue and Old Windsor Road and the dual right turn lanes in Old Windsor Road at Celebration Drive will need to be extended.

3.15 No truck movements are to be permitted from the construction site along Lexington Avenue or through the residential area to the east.

Construction Noise and Vibration

4.1 While the criteria used to determine acceptable noise impacts is supported, that criteria predicts that there will be significant noise impacts and more investigation around the major construction sites is required.

4.2 Any amendment to construction methodologies and associated mitigation measures should be required to improve or maintain those impacts anticipated by this EIS.

4.3 Further background measurements should be undertaken to assure the accuracy of the background noise levels and resultant modelling of the impacts on receivers where the background noise is lower than that modelled.

4.4 While it is proposed to "primarily" conduct site establishment works during the daytime, the duration of these works and occasional evening and night time works during this period will inevitably lead to some level of community dissatisfaction and complaints. Further consideration should be given to mitigation measures at individual receiver's premises to reduce these impacts.

4.5 Further consideration and commitment to reducing truck movements to and from constructions sites along Carrington Road and Norwest during the night time hours should be included in the Construction Noise and Vibration Strategy for the project.

4.6 In relation to the prediction that on-site truck movements causing awakening reactions (or sleep disturbance) at nearby residences. At each of the underground station sites, including the Bella Vista TBM support site, during night time periods, further consideration of mitigation measures either at the construction site and/or at sensitive or residential receivers to reduce these impacts should be included.

4.7 Where blasting is required (presumably as a last resort), in addition to the proposed assessment of the realistic worst-case noise and vibration levels being undertaken and compared with noise and vibration criteria, a comprehensive community information program should be undertaken to advise potential receivers of; the need for the activity, the days and times proposed and the expected noise impacts associated with the activity.

4.8 Acoustic treatment should be offered for the dwellings of those residents most affected by the on-going construction noise. Such treatment measures may include additional acoustic insulation of walls and ceilings, installation of double glazing, installation of air conditioning units etc. These measures should be considered particularly around the Hills Centre, Castle Hill & Bella Vista stations. Particular

residential receivers of concern include, Carrington Road, Showground Road, residents to the east of Bella Vista Station & Precast Yards including Celebration Drive, Sharrock Avenue.

4.9 A commitment to upgrade the acoustic treatment of the acoustic enclosure at the Bella Vista station and pre-cast yard acoustic sheds is required. The modelled impacts on residential receivers for the duration of this project are unreasonably high based on standard acoustic shed construction.

4.10 An on-going commitment to complaint management and community liaison is required to manage and resolve future issues.

4.11 The construction methodology and proposed mitigation measures for the construction of the viaduct require review. The modelled impact of the construction of the viaduct are unacceptable as the prediction indicates significant exceedance of the NMLs for the entirety of the construction works on the residences described as:

- "Residences East of Old Windsor Road from the North section of Arnold Avenue to the North border of the Celebration Drive shopping centre";
- "Residences East of Old Windsor Road and South of Samantha Riley Drive";
- "Residences East of Old Windsor Road, between the group of residences North East of Windsor Road/Old Windsor Road junction and Samantha Riley Drive" and
- "Residences East of Windsor Road, between Bellcast Road and Sanctuary Drive" .

European Heritage

5.1 Views to Mungerie House from Windsor Road must also be considered in the design and placement of the viaduct and its piers.

5.2 During the detailed design of the viaduct and consideration of view corridors, Transport NSW should consult the Mungerie House Conservation Management Plan (2007) prepared for Lend Lease by Tanner Architects and endorsed by Council as it contains important information regarding view corridors and the setting of Mungerie House.

Indigenous Heritage

6.1 No further recommendation other than those contained in EIS 1.

Local Business Impacts

7.1 The Small Business Commissioner commence a study into the structural adjustment and support required for specific small businesses directly affected by the construction work.

7.2 The EIS does not recognise that the national headquarters of IBM Australia is also located in Coonara Avenue. It employs more than 2,000 people, most of whom would drive to work. Therefore increased truck movements and any resulting traffic delays around the construction site could have some impact on those employees travelling to and from work.

7.3 A community liaison group to cater and involve business operators in Castle Hill Town Centre should be established to help respond to issues relating to traffic, access and parking during construction.

Land Use and Community Facilities

8.1 Negotiations should also continue with Council and the RSL Sub-Branch with regard to the temporary relocation of the war memorial during construction of the Castle Hill station. Expert technical advice should also be obtained on the feasibility of transplanting the 'lone pine' located adjacent to the war memorial to an alternate site to the satisfaction of Council and the RSL sub-branch. Consideration should also be given to the collection of seeds or cuttings from the 'lone pine' to enable propagation should transplanting of the tree not be considered feasible or is unsuccessful.

8.2 Transport NSW should consult with the Hills District Historical Society with regard to the railway heritage and monument within the Arthur Whitling Park and future inclusion of railway heritage into the future station and open space.

8.3 Transport NSW must also ensure consultation is carried out with residents and owners, including Kindalin Child Care Centre on The Hills Shire side of Old Castle Hill Road at West Pennant Hills (opposite Cherrybrook station).

Ecology

9.1 Offset sites should be identified and procured prior to works commencing that involve the removal of ecology.

9.2 It is requested that specific priority be given to securing offset sites as near to the location of the impact/loss as possible, to assist with the preservation of the specific endemic community of the area and assure that the ecological and amenity benefits of retaining endemic vegetation remain within the Local Government Area.

9.3 The management of off-set sites could be secured through the registration of land as Biobank Sites with the Biobank Trust funding the in perpetuity maintenance of the vegetation. This could be achieved without the need to purchase the land, rather the purchase and surrender of credits under the Biobanking scheme.

9.4 Three distinct patches of Cumberland Plain vegetation within the Balmoral Road Release area seem particularly appropriate which are 21.6ha, 13.7ha & 6.1ha respectively located on Balmoral Road and Fairway Drive. Additional smaller patches are also mapped within the immediate area. Consideration should be given to securing these sites to offset the loss of vegetation.

Visual Amenity

10.1 The reflectivity of acoustic sheds and site buildings is an additional measure that should be considered.

10.2 If possible, 6m hoarding proposed on Castle Hill Road (Cherrybrook Station) should be reduced in height if it will not reduce the amenity of residents / child care centre on the opposite side of Castle Hill Road.

10.3 Due to the visibility of the viaduct it is expected that the detailed design stage will give particular consideration to making the structure interesting and visually appealing is required. The ultimate design is to incorporate measures to reduce its visual impact and where possible use engineering art to decorate, provide visual interests where landscaping cannot be adequately provided.

10.4. The possible use of the viaduct structure for advertising is an ongoing concern for Council and should be addressed in EIS2.

Climate Change and Greenhouse Gas Emissions

11.1 The 20% electricity offset target should be increased.

11.2 Further offset options associated with revegetation projects and biodiversity offset requirements should also be included.

ATTACHMENTS

1. Proposed Mitigation Measures – Soils and Groundwater (5 pages)
2. Proposed Mitigation Measures – Construction Traffic (2 pages)
3. Mitigation Measures – Noise and Vibration (2 pages)
4. Mitigation Measures – European Heritage (2 pages)
5. Mitigation Measures - Indigenous Heritage (1 page)
6. Mitigation Measures - Land Use and Community Facilities (2 pages)
7. Mitigation Measures – Ecology (3 pages)
8. Mitigation Measures – Visual Amenity (1 page)
9. Mitigation Measures – Climate Change and Greenhouse Gas Emissions (2 pages)
10. Mitigation Measures – Surface Water and Hydrology (5 pages)
11. Mitigation Measures – Non-Key Environmental Issue – Air Quality (3 pages)
12. Mitigation Measures – Non-Key Environmental Issue – Waste Management (2 pages)
13. Environmental Risk Analysis (7 pages)

<< Insert ALL attachments below the section break >>

Attachment 1 - Proposed Mitigation Measures - Soils and Groundwater
Attachment 2 - Proposed Mitigation Measures - Construction Traffic
Attachment 3 - Mitigation Measures - Noise and Vibration
Attachment 4 - Mitigation Measures - European Heritage
Attachment 5 - Mitigation Measures - Indigenous Heritage
Attachment 6 - Mitigation Measures - Land Use and Community Facilities
Attachment 7 - Mitigation Measures - Ecology
Attachment 8 - Mitigation Measures - Visual Amenity
Attachment 9 - Mitigation Measures - Climate Change and Greenhouse Gas...
Attachment 10 - Mitigation Measures - Surface Water and Hydrology
Attachment 11 - Mitigation Measures - Non Key Environmental Issue - Ai...
Attachment 12 - Mitigation Measures - Non Key Environmental issue - Wa...
Attachment 13 - Environmental Risk Analysis

ATTACHMENT 1

PROPOSED MITIGATION MEASURES – SOILS AND GROUNDWATER

No.	Mitigation Measure	Applicable Sites*
Ground Movement		
SG1	The likely effects of any groundwater drawdown would be considered as part of detailed design, including the development of a detailed modelling of geotechnical conditions.	All
SG2	Settlement criteria would be established in consultation with relevant government agencies.	All
SG3	A detailed geotechnical model for the alignment and its surroundings would be developed and progressively updated during design and construction. The detailed geotechnical model would include: ▪ Full details of structures, services, basements and other sub-surface elements that may be impacted by the development of NWRL. ▪ Assessment of the predicted settlement and horizontal strain profiles caused by construction. ▪ Assessment of the predicted settlements and strains on buildings and basements. ▪ Condition surveys of buildings and structures in the vicinity of the tunnel and station excavations. ▪ Detailed modelling of identified property and infrastructure at risk from damage	All
SG4	Where settlement predictions exceed the settlement criteria, feasible and reasonable management measures to minimise potential ground settlement would be implemented.	All
SG5	Monitoring of ground settlement would include installation and monitoring of instrumentation that could include inclinometers, extensometers and surface settlement points at construction sites and along the alignment during construction and for a period of not less than six months after settlement has stabilised with particular reference to risk areas.	All
SG6	Where monitoring during construction indicates exceedance of settlement criteria (or variations to these criteria as agreed through agency consultation), all work affecting settlement would cease immediately and would not resume until fully rectified or a revised method of work has been established to ensure protection of affected structures.	All
SG7	Settlement would be accurately measured during construction with building audits and monitoring of ground movement undertaken, with any additional ground support required identified and implemented.	All

No.	Mitigation Measure	Applicable Sites*
Soil Salinity		
SG8	Appropriate soil salinity mitigation measures would be adopted in accordance with Western Sydney Regional Organisation of Council's Draft Salinity Code of Practice and the former Department of Infrastructure, Planning and Natural *Resources' Guidelines to Accompany Map of Salinity Potential in Western Sydney* (2002).	All
SG9	Where appropriate, a soil salinity assessment would be undertaken in accordance with the DLWC *Site Investigations for Urban Salinity* (2002), including Phase 2 and Phase 3 investigation. This assessment would enable site specific mitigation measures to be developed to ensure saline soils are appropriately managed and damage to the environment and infrastructure is minimised. These investigations would be informed by the completed groundwater monitoring program.	All
Contamination		
SG10	The results from pending investigations on the presence of dense non aqueous phase liquids (DNAPLs) or contaminated groundwater plumes would be assessed and mitigation measures refined as appropriate.	All
SG11	Any contaminated areas to be directly affected by the project would be investigated and remediated prior to the commencement of construction works. All remediation works would be undertaken in accordance with the requirements of the Contaminated Land Management Act 1997 and *Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites* (EPA, 1997b).	All
SG12	Prior to the commencement of site preparation or construction in potentially contaminated areas, a summary of soil contamination would be prepared detailing the outcomes of the Stage 2 contamination site investigations. The summary would detail, where relevant, whether or not the soil is suitable for the intended land use or can be made suitable for reuse through the application of a Remediation Action Plan (or similar).	All
SG13	An accredited Site Auditor would endorse the documentation of site contamination and any Remediation Action Plan or similar.	All

No.	Mitigation Measure	Applicable Sites*
SG14	In the event of discovery of previously unidentified area(s) of potentially contaminated material, all work would cease in the vicinity of the discovery and not recommence until the extent of contamination has been assessed and if necessary, a Remediation Action Plan or similar has been prepared and endorsed by an accredited Site Auditor.	All
SG15	A Site Auditor would be required to certify that any contaminated areas have been remediated to a standard consistent with the intended land use prior to operation of the remediated site(s).	All
SG16	Bunds around fuel depots and stockpile areas would be installed to minimise the risks of contaminants reaching the water table.	All
Groundwater Management		
SG17	A routine groundwater monitoring plan would be established and continue throughout the construction period. Parameters to be monitored would include groundwater levels and groundwater quality with field parameters, laboratory parameters and sample frequency to be developed prior to construction.	All
SG18	A groundwater monitoring network to monitor groundwater levels and groundwater quality would be established throughout the construction phase. The groundwater monitoring network would contain monitoring wells along the whole NWRL route intersecting groundwater in both Ashfield Shale and Hawkesbury Sandstone.	All
SG19	Water sampling and testing of groundwater would be undertaken during construction to determine the most suitable treatment processes to meet the required water quality standards.	All
SG20	Groundwater quality would be subject to testing. Where it does not meet license requirements it would be treated prior to discharge.	All
SG21	Bore performance tests would be conducted, at a minimum, on bores GW100981 and GW16144 to accurately gauge the magnitude of drawdown from tunnel construction with post-construction bore tests. Owners of these bores would be consulted once the groundwater investigations are completed regarding potential for the construction works to impact the water bores. Appropriate mitigation measures, if required, would be developed following consultation.	Tunnels
SG22	All feasible and reasonable measures would be implemented during construction, to limit operational groundwater inflows to stations and crossovers. Any inflows would be collected and treated prior to discharge.	1, 4 – 8
SG23	The use of chemicals in tunnel construction would be minimised.	Tunnels

No.	Mitigation Measure	Applicable Sites*
SG24	A groundwater water supply from the Hawkesbury Sandstone for construction purposes would be used where feasible and reasonable. Negotiation with the NOW would be undertaken regarding impacts and applicable licenses.	All
SG25	If Acid Sulfate Soils are encountered, they would be managed in accordance with the *Acid Sulfate Soil Management Advisory Committee Manual*.	All
Groundwater Treatment		
SG26	All feasible and reasonable opportunities for groundwater reuse for construction purposes or recycling nearby would be utilised in the first instance. However it is expected that groundwater inflows and required treatment volumes would outstrip potential for water reuse for construction purposes and some discharge would be required.	1 – 8 and tunnels
SG27	Where water salinity is found to be too high for discharge to creeks, brackish water reverse osmosis would be undertaken, or another treatment method to achieve water quality requirements.	1 – 8 and tunnels
SG28	Dissolved iron would typically be removed from discharge water by oxidising the Ferric ion (Fe3+) to Ferrous (Fe2+) which enables precipitation and physical removal.	1 – 8 and tunnels
SG29	Water turbidity would typically be treated by settling / filters.	1 – 8 and tunnels
SG30	Iron reducing bacteria in discharge water would be treated by biocide dosing.	1 – 8 and tunnels
SG31	A typical discharge into a natural waterway (where approved) would require a groundwater treatment process that includes the following steps: ▪ Inlet buffer tank, with aeration ▪ Coagulation / flocculation ▪ Dissolved air floatation (solids removal) ▪ Multimedia filtration (25 micrograms) ▪ Cartridge filtration (2 micrograms) ▪ Brackish water reverse osmosis ▪ Disposal of water brine concentrate to sewer (dependant of future environmental policies) ▪ Discharge of adequately treated water (into aquifer of origin, stormwater (creek catchments), sewer under a trade waste agreement, onsite reuse or recycling or a combination of these options).	1 – 8 and tunnels
SG32	Groundwater discharge quality would be required to comply with the relevant Environment Protection Licence	1 – 8 and tunnels

No.	Mitigation Measure	Applicable Sites*
SG33	Specific processes regarding groundwater discharge and treatment methods would be identified during detailed design.	1 – 8 and tunnels
Drawdown, Defects and Bed Cracking		
SG34	Targeted pre-excavation grouting would be carried out where necessary to limit groundwater inflows.	Tunnels
SG35	Treatment would be undertaken as required to minimise inflows and drawdown impacts where tunnels and stations are permanently drained structures.	1 – 8 and tunnels

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ATTACHMENT 2

PROPOSED MITIGATION MEASURES – CONSTRUCTION TRAFFIC

No.	Mitigation Measure	Applicable Sites*
T1	Directional signage and line-marking would be used to direct and guide drivers and pedestrians past construction sites and on the surrounding network. This would be supplemented by permanent and portable Variable Message Signs, where reasonable and feasible, to advise drivers of any potential delays, traffic diversions, speed restrictions, or alternative routes.	1 – 17
T2	The public would be notified of proposed traffic changes by newspaper, radio, project web site and other forms of community liaison.	1 – 17
T3	Co-ordination would occur with RMS via the Transport Management Centre's Traffic Operations Manager in the event of incidents or undue congestion.	1 – 17
T4	Management of pedestrian and vehicular access to and past construction sites would occur to ensure safe entry and exit procedures. Depending on the location, this may require manual supervision, physical barriers, temporary traffic signals and modification to existing signals or, on occasions, police presence.	1 – 17
T5	Access to existing properties and buildings would be maintained.	1 – 17
T6	Traffic controllers would manage heavy vehicle movements at worksites, and monitor the need for pedestrian control.	1 – 17
T7	All trucks would enter and exit the worksites in a forward direction, where feasible and reasonable.	1 – 17
T8	The management of buses at key transport interchanges, such as Castle Hill and Rouse Hill, would be reviewed during the detailed construction planning to minimise impacts on existing services.	5 and 14
T9	The T-way operations, including car parking, would be maintained at all times during the construction of the NWRL.	9 – 14
T10	The need for, and provision of, alternative remote parking locations and shuttle bus transfers for daytime and night time construction staff would be considered for all construction sites during detailed construction planning.	1 – 17
T11	Special event bus services for Sydney Olympic Park (Royal Easter Show, and Major Sporting and Entertainment Events) would be managed, in particular, in Carrington Road at the Hills Centre Station site, to ensure minimal disruption.	6
T12	The Traffic and Transport Liaison Group established for the NWRL would consider individual events and any other special event needs and, make reasonable and feasible short-term adjustment to the construction phase activities and / or review and update detailed TMPs.	1 – 17

No.	Mitigation Measure	Applicable Sites*
T13	Site traffic would be managed, where reasonable and feasible, to avoid significant movements in the AM peak in the critical southbound direction and in the PM peak in the critical northbound direction on Beecroft Road at Epping.	1 and 2
T14	An alternative access would be provided to the commercial buildings adjacent to the Epping Services Facility site to ensure access is maintained and separate to the site access.	1
T15	Access would be maintained to sections of the pedestrian bush track at Cheltenham which would not affected by construction works. Additionally, the provision of an alternative track would be considered during construction planning.	3
T16	Access to the Bella Vista Station site during the daytime would be at a location off Celebration Drive to the east of the Lexington Avenue intersection to minimise traffic impacts at the Celebration Drive / Lexington Avenue intersection. The Celebration Drive / Lexington Avenue intersection would be used as an access during the night and at low traffic times.	8
T17	If construction of NWRL occurs before the Schofields Road upgrade, interim upgrading of the road would be undertaken (unless otherwise agreed with RMS) with improved pavement quality and wider sealed shoulders to accommodate heavy vehicle usage.	15 – 17

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ATTACHMENT 3

MITIGATION MEASURES – NOISE AND VIBRATION

No.	Mitigation Measure	Applicable Sites*
NV1	Noise and vibration mitigation measures described in the Construction Noise and Vibration Strategy would be implemented (refer Appendix E of Technical Paper 2).	All
NV2	An acoustic shed would be constructed to reduce impact of spoil removal during night-time periods.	1, 2, 4 – 6 and 8
NV3	An acoustic shed would be constructed at Norwest to reduce impact of vertical excavation (if required to be conducted during night-time periods).	7
NV4	An acoustic shed would be constructed to reduce impact of concrete pre-cast works during night-time periods.	9 and 10
NV5	3m high noise barriers (site hoardings) would be constructed around the perimeter of construction sites.	1 – 3, 5 – 7 and 14
NV6	6m high barriers would be constructed at Cherrybrook to manage night-time spoil truck movements.	4
NV7	3m high noise barriers (site hoardings) would be constructed at Bella Vista Station site on the north and eastern side of the main construction site and to the west of the station box.	8
NV8	Attended vibration monitoring would be undertaken at the nearest commercial building during high vibration activities to ensure vibration levels remain below safe limits.	1 and 5 – 7
NV9	Attended vibration monitoring would be undertaken at the nearest residential buildings during high vibration activities to ensure vibration levels remain below safe limits.	3 and 4
NV10	Noise measurements in the Gold Class cinema complex at Castle Hill during high vibration activities would be undertaken to determine ground-borne noise levels. Depending on the results of this monitoring, discussions would be held with the cinema managers to identify additional feasible and reasonable mitigation measures such as respite period and use of alternative equipment.	5
NV11	During construction, attended measurements would be undertaken at the commencement of rock breaking activities to confirm the magnitude of the ground-borne noise emissions in the Hills Centre for Performing Arts. Alternative construction methods such as smaller rock breakers, the use of rock saws or implementation of respite periods would be considered to minimise noise impacts, and implemented where reasonable and feasible.	6

No.	Mitigation Measure	Applicable Sites*
NV12	TBM works would be co-ordinated to avoid performance times when near / under the Hills Centre for Performing Arts, if feasible and reasonable.	6
NV13	Night-time truck access at Bella Vista Station site would be via the Celebration Drive roundabout to the south of the site.	8
NV14	No external night-time construction activities (ie forklift, front end loader, or similar activities) would be undertaken at the concrete pre-cast sites.	9 and 10
NV15	Noise from conveyors at the concrete pre-cast sites would be assessed during the Construction Noise and Vibration Impact Statements (which would be prepared for each major stage of works or activity) and additional measures implemented if feasible and reasonable (eg improved enclosures, low noise idlers).	9 and 10
NV16	Noise attenuation measures would be implemented where reasonable and feasible on tunnel ventilation equipment and other items of fixed plant (eg pumps, water treatment plant, diesel generators) that would be required to operate on a 24 hour per day, seven day per week basis in support of the underground works (eg ventilation fan enclosures and silencers, and additional enclosures and silencers for diesel generating equipment). At each site the combined LAeq noise from the operation of this equipment would aim to not exceed the rating background level at nearest residential receivers.	1 – 10
NV17	Further assessment would be undertaken of the potential ground-borne noise and vibration impacts associated with work train operations within the tunnels. This study would form part of the Construction Noise and Vibration Management Plan and include an assessment of feasible and reasonable mitigation measures.	4, 6 and 8

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ATTACHMENT 4

MITIGATION MEASURES – EUROPEAN HERITAGE

No.	Mitigation Measure	Applicable Sites*
Heritage Items		
EH1	Rehabilitate removed areas of bushland following completion of construction works.	1 and 2
EH2	Reinstate street trees and rehabilitate / reinstate bushland around the Cheltenham Services Facility following completion of construction works.	3
EH3	Where feasible and reasonable, retain or reinstate an adequate buffer of vegetation along the northern side of Castle Hill Road opposite the Glenhope property to preserve the character of its setting and to screen the visual impacts of the station construction site in the northern outlook from the Glenhope property.	4
EH4	Where feasible and reasonable, retain or reinstate a buffer of vegetation along the western side of Franklin Road opposite Inala School.	4
EH5	If feasible, the existing mature plantings along the Old Northern Road edge of the park would be retained and protected during construction.	5
EH6	Reinstate key elements of Arthur Whitling Park in consultation with the Castle Hill sub-branch of the RSL, where feasible and reasonable.	5
EH7	Reinstate the landscaped public parkland (Arthur Whitling Park) following completion of construction to improve the visual setting of the White House Gallery.	5
EH8	Reinstate or rejuvenate any areas of the Showground disturbed for construction works following completion of the works.	6
EH9	Re-establish planted vegetation along the eastern side of the North-west T-way following completion of the construction works.	11 and 13
EH10	The viaduct would be designed and constructed to be as visually light and stream-lined as possible. At Mungerie, the viaduct piers would be spaced widely and, where feasible and reasonable, symmetrically on either side of the carriage loop from Old Windsor Road.	13
EH11	A buffer of trees between Mungerie and the rail corridor would be maintained. Any trees removed to facilitate construction would be reinstated on completion of works.	13
EH12	The area of the Mungerie carriage drive that would be removed during construction works would be reinstated.	13

No.	Mitigation Measure	Applicable Sites*
Archaeological Sites		
EH13	Further assessment of the archaeological potential and significance of the potential resource (house sites on Franklin Road and Carrington Road at sites 4 and 6 respectively, and an archaeological site south of Samantha Riley Drive at site 11) would be undertaken prior to construction to define specific mitigation measures.	4, 6 and 11
EH14	Exposed archaeological features at Cherrybrook (should there be any) would be identified, excavated and fully recorded prior to their removal. Based on the level of significance, preparation of an interpretation plan and strategy would be undertaken for archaeological features at Cherrybrook.	4
EH15	Any exposed archaeological features and deposits related to the Parramatta to Castle Hill tramway would be fully investigated and recorded prior to their removal. Any information retrieved regarding the Parramatta to Castle Hill tramway would be used to inform the interpretation of the site for communication of the site's history.	5
EH16	Archaeological monitoring of the areas (the house site on Carrington Road at site 6, the archaeological site south of Samantha Riley Drive at site 11, and the remains of track and post holes at site 16 and site 17) that are likely to contain archaeological remains would be undertaken with recording of any identified features and/or deposits associated with the identified buildings in accordance with archaeological best practice.	6, 11, 16 and 17
EH17	The two identified brick cisterns / wells at the Kellyville Station site would be recorded in detail and retained in situ if feasible and reasonable.	11
EH18	Further research would be undertaken to assess archaeological potential and significance of the former Swan Inn. Depending on the outcomes of the research archaeological excavation and recording of features and / or deposits would be undertaken if required. Excavation would be undertaken in accordance with archaeological best practice and would occur before or in conjunction with the construction works in this area. Based on the extent and level of significance of discovered features, the preparation of an interpretation plan and strategy could be required.	13
EH19	If archaeological deposits relating to the Rouse Hill Estate are encountered during construction, recording of the surviving features and deposits would be undertaken in accordance with archaeological best practice. Depending on the extent and level of significance of any discovered features, the preparation of an interpretation plan and strategy could be required.	16 and 17

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ATTACHMENT 5

MITIGATION MEASURES - INDIGENOUS HERITAGE

No.	Mitigation Measure	Applicable Sites*
IH1	Basic Phase 1[1] archaeological excavation would be undertaken prior to construction in the areas of impact. Phase 2[2] archaeological excavation would be carried out prior to construction in any locations deemed appropriate by the Phase 1[1] excavations.	3, 4, 10,11 and 13 – 15
IH2	Detailed Phase 1[1] archaeological excavation in the areas of impact. Possibly Phase 2[2] archaeological excavation in any locations deemed appropriate by the Phase 1[1] excavations.	6, 9, 10, 12, 16 and 17
IH3	The boundary of the construction sites would be fenced to prevent construction personnel entering PAD or known sites outside the construction footprint.	3, 4, 6 and 11 –16
IH4	The Indigenous Heritage component of the site induction would include information on: Aboriginal heritage conservation areas and/or no-go zones for each construction site. The legislation and penalties for impacting Aboriginal heritage objects would be conveyed to all construction managers and personnel.	1 – 17
IH5	TfNSW would consider permanent public interpretation within at least one of the new railway stations following development if an extensive and high value archaeological deposit were to be uncovered during the excavation of a site.	3, 4, 6 and 9 –17

1 A two-phase investigation should be undertaken for each of the 27 Aboriginal heritage sites/PADs. Basic Phase 1 would undertake determination of the extent, content, condition and integrity of each site/PAD. For sites/PADs assessed to have a low to moderate level of potential, a basic grid of test units would be sampled to determine whether the site contains a deposit worthy of more detailed investigation. Detailed Phase 1 would involve a more detailed initial stage of investigation for Sites/PADs with a moderate or high level of archaeological potential.

2 Subject to an assessment of the results from Phase 1 (by the archaeologist and Aboriginal representatives), excavation may move into Phase 2—an open area excavation of any significant deposits present. The need for and/or extent of Phase 2 cannot be determined for any site/PAD until Phase 1 has been completed. Following Phases 1 and 2, an excavation report would be prepared for the sites (combining the results of all excavation together in one report). This report would be provided to the RAPs and OEH for public record. Post-impact AHIMS cards would be completed for all sites subject to archaeological excavation; and these must be submitted to the OEH AHIMS registrar.

3 This Aboriginal site may be subject to some test excavation by the RMS (in 2012). This work may alter the required scope of work for the NWRL.

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ATTACHMENT 6

MITIGATION MEASURES - LAND USE AND COMMUNITY FACILITIES

No.	Mitigation Measure	Applicable Sites*
LC1	Liaison would continue with statutory organisations, DP&I and local Councils to ensure the Project is integrated with local and regional land use planning, and that environmental planning instruments reflect the planning, construction and operation of the Project, and include integrated planning provisions to enhance potential future development.	All
LC2	Consultation would continue with the community throughout the project planning and construction phases to ensure that community members have adequate information about the project, the timing and scope of activities in their local area and impacts on their local facilities and recreational areas. Area specific Place Managers have been allocated to undertake this ongoing consultation.	All
LC3	Further consultation regarding the implications of the Project in relation to the Epping Town Centre Study would be undertaken with Hornsby Shire Council, Parramatta City Council and DP&I.	1 and 2
LC4	Consultation with Cheltenham Oval user groups would be undertaken as part of identifying appropriate post-construction configuration and facilities for sporting activities.	3
LC5	Consultation with stakeholders of Beecroft Reserve would be undertaken as part of identifying appropriate adjustments to walking trails both during construction (temporary adjustments) and operational phases (permanent adjustments). Enhancements or modifications to the trail network would also be considered as part of this process.	3
LC6	Consultation with schools near the Cherrybrook site would be undertaken to develop specific mitigation measures to reduce impacts on their operation and amenity.	4
LC7	Consultation would be undertaken with the Castle Hill RSL sub branch and The Hills Shire Council regarding appropriate management of the war memorial in Arthur Whitling Park. This would include consideration of possible temporary relocation and an appropriate long term solution.	5

No.	Mitigation Measure	Applicable Sites*
LC8	Activities occurring in Showground buildings and pavilions to be acquired as part of the construction footprint would be re-accommodated within the Showground precinct or as otherwise agreed with the Showground Trust.	6
LC9	Consultation with Hillsong Church would be undertaken prior to construction to identify specific mitigation measures to reduce operational and amenity impacts.	7
LC10	Consultation with Emmanuel Baptist Church and Anglican Technical College Western Sydney would be undertaken prior to construction to identify specific mitigation measures to reduce operational and amenity impacts.	8
LC11	Consultation regarding the implications of the Project in relation to the Balmoral Road Release Area would be undertaken with The Hills Shire Council.	9 – 11
LC12	Consultation would be undertaken with relevant stakeholders regarding the implications of the project on the Rouse Hill Town Centre Northern Frame works.	14
LC13	Consultation regarding the implications of the project on the proposed land use plan for Area 20 would be undertaken with DP&I, Blacktown City Council and relevant stakeholders.	15 – 17

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ATTACHMENT 7

MITIGATION MEASURES - ECOLOGY

No.	Mitigation Measure	Applicable Sites*
E1	The ecological component of the site induction would include information on: ▪ Sensitivity of surrounding vegetation (particularly threatened vegetation). ▪ Sensitivity of threatened fauna species (birds and bats). ▪ Site environmental procedures (vegetation management, sediment and erosion control, protective fencing, weed control). ▪ Emergency and incident response/ spill management (chemical spills, fire, injured fauna).	All
E2	Pre-clearing surveys would be undertaken to identify the presence of: ▪ Hollow bearing trees and other habitat features. ▪ Threatened flora and fauna	1 – 17
E3	Prior to clearing of vegetation within the Cheltenham Services Facility construction footprint, additional targeted searches for the threatened flora *species Epacris purpurascens* var. *purpurascens* would be undertaken. The result of this survey would be submitted to OEH, as well as the scope of any impact to *Epacris purpurascens* var. *purpurascens* and if necessary details of additional mitigation measures.	3
E4	The limits of clearing (ie edge of construction site footprint) would be clearly marked and minimised where feasible and reasonable.	1 – 17
E5	Where native vegetation is to be retained adjacent to or within construction sites, protective fencing and signage would be installed in accordance with Australian Standard 4970 – 2009 *Protection of Trees.*	1 – 17
E6	Trees containing hollows would be felled using "Slow drop" technique (or similar as agreed with OEH). The slow-drop technique involves nudging and shaking the tree, followed by a controlled lowering of the tree to the ground.	1 – 17
E7	Where feasible and reasonable, topsoil and habitat elements (eg logs and felled trees) from sites that have few weed species would be stored and reused onsite.	1 – 17
E8	Site offices, stockpiles, machinery wash down areas, and plant storage areas would be located outside of any ecologically sensitive areas being retained onsite.	1 – 17
E9	Fuel (or other chemical) storage would be located outside all riparian zones, and at least 10m from any retained ecologically sensitive areas onsite.	1 – 17
E10	Construction sites would be revegetated using endemic native plant species where appropriate.	1 – 17

No.	Mitigation Measure	Applicable Sites*
E11	A revegetation program would occur at the Cheltenham Services Facility site, with the aim of re-establishing Coastal Shale-Sandstone Forest in areas not required for sporting facilities or NWRL operational purposes.	3
E12	To prevent establishment or spread of weeds: ▪ Machinery would be cleaned before entering work sites ▪ Weeds would be removed from within the mapped native vegetation areas at least 10m from the edge of the construction footprint (where access allows). Cleared weed material would be disposed of at a site licensed to receive green waste.	1 – 17
E13	If practical, seeds from *Epacris purpurascens* var. *purpurascens* would be collected and released within potential habitat in the vicinity of Cheltenham oval. This would be undertaken in consultation with Hornsby Shire Council and in accordance with any conditions set out in a section 132C licence under the NPW Act and any other licences as required.	3
E14	Regular visual inspections would be undertaken of creeks above bored tunnel sections, both prior to boring to establish baseline conditions and during and / or shortly after boring. Inspections would target permanent pools and be compared to non-impacted reference sites. In the event that substantial drops in the water level of permanent pools are detected, further investigations would be undertaken to determine the cause. If changes are determined to be caused by, or suspected to be caused by, tunnelling activities, mitigation measures would be discussed with NOW and implemented as appropriate.	Tunnels
E15	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.. ▪ Amplified speakers would be directed downwards and away from areas of native vegetation	1 – 17
E16	Biodiversity offsets would be carried out consistent with the *Offset Strategy* and any conditions of approval.	1, 3, 4, 6, 8 – 13, 15 – 17

No.	Mitigation Measure	Applicable Sites*
E17	Design of waterway crossings and structures would be undertaken in accordance with relevant guidelines such as *Fish and Fauna Friendly Waterway Crossings* (Fairfull & Witheridge, 2003) and *Fish Passage Requirements of Waterway Crossings* (2003). Relevant Government Agencies would be consulted with regard to crossings and waterway structures.	3, 4, 6 and 8 –17.
E18	Any creeks, core riparian zones and vegetated buffers disturbed by the project would be revegetated with the aim of maximising their ecological value.	1 – 4 and 6 – 17
E19	If feasible and reasonable, the proposed viaduct and bridge structural elements would be placed out of the creek(s) and away from the banks.	11 – 16
E20	The areas identified as 'likely' or 'potential' GDEs would be considered in the development of the groundwater monitoring plan. Any groundwater monitoring undertaken within these areas would include monitoring of water quality and levels.	3, 6, 9 – 13 and tunnels

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ATTACHMENT 8

MITIGATION MEASURES – VISUAL AMENITY

No.	Mitigation Measure	Applicable Sites*
V1	Existing vegetation around the perimeter of the construction sites would be retained where feasible and reasonable to act as a visual screen.	1 – 17
V2	Cut-off and directed lighting would be used to ensure glare and light trespass are minimised.	1 – 17
V3	Where feasible and reasonable the elements within construction sites would be located to minimise visual impact, eg setting particular equipment/ structures back from the site boundaries to minimise their visual impact.	1 – 17
V4	Regular maintenance of site hoarding and perimeter site areas would be undertaken, including the prompt removal of graffiti.	1 – 17
V5	Visual mitigation would be implemented as soon as feasible and reasonable, and remain for the duration of the construction period.	1 – 17
V6	Monitoring of the effectiveness of mitigation measures would be undertaken by the relevant construction contractor. This would primarily include regular visual inspection of the condition of the various measures.	1 – 17
V7	The colour and materials of acoustic sheds at selected sites would be selected to blend into adjacent bushland or rural setting.	1 – 4 and 8
V8	The design of acoustic sheds as visual features would be considered where there is limited opportunity to make them recede.	5 and 8
V9	Designing hoarding as a feature would be considered at appropriate locations. This may include artworks or project information. These would be installed as early as feasible and reasonable in the construction process.	1, 2, 4, 6 – 8 and 14
V10	Hoardings would be designed to visually recede in more rural or bushland settings.	3 – 5, 9 – 13 and 15 – 17

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ATTACHMENT 9

MITIGATION MEASURES – CLIMATE CHANGE AND GREENHOUSE GAS EMISSIONS

No.	Mitigation Measure	Applicable Sites*
Climate Change		
CC1	The detailed design of the drainage system would take account of increased rainfall events through flood modelling with a climate change margin (ie design can't be based on past flood levels of 1 in 100 return interval events). For example design elevation levels for tunnels, stations and transport interchange areas would be based on future climatic conditions at least up to future climate projections for 2070.	All
CC2	The detailed design of the embankments would take into account a changing climate. For example, structures would be designed to reduce water build up behind and under embankments to prevent lubrication and loss of stability.	9 – 17
CC3	Geotechnical materials would be considered in detailed design to address extreme weather related impacts. For example, avoid the use of expansive clays which may develop cracks during drought events causing greater weakness to water access, lubrication and movement during extreme rainfall events.	9 – 17
CC4	Tunnel design would allow for an increasing shrinkage margin and develop drainage systems to respond to significant changes in ground water.	Tunnels
Greenhouse Gas		
GHG1	Spoil management would be undertaken in accordance with the spoil reuse hierarchy.	All
GHG2	Where feasible and reasonable local materials would be preferentially used.	All
GHG3	If feasible and reasonable low GHG intensive alternative fuels (for example biofuels) would be used in construction equipment and vehicles.	All
GHG4	Vehicles with low fuel consumption ratings would be preferentially used where feasible and reasonable.	All
GHG5	Construction equipment and vehicle operators would be trained in driving practices which reduce fuel consumption.	All
GHG6	Construction equipment and vehicles would be regularly maintained to maximise fuel efficiency.	All
GHG9	A minimum of 20% of electricity needs associated with construction works would be offset.	All

No.	Mitigation Measure	Applicable Sites*
GHG10	If feasible and reasonable non-potable / recycled water would be used in tunnelling operations and at the pre-cast sites.	9, 10 and Tunnels
GHG 11	If feasible and reasonable materials with lower embodied emissions would be preferentially specified for use.	All
GHG 12	An updated GHG assessment would be prepared during the detailed design stage of the project.	All

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ATTACHMENT 10

MITIGATION MEASURES – SURFACE WATER AND HYDROLOGY

No.	Mitigation Measure	Applicable Sites*
Flooding		
SW1	The need or extent of any obstructions required to be placed within waterway areas would be avoided in the first instance, and minimised if avoidance is not feasible or reasonable.	1 – 4, 6 and 8 – 17
SW2	Programming or staging any construction associated with creek/ channel works or the temporary transverse culverts would be undertaken to minimise the total time that works are undertaken in the vicinity of watercourses.	1 – 4, 6 and 8 – 17
SW3	Construction equipment (or excess material) would be removed from waterway or flood prone areas if wet weather is approaching and at the completion of each day's work activity. The extent of the flood prone area would be defined during detailed construction planning.	1 – 17
SW4	Temporary levees or bunds would be strategically placed to contain potential flooding impacts resulting from any temporary works on the floodplain and minimise the risk to surrounding properties which might otherwise be affected.	1 – 17
SW5	Entries to tunnel excavations would be protected against flooding by locating openings outside flood prone areas, local bunding and / or appropriate drainage.	1 – 9 and tunnels
SW6	The flood standard adopted at each tunnel entry during construction would need to be developed taking into consideration the duration of construction, the magnitude of inflows and the potential risks to the project works and personal safety.	1 – 9 and tunnels
SW7	Earthworks located within the floodplain would be staged to ensure that the extent of works exposed at any one time is minimised.	8 – 11, 16 and 17
SW8	Construction works would be staged to ensure diversion channels are in place and stabilised to enable diversion of external catchment flows around the work site.	8 – 11, 16 and 17
SW9	For the Caddies Creek and Elizabeth Macarthur Creek floodplain, embankments would be limited to 0.5m maximum height for appropriate lengths of floodplain to allow controlled overtopping (subject to confirmation with detailed modelling of final construction layouts during the detailed design phase). Consideration may also be given to implementation of additional mitigation measures for the few properties identified as being at increased or greatest risk of affectation. This could include the design of viaduct piers and local flood mitigation works such as bunding, temporary levees, regarding overbank areas or flood proofing of properties.	9 – 12

No.	Mitigation Measure	Applicable Sites*
SW10	Embankments would be limited to 0.5m maximum height (subject to confirmation with detailed modelling of final construction layouts during the detailed design phase) for the construction of bridge piers across the Second Ponds Creek floodplain (Site 16).	15
SW11	Temporary embankments, haul road and working pads would be removed as soon as feasible after serving their purpose.	9 – 15
SW12	Stockpile sites would be generally located outside the 20 year ARI flood. The exact level of flood immunity provided to stockpile sites would depend on the duration of stockpiling operations, the type of material stored and the nature of the downstream waterway or any other specified requirements. This would be defined during detailed construction planning.	1 – 17
SW13	The concrete batch plant and pre-cast facilities at the Balmoral Road and Memorial Avenue sites would be located outside the 100 year flood extent.	9 and 10
Water Quality		
SW14	Water quality mitigation measures would be implemented in accordance with relevant requirements of: ❖ Landcom Managing Urban Stormwater - Soils and Construction Volumes 1 and 2 (often referred to as the Blue Book, 2004 and 2006). ❖ NOW Guidelines for Controlled Activities. ❖ ANZECC Guidelines for Fresh and Marine Water Quality. ❖ ANZECC Guidelines for Water Quality Monitoring and Reporting. ❖ Water Management Act 2000. ❖ Applicable Environment Protection Licences.	All
SW15	Treatment measures would be applied to water collected in sediment basins, including settling of coarse sediments, the use of flocculation for finer sediments and pH correction.	9 – 17
SW16	As a first preference, treated surface water collected in sediment basins would be reused onsite, eg for dust suppression. Additional opportunities for re-using water on site or for construction would be investigated and implemented where feasible and reasonable.	9 – 17 and tunnels
Erosion and Sediment Control		
SW17	Exclusion zones would be designated on construction sites to limit disturbance.	1 – 17

No.	Mitigation Measure	Applicable Sites*
SW18	Re-vegetating or stabilising disturbed areas would occur as soon as feasible.	1 – 17
SW19	Cleared native vegetation would be mulched for use in erosion and sediment control where feasible and reasonable.	1 – 17
SW20	Appropriate erosion control measures would be installed such as sediment fencing, check dams, temporary ground stabilisation, diversion berms or site regrading.	1 – 17
SW21	Clean water runoff would be diverted away from the works or disturbed areas wherever possible.	1 – 17
SW22	Temporary sediment basins would be installed as appropriate. The exact size and layout of sediment basins would be determined as part of the CEMP in accordance with the requirements of the relevant Environment Protection Licence.	1 – 17
SW23	Appropriate measures would be implemented where spoil handling occurs outside acoustic sheds. This would include diversion drains and sediment basins.	1 – 17
SW24	Works staging would be undertaken to maintain flows in undisturbed or stable remediated areas.	1 – 17
SW25	Specific activity procedures would be implemented for vegetation clearing and access track creation, such as minimising amount of clearing, all weather access track creation, keeping to formed tracks where feasible and reasonable and fencing of retained vegetation.	1 – 17
SW26	Surface controls to promote ground stability, limit run-off lengths and reduce run-off velocities within the work sites would be implemented.	1 – 17
SW27	Ground stability would be re-established as soon as practicable following the completion of construction.	1 – 17
SW28	Installation of any permanent scour protection measures required for the operational phase would occur as soon as practical.	1 – 17
Riparian Areas		
SW29	The detailed design of viaduct and bridges spanning the waterways of Elizabeth Macarthur Creek, Caddies Creek and Second Ponds Creek would provide for minimal encroachment of piers within the main creek channel to minimise disturbance and impacts to creeks during construction and operation.	8 – 16
SW30	Temporary haul roads required to construct the bridge and viaduct would be designed to minimise the extent of encroachment within creek channels.	8 – 16

No.	Mitigation Measure	Applicable Sites*
SW31	Monitoring of weather forecasts would be undertaken with commencement of in channel works when dry weather is forecasted.	1 – 17
SW32	Where water is released into local creeks, outlet scour protection and energy dissipation would be implemented. The discharge point would be at the upstream end of a large pool where feasible and reasonable, to allow for slowing of water.	1 – 4, 6 and 8 – 17
SW33	Any work platforms or access tracks required through waterway areas would be constructed of large clean rock material wrapped or underlain with geofabric (or equivalent).	4, 6 and 9 – 17
SW34	Temporary waterway crossings would be provided in preference to creek diversions.	1 – 4 and 6 – 17
SW35	Temporary waterway crossings and associated scour protection would be installed to control scour to the downstream waterway due to increases in localised water velocity while minimising disturbance within the riparian area.	4, 6 and 9 – 17
SW36	Permanent diversion of small channels in localised areas would be considered for situations where the permanent works (such as bridge piers) may be required to remain adjacent to or partially obstructing the waterway in order to better facilitate construction methods and reduce potential erosion/scour problems.	1 – 17
SW37	Temporary stockpile locations for both site establishment and earthworks operations would be specified prior to the commencement of construction activities. Diversion drains and erosion and sediment control measures would be in place prior to the commencement of any stockpiling activities. Material would only be stockpiled in designated stockpiling areas.	1 – 17
Contamination and Spills		
SW38	Site specific controls would be developed to reduce the potential for environmental releases of potentially harmful chemicals and to reduce the risk of any such releases entering local waterways. Storage of hazardous materials such as oils, chemicals and refuelling activities would occur in bunded areas.	All
SW39	Appropriate mitigation measures including stockpiling and management of potentially contaminated material would be undertaken at building demolition sites to prevent movement of material into receiving waters.	1 – 17

No.	Mitigation Measure	Applicable Sites*
Monitoring and Implementation		
SW40	A qualified environmental officer would be employed to advise on appropriate controls and to monitor the implementation and maintenance of mitigation measures.	All
SW41	All site staff would be engaged through toolbox talks or similar with appropriate training on soil and water management practices.	All
SW42	A surface water quality monitoring program for the construction period would be implemented to monitor water quality upstream and downstream of the construction areas. The monitoring programme would commence prior to commencement of any construction works and would build on available water quality data.	1 – 17
SW43	Surface water and water quality monitoring would be carried out periodically and after rainfall events. Monitoring would examine a range of appropriate indicators in accordance with standard guidelines.	1 – 17
SW44	Inspection of water quality mitigation controls (eg sediment fences, sediment basins) would be carried out regularly and following significant rainfall to detect any breach in performance.	All

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ATTACHMENT 11

MITIGATION MEASURES - NON-KEY ENVIRONMENTAL ISSUE – AIR QUALITY

No.	Mitigation Measure	Applicable Sites*
General		
A1	Working face and areas of open excavation would be kept to a minimum, where feasible and reasonable.	1 – 17
A2	Water suppression would be used for active earthwork areas, stockpiles, gravel roads and loads of soil being transported to reduce wind-blown dust emissions.	1 – 17
A3	Waste or any other material would not be burnt on construction sites.	1 – 17
A4	The amount of excavated material held on site would be minimised.	1 – 17
A5	Areas of exposed earth would be minimised by staging construction activities and progressively landscaping and vegetating completed areas as the construction activities proceed, where feasible and reasonable.	1 – 17
A6	Enclosed rubble chutes and conveyors would be used where feasible and reasonable. Drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment would be minimised and/or water used to suppress dust emissions from such equipment.	1 – 17
A7	Cutting, grinding or sawing equipment would only be used in conjunction with suitable dust suppression techniques such as water sprays or local extraction.	1 – 17
A8	Wind breaks, which may include site hoardings, would be constructed, where construction works are in close proximity to sensitive receptors and where feasible and reasonable.	1 – 17
A9	Dust generating activities would be assessed during periods of strong winds and rescheduled, where required.	1 – 17
A10	All vehicles carrying loose or potentially dusty material to and/or from the site would be covered.	1 – 17
Spoil Stockpiles		
A11	Stockpiles would be located away from sensitive receivers, where feasible and reasonable, and protected from the elements through barriers, covering or establishing a cover crop.	1 – 17
Haul Roads		
A12	Longer term and/or heavily used haul roads would generally be sealed. The criteria for sealing haul roads would be defined during detailed construction planning. Sealed haul roads would be regularly cleaned.	1 – 17
A13	Unsealed haul roads would be regularly damped down with fixed or mobile sprinkler systems.	1 – 17
A14	Vehicular and foot traffic would be restricted to designated areas.	1 – 17

No.	Mitigation Measure	Applicable Sites*
A15	Appropriate site speed limits would be imposed and signed on haul routes.	1 – 17
A16	Wheel-wash facilities or rumble grids would be provided and used near site exit points, and a street-cleaning regime would be implemented to remove any dirt tracked onto roads.	1 – 17
Demolition		
A17	Water suppression would be used during demolition as required.	1 – 17
A18	The insides of buildings would be stripped where feasible and reasonable, before demolition.	1 – 17
A19	Biological debris (such as bird nests and droppings) would be bagged and removed or damped down prior to building demolition.	1 – 17
A20	Debris screens or sheeting would be used to screen buildings, where dust-producing activities are taking place.	1 – 17
A21	An asbestos survey would be undertaken of buildings that would be demolished as part of the NWRL construction works. The survey would be conducted by a suitably qualified person.	1 – 17
A22	Asbestos handling and management would be in accordance with: ▪ *NSW Occupational Health & Safety Act 2000.* ▪ *NSW Occupational Health & Safety Regulation 2001.* ▪ Code of Practice for the Safe Removal of Asbestos 2nd edition (NOHSC, 2005). ▪ Code of Practice for the Management and Control of Asbestos in Workplaces (NOHSC, 2005). ▪ *NSW Protection of the Environment Operations (Waste) Regulation 2005*: 'Section 42 Special Requirements Relating to Asbestos Waste'. ▪ AS2601:1991 Demolition of Structures.	1 – 17
Vehicles and Equipment		
A23	Engines of on site vehicles and plant would be switched off if left idling for extended periods of time.	1 – 17
A24	Low emission vehicles and plant fitted with catalysts, diesel particulate filters or similar devices would be used, where feasible and reasonable.	1 – 17
A25	Plant would be well maintained and serviced in accordance with manufacturers' recommendations.	1 – 17
A26	Haul routes and plant (including generators) would be sited away from sensitive receivers, such as dwellings and schools, where feasible and reasonable.	1 – 17

No.	Mitigation Measure	Applicable Sites*
A27	Vehicle emissions would be minimised through methods such as using alternative modes of transport, such as encouraging car pooling by construction workers, and maximising vehicle utilisation by ensuring full loading and efficient routing.	1 – 17
A28	Precautions would be implemented to prevent the occurrence of smoke emissions or fumes from site plant or stored fuel oils.	1 – 17
Tunnel Ventilation		
A29	Dust extraction and filtration systems would be installed for tunnel excavation works and deep excavation with limited surface exposure.	1 – 8 and tunnels
A30	Bag filters would be dampened prior to emptying.	1 – 8 and tunnels
Concrete Batch Plant and Pre-cast Facilities		
A31	Truck unloading activities at concrete batching plants would be carried out in a way that minimises potential fugitive dust emissions, such as a silo or two sided enclosure.	9 and 10
A32	Water sprays would be utilised in concrete batch plants to reduce the emissions from the dumping of aggregate into the storage bins.	9 and 10
A33	Bulk cement and other bulk fine powder materials would be stored in silos with dust filters and suitable emission control systems to prevent escape of material and overfilling during delivery.	9 and 10
A34	Sand and aggregate stockpiles at concrete batch plants would be stored in hoppers, bunkers, storage bins or similar which shields the materials from winds.	9 and 10

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ATTACHMENT 12

MITIGATION MEASURES - NON-KEY ENVIRONMENTAL ISSUE – WASTE MANAGEMENT

No.	Mitigation Measure	Applicable Site-s*
W1	All waste would be assessed, classified, managed and disposed of in accordance with the Waste Classification Guidelines (DECC, 2008).	All
W2	All waste materials removed from the sites would only be directed to a waste management facility lawfully permitted to accept the materials.	All
W3	Excavated material and spoil would be beneficially reused on the project site or other sites, where feasible and reasonable, in accordance with the spoil reuse hierarchy.	All
W4	Appropriate storage, treatment and disposal procedures would be implemented for any contaminated spoil.	1 – 17
W5	Cleared site vegetation would be mulched for reuse in rehabilitation and landscaping works. Topsoil generated during site preparation activities would be stockpiled for reuse in landscaping activities.	1 – 17
W6	Initial and ongoing education would be provided to staff and sub-contractors regarding the importance of appropriately managing waste.	1 – 17
W7	Recyclable wastes, including paper at site offices, would be stored separately from other wastes. Storage facilities would be secure and recyclables collected on a regular basis.	1 – 17
W8	Reusable materials would be stored separately, in secure facilities.	1 – 17
W9	Worksites would be free of litter and good housekeeping would be maintained.	1 – 17
W10	Vermin proof bins would be utilised onsite.	1 – 17
W11	Waste oil, other liquid wastes and spillages would be collected and stored in bunded areas.	1 – 17
W12	Trucks transporting wastes off site would be appropriately licensed to carry the materials to appropriately licensed waste facilities.	1 – 17
W13	Waste truck loads would be covered, and tailgates secured prior to trucks leaving the worksite.	1 – 17
W14	Centralised reporting and auditing of waste volumes and disposal destinations would be employed.	1 – 17

No.	Mitigation Measure	Applicable Site-s*
W15	Construction waste would be minimised by accurately calculating materials brought to the site and limiting materials packaging.	1 – 17
W16	Materials such as (noise hoarding, site fencing, and so on) would be reused or shared, between sites and between construction contractors where feasible and reasonable.	1 – 17

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ATTACHMENT 13

ENVIRONMENTAL RISK ANALYSIS

Issue	Potential Adverse Impacts	Consequence	Likelihood	Risk Rating	Proposed Mitigation Measures	Residual Consequence	Residual Likelihood	Residual Risk Rating
Soils and groundwater	Local and regional water table drawdown from interception of groundwater during tunnelling and other excavation	Moderate	Almost Certain	20 Very High	Chapter 8	Minor	Almost Certain	16 High
	Interface with existing contaminated sites such as former petrol stations and other hazardous industries	Moderate	Likely	17 High	Chapter 8	Minor	Likely	12 Moderate
	Uncovering and subsequent release of contaminated groundwater	Major	Unlikely	14 High	Chapter 8	Moderate	Unlikely	9 Moderate
	Settlement / ground movement from tunnelling activities and other excavation	Moderate	Almost Certain	20 Very High	Chapter 8	Minor	Almost Certain	16 High
	Potential bed cracking and loss of surface flow from tunnelling activities beneath waterways	Moderate	Unlikely	9 Moderate	Chapter 8	Minor	Unlikely	5 Low
	Sterilisation of mineral resources	Minor	Unlikely	5 Low	Chapter 8	Minor	Unlikely	5 Low

Issue	Potential Adverse Impacts	Consequence	Likelihood	Risk Rating	Proposed Mitigation Measures	Residual Consequence	Residual Likelihood	Residual Risk Rating
Construction traffic	Reduced performance of the surrounding road network from the introduction of vehicle movements or temporary lane/ road closures	Minor	Almost Certain	16 High	Chapter 9	Insignificant	Almost Certain	11 Moderate
	Removal of parking spaces and use of public parking spaces by construction workforce	Minor	Almost Certain	16 High	Chapter 9	Minor	Possible	8 Moderate
	Disruption to existing public transport, eg T-way operations and bus interchanges around construction work sites	Major	Almost Certain	23 Extreme	Chapter 9	Minor	Possible	8 Moderate
	Disruption to existing pedestrians and cyclists facilities	Moderate	Almost Certain	20 Very High	Chapter 9	Insignificant	Almost Certain	11 Moderate

Issue	Potential Adverse Impacts	Consequence	Likelihood	Risk Rating	Proposed Mitigation Measures	Residual Consequence	Residual Likelihood	Residual Risk Rating
Construction noise and vibration	Airborne noise impacts on local residents and other sensitive receivers from construction activities	Moderate	Almost Certain	20 Very High	Chapter 10	Minor	Almost Certain	16 High
	Ground-borne noise from tunnelling activities and other excavations	Minor	Almost Certain	16 High	Chapter 10	Minor	Likely	12 Moderate
	Noise impacts on local residents and sensitive receivers from construction traffic	Minor	Almost Certain	16 High	Chapter 10	Minor	Likely	12 Moderate
	Noise impacts to sensitive receivers from works undertaken outside of standard construction hours	Minor	Almost Certain	16 High	Chapter 10	Minor	Likely	12 Moderate
	Damage to buildings from vibration	Minor	Possible	8 Moderate	Chapter 10	Minor	Unlikely	5 Low
	Impacts on sensitive receivers from vibration (human comfort levels)	Minor	Likely	12 Moderate	Chapter 10	Insignificant	Likely	7 Low
European heritage	Impacts on European heritage sites, including damage or alterations to items of heritage or archaeological significance	Moderate	Almost Certain	20 Very High	Chapter 11	Minor	Almost Certain	16 High
	Impacts to the curtilage of European heritage items	Moderate	Almost Certain	20 Very High	Chapter 11	Minor	Almost Certain	16 High

Issue	Potential Adverse Impacts	Consequence	Likelihood	Risk Rating	Proposed Mitigation Measures	Residual Consequence	Residual Likelihood	Residual Risk Rating
Indigenous heritage	Impacts on known indigenous heritage artefacts or sites	Major	Almost Certain	23 Extreme	Chapter 12	Minor	Almost Certain	16 High
	Impacts to unidentified indigenous objects and places	Major	Unlikely	14 High	Chapter 12	Minor	Very Unlikely	3 Low
Local business impacts	Disruptions to the operations of local businesses	Major	Almost Certain	23 Extreme	Chapter 13	Minor	Likely	12 Moderate
Land use and community facilities	Construction works / footprint impacting on existing land-use and future land-use plans	Major	Almost Certain	23 Extreme	Chapter 14	Minor	Likely	12 Moderate
	Land severance resulting from above ground sections of the alignment	Moderate	Possible	13 High	Chapter 14	Minor	Unlikely	5 Low
	Impacts to the functionality and use of community facilities	Moderate	Almost Certain	20 Very High	Chapter 14	Minor	Likely	12 Moderate

Issue	Potential Adverse Impacts	Consequence	Likelihood	Risk Rating	Proposed Mitigation Measures	Residual Consequence	Residual Likelihood	Residual Risk Rating
Ecology	Impacts to EECs	Major	Almost Certain	23 Extreme	Chapter 15	Minor	Almost Certain	16 High
	Impacts to threatened flora species	Major	Unlikely	14 High	Chapter 15	Major	Very Unlikely	10 Moderate
	Impacts to threatened fauna species	Major	Possible	18 High	Chapter 15	Major	Unlikely	14 High
	Loss of fauna habitat values from impacts to and direct removal of vegetation	Moderate	Almost Certain	20 Very High	Chapter 15	Minor	Almost Certain	16 High
	Impacts to non listed native vegetation	Moderate	Almost Certain	20 Very High	Chapter 15	Minor	Almost Certain	16 High
	Impacts to aquatic ecosystems	Moderate	Almost Certain	20 Very High	Chapter 15	Minor	Almost Certain	16 High
	Impacts to GDEs	Moderate	Unlikely	9 Moderate	Chapter 15	Minor	Unlikely	5 Low
Visual amenity	Impact on visual amenity due to the introduction of individual construction sites, hoardings and acoustic sheds	Moderate	Almost Certain	20 Very High	Chapter 16	Insignificant	Almost Certain	11 Moderate
	Visual intrusion from the construction of the aboveground sections of the alignment, especially viaduct construction	Moderate	Almost Certain	20 Very High	Chapter 16	Minor	Almost Certain	16 High
Greenhouse Gas & climate change	Emissions of greenhouse gases during construction contributing to climate change	Minor	Almost Certain	16 High	Chapter 17	Insignificant	Almost Certain	11 Moderate

Issue	Potential Adverse Impacts	Consequence	Likelihood	Risk Rating	Proposed Mitigation Measures	Residual Consequence	Residual Likelihood	Residual Risk Rating
Surface water and hydrology	Pollution of watercourses from discharge of untreated tunnelling water	Catastrophic	Possible	22 Very High	Chapter 18	Major	Unlikely	14 High
	Pollution of water courses from sediment laden surface water runoff	Catastrophic	Possible	22 Very High	Chapter 18	Major	Unlikely	14 High
	Change to instream environment from alteration in water flow	Moderate	Likely	17 High	Chapter 18	Minor	Possible	8 Moderate
	Contamination of water through spills of fuels or chemicals	Major	Possible	18 High	Chapter 18	Major	Unlikely	14 High
	Increased flood levels from temporary construction sites and activities located on floodplains	Major	Almost Certain	23 Extreme	Chapter 18	Minor	Almost Certain	16 High
Air quality	Impacts to surrounding receivers from dust and exhaust emissions	Minor	Likely	12 Moderate	Chapter 19	Insignificant	Possible	4 Low
Waste management	Impacts associated with the incorrect disposal of waste material	Major	Unlikely	14 High	Chapter 19	Major	Very Unlikely	10 Moderate
	Excessive waste directed to landfill	Moderate	Likely	17 High	Chapter 19	Moderate	Unlikely	9 Moderate
	Inadequate re-use or recycling of spoil	Moderate	Likely	17 High	Chapter 19	Moderate	Unlikely	9 Moderate

Issue	Potential Adverse Impacts	Consequence	Likelihood	Risk Rating	Proposed Mitigation Measures	Residual Consequence	Residual Likelihood	Residual Risk Rating
Resource use	Increased demand on local and regional resources including sand and aggregate	Major	Almost Certain	23 Extreme	Chapter 17 Chapter 4	Major	Likely	21 Very High
	Increased demand for potable water for use in tunnelling operations	Minor	Almost Certain	16 High	Chapter 17 Chapter 4	Minor	Possible	8 Moderate
	Increased electricity consumption	Moderate	Almost Certain	20 Very High	Chapter 17 Chapter 4	Moderate	Likely	17 High
Cumulative impacts	Impacts to local community and the environment compounded by other concurrent construction activities in the vicinity of the project	Moderate	Almost Certain	20 Very High	Chapter 20	Minor	Likely	12 Moderate

Agenda Report

COUNCIL MEETING – RESOLUTION

USER INSTRUCTIONS

If necessary to view the original Agenda Item, double-click on 'Agenda Report' blue hyperlink above.

RESOLVED ITEMS ACTION STATEMENT

Action is required for the following item as per the Council Decision or Resolution Under Delegated Authority.

ACTION ITEM

ITEM NORTH WEST RAIL LINK - ENVIRONMENTAL IMPACT STATEMENT 1

A MOTION WAS MOVED BY COUNCILLOR HAY AND SECONDED BY COUNCILLOR DR BYRNE THAT the Recommendation contained in the report be adopted.

THE MOTION WAS PUT AND CARRIED.

RESOLUTION

This report and the following recommendations form the basis of The Hills Shire Council's response to EIS 1.

General

1.1 Overall, Council supports the delivery of the NWRL project.

1.2 The NWRL Project Delivery team should include a meaningful community reference and liaison group that will help to build collaboration to help manage the inevitable impacts of construction a project of this scale amongst an established community.

1.3 The retention of the tunnel stubs to support a future Parramatta to Epping linkage at Epping is supported.

1.4 It remains Council's preference for the entire NWRL to be constructed entirely below ground.

1.5 It is essential that any construction and operation of a Skytrain ensure sufficient acoustic treatment is provided so as to not cause offensive noise pollution to surrounding areas. Further, the design of the elevated viaduct that supports the Skytrain must incorporate design elements including artistic features, to make the construction more visually attractive to contribute positively to the setting.

1.6 The route of the NWRL should be as exhibited in the 2006 growth centres structure plan so as to serve future population north of Windsor road at Box Hill.

Soils and Groundwater

2.1 Council's LEP maps indicating the extent of the geotechnical assessment area be included in Council's submission and that the geotechnical experts investigate the potential risk to land in that area as a result of the construction and operation of the NWRL.

2.2 The mitigation measure of conducting before and after dilapidation surveys of buildings in the vicinity of stations, works and construction sites is supported.

Construction Traffic

3.1 A dilapidation report is to be prepared prior to work commencing to ascertain the current condition of the affected local roads and a form of Contributions Plan must be established to collect contributions which will assist with the cost of maintenance, repair and reconstruction as a result of damage caused by trucks.

3.2 Restricted truck access on Council's local roads will be enforced in accordance with weight restrictions within the Shire. The weight restricted routes that are near the station construction precincts include Gilbert Road, Highs Road, Taylor St, Aiken Road, Oakes Road, Jenkins Road, Glenhaven Road, Commercial Road, Withers Road, Hezlett Road, Annangrove Road and Kenthurst Road.

3.3 Council also has several sub-arterial roads near the station construction sites that do not have weight restrictions. These roads include Samantha Riley Drive, Green Road, Sanctuary Drive, Carrington Road and Victoria Avenue. These unrestricted sub-arterial roads should not be used for truck movements to and from the station construction areas - Any conditions of consent issued for the construction of the NWRL by the NSW Government should restrict truck access on these roads.

3.4 Street lighting issues are likely to arise at each construction site because of the extensive excavations. Interrupted power supply and light pole relocations will occur at various stages and the construction management plans will need to detail how these issues are continuously monitored and resolved. This issue will be critical at Castle Hill and Norwest Stations in particular because of pedestrian movements, and site modifications will be required for street lighting at each area to ensure continued operation.

3.5 Traffic volumes along Glenhope Road and Glenridge Avenue will be over their environmental capacity of 250 movements in peak hour, and LATM treatment will be needed along the full length of the connection to Coonara Avenue. Public consultation and funding of any LATM Scheme along Glenhope Road and Glenridge Avenue will be the responsibility of NWRL. The LATM scheme will need to include Parking restrictions in Glenhope Road to control contractors vehicles during construction and these restrictions will remain to control commuter parking.

3.6 The West Pennant Hills Bus Link may be needed as an alternative to Castle Hill Road as buses are likely to use Glenhope Road as a major connection between the residential areas and Cherrybrook station. The proposed Bus Link will need to be re-evaluated as part of a general review of bus services integrating with the Station precinct.

3.7 Relocation of the Castle Hill bus interchange area is critical because pedestrian access will be restricted through and across the site. Buses, and pedestrian traffic using those buses, will all revert to Old Castle Hill Road resulting in severe congestion. NWRL will need to show how bus and pedestrian traffic will operate in

the temporary location in conjunction with the re-introduction of two way traffic flow along the full length of that road.

3.8 A new bus layover area is needed to reduce demand for bus parking – options include unused Castle Towers overflow parking areas, or Council land in Brisbane Road. The State Government must identify where that layover area is, and clearly show how it will operate to reduce traffic issues in Old Castle Hill Road.

3.9 The proposed major truck access for The Hills Centre Station station goes direct to Showground Road through the dog show area adjacent to the Cattai Creek bridge. It is unlikely that this proposed access arrangement will be approved on on safety grounds because of the steep gradients of Showground Road. A better location is through the Showground upper precinct at the existing signals for Gilbert Road. A fourth leg of this intersection would provide for construction access as well as supporting functions at the Showground during construction of the station.

3.10 No truck movements will be permitted onto Carrington Road. Secondary access for contractors is from Carrington Road at Doran Drive. No improvements are proposed but some form of intersection control such as a roundabout or traffic signals will be needed.

3.11 Peak travel time access through the Business Park must not be affected by the Norwest Station construction. As a result, four traffic lanes must be available in Norwest Boulevarde every work day from 7am to 9am, and 4.30pm to 6.30pm. Brookhollow Avenue must not become a defacto bypass for Norwest Boulevarde.

3.12 Most truck movements will head to the west along Norwest Boulevarde (Old Windsor Road) This will place a further burden on the roundabout at Lexington Avenue which performs at level of service "F" every morning and afternoon. Either a signalized intersection to replace the roundabout is needed ($8M) or the roundabout itself must be signalized ($0.3M).

3.13 No trucks will be permitted to exit/enter the Business Park except via the eastern end of Norwest Boulevarde at Windsor Road, or via Celebration Drive at the western end of the Business Park at Old Windsor Road. None of the local roads leading off Norwest Boulevarde will be used for truck traffic.

3.14 The Roundabout at the intersection of Lexington Avenue and Celebration Drive will need to be replaced with traffic signals. Celebration Drive will also need to be upgraded to a four lane carriageway between Lexington Avenue and Old Windsor Road and the dual right turn lanes in Old Windsor Road at Celebration Drive will need to be extended.

3.15 No truck movements are to be permitted from the construction site along Lexington Avenue or through the residential area to the east.

Construction Noise and Vibration

4.1 While the criteria used to determine acceptable noise impacts is supported, that criteria predicts that there will be significant noise impacts and more investigation around the major construction sites is required.

4.2 Any amendment to construction methodologies and associated mitigation measures should be required to improve or maintain those impacts anticipated by this EIS.

4.3 Further background measurements should be undertaken to assure the accuracy of the background noise levels and resultant modelling of the impacts on receivers where the background noise is lower than that modelled.

4.4 While it is proposed to "primarily" conduct site establishment works during the daytime, the duration of these works and occasional evening and night time works during this period will inevitably lead to some level of community dissatisfaction and complaints. Further consideration should be given to mitigation measures at individual receiver's premises to reduce these impacts.

4.5 Further consideration and commitment to reducing truck movements to and from constructions sites along Carrington Road and Norwest during the night time hours should be included in the Construction Noise and Vibration Strategy for the project.

4.6 In relation to the prediction that on-site truck movements causing awakening reactions (or sleep disturbance) at nearby residences. At each of the underground station sites, including the Bella Vista TBM support site, during night time periods, further consideration of mitigation measures either at the construction site and/or at sensitive or residential receivers to reduce these impacts should be included.

4.7 Where blasting is required (presumably as a last resort), in addition to the proposed assessment of the realistic worst-case noise and vibration levels being undertaken and compared with noise and vibration criteria, a comprehensive community information program should be undertaken to advise potential receivers of; the need for the activity, the days and times proposed and the expected noise impacts associated with the activity.

4.8 Acoustic treatment should be offered for the dwellings of those residents most affected by the on-going construction noise. Such treatment measures may include additional acoustic insulation of walls and ceilings, installation of double glazing, installation of air conditioning units etc. These measures should be considered particularly around the Hills Centre, Castle Hill & Bella Vista stations. Particular residential receivers of concern include, Carrington Road, Showground Road, residents to the east of Bella Vista Station & Precast Yards including Celebration Drive, Sharrock Avenue.

4.9 A commitment to upgrade the acoustic treatment of the acoustic enclosure at the Bella Vista station and pre-cast yard acoustic sheds is required. The modelled impacts on residential receivers for the duration of this project are unreasonably high based on standard acoustic shed construction.

4.10 An on-going commitment to complaint management and community liaison is required to manage and resolve future issues.

4.11 The construction methodology and proposed mitigation measures for the construction of the viaduct require review. The modelled impact of the construction of the viaduct are unacceptable as the prediction indicates significant exceedance of the NMLs for the entirety of the construction works on the residences described as:

- "Residences East of Old Windsor Road from the North section of Arnold Avenue to the North border of the Celebration Drive shopping centre";
- "Residences East of Old Windsor Road and South of Samantha Riley Drive";
- "Residences East of Old Windsor Road, between the group of residences North East of Windsor Road/Old Windsor Road junction and Samantha Riley Drive" and

- "Residences East of Windsor Road, between Bellcast Road and Sanctuary Drive".

European Heritage

5.1 Views to Mungerie House from Windsor Road must also be considered in the design and placement of the viaduct and its piers.

5.2 During the detailed design of the viaduct and consideration of view corridors, Transport NSW should consult the Mungerie House Conservation Management Plan (2007) prepared for Lend Lease by Tanner Architects and endorsed by Council as it contains important information regarding view corridors and the setting of Mungerie House.

Indigenous Heritage

6.1 No further recommendation other than those contained in EIS 1.

Local Business Impacts

7.1 The Small Business Commissioner commence a study into the structural adjustment and support required for specific small businesses directly affected by the construction work.

7.2 The EIS does not recognise that the national headquarters of IBM Australia is also located in Coonara Avenue. It employs more than 2,000 people, most of whom would drive to work. Therefore increased truck movements and any resulting traffic delays around the construction site could have some impact on those employees travelling to and from work.

7.3 A community liaison group to cater and involve business operators in Castle Hill Town Centre should be established to help respond to issues relating to traffic, access and parking during construction.

Land Use and Community Facilities

8.1 Negotiations should also continue with Council and the RSL Sub-Branch with regard to the temporary relocation of the war memorial during construction of the Castle Hill station. Expert technical advice should also be obtained on the feasibility of transplanting the 'lone pine' located adjacent to the war memorial to an alternate site to the satisfaction of Council and the RSL sub-branch. Consideration should also be given to the collection of seeds or cuttings from the 'lone pine' to enable propagation should transplanting of the tree not be considered feasible or is unsuccessful.

8.2 Transport NSW should consult with the Hills District Historical Society with regard to the railway heritage and monument within the Arthur Whitling Park and future inclusion of railway heritage into the future station and open space.

8.3 Transport NSW must also ensure consultation is carried out with residents and owners, including Kindalin Child Care Centre on The Hills Shire side of ~~Old~~ Castle Hill Road at West Pennant Hills (opposite Cherrybrook station).

Ecology

9.1 Offset sites should be identified and procured prior to works commencing that involve the removal of ecology.

9.2 It is requested that specific priority be given to securing offset sites as near to the location of the impact/loss as possible, to assist with the preservation of the specific endemic community of the area and assure that the ecological and amenity benefits of retaining endemic vegetation remain within the Local Government Area.

9.3 The management of off-set sites could be secured through the registration of land as Biobank Sites with the Biobank Trust funding the in perpetuity maintenance of the vegetation. This could be achieved without the need to purchase the land, rather the purchase and surrender of credits under the Biobanking scheme.

9.4 Three distinct patches of Cumberland Plain vegetation within the Balmoral Road Release area seem particularly appropriate which are 21.6ha, 13.7ha & 6.1ha respectively located on Balmoral Road and Fairway Drive. Additional smaller patches are also mapped within the immediate area. Consideration should be given to securing these sites to offset the loss of vegetation.

Visual Amenity

10.1 The reflectivity of acoustic sheds and site buildings is an additional measure that should be considered.

10.2 If possible, 6m hoarding proposed on Castle Hill Road (Cherrybrook Station) should be reduced in height if it will not reduce the amenity of residents / child care centre on the opposite side of Castle Hill Road.

10.3 Due to the visibility of the viaduct it is expected that the detailed design stage will give particular consideration to making the structure interesting and visually appealing is required. The ultimate design is to incorporate measures to reduce its visual impact and where possible use engineering art to decorate, provide visual interests where landscaping cannot be adequately provided.

10.4. The possible use of the viaduct structure for advertising is an ongoing concern for Council and should be addressed in EIS2.

Climate Change and Greenhouse Gas Emissions

11.1 The 20% electricity offset target should be increased.

11.2 Further offset options associated with revegetation projects and biodiversity offset requirements should also be included.