

7.10 Non-Aboriginal heritage

A technical working paper: non-Aboriginal heritage (**Appendix L**) has been prepared to assess the potential impact from the project on non-Aboriginal heritage. This section provides a summary of the technical report.

Table 7-180 sets out the Director-General's Requirements as they relate to non-Aboriginal heritage and where in the environmental impact statement these have been addressed.

Table 7-180 Director-General's Requirements – non-Aboriginal heritage

Director-General's Requirement	Where addressed
An assessment of direct and/or indirect impacts to state and local heritage. Where impacts to State or locally significant historic heritage is identified, the assessment shall: <ul style="list-style-type: none">• outline the proposed mitigation and management measures (including measures to avoid significant impacts and an evaluation of the effectiveness of the mitigation measures) generally consistent with the guidelines in the NSW Heritage Manual (Heritage Office and Department of Urban Affairs and Planning 1996),• a statement of heritage impact for all heritage items/areas to be impacted (including significance assessment), and• consider the impacts from vibration, demolition, altered historical arrangements and access, and architectural noise treatment.	Potential direct and indirect impacts to non-Aboriginal heritage items are identified in Section 7.10.3 . Proposed mitigation and management measures are identified in Section 7.10.4 . Appendix L – Technical working paper: non-Aboriginal heritage.

7.10.1 Assessment methodology

The methodology used to identify non-Aboriginal heritage items with the study area included a search of relevant heritage registers and schedules, a literature review and field survey.

The significance of identified items was assessed following the guideline Assessing Significance for Historical Archaeological Sites and Relics (Department of Planning, 2009). This was followed by an impact assessment and the recommendation of mitigation measures for each potentially impacted item.

Study area

The study area for the non-Aboriginal heritage assessment has been informed by the operational and construction footprints of the project, the preferred project corridor, and the location and construction methodology of underground infrastructure.

Literature and database review

A review was undertaken of archaeological and historical data relevant to the project, which included heritage registers, databases and schedules, local histories and archaeological reports. This literature and data review was used to identify known non-Aboriginal heritage sites located within the study area.

Initial searches of the wider study area were conducted as a part of the preliminary assessment for the project in mid-2013. An updated search was undertaken on 2 December 2013 of the following relevant heritage inventories for items within or immediately adjacent to the study area, as defined in **Section 7.10.1**:

- Statutory:
 - World Heritage List (World Heritage Committee, UNESCO).
 - The Commonwealth Heritage List (Australian Heritage Council).
 - The National Heritage List (Australian Heritage Council).
 - The State Heritage Register (NSW Heritage Branch, OEH).
 - The State Heritage Inventory (NSW Heritage Branch, OEH).
 - Section 170 Heritage and Conservation Register compiled by Roads and Maritime.
 - Section 170 Heritage and Conservation Register compiled by Sydney Trains
 - Section 170 Heritage and Conservation Register compiled by Transport for NSW.
 - Section 170 Heritage and Conservation Register compiled by Sydney Water.
 - Schedule 5 of *The Hills Local Environmental Plan 2012* (Hills LEP).
 - Schedule 5 of the *Hornsby Local Environmental Plan 2013* (Hornsby LEP).
 - Schedule 5 of the Draft *Ku-ring-gai Local Environmental Plan 2013* (Draft Ku-ring-gai LEP).
 - Schedule 7 of the *Ku-ring-gai Planning Scheme Ordinance 1971*, as amended (Ku-ring-gai Planning Scheme Ordinance).
- Non-statutory:
 - The Register of the National Estate (Australian Heritage Council).The Register of the National Trust of Australia (NSW).

Non-Aboriginal heritage items and areas identified through searches of these databases and registers are listed in **Table 7-181** and shown in **Figure 7-82**.

Field inspection

Known non-Aboriginal heritage items and areas identified as having the potential to be impacted (either directly or indirectly) by the project were subject to a targeted inspection to determine their current condition. Results from these inspections were used to inform an assessment of potential impacts on non-Aboriginal heritage values. This process comprised:

- Review of mapped non-Aboriginal heritage listings to identify those properties with the potential to be directly or indirectly impacted during construction or operation of the project.
- Compilation of available information on potentially impacted non-Aboriginal heritage listings, including past inspection photographs, as a point of comparison.
- Field inspections of the identified listings, which involved recording the current condition of each site. Each listed item was photographed and compared to past descriptions / photos. Interior features or the condition of the interior of each site, if relevant to the listing, were based on the details provided within the database.

- Investigation, during field inspections, of potential items of non-Aboriginal heritage outside of recorded listing locations that may be impacted by the project.
- Update of existing background information with results of field inspections.

7.10.2 Existing environment

Historical context

Aboriginal History

Archaeological research at Parramatta (about five kilometres south of the study area) suggests that Aboriginal occupation of this part of Sydney commenced at least 35,000 years Before Present (B.P.) (Attenbrow, 2010). From 18,000 B.P. rising sea levels significantly reduced land area in the Sydney region, and likely prompted a general westward movement of peoples, along with changes in group organisation and economic strategies. It is at this time that the study area first appears to have been occupied, with a living site in the Bidjigal Reserve (SF2) dated to at least 11,800 B.P. (Attenbrow, 2010). Further information on the Aboriginal historical context of the study area is provided in **Section 7.11** (Aboriginal heritage).

Settlement

Colonial settlement of the study area was driven principally by convict timber-getters seeking out blue gums, ironbarks, cedar and mahogany available in the Western Sydney forests (Kass, 1993). Seeking to support this industry, Governor Macquarie established a government sawmill on the northern edges of the Field of Mars Common (present day Pennant Hills) in 1816. The bullock road established to link this sawmill with Ermington Wharf to the south, became the Pennant Hills Road that lies within the study area (Kass, 1993).

Agriculturalists and other primary producers followed in the wake of the timber getters, establishing small holdings on the cleared land. The area was soon discovered to be excellent for the production of stone and citrus fruit, and became Sydney's main orcharding district. Small villages were subsequently established at Pennant Hills, Hornsby and Wahroonga to support the farmers and their workers (Kass, 1993).

Early 20th Century

The trajectory for the study area's 20th century history was set when the Homebush to Waratah railway line was established in 1886. This railway line linked the study area to the centre of Sydney, and what had once been an isolated rural area suddenly became an easy commute from the city. The elevated, picturesque nature of the study area added to its attractions, and it was soon a popular residential retreat. Orchards were quickly replaced by the grand houses of the colonial elite, as well as more modest housing estates for workers, including the Bundarra Estate which straddles the study area (Kass, 1993; Davies, 2010).

The progress of the railway and the associated population increase was accompanied by industrial development, and a number of industries were established in the study area in the early 20th century. This included the building of sawmills, brickworks and maltworks, as well as the establishment of quarries to service the railway and, from the 1920s, the road builders (Kass, 1993).

Travelling overland by horse or bullock wagon was a slow and laborious process in colonial NSW and, as a consequence, river and rail transport was used by preference and road networks were limited. This changed with the introduction of the motorcar in the early 20th century and, by the 1920s, there was growing demand for an improved road system. One of the main priorities was a road linking Sydney with its northern regions, and the first stage of this road was constructed between Pennant Hills Road in Hornsby and Peat's Ferry. Opened in the late 1920s, the road was originally called the Great North Road, but was soon renamed the Pacific Highway (Kass, 1993). Both Pennant Hills Road and the Pacific Highway were repeatedly upgraded in the ensuing years to cater for the ever increasing traffic load (Kass, 1993).

Post World War II

Building and development in and around the study area had slowed during the depression and the ensuing war years but, in 1945, work resumed apace. Remaining rural land and larger residential estates were further subdivided to provide more housing, with both private enterprise and Housing Commission of NSW developing new estates (Kass, 1993). With the increasing population came a growing number of service and commercial enterprises, including one of the first major shopping malls in suburban Sydney, constructed at Hornsby by the Westfield Group in 1961.

Increasing pressure on the road system between Sydney and Newcastle saw the establishment of a new freeway during the second half of the 20th century. Beginning with an upgrade of a section of the Pacific Highway, the 'F3 Freeway' gradually expanded to link the road systems of Sydney and Newcastle, with the section through the study area in Wahroonga opening in 1989. Now renamed the 'M1 Pacific Motorway', the road has been continually upgraded and widened.

Present Day

Today, the study area covers a populous residential and commercial area in north western Sydney, and supports the main road infrastructure linking Sydney to the Central Coast, Newcastle and Hunter region.

Literature and database review

The review of heritage registers and databases identified 71 heritage listings within the study area (refer to **Table 7-181** and **Figure 7-82**).

The following heritage items were found to have multiple listings:

- The Windsor Road and Old Windsor Road site (listed under the section 170 register maintained by Roads and Maritime, and under The Hills LEP as I28)
- Blackwood Memorial Sanctuary (listed under the Hornsby LEP (reference A61) and under the National Trust register).
- Observatory Park (listed under the Hornsby LEP as I654 and A62).

For the purposes of the non-Aboriginal heritage assessment, these items have been counted as one item each.

The Beecroft-Cheltenham Conservation Area, Wahroonga Conservation Area (Hornsby), Wahroonga Conservation Area (Ku-ring-gai) and Wahroonga North Conservation Area are broad, landscape based recordings. The significance of these areas is discussed further in **Table 7-182**.

Table 7-181 Historic heritage items identified on heritage registers

Register	Jurisdiction	Items within study area
World Heritage List	Commonwealth	No listed items.
National Heritage List	Commonwealth	No listed items.
Commonwealth Heritage List	Commonwealth	No listed items.
Register of the National Estate (non-statutory)	Commonwealth	No listed items.
NSW State Heritage Register	State	No listed items.
NSW State Heritage Inventory	State	No listed items.
Section 170 Registers	State	One item - Windsor Road and Old Windsor Road (Roads and Maritime).
Hills LEP	Local	One listed item – Windsor Road from Baulkham Hills to Box Hill.
Hornsby LEP	Local	Fifty-three heritage listed items, including four archaeological items and three heritage conservation areas.
Ku-ring-gai Planning Ordinance	Local	Ten heritage listed items, including two heritage conservation areas.
Draft Ku-ring-gai LEP	Local	Five additional items are included in the draft Ku-ring-gai LEP that are not already listed on the Ku-ring-gai Planning Ordinance.
National Trust of Australia (non-statutory)	Voluntary	One item – Blackwood Memorial Sanctuary.

Significance assessment

An assessment of significance was undertaken to analyse why a particular site is important and to enable appropriate site management and curtilage to be determined. A heritage item may be significant at a local level (ie to the people living in the vicinity of the item), at a State level (ie to all people living within NSW) or be significant to the country as a whole (National or Commonwealth significance). The significance assessment criteria are provided in the technical working paper: non-Aboriginal heritage (**Appendix L**).

Significance assessments were undertaken for all properties identified as listed non-Aboriginal heritage items located within the bounds of, or in proximity to the study area. These listed heritage items were assessed for current condition and compared to photographs from past inspections (where available) and the descriptions contained in heritage listings. Statements of significance were sourced from the published listings for these properties.

Summarised significance assessments for each site or item are provided in **Table 7-182**. A more detailed assessment is presented in the technical working paper: non-Aboriginal heritage (**Appendix L**).

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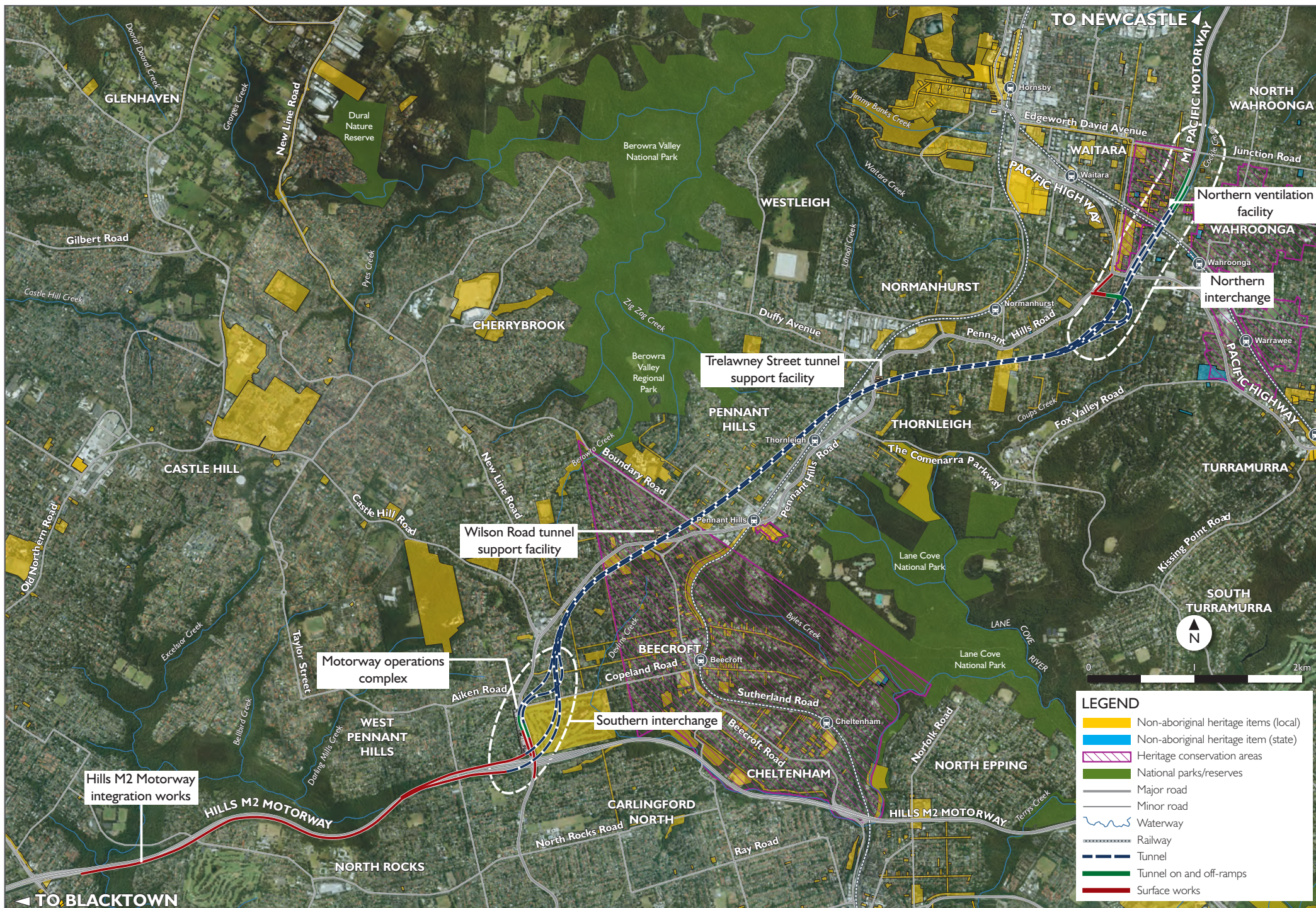


Figure 7-82 Heritage inventory results within the study area and surrounds

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Table 7-182 Summary significance assessments of listed heritage items

LEP ID	Item	Context of significance	Summary statement of significance	Field inspection results
Hornsby LEP				
A60	Loretto [sic] Convent group - grounds, gates and cemetery	Local	Early Federation period brick school buildings, social and historical significance as a local centre of education. Well maintained ground of college and former convent displaying characteristic elements from late Victorian / Federation period. Example of an enclosed religious order which buries its dead within the grounds of the institution.	Significance confirmed
A61	Blackwood Memorial Sanctuary, including North Road culvert	Local	Site in small sloping valley conserving remnant of the high Blue Gum / Blackbutt forest that once dominated this area of the Shire. Also conserves embankment of the New North Road, opened in 1829. Important survival of crucial phase in the European settlement of NSW and Hornsby Shire.	Significance confirmed
A62	Observatory Park - Observatory site and park	Local	Outstanding small example of remnant high Blue Gum and Blackbutt. Native forest conserved on shale derived soils, originally logged in the colonial period. Significant in surrounding landscape, and seen from as far as the city.	Significance confirmed
A66	Remains of Maltworks	Local	Unusual industry which continues to use an older building layout and style though the present buildings date to the late 1960s. Important industry for the region and employer in the locality.	Significance confirmed.
C2	Beecroft - Cheltenham heritage conservation area	Local	The heritage conservation area covers the suburbs of Beecroft and Cheltenham in the Hornsby LGA. The heritage conservation area is part of a larger landscape of existing roads, houses and vegetation. The Beecroft – Cheltenham Heritage Conservation Area is significant because it demonstrates the dominant impact on the suburban fabric of the natural topography and its associated prominent native vegetation, closely integrated into the street patterns and residential allotments of the area.	Significance confirmed
C7	Wahroonga heritage conservation area	Local	Wahroonga Heritage Conservation Area is of heritage significance for its distinctive residential streetscapes which evidence the transformation of early subdivisions of the 1890s into the later rectilinear grid lot street and lot pattern of later subdivisions including the Wahroonga Heights Estate. The area contains a significant collection of grand residences from the Federation and Inter-war periods, built following the opening of the North Shore Railway Line in 1890.	Significance confirmed

LEP ID	Item	Context of significance	Summary statement of significance	Field inspection results
C8	Wahroonga North heritage conservation area	Local	The heritage conservation area covers from Highlands Avenue to Woonona Avenue and Alexandria Parade, Wahroonga. The area is part of a larger landscape of existing roads, houses and vegetation. It is important as a reference site for Hornsby, particularly in relation to the early development of the area. The area has potential to reveal its pre-Victorian development and use through research. The heritage conservation area demonstrates the post 1892 residential development of the area, exhibiting built and landscape qualities that are becoming rare within Hornsby and which are endangered by continuing unsympathetic development.	Significance confirmed
I68	Street trees	Local	This large group of native trees are remnant components (canopy trees) of the Blue Gum High Forest community. Although fragmented and reduced to only scattered remnant canopy trees, the group is considered to be significant in terms of its natural, representative, rarity, ecological / biodiversity, genetic, visual and aesthetic values. The Cardinal Avenue group contains some exceptional old growth specimen trees in the public verges and large private gardens. Remnant native trees of this age structure, size and scale are now rare.	Significance confirmed
I98	Street trees	Local	Hannah Street is comprised of two fragmented groups (ie Western group between Pennant Hills Road and Hull Road and an eastern group between York Street and Beecroft Road). Both groups contain remnant native components of the Blue Gum High Forest community. Both groups are of significance in terms of their natural, representative, rarity, ecological / biodiversity, genetic, visual and aesthetic values.	Significance confirmed
I111	Street trees	Local	This group of native trees, of mixed age and floristic structure, are remnant components (canopy trees) of the Blue Gum High Forest community. Although highly fragmented and reduced to only scattered remnant canopy trees (particularly in the section north of Pennant Hills Road), the group is considered to be significant in terms of its natural, representative, rarity, ecological / biodiversity, genetic, visual and aesthetic values.	Significance confirmed
I138	Pennant Hills Golf Club – grounds	Local	Golf course conserving significant Blackbutt and Blue Gums. Remnant forest above Devlins Creek in a naturalistic landscape and intact landscape elements and cultural planting from c1960s. Clubhouse and entry area developed c1950/60. Exotic planting around the parking area has significance as an important period landscape.	Significance confirmed

LEP ID	Item	Context of significance	Summary statement of significance	Field inspection results
I475	Street trees	Local	This small group of native trees located between Newcastle Expressway (M1 Pacific Motorway) and Myra Street are remnant components (canopy trees) of the Blue Gum High Forest community. This group has significance in terms of its natural, representative, rarity, ecological / biodiversity, genetic, visual and aesthetic values. The formal single species avenue/ row plantation of Brush Box (<i>Lophostemon confertus</i>) located between the Pacific Highway and Myra Street is believed to date from the mid to late Post War period (c. 1950s- 1960s). This plantation has local group significance in terms of its historic, cultural visual / aesthetic and representative values.	Significance confirmed
I590	Street trees	Local	This large but highly fragmented group of native trees are components (canopy trees) of the Blue Gum High Forest community. This group, dominated by Sydney Blue Gums (<i>Eucalyptus saligna</i>), is considered to be significant in terms of its natural, representative, rarity, ecological / biodiversity, genetic, visual and aesthetic values.	Significance confirmed
I596	Garden	Local	Significance has been reduced by the loss of the house and much of its original planting but a number of significant trees survive on the site. Notable among these are mature specimens of Japanese Cedar, Norfolk Island Pine, Hoop Pine, Illawarra Flame Tree, Bull Bay, Crepe Myrtle and Australian Nut. These remnants interpret the previous use of the place and contribute to the aesthetic value of the site.	Significance confirmed
I603	House	Local	Grand example of a late Federation style house set in generous landscaped grounds. Excellent condition and virtually unaltered. Distinctive half-timbered gable. Excellent quality leadlight windows.	Significance confirmed
I607	Loretto [sic] Convent group -grounds, gates and cemetery	Local	See Item A60.	Significance confirmed
I618	St. Agatha's Primary School - grounds (excluding buildings)	Local	School grounds conserving indigenous trees and cultural planting from c.1940s.	Significance confirmed

LEP ID	Item	Context of significance	Summary statement of significance	Field inspection results
I619	"Cheddington" and stables (formerly "Niara")	Local	Example of a large early Queen Anne Federation style house. Cheddington is of social historic significance for its association with Chief Commissioner of Railways, Charles Oliver. A rare existing example of a vernacular stable. The grouping and siting of the buildings is indicative of late Victorian site planning and subdivision related to a major road junction.	The main building 'Cheddington' has been significantly renovated and extended. The stables have undergone only minor modification
I626	House	Local	Good example of fully restored weatherboard cottage from Inter-War period (c.1935).	Significance confirmed
I630	House	Local	Good example of an Inter-War period house in excellent condition and virtually unaltered. Fine quality original detail, including liver brickwork and casement windows. The work of innovative architect George Sydney Jones.	Significance confirmed
I652	"Camira"	Local	Good example of a large, Federation period, two storey bungalow. Notable for large areas of shingling. Good condition. Built for Charles N.J. Oliver, Chief Railway Commissioner until 1907.	Significance confirmed
I653	Mount St. Benedict's Convent and grounds	Local	The original building is an outstanding example of a Federation Free style building, designed by George Sydney Jones. It retains most of its original exterior and interior features. Social and historical significance as a centre of education in the area.	Significance confirmed
I654	Observatory Park - Observatory site and park	Local	See Item A62.	Significance confirmed
I660	Fence	Local	Excellent example of an Inter-War period brick fence c.1925. Good condition and virtually unaltered.	Repainted
I661	Fence	Local	Excellent example of an Inter-War period brick and chain wire fence c.1930. Good condition and virtually unaltered.	Vegetation growth has obscured the fence
I662	House and fence	Local	Excellent example of an Inter-War Bungalow c.1920/1930. Good condition and virtually unaltered. Exterior features much original fine detail throughout.	Significance confirmed

LEP ID	Item	Context of significance	Summary statement of significance	Field inspection results
I666	"Bushloe"	Local	Good representative example of an early 20th Century Federation bungalow style house, altered in parts. House however remains as evidence of historical development in the area.	Significance confirmed
I680	House	Local	Good example of an Inter-War period house c.1925. Unusual masonry verandah. Good condition.	Significance confirmed
I681	House	Local	Good example of an early Federation period cottage in traditional Georgian form c.1910. Best of a row of three. Good condition. Little integrity lost through generally sympathetic modifications.	Significance confirmed
I682	House	Local	Good example of an Inter-War period house c.1935. Fine quality original materials in good condition, including extensive use of shingling.	Significance confirmed
I683	"Hillcourt"	Local	Good representative example of early 20th Century Federation bungalow style, suitably sited on a large block. House remains as evidence of historical development in the area. Examples of this age and level of intactness in the Pennant Hills area appear to be uncommon.	Significance confirmed
I684	"Karoola"	Local	Good intact representative example of an early 20th Century timber framed Federation bungalow style house in extensive gardens. House remains as evidence of historical development in the area.	Significance confirmed
I689	House	Local	Good example of an early Federation period weatherboard cottage in traditional Georgian style c.1900. Good condition. Integrity little affected by generally sympathetic alterations.	Significance confirmed
I690	House	Local	Excellent timber example of an Inter-War Bungalow c.1930. Has much in common with the original Californian model, with suggested Japanese influence. Unusual double-gabled design. Good condition. Fine quality original timber detail, including windows and gables.	Significance confirmed
I691	The Maze	Local	Good example of an early Federation brick house with traditional wrap-around verandah. Integrity partly compromised by painting of brickwork.	Significance confirmed

LEP ID	Item	Context of significance	Summary statement of significance	Field inspection results
I710	Street trees	Local	This small group of native trees, dominated by old growth specimens, are remnant components (canopy trees) of the Blue Gum High Forest community. Although highly fragmented and reduced to only scattered remnant canopy trees, the group is considered to be significant in terms of its natural, representative, rarity, ecological / biodiversity, genetic, visual and aesthetic values. A number of large specimen trees are conserved in rear gardens (eastern side) near the creek-line.	Significance confirmed
I714	"Loch Maree House" and garden	Local	Outstanding Federation house. Finely crafted detail in a variety of materials. Excellent condition. One of the best quality houses in the area. Outbuilding at the rear also of interest.	Significance confirmed
I716	House	Local	Good example of a late Federation style Bungalow. Originally a single-storey c. 1920s weatherboard cottage with a terracotta tiled roof. Now greatly extended and modified with the addition of an upper level, side wing and corrugated steel roofing.	Significance confirmed
I723	House	Local	Good example of an Inter-War period weatherboard house c.1925. Unusual verandah column brackets. Much good quality original detail.	Significance confirmed
I724	Gardens	Local	Remnants of original indigenous Sydney Blue Gum High Forest surviving on nature strip and in several gardens on the north side of Trelawney Street. Although only isolated trees and possibly regrowth after early logging in the area, these specimens have local historical, aesthetic and scientific / research significance and are representative of the original dominant tree species in the area.	Significance confirmed
I725	House	Local	Example of a Federation period Arts and Crafts weatherboard cottage with standard asymmetrical plan c.1915. Only in fair condition and has unsympathetic new work. Unusual hood design and fine quality original detail.	Significance confirmed
I731	Garden	Local	Garden conserving cultural trees from c.1950 period forming Bundarra Ave precinct of high local landscape significance.	Significance confirmed
I743	Street trees	Local	Although highly fragmented and reduced to only scattered remnant canopy trees, the group in Edwards Road is considered to have significance in terms of its natural, representative, rarity, ecological/biodiversity, genetic, visual and aesthetic values. This group is dominated by mature Sydney Blue Gums, Blackbutts and Smooth-barked Apple.	Significance confirmed

LEP ID	Item	Context of significance	Summary statement of significance	Field inspection results
I750	Street trees	Local	The formal avenue plantation along Ingram Road is a fine example of late Post War period (c.1960s) public planting. This avenue is significant in terms of its historic/cultural associations, visual/aesthetic and representative values. The use of a single native species, Brush Box, continues an important local thematic approach typical of this period. The original design intent of a single species avenue has been retained.	Significance confirmed
I755	House	Local	Good example of Post War Spanish Mission Style house. Features typical of the style include rendered walls with exaggerated texture and verandah logia. Good condition and little altered.	Significance confirmed
I762	Garden	Local	Domestic garden with period palm trees, forming a prominent landscape element on busy main road corner.	Significance confirmed
I767	St Pauls Church – Pearce's Corner	Local	Neat stone church. One of very few nineteenth century churches to survive in the Shire, reasonably unaltered. A good example of Victorian Gothic styling. Prominently sited at Pearce's Corner and closely associated with its long history. Constructed in 1881.	Significance confirmed
I768	Street trees	Local	The impressive stand of trees in Russell Avenue is dominated by Sydney Blue Gums of varying age structure. A large number of old growth specimen trees are each of individual significance. The group has significance in terms of its natural, representative, rarity, ecological/biodiversity, genetic, visual and aesthetic values. Furthermore, these trees are part of a larger, albeit highly fragmented community (BGHF).	Significance confirmed
I769	Street trees	Local	These native trees are remnant components (canopy trees) of the Blue Gum High Forest community. Although highly fragmented and reduced to remnant groups of canopy species (north and south of Edgeworth David Avenue), these trees are considered to have significance in terms of natural, representative, rarity, ecological / biodiversity, genetic, visual and aesthetic values. It is important to recognise the combined significance of this cluster of trees in the Wahroonga local area.	Significance confirmed
I770	"Cherrygarth" and garden	Local	Outstanding Federation mansion. Let down by painted brick but little altered otherwise. One of the better examples in the Shire and one of only a handful retaining their original landscaped grounds.	Significance confirmed
I771	"Neringala" and garden	Local	Period trees remaining in grounds of Federation residence. Of local significance. Notable Federation mansion. Spoiled by some unsympathetic alterations and additions but seems easily capable of reconstruction.	Significance confirmed

LEP ID	Item	Context of significance	Summary statement of significance	Field inspection results
I772	Street trees and bushland	Local	The road reserve adjacent to the railway easement conserves a significant linear group of Blue Gum High Forest. This group has significance in terms of its natural, representative, rarity, ecological / biodiversity, genetic, visual and aesthetic values. A formal row plantation of Brush Box (<i>Lophostemon confertus</i>), located in the western portion of Alexandria Parade, is believed to date from c.1950s period. The plantation has local group significance in terms of its historic, cultural, visual / aesthetic and representative values.	Significance confirmed
I791	House	Local	The original cottage is one of the oldest structures in the Shire, possibly the oldest. Despite subsequent alteration most of the original fabric is retained. Much is also revealed internally. Rare example of an early surviving primitive cottage.	Significance confirmed
Ku-ring-gai Planning Ordinance				
C1	Wahroonga heritage conservation area	Local	The heritage conservation area covers an area from John Hughes Place to Ingram Road and Isis Street, Wahroonga. The area is part of a larger landscape of existing roads, houses and vegetation. Wahroonga Heritage Conservation Area is of heritage significance for its distinctive residential streetscapes which evidence the transformation of early subdivisions of the 1890s into the later rectilinear grid lot street and lot pattern of later subdivisions including the Wahroonga Heights Estate. The area contains a significant collection of grand residences from the Federation and Inter-war periods	Significance confirmed
I897	Timber Cottages Group	Local	The listed statement of significance, historic background and description for this site states that these are residential buildings (private) that are examples of timber cottages.	Significance confirmed
I898	Timber Cottages Group	Local	The listed statement of significance, historic background and description for this site states that these are residential buildings (private) that are examples of timber cottages.	Significance confirmed
I900	Timber Cottages Group	Local	The listed statement of significance, historic background and description for this site states that these are residential buildings (private) that are examples of timber cottages.	Significance confirmed
I901	Timber Cottages Group	Local	The listed statement of significance, historic background and description for this site states that these are residential buildings (private) that are examples of timber cottages.	Significance confirmed

LEP ID	Item	Context of significance	Summary statement of significance	Field inspection results
1902	Timber Cottages Group	Local	The listed statement of significance, historic background and description for this site states that these are residential buildings (private) that are examples of timber cottages.	The structure currently at the listed address is a two storey brick house. The timber structure previously registered here has likely been demolished.
1953	"Bolton Grange" Dwelling House	Local	No statement of significance is contained within the Ku-ring-gai Planning Ordinance. Reasons for listing are due to its cultural, architectural, municipal significance. Historical period: 1921-1940. Substantially intact.	Significance confirmed
1955	"Matakana" Dwelling House	Local	No statement of significance is contained within the Ku-ring-gai Planning Ordinance. The reasons for listing this item are due to its cultural, architectural and municipal significance.	Significance confirmed
1956	"Cullingral" Dwelling House	Local	No statement of significance is contained within the Ku-ring-gai Planning Ordinance. The reasons for listing this item are due to its cultural, architectural and municipal significance.	Significance confirmed
11012	"Poole House" Dwelling House	Local	Reasons for listing; architectural, municipal significance. Historical period: 1901-1920. The oldest building on the Junior Campus. Altered or extended unsympathetically.	Significance confirmed
Draft Ku-ring-gai LEP				
1855	Dwelling House	Local	No statement of significance is contained within the Ku-ring-gai Planning Ordinance. The reasons for listing this item are due to its cultural, architectural and municipal significance.	Significance confirmed
1954	Dwelling House	Local	No statement of significance is contained within the Ku-ring-gai Planning Ordinance. The reasons for listing this item are due to its cultural, architectural and municipal significance.	Significance confirmed
1957	"Mansfield" Dwelling House	Local	No statement of significance is contained within the Ku-ring-gai Planning Ordinance. The reasons for listing this item are due to its cultural, architectural and municipal significance.	Significance confirmed

LEP ID	Item	Context of significance	Summary statement of significance	Field inspection results
1959	"Hindfell" Dwelling House	Local	No statement of significance is contained within the Ku-ring-gai Planning Ordinance. The reasons for listing this item are due to its cultural, architectural and municipal significance.	Significance confirmed
1960	Dwelling House	Local	Excellent timber example of an Inter-War Bungalow. Has much in common with the original Californian model, with suggested Japanese influence. Unusual double-gabled design. Good condition. Fine quality original timber detail, including windows and gables.	Significance confirmed
The Hills LEP				
128	Windsor Road from Baulkham Hills and Box Hill	Local	Windsor and Old Windsor Roads retain characteristics evocative of the historic, rural character of the Cumberland plain, both within the current road reserve and in redundant sections outside the reserve. Together they are vital in understanding the cultural landscapes of the region. Remaining historic road fabric, both inside and outside the current road reserve, demonstrates the methods of road construction and maintenance over two centuries.	The sections of road that represent this listing are not within the study area. Nonetheless, the section of the road within the study area has been recently modified following the construction of additional ramps at the Windsor Road interchange as part of the Hills M2 Motorway Upgrade project.

7.10.3 Assessment of potential impacts

Potential impact types

Impacts on non-Aboriginal heritage items have been categorised as follows:

- Direct – where the project would be located within the curtilage of the heritage item and / or involve the demolition or modification of the heritage item.
- Potentially direct – where the project may impact on the heritage item subject to the condition of the item, more detailed investigation, construction methodologies and / or the implementation of mitigation and management measures.
- Indirect – where the project would change the visual context and surroundings of a heritage item.

Types of impacts that may result from construction or operation of the project are identified and described in **Table 7-183**.

Table 7-183 Types of impacts to non-Aboriginal heritage items

Impact	Description
Direct	
Heritage vegetation removal	Road widening and construction activities resulting in the removal of heritage listed vegetation.
Acquisition	Impacts resulting from the full or partial acquisition (and associated demolition) of properties that contain heritage items.
Change in heritage conservation area values	Construction of a new element within a heritage conservation area.
Potentially direct	
Acoustic treatment	Properties, some of which may be listed heritage items, may qualify for at-property acoustic treatment. This may impact on the fabric of the heritage item.
Vibration, settlement and groundwater drawdown from tunnelling works	<p>The area of potential impact for the main alignment tunnels, on-ramp and off-ramp tunnels includes a zone on the surface equal to a distance of 50 metres from the outer edge of the underground tunnels.</p> <p>The potential impacts on non-Aboriginal heritage items would be a potential indirect impact by virtue of:</p> <ul style="list-style-type: none"> • Construction vibration as the road headers pass underneath properties. • The settlement of land if tunnelling activities are conducted underneath or close to heritage features. • Impacts on tree roots, in the case of street trees, depending on the depth of the tunnelling activity.
Vibration from surface works	Depending on the setback of buildings from the construction footprint, there is the potential for vibration impacts associated with surface road works, building construction and / or the cut-and-cover sections of the main alignment tunnels, and on and off-ramps.

Impact	Description
Dust	Construction activities may result in the generation of dust where works are at the surface or during the handling of spoil. Spoil handling would be in part undertaken inside acoustic sheds at compounds. Air quality impacts during construction would be managed by implementing standard and best practice mitigation measures. As such, this potential impact has not been considered further.
Indirect	
Visual	<p>There may be temporary and permanent visual impacts as result of the project. These may include:</p> <ul style="list-style-type: none"> • Construction of new road infrastructure or ancillary facilities. • Alterations to surface roads. • New noise walls or modifications to existing noise walls, including changes to the height of noise walls. • Removal of vegetation. • Establishment and use of construction compounds.

The degree to which the impacts listed above would affect the heritage value or significance of identified non-Aboriginal heritage items would vary. In order to undertake a comparative assessment, a set of impact criteria were established and used to rank the degree of impact. These criteria are described in **Table 7-184** below.

Table 7-184 Non-Aboriginal heritage impact criteria

Impact assessment	Criteria
Negligible	Impacts to the heritage item in question would be negligible and would not affect the overall heritage significance of the item.
Minor	Minor impacts may occur to the listed item, typically with respect to its reported curtilage as opposed to the listed item itself. These impacts would be minimal in nature and would not affect the overall heritage significance of the item.
Significant	Impacts to the heritage item are unavoidable with the current project design. The heritage value of the item would be impacted.

Construction and operation of the project is anticipated to result in direct and / or indirect impacts to a total of 62 listed non-Aboriginal heritage items, the locations of which are shown on **Figure 7-82**. The early identification of non-Aboriginal heritage items and conservation areas during the design phase informed the project design and enabled the avoidance of heritage items where practicable.

Impacts to heritage items are discussed below and in **Table 7-185**. A statement of heritage impact has been undertaken for:

- Directly impacted items.
- Potentially directly impacted items with an impact rating of minor or significant.
- Indirectly impacted items with an impact rating of minor or significant.

Statements of heritage impact for the 19 heritage items that meet the above-listed criteria are provided in **Table 7-185**. Impacts to the remaining 43 items consist primarily of potential negligible direct impacts as a result of tunnelling works.

Further information regarding impacts to non-Aboriginal heritage items is provided in the technical working paper: non-Aboriginal heritage (**Appendix L**), including descriptions of impacts specific to each heritage item.

Direct impacts

Only five listed non-Aboriginal heritage items are expected to be directly impacted by the project. These are all associated with surface elements of the project and include:

- One listed heritage item expected to be fully and directly impacted by the project. This item is a garden at the northern interchange (ID No I762 under the Hornsby LEP), including two heritage listed trees. Feasible and reasonable options to relocate these trees would be investigated during detailed design.
- Four listed heritage items expected to be partially and directly impacted by the project. These items are:
 - The Thornleigh Maltworks (ID No A66 under the Hornsby LEP) in Thornleigh would be impacted by the construction of the Pioneer Avenue compound. Archival recording has the potential to preserve the overall site's local significance prior to demolition.
 - The Beecroft-Cheltenham heritage conservation area (ID No C2 under the Hornsby LEP), in which the Wilson Road compound (C6) and the southern emergency smoke extraction facility would be located.
 - The Wahroonga North heritage conservation area (ID No C8 under the Hornsby LEP), in which part of the northern interchange would be located.
 - Street trees (ID No I769), the listed curtilage of which would be impacted by the northern interchange.

Measures proposed to mitigate or manage direct impacts to listed heritage items are presented in **Table 7-186**.

Potentially direct impacts

Acoustic treatment

Technical working paper: noise and vibration identifies properties that may be eligible for at-property acoustic treatment, due to the potential for exceedences of appropriate noise criteria at these locations. Depending on the level of noise exceedence, at-property treatment may include for example, sealing of wall vents or upgrading of window and door seals.

Three of the properties identified for at-property acoustic treatment are listed heritage items, namely:

- "Hindfell" Dwelling House (Draft Ku-ring-gai LEP reference: I959).
- St Pauls Church - Pearce's Corner (Hornsby LEP reference: I767).
- "Cherrygarth" and garden (Hornsby LEP reference: I770).

The need for acoustic treatment at each property would be confirmed during detailed design, in consultation with landowners, and with consideration of potential impacts to heritage values.

Should at-property acoustic treatment be required for the above listed heritage items, this may result in impacts to the fabric of these items. Treatment would be sympathetic to the heritage values of each item and would be undertaken in accordance with the Burra Charter, which stipulates that changes which reduce cultural significance should be reversible.

Tunnelling works – settlement, vibration and street trees

The majority of non-Aboriginal heritage items would be located within the area of potential impact for the main alignment tunnels, and / or on-ramp and off-ramp tunnels, which includes a zone on the surface equal to a distance of 50 metres from the outer edge of the tunnels. For each item included in this impact area there is potential for impacts by virtue of construction vibration, ground settlement, and impacts to tree roots.

Impacts on heritage structures as a result of ground settlement would be dependent on geotechnical conditions, the depth of the tunnelling activity and factors such as the position, condition, height, and masonry of the structure itself. An assessment of potential impacts to structures due to ground settlement is provided in **Section 7.8** (Hydrogeology and soils) of this environmental impact statement. Specific to heritage items, it is noted that:

- For the majority of items, no or very little settlement (five millimetres or less) is anticipated. The magnitude of potential movement would be minor, and therefore the risk of damage to structures would be negligible.
- For a limited number of properties located near the southern and northern interchanges, settlement of up to around ten millimetres has been estimated, with an angular distortion of up to around 0.03 per cent. The resulting degree of damage to structures is considered to be negligible, and may include cosmetic visual impacts such as hairline cracks less than 0.1 millimetres wide.

These results are preliminary and do not take into account the specific conditions of individual properties. Further assessments would be undertaken during detailed design to determine the level of potential impact on structures and to identify appropriate mitigation and management measures to minimise these impacts. For some properties, this may involve undertaking an existing condition survey and a program of monitoring. The process involved in undertaking an existing condition survey is described in **Section 7.2** (Noise and vibration).

The extent of potential vibration impacts to heritage structures as a result of construction vibration would be dependent on the type of equipment, the activity being undertaken and the distance of separation between the equipment and the structure. For tunnelling activities, vibration levels are predicted to be around two millimetres per second or less. This is below the recommended maximum level of vibration that would be applicable for heritage structures, as set within the German Standard DIN 4150 - Part 3 - Structural Vibration in Buildings – Effects on Structures (technical working paper: non-Aboriginal heritage, **Appendix L**).

Several listed groups of prominent street trees (generally consisting of remnant Blue Gum High Forest) are located within the project corridor. Potential impacts to street trees considered as part of this non-Aboriginal heritage assessment include damage to roots as a result of underground works, and potential ground movement.

Street tree group listings I111 and I68 (Hull Road and Cardinal Avenue) as well as trees included under item A61 (Blackwood Memorial Sanctuary, including the North Road culvert) and A62/I654 (Observatory Park – observatory site and park) are located in areas where the main alignment tunnels would be about 85 metres below the existing ground surface. Listings I98 and I590 (Hannah Street and Campbell Avenue) are located in areas where the main alignment tunnels would be between 20 and 55 metres deep.

For the majority of listed street tree groups, potential impacts as a result of the project would be minor and / or negligible due to the depth of the tunnel at these locations.

Surface works – vibration

Surface construction works have the potential to result in vibration impacts to heritage items. This would be dependent on the distance of the works to the heritage item and the selection of plant and equipment. Wherever possible, plant and equipment would be selected to maintain safe working distances to minimise the potential for vibration related impacts.

Indirect impacts

Indirect impacts may result from changes to the visual context and surrounds of heritage items associated with the introduction of new infrastructure including:

- Construction of new road infrastructure or ancillary facilities.
- Alterations to surface roads.
- New noise walls or modifications to existing noise walls, including changes to the height of noise walls.
- Removal of vegetation.
- Establishment and use of construction compounds.

The introduction of new elements within the study area has the potential to visually impact heritage items, particularly if the visual characteristics of these elements are unsympathetic with those of the heritage items. In addition, new elements may obstruct significant views from or to heritage items or places, when viewed from public or private land.

The majority of new infrastructure proposed as part of the project is anticipated to be largely in keeping with the existing visual character of the area. Further, visual impacts to affected heritage items would be reduced in part by distance and the screening effect of surrounding residential developments and proposed landscaping. Existing vistas and view lines from heritage items would be considered during detailed design, and rehabilitation strategies sympathetic to the heritage item would be determined.

Further information on indirect visual impacts to heritage items, and recommended measures to mitigate these impacts, are provided in **Table 7-185**, **Table 7-186**, and in **Section 7.5** (Urban design, landscape character and visual amenity).

Table 7-185 Statements of heritage impact

LEP ID	Item	Impact area	Impact type	Statement of heritage impact	Degree of impact
Hornsby LEP					
A66	Thornleigh Maltworks	Pioneer Avenue compound (C8)	Direct – Acquisition	The proposed acquisition and demolition of many of the Thornleigh Maltworks structures would remove much of the evidence of the existence of this industry at this location for the past 100 years. While the historical, rarity and representative values currently held by the site would not be lost through conservation of the main germination building, the connection of this structure to the rest of the site would be lost. Archival recording has the potential to preserve the overall site's local significance prior to demolition.	Significant
C2	Beecroft - Cheltenham heritage conservation area	Wilson Road compound (C6) Wilson Road tunnel support facility Main alignment tunnel	Direct – change in heritage conservation area values	Impacts to heritage values within the conservation area would be localised to specific areas already associated with major transport network infrastructure. The overall heritage value of the heritage conservation area would not be significantly impacted by the proposed works.	Minor
C8	Wahroonga North heritage conservation area	Northern interchange	Direct – change in heritage conservation area values	Impacts to heritage values within the conservation area would be localised to specific areas already associated with major transport network infrastructure. The overall heritage value of the heritage conservation area would not be significantly impacted by the proposed works.	Minor

LEP ID	Item	Impact area	Impact type	Statement of heritage impact	Degree of impact
I138	Pennant Hills Golf Course – grounds	Southern interchange	<p>Potentially direct – vibration and settlement (tunnelling)</p> <p>Indirect – visual</p>	<p>Pennant Hills Golf Course is located adjacent to the southern interchange. The main alignment tunnels would pass directly underneath the golf course. Potential impacts to heritage values would be largely avoided as the project would not be located near the golf club house or club entry.</p> <p>Potential impacts may include:</p> <ul style="list-style-type: none"> • Settlement within the western fairways during and after construction, however this would be ten millimetres or less, which may result in cosmetic changes only. • Vibration impacts during tunnelling. However, vibration levels are anticipated to be below potential damage levels relevant to heritage structures. • Visual impact during construction and operation. However existing vegetation along the perimeter of the golf course would not be impacted and would effectively screen construction activities and operational buildings from the golf course. <p>The overall heritage value of the listed item would not be affected by the project and associated works.</p>	<p>Potential minor – vibration and settlement</p> <p>Minor – visual</p>
I762	Garden	Northern interchange	<p>Direct – acquisition</p> <p>Direct – heritage vegetation removal</p>	<p>The two heritage listed trees would be removed during construction of the project, resulting in a direct loss of heritage value for this item.</p> <p>Options to avoid direct impacts or identify appropriate areas for potential relocation would be investigated during the detailed design phase.</p> <p>In the event that a feasible and reasonable option to relocate the trees cannot be identified, there would be a direct loss of the heritage item. In this event seed collection and archival samples would be undertaken.</p>	Significant

LEP ID	Item	Impact area	Impact type	Statement of heritage impact	Degree of impact
1769	Street trees	Northern interchange	Direct – heritage vegetation removal	<p>The trees identified in this streetscape are reflective of the original floral biota of this area. The identified impacts to this area as a result of the project would be restricted to the southern portion (around 100 square metres or one per cent of the total area) of the listed curtilage for this streetscape.</p> <p>Measures to avoid direct impacts to the specific listed vegetation “<i>Blue Gum High Forest</i>” would be investigated during the detailed design phase in order to minimise potential impacts to the item’s heritage value.</p> <p>If avoidance is not feasible or reasonable, some impact to the overall heritage value of this item would occur. However this would be mitigated through sympathetic plantings of similar species as part of landscaping / revegetation of the site following completion of construction.</p>	Minor
1770	"Cherrygarth" and garden	Northern interchange and northern ventilation facility	<p>Potentially direct – vibration and settlement (tunnelling)</p> <p>Potentially direct – vibration (surface works)</p> <p>Indirect – visual</p>	<p>This heritage item is located opposite the northern ventilation facility.</p> <p>Noise walls and landscaping would provide some visual screening between the project and the heritage item, once established. However, the taller components of the northern ventilation facility would be located further north and may be visible above the noise walls.</p> <p>Potential impacts may include:</p> <ul style="list-style-type: none"> • Settlement during and after construction, however this would be less than five millimetres, which would be negligible. • Vibration impacts during tunnelling and surface construction, however: • Vibration levels from tunnelling are anticipated to be below potential damage levels relevant to heritage structures. • Surface works would adhere to safe working distances. • An existing condition survey and a program of monitoring would be undertaken to identify early potential risks to the heritage item. 	<p>Potential minor – vibration and settlement</p> <p>Minor – visual</p>

LEP ID	Item	Impact area	Impact type	Statement of heritage impact	Degree of impact
				<ul style="list-style-type: none"> Visual impacts during construction and operation. Existing vistas and view lines from the property would be considered during detailed design, including rehabilitation strategies that are sympathetic to the heritage item. <p>The overall heritage value of the listed item would not be affected by the project and associated works.</p>	
I771	"Neringala" and garden	Northern interchange and northern ventilation facility	<p>Potentially direct – vibration (surface works)</p> <p>Indirect – visual</p>	<p>This heritage item would be located directly opposite the northern ventilation facility.</p> <p>Noise walls and landscaping would provide some visual screening between the project and the heritage item, once established. However, the taller components of the northern ventilation facility would be located further north and may be visible above the noise walls.</p> <p>Potential impacts may include:</p> <ul style="list-style-type: none"> Vibration impacts during surface construction, however surface works would adhere to safe working distances. An existing condition survey and a program of monitoring would be undertaken to identify early potential risks to the heritage item. Visual impacts during construction and operation. Existing vistas and view lines from the property would be considered during detailed design, including rehabilitation strategies that are sympathetic to the heritage item. <p>The overall heritage value of the listed item would not be affected by the project and associated works.</p>	<p>Potential minor – vibration</p> <p>Minor – visual</p>

LEP ID	Item	Impact area	Impact type	Statement of heritage impact	Degree of impact
1791	House	Southern interchange	<p>Potentially direct – vibration and settlement (tunnelling)</p> <p>Potentially direct – vibration (surface works)</p> <p>Indirect – visual</p>	<p>This heritage item would be located near the southern interchange and would be located directly above the northbound on-ramp tunnel from Pennant Hills Road.</p> <p>Potential impacts may include:</p> <ul style="list-style-type: none"> • Settlement during or after construction, however this would be five millimetres or less, which would be negligible. • Vibration impacts during tunnelling and surface construction, however: • Vibration levels from tunnelling are anticipated to be below potential damage levels relevant to heritage structures. • Surface works would adhere to safe working distances • An existing condition survey and a program of monitoring would also be undertaken to identify early potential risks to the heritage item. • Visual impact during construction and operation. This would be reduced, in part, due to the large brick wall surrounding the property. <p>The overall heritage value of the listed item would not be affected by the project and associated works.</p>	<p>Potential minor – vibration and settlement</p> <p>Minor – visual</p>
Ku-ring-gai Planning Ordinance (IDs from draft Ku-ring-gai LEP)					
1897	Timber Cottages Group	Northern interchange	<p>Potentially direct – vibration (surface works)</p> <p>Indirect – visual</p>	<p>This heritage item would be located near the northern portals of the project with surface works required immediately adjacent to the item on the M1 Pacific Motorway.</p> <p>Potential impacts may include:</p> <ul style="list-style-type: none"> • Vibration impacts during surface construction, however surface works would adhere to safe working distances. An existing condition survey and a program of monitoring would also be undertaken to identify early potential risks to the heritage item. 	<p>Potential minor – vibration</p> <p>Minor – visual</p>

LEP ID	Item	Impact area	Impact type	Statement of heritage impact	Degree of impact
				<ul style="list-style-type: none"> Visual impacts during construction and operation. Existing vistas and view lines from the property would be considered during detailed design, including rehabilitation strategies that are sympathetic to the heritage item. <p>The overall heritage value of the listed item would not be affected by the project and associated works.</p>	
1898	Timber Cottages Group	Northern interchange	<p>Potentially direct – vibration (surface works)</p> <p>Indirect – visual</p>	<p>This heritage item would be located near the northern portals of the project with surface works required immediately adjacent to the item on the M1 Pacific Motorway.</p> <p>Potential impacts may include:</p> <ul style="list-style-type: none"> Vibration impacts during surface construction, however surface works would adhere to safe working distances. An existing condition survey and a program of monitoring would also be undertaken to identify early potential risks to the heritage item. Visual impacts during construction and operation. Existing vistas and view lines from the property would be considered during detailed design, including rehabilitation strategies that are sympathetic to the heritage item. <p>The overall heritage value of the listed item would not be affected by the project and associated works.</p>	<p>Potential minor – vibration</p> <p>Minor – visual</p>

LEP ID	Item	Impact area	Impact type	Statement of heritage impact	Degree of impact
1900	Timber Cottages Group	Northern interchange	<p>Potentially direct – vibration (surface works)</p> <p>Indirect – visual</p>	<p>This heritage item would be located near the northern portals of the project with surface works required immediately adjacent to the item on the M1 Pacific Motorway.</p> <p>Potential impacts may include:</p> <ul style="list-style-type: none"> • Vibration impacts during surface construction, however surface works would adhere to safe working distances. An existing condition survey and a program of monitoring would also be undertaken to identify early potential risks to the heritage item. • Visual impacts during construction and operation. Existing vistas and view lines from the property would be considered during detailed design, including rehabilitation strategies that are sympathetic to the heritage item. <p>The overall heritage value of the listed item would not be affected by the project and associated works.</p>	<p>Potential minor – vibration</p> <p>Minor – visual</p>

LEP ID	Item	Impact area	Impact type	Statement of heritage impact	Degree of impact
I901	Timber Cottages Group	Northern interchange	<p>Potentially direct – vibration (surface works)</p> <p>Indirect – visual</p>	<p>This heritage item would be located near the northern portals of the project with surface works required immediately adjacent to the item on the M1 Pacific Motorway.</p> <p>Potential impacts may include:</p> <ul style="list-style-type: none"> • Vibration impacts during surface construction, however surface works would adhere to safe working distances. An existing condition survey and a program of monitoring would also be undertaken to identify early potential risks to the heritage item. • Visual impacts during construction and operation. Existing vistas and view lines from the property would be considered during detailed design, including rehabilitation strategies that are sympathetic to the heritage item. <p>The overall heritage value of the listed item would not be affected by the project and associated works.</p>	<p>Potential minor – vibration</p> <p>Minor – visual</p>
I902	Timber Cottages Group	Northern interchange	<p>Potentially direct – vibration (surface works)</p> <p>Indirect – visual</p>	<p>Despite being listed on the current Ku-ring-gai Planning Scheme Ordinance, the current state of the property is not consistent with the listed heritage item description. Ku-ring-gai Municipal Council has resolved to recommend its removal from Schedule 5 of the Draft Ku-ring-gai LEP to the Department of Planning and Environment.</p>	Negligible

LEP ID	Item	Impact area	Impact type	Statement of heritage impact	Degree of impact
1953	"Bolton Grange" Dwelling House	Northern interchange	<p>Potentially direct – vibration and settlement (tunnelling)</p> <p>Indirect – visual</p>	<p>This heritage item would be located above the on-ramp and off-ramp portals on the M1 Pacific Motorway / Pennant Hills Road connector and would lie directly above the on-ramp and off-ramp tunnels. The northern interchange compound would also be located directly adjacent to the property boundary.</p> <p>Potential impacts may include:</p> <ul style="list-style-type: none"> • Settlement during and after construction, however this would be ten millimetres or less, which may result in cosmetic damage only. • Vibration impacts during tunnelling. However, vibration levels are anticipated to be below potential damage levels relevant to heritage structures. An existing condition survey and a program of monitoring would also be undertaken to identify early potential risks to the heritage item. • Visual impacts from vegetation clearance and the introduction of new infrastructure. Re-vegetation of the area would occur following construction which would limit potential long-term visual impacts. Existing vistas and view lines from the property would be considered during detailed design, including rehabilitation strategies that are sympathetic to the heritage item. <p>The overall heritage value of the listed item would not be affected by the project and associated works.</p>	<p>Potential minor – vibration and settlement</p> <p>Minor – visual</p>

LEP ID	Item	Impact area	Impact type	Statement of heritage impact	Degree of impact
1956	"Cullingral" Dwelling House	Northern interchange	Potentially direct – vibration and settlement (tunnelling) Indirect – visual	<p>This heritage item would be located above the on-ramp and off ramp portals on the M1 Pacific Motorway connector and would lie directly above the ramps to the main alignment tunnels. The northern interchange compound would also be located near the item.</p> <p>Potential impacts may include:</p> <ul style="list-style-type: none"> • Settlement during and after construction, however this would be ten millimetres or less, which may result in cosmetic damage only. • Vibration impacts during tunnelling. However, vibration levels are anticipated to be below potential damage levels relevant to heritage structures. An existing condition survey and a program of monitoring would also be undertaken to identify early potential risks to the heritage item. • Visual impacts however adjacent properties are likely to screen views to the project from this property. Existing vistas and view lines from the property would be considered during detailed design, including rehabilitation strategies that are sympathetic to the heritage item. <p>The overall heritage value of the listed item would not be affected by the project and associated works.</p>	<p>Potential minor – vibration and settlement</p> <p>Minor – visual</p>
Draft Ku-ring-gai LEP					
1855	Dwelling House	Northern interchange	Potentially direct – vibration (surface works) Indirect – visual	<p>Part of the property would be located within 50 metres of cut-and-cover sections of the northern portal.</p> <p>Potential impacts may include:</p> <ul style="list-style-type: none"> • Vibration impacts during surface construction, however surface works would adhere to safe working distances. Vibration levels are anticipated to be below potential damage levels relevant to heritage structures. An existing 	<p>Potential minor – vibration</p> <p>Minor – visual</p>

LEP ID	Item	Impact area	Impact type	Statement of heritage impact	Degree of impact
				<p>condition survey and a program of monitoring would also be undertaken to identify early potential risks to the heritage item.</p> <ul style="list-style-type: none"> Visual impacts during construction and operation primarily due to the widening of the existing M1 Pacific Motorway corridor at this location and changes to noise walls. However, this impact would be minimised due to the screening effect from surrounding residential developments. <p>The overall heritage value of the listed item would not be affected by the project and associated works.</p>	
1957	"Mansfield" Dwelling House	Northern interchange	<p>Potentially direct – vibration and settlement (tunnelling)</p> <p>Indirect – visual</p>	<p>This heritage item would be located near the on and off-ramp portals on the M1 Pacific Motorway / Pennant Hills Road connector and would lie directly above the on-ramp and off-ramp tunnels. The northern interchange compound would also be located near the item.</p> <p>Potential impacts may include:</p> <ul style="list-style-type: none"> Settlement impacts during and after construction, however this would be five millimetres or less, which is considered to be negligible. Vibration impacts during tunnelling. However, vibration levels are anticipated to be below potential damage levels relevant to heritage structures. An existing condition survey and a program of monitoring would also be undertaken to identify early potential risks to the heritage item. Visual impacts during construction and operation. However this would be reduced in part due the screening effect of surrounding residential developments. Existing vistas and view lines from the property would be considered during detailed design, including rehabilitation strategies that are sympathetic to the heritage item. <p>The overall heritage value of the listed item would not be affected by the project and associated works.</p>	<p>Potential minor – vibration and settlement</p> <p>Minor – visual</p>

LEP ID	Item	Impact area	Impact type	Statement of heritage impact	Degree of impact
1960	Dwelling House	Northern interchange	<p>Potentially direct – vibration and settlement (tunnelling)</p> <p>Indirect – visual</p>	<p>This item would be located above the on-ramp and off-ramp portals on the M1 Pacific Motorway / Pennant Hills Road connector and would lie directly above the on-ramp and off-ramp tunnels. The northern interchange compound would also be located near item.</p> <p>Potential impacts may include:</p> <ul style="list-style-type: none"> • Settlement during and after construction, however this would be ten millimetres or less, which may result in cosmetic damage only. • Vibration impacts during tunnelling. However, vibration levels are anticipated to be below potential damage levels relevant to heritage structures. An existing condition survey and a program of monitoring would also be undertaken to identify early potential risks to the heritage item. • Visual impacts during and after construction, however this would be reduced in part by distance and the screening effect of surrounding residential developments. Existing vistas and view lines from the property would be considered during detailed design, including rehabilitation strategies that are sympathetic to the heritage item. <p>The overall heritage value of the listed item would not be affected by the project and associated works.</p>	<p>Potential minor – vibration and settlement</p> <p>Minor – visual</p>

7.10.4 Environmental management measures

The early identification of non-Aboriginal heritage items and conservation areas during the design phase informed the project design and enabled the avoidance of heritage items where practicable.

The mitigation and management measures provided in **Table 7-186** have been developed to avoid, reduce and manage identified potential impacts to non-Aboriginal heritage. These measures would be developed further on a case by case basis during detailed design, with consideration of finalised areas of disturbance. The final suite of mitigation and management measures would be documented within a construction heritage management plan (as part of the Construction Environmental Management Plan).

Heritage specialists would work with the construction contractor and design team to ensure that appropriate mitigation measures are implemented and impacts to heritage items minimised. Heritage specialists would also assist in identifying opportunities for enhancing the significance of heritage items and archaeological sites.

Mitigation and management measures relevant to non-Aboriginal heritage items are also included in other sections of this environmental impact statement as follows:

- Construction vibration in **Section 7.2** (Noise and vibration).
- Ground settlement in **Section 7.8** (Hydrogeology and soils).
- Dust in **Section 7.3** (Air quality).
- Landscaping in the vicinity of non-Aboriginal heritage items in **Section 7.5** (Urban design, landscape character and visual amenity).
- Revegetation of the temporary construction footprint in the vicinity of non-Aboriginal heritage items in **Section 7.6** (Biodiversity).

Table 7-186 Environmental management measures – non-Aboriginal heritage

Impact	No.	Environmental management measure	Timing
Construction			
General	NAH1	In the event of an unexpected cultural heritage find, the Standard Management Procedure – Unexpected Archaeological Finds (Roads and Maritime, 2012d) would be followed. This would include notification to the NSW Heritage Branch.	Pre-construction and construction
	NAH2	Construction personnel would be made aware of non-Aboriginal heritage sites as part the site induction. These sites would be identified on sensitive area plans and in the CEMP.	Pre-construction and construction

Impact	No.	Environmental management measure	Timing
Removal of heritage listed vegetation	NAH3	<p>Feasible and reasonable options for the relocation of the two mature Canary Island Palms (I762) would be investigated.</p> <p>If the trees cannot be relocated:</p> <ul style="list-style-type: none"> Archival samples would be collected in accordance with NSW Royal Botanic Gardens collection procedures. Options would be investigated to collect seed samples for later propagation. Oral histories (if relevant) would be obtained. 	Detailed design
	NAH4	<p>Feasible and reasonable options to avoid direct impacts to identified heritage listed vegetation along Woonona Ave, Wahrenonga (I769) would be investigated during detailed design.</p> <p>If impacts cannot be avoided:</p> <ul style="list-style-type: none"> The street frontage would be revegetated in consultation with the landowner (Hornsby Shire Council). Plantings that are representative species of the Blue Gum High Forest ecological community would be considered. 	Detailed design
Construction vibration and / or ground settlement	NAH5	<p>Where non-Aboriginal heritage items have been identified as having the potential to be impacted by construction vibration or ground settlement, the following would be implemented:</p> <ul style="list-style-type: none"> A ground settlement assessment would be undertaken during detailed design to confirm predicted impacts on heritage structures. Completion of existing condition surveys prior to the commencement of construction for heritage items within the project corridor or that have been identified during detailed design to be within recommended safe working distances to surface works. A post-construction condition survey would also be undertaken of these items to identify if impacts have occurred. <p>Additional feasible and reasonable mitigation and management measures to be implemented would be identified based on the above assessments. This would include the use of vibration monitoring where recommended maximum levels are predicted to be exceeded. The placement of vibration monitors would consider the heritage fabric of the item.</p>	Pre-construction, construction and post-construction

Impact	No.	Environmental management measure	Timing
Impacts to North Wairoonga heritage conservation area and Beecroft Cheltenham heritage conservation area	NAH6	Landscaping of ancillary infrastructure sites would be undertaken with consideration of the heritage values of the Wairoonga North heritage conservation area and Beecroft Cheltenham heritage conservation area.	Detailed design
Impacts to heritage values due to changes in views (construction)	NAH7	The heritage values of items I771, 1953, 1956, 1957 (including views and vistas from the items) would be considered during the detailed design of built elements of the project and the development of the landscaping plan.	Pre-construction
Removal of heritage listed structures	NAH8	<p>The germination building at the Thornleigh Maltworks (A66) would be conserved. Prior to demolition of other structures:</p> <ul style="list-style-type: none"> • A structural assessment of the germination structure would be conducted to ascertain the possible impact of the demolition of adjacent structures and to identify suitable mitigation methods to ensure the germination structure remains intact. Additional measures would be identified and implemented, if required, to treat the newly exposed surfaces of the germination structure to protect it from the elements as a result of the demolition of adjacent structures. • An archival recording of the industrial site would be undertaken to record the connection of the original structures to the modern upgraded structures. • An archaeological test excavation program would be undertaken to assess the archaeological potential of identifying evidence of the early malting industry in this area, and the relationship of the industrial to the urban site and evidence of the occupation of the Manager's house by the Chilvers family. 	Pre-construction
Operation			
Impacts to heritage values due to changes in views (operation)	OpNAH1	The heritage values of items I771, 1953, 1956, 1957 (including views and vistas from the items) would be considered during the detailed design of built elements of the project and the development of the landscaping plan.	Detailed design / Pre-construction