

Ventilation facilities

Two ventilation facilities would be constructed as part of the project, with one facility situated at either end of the main alignment tunnels near the portals (refer to **Figure 5-13**). The southern ventilation facility would be located to the north-west of the Hills M2 Motorway / Pennant Hills Road interchange, with the northern ventilation facility located on the western side of the M1 Pacific Motorway on the corner of Bareena Avenue and Woonona Avenue, Wahroonga.

The construction methodology for the ventilation facilities would typically involve:

- Excavation to the main alignment tunnels.
- Backfilling or erecting a secondary floor to raise the plant as required to suit maintenance access requirements.
- Erecting precast concrete panels, block walls, steel roof to enclose the building.
- Erecting a facade supporting steel and cladding panels as per architectural design.
- Installing roof panels.
- Internal fit out of plant areas, equipment installation and commissioning.

Switching station

A switching station would be constructed on Coral Tree Drive adjacent to the Hills M2 Motorway (refer to **Figure 5-33**). The construction methodology for the switching station would typically involve:

- Excavation, footing and base slab installation.
- Erection of a precast concrete column to support the roof.
- Enclosure of the building with precast panels.
- Internal fit out electrical infrastructure.

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Figure 5-33 Coral Tree Drive switching station

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5.3.12 Construction ancillary facilities

Eleven construction ancillary facilities would be required as part of the project. This would include locations for road header and surface miner launch and support, earthworks support and workforce amenities.

The construction footprint and construction ancillary facilities are shown in overview in **Figure 5-24** to **Figure 5-32**, and described in detail in the following sections.

Table 5-7 outlines the proposed construction ancillary facilities and their uses during the construction of the project. Details of each of these facilities are provided in the following sections.

Table 5-7 Proposed construction ancillary facilities and activities

No.	Site	Temporary facilities							Permanent facilities				
		Site offices	Staff amenities	Stores and laydown	Workshop and maintenance	Tunnelling launch and support	Spoil management	Water treatment plant	Ventilation outlet	Emergency smoke outlet	Substation	Motorway control centre	Water treatment plant
C1	Windsor Road compound	✓	✓	✓									
C2	Darling Mills Creek compound		✓										
C3	Barclay Road compound		✓	✓									
C4	Yale Close compound		✓										
C5	Southern interchange compound	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓
C6	Wilson Road compound	✓	✓	✓	✓	✓	✓	✓		✓	✓		
C7	Trelawney Street compound	✓	✓	✓	✓	✓	✓	✓		✓	✓		
C8	Pioneer Avenue compound	✓	✓										
C9	Northern interchange compound	✓	✓	✓	✓	✓	✓	✓					
C10	Bareena Avenue compound	✓	✓	✓					✓		✓		
C11	Junction Road compound	✓	✓										

Windsor Road compound (C1)

The Windsor Road compound would be located on the north-western side of the Windsor Road / Hills M2 Motorway interchange. The site was formerly utilised as a compound for recently completed Hills M2 Motorway Upgrade project and currently comprises vacant open space.

Site offices lunch rooms and staff amenities would be located in the eastern area of the site, with car parking located in the northern area of the site and storage in the western area.

An indicative construction site layout for the Windsor Road compound is shown in **Figure 5-34** and the proposed construction activities sequence is outlined in **Table 5-8**.

The site is proposed to be used as the main site office for the Hills M2 Motorway integration works. Site access and egress would be to and from Torr Street.

Table 5-8 Windsor Road compound indicative construction program

Construction activity	Indicative construction timeframe											
	2014			2015			2016			2017		
Site establishment												
Integration works support												
Site rehabilitation / landscaping												

Darling Mills Creek compound (C2)

The Darling Mills Creek compound would be located within the road reserve adjacent to the Darling Mills Creek viaduct. The site would generally consist of basic amenities for the workforce at the Darling Mills Creek viaduct. An indicative construction site layout for the Darling Mills Creek compound is shown in **Figure 5-35** and the proposed construction activities sequence is outlined in **Table 5-9**.

Primary site access would be provided from the Hills M2 Motorway westbound carriageway at the eastern bridge abutment by construction of a new access track. Access would also be provided from Ventura Road however this would be limited to the delivery and removal of drill rigs and excavation equipment.

Table 5-9 Darling Mills Creek compound indicative construction program

Construction activity	Indicative construction timeframe											
	2014			2015			2016			2017		
Site establishment												
Substructure												
Superstructure												
Finishing works												
Site rehabilitation / landscaping												

Barclay Road compound (C3)

The Barclay Road compound would be located on the southern side of the Hills M2 Motorway adjacent to Barclay Road and Perry Road. The site was formerly used as a construction compound for the recently completed Hills M2 Motorway Upgrade project and currently comprises open space, with some native and non-native vegetation.

The site would be used as a support site for the Barclay Road overbridge works and would comprise a laydown area and storage in the western area of the site, staff amenities in the southern area of the site and parking in the northern area of the site. An indicative construction site layout for the Barclay Road compound is shown in **Figure 5-36** and the proposed construction activities sequence is outlined in **Table 5-10**.

Vehicle access and egress would be to and from Perry Street.

Table 5-10 Barclay Road compound indicative construction program

Construction activity	Indicative construction timeframe											
	2014			2015			2016			2017		
Site establishment												
Substructure												
Superstructure												
Finishing works												
Site rehabilitation / landscaping												

Yale Close compound (C4)

The Yale Close compound would be located within the road reserve adjacent to the Yale Close Bridge. The site would generally consist of basic amenities for the workforce at the Yale Close Bridge. An indicative construction site layout for the Yale Close compound is shown in **Figure 5-37** and the proposed construction activities sequence is outlined in **Table 5-11**.

Vehicle access and egress would be to and from the westbound carriageway of the Hills M2 Motorway.

Table 5-11 Yale Close compound indicative construction program

Construction activity	Indicative construction timeframe											
	2014			2015			2016			2017		
Site establishment												
Substructure												
Superstructure												
Finishing works												
Site rehabilitation / landscaping												

Southern interchange compound (C5)

The southern interchange compound would be located to the north of the Hills M2 Motorway and to the west of Pennant Hills Road. The site currently comprises a number of residential properties, most of which are currently owned by Roads and Maritime, and one commercial property.

The construction works at the site would include:

- Excavation of two decline tunnels to the northbound on-ramp and the main northbound alignment tunnel. A shaft may also be excavated to the main northbound alignment tunnel.
- Support for tunnel excavation works, including power supply, ventilation, water supply, water treatment plant and workforce facilities.
- Removal of around 613,900 cubic metres of spoil.
- Construction of permanent operational facilities.

An indicative construction site layout for the southern interchange is shown in **Figure 5-38** and the construction activities sequence is outlined in **Table 5-12**.

Four road headers would be launched from this site and would excavate the tunnels in a northerly direction. Two acoustic sheds would be established in the middle of the site for the purpose of managing out of hours tunnelling and spoil handling. Heavy vehicle movements to and from the site, and on the site outside the acoustic sheds, would occur up to 24 hours per day and seven days per week. Spoil handling outside of the acoustic sheds would be limited to standard daytime construction hours only.

Heavy vehicle movements outside of standard construction hours associated with tunnel spoil removal would only occur via access and egress directly to and from Pennant Hills Road.

Spoil would be moved during the day where practical, and feasible and reasonable management strategies investigated to minimise the volume of heavy vehicle movements at night.

Car parking, site office and staff amenities would be located at the northern end of the site, with a workshop and general laydown area between the two acoustic sheds.

Following tunnel construction the permanent operational facilities would be constructed, including the southern ventilation outlet, the motorway control centre, a substation and the operational water treatment plant.

Heavy vehicle and light vehicle access and egress to and from the site would be from Eaton Road.

At the completion of construction, the areas surrounding the permanent operational facilities would be rehabilitated and landscaped.

Table 5-12 Southern interchange indicative construction program

Construction activity	Indicative construction timeframe											
	2014	2015	2016	2017	2018	2019						
Site establishment												
Southern portals												
Tunnelling												
Tunnel lining												
Pavement												
Tunnel mechanical and electrical fit-out												
Ventilation station												
Motorway control centre construction												
Motorway control centre fit-out												
Site rehabilitation / landscaping												

Wilson Road compound (C6)

The Wilson Road compound would be located on the corner of Wilson Road and Pennant Hills Road. The site is currently occupied by residential properties.

The proposed construction works at the site would include:

- Excavation of a shaft to main alignment tunnels.
- Support for tunnel excavation works, including power supply, ventilation, water supply, water treatment plant and workforce facilities.
- Removal of around 441,950 cubic metres of spoil.
- Construction of permanent operational facilities.

An indicative construction site layout for the Wilson Road compound is shown in **Figure 5-39** and the proposed construction activities sequence is outlined in **Table 5-13**.

Four large road headers and one smaller road header would be launched from this site. Large road headers would excavate the tunnels in both a northerly and southerly direction while the smaller road header would be used for cross passage excavation. An acoustic shed would be established in the middle of the site for the purpose of managing out of hours tunnelling and spoil handling. Heavy vehicle movements to and from the site, and on the site outside the acoustic shed, would occur up to 24 hours per day and seven days per week. Spoil handling outside of the acoustic shed would be limited to standard daytime construction hours only. Heavy vehicle movements outside of standard construction hours associated with tunnel spoil removal would only occur via access and egress directly to and from Pennant Hills Road.

Spoil would be moved during the day where practical, and feasible and reasonable management strategies investigated to minimise the volume of heavy vehicle movements at night.

Car parking, site office and staff amenities would be located at the northern end of the site, with a workshop and general laydown located to the east of the acoustic shed.

Following tunnel construction, the permanent tunnel support facility would be constructed.

Heavy vehicle access and egress to and from the site would be left in and left out from Pennant Hills Road. Light vehicle access and egress would be to and from Wilson Road.

At the completion of construction, the areas surrounding the permanent operational facilities would be rehabilitated and landscaped.

Table 5-13 Wilson Road indicative construction program

Construction activity	Indicative construction timeframe											
	2014	2014	2014	2014	2015	2015	2015	2015	2015	2015	2015	2015
Site establishment												
Shaft excavation												
Tunnelling												
Tunnel lining												
Pavement												
Tunnel mechanical and electrical fit-out												
Tunnel support facility construction												
Site rehabilitation / landscaping												

Trelawney Street compound (C7)

The Trelawney Street compound would be located between Trelawney Street and Loch Maree Avenue on the eastern side of Pennant Hills Road in Thornleigh. The site currently comprises residential properties and several businesses.

The proposed construction works at the site would include:

- Excavation of a shaft to main alignment tunnels.
- Support for tunnel excavation works, including power supply, ventilation, water supply, water treatment plant and workforce facilities.
- Removal of around 492,200 cubic metres of spoil.
- Construction of permanent operational facilities.

An indicative construction site layout for the Trelawney Street compound is shown in **Figure 5-40** and the proposed construction activities sequence is outlined in **Table 5-14**.

Four large road headers and one smaller road header would be launched from this site. Large road headers would excavate the tunnels in both a northerly and southerly direction while the smaller road header would be used for cross passage excavation. An acoustic shed would be established in the northern section of the site for the purpose of managing out of hours tunnelling and spoil handling. Heavy vehicle movements to and from the site, and on the site outside the acoustic shed, would occur up to 24 hours per day and seven days per week. Spoil handling outside of the acoustic shed would be limited to standard daytime construction hours only.

Heavy vehicle movements outside of standard construction hours associated with tunnel spoil removal would only occur via access and egress directly to and from Pennant Hills Road.

Spoil would be moved during the day where practical, and feasible and reasonable management strategies investigated to minimise the volume of heavy vehicle movements at night.

Car parking and office / staff amenities, general storage, laydown areas and a substation would be located at the southern end of the site.

Following tunnel construction, the permanent tunnel support facility would be constructed.

Heavy vehicle access to the site would be from Loch Maree Avenue with egress to Pennant Hills Road. Light vehicle access and egress would be to and from a separate point on Loch Maree Avenue.

At the completion of construction, the areas surrounding the permanent operational facilities would be rehabilitated and landscaped.

Table 5-14 Trelawney Street indicative construction program

Construction activity	Indicative construction timeframe											
	2014	2015	2016	2017	2018	2019						
Site establishment												
Shaft excavation												
Tunnelling												
Tunnel lining												
Pavement												
Tunnel mechanical and electrical fit-out												
Tunnel support facility construction												
Site rehabilitation / landscaping												

Pioneer Avenue compound (C8)

An indicative construction site layout for the Pioneer Avenue compound is shown in **Figure 5-41** and the proposed construction activities sequence is outlined in **Table 5-15**.

Pioneer Avenue compound would be located directly adjacent to the Northern Railway Line on Pioneer Avenue in Thornleigh. The site was previously used as a malt works which is not currently operational. A number of structures exist on the site which would require removal for construction of the compound.

The site would generally consist of:

- Up to 600 light vehicle parking spaces.
- A bus transfer area for up to 12 buses.
- Employee change rooms and showers.
- A first aid station.

The compound would be primarily used as a car parking location for construction personnel. A shuttle bus would be used to transfer workers to and from construction sites throughout the construction footprint. This would limit the amount of workforce parking required within the construction compounds and in the surrounding streets.

The site would be established at the commencement of the construction period and would remain in use until construction works are complete. The employee car parking and shuttle bus would operate up to 24 hour per day and seven days per week.

Access to the site would primarily be from Lymoore Avenue with secondary access from Pioneer Avenue.

Table 5-15 Pioneer Avenue indicative construction program

Construction activity	Indicative construction timeframe											
	2014	2014	2014	2014	2015	2015	2015	2015	2015	2015	2015	2015
Site establishment												
Construction support												
Site rehabilitation / landscaping												

Northern interchange compound (C9)

The northern interchange compound would be located adjacent to the M1 Pacific Motorway / Pennant Hills Road connector and north of Eastbourne Avenue. The area currently comprises vegetated vacant land owned by Roads and Maritime.

The proposed construction works at the site would include:

- Excavation of a shaft to main alignment tunnels.
- Support for tunnel excavation works, including power supply, ventilation, water supply, water treatment plant and workforce facilities.
- Removal of around 743,150 cubic metres of spoil.

An indicative construction site layout for the northern interchange is shown in **Figure 5-42** and the proposed construction activities sequence is outlined in **Table 5-16**.

Four road headers would be launched from this site and excavate the tunnels in both a northerly and southerly direction. An acoustic shed would be established in the northern section of the site for the purpose of managing out of hours tunnelling and spoil handling. Heavy vehicle movements to and from the site, and on the site outside the acoustic shed, would occur up to 24 hours per day and seven days per week. Spoil handling outside of the acoustic shed would be limited to standard daytime construction hours only.

Heavy vehicle movements outside of standard construction hours associated with tunnel spoil removal would only occur via access and egress directly to and from the M1 Pacific Motorway.

Spoil would be moved during the day where practical, and feasible and reasonable management strategies investigated to minimise the volume of heavy vehicle movements at night.

The southern end of the compound would comprise car parking, staff facilities and general laydown areas.

This compound would also be used to support the northern interchange surface construction works including earthworks and road widening for the on and off-ramp portals.

Heavy vehicle access and egress to and from the compound would be from the M1 Pacific Motorway / Pennant Hills Road connector. Light vehicle access and egress would be to and from Eastbourne Avenue via a new access road.

At the completion of construction, the site would be rehabilitated and landscaped.

Table 5-16 Northern interchange indicative construction program

Construction activity	Indicative construction timeframe											
	2014	2014	2014	2014	2015	2015	2015	2015	2015	2016	2016	2016
Site establishment												
Shaft excavation												
Tunnelling												
Tunnel lining												
Pavement												
Tunnel mechanical and electrical fit-out												
Site rehabilitation / landscaping												

Bareena Avenue compound (C10)

The Bareena Avenue compound would be located on the corner of Bareena Avenue and Woonona Avenue North in Wahroonga. The site currently comprises residential properties.

The proposed construction works would include:

- Construction of the ventilation facility building.
- Fit out of tunnel ventilation, mechanical and electrical equipment.

Spoil from the cut-and-cover tunnel construction would also be removed through this site.

An indicative construction site layout for the Bareena Avenue compound is shown in **Figure 5-43** and the proposed construction activities sequence is outlined in **Table 5-17**.

Site offices and car parking would be located in the western portion of the site, with general storage and water collection areas provided in the eastern portion of the site.

Heavy vehicle and light vehicle access and egress to and from the compound would primarily be from the M1 Pacific Motorway however occasional access would be required from Woonona Avenue North, Wahroonga.

At the completion of construction, the areas surrounding the permanent operational facility would be rehabilitated and landscaped.

Table 5-17 Bareena Avenue indicative construction program

Construction activity	Indicative construction timeframe											
	2014	2014	2014	2014	2015	2015	2015	2015	2015	2016	2016	2016
Site establishment												
Ventilation outlet construction												
Site rehabilitation / landscaping												

Junction Road compound (C11)

The Junction Road compound would be located on the eastern side of the M1 Pacific Motorway, north of Junction Road. The site currently comprises vegetated vacant land, part of which is located within the existing road reserve of the M1 Pacific Motorway.

An indicative construction site layout for the Junction Road compound is shown in **Figure 5-44** and the proposed construction activities sequence is outlined in **Table 5-18**.

The site is proposed to be used as a parking and site office facility only, with office facilities located at the southern end of the site and car parking facilities at the northern end.

Light vehicle access and egress would be to and from Coonanbarra Road and Carrington Road. With the exception of site establishment and delivery vehicles, heavy vehicle movements are not proposed at this site. The access road from Coonanbarra Road would require a temporary crossing of Cockle Creek.

At the completion of construction, the site would be rehabilitated and landscaped.

Table 5-18 Junction Road indicative construction program

Construction activity	Indicative construction timeframe											
	2014			2015			2016			2017		
Site establishment												
Construction support												
Site rehabilitation / landscaping												



Figure 5-34 Indicative Windsor Road construction compound

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Figure 5-35 Indicative Darling Mills Creek viaduct construction compound

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Figure 5-36 Indicative Barclay Road construction compound

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Figure 5-37 Indicative Yale Close construction compound

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Figure 5-38 Indicative southern interchange construction compound

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Figure 5-39 Indicative Wilson Road construction compound

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Figure 5-40 Indicative Trelawney Street construction compound

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Figure 5-41 Indicative Pioneer Avenue construction compound

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Figure 5-42 Indicative northern interchange construction compound

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Figure 5-43 Indicative Bareena Avenue construction compound

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Figure 5-44 Indicative Junction Road construction compound

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5.3.13 Demolition

The project has been designed with the aim of minimising the need for land acquisition and property demolition as far as practical. However, the project would require the demolition of a number of properties located within the construction footprint with the majority of these being residential properties. Indicatively, the project would involve the demolition of:

- Forty-seven residential properties.
- Three commercial properties.
- Various industrial buildings and structures at the Pioneer Avenue compound (C8) including a storage shed, steel silos, a kiln structure and a residential house.

The Hills M2 Motorway integration works and the M1 Pacific Motorway tie-in would also require the demolition of some existing road infrastructure including bridge elements, road pavement and retaining walls.

Generally, demolition works would be undertaken early in the construction program to ensure site readiness and to allow main construction activities to commence.

5.3.14 Traffic management and access

The construction of the project would be subject to careful traffic management to ensure the ongoing functionality of surrounding roads, and the safety of members of the public, motorists and construction personnel.

Generally, temporary road pavements would be constructed early in the construction program to remove live traffic from the construction work zones. However, a number of phases of traffic management and traffic switches would be required around the two interchanges to facilitate construction of the on and off-ramps as well as the Hills M2 Motorway integration works and the M1 Pacific Motorway tie-in.

The project would also necessitate the temporary alteration of cyclist and pedestrian facilities, although alternative access arrangements would be implemented around construction sites, compounds and access points. As the project would occupy the breakdown lanes of both the Hills M2 Motorway and the M1 Pacific Motorway during the construction period, it would be necessary to exclude cyclists from these stretches of road for safety reasons. Appropriate detour routes would be established, utilising existing cycle routes and paths wherever possible.

The proposed access and egress points to and from the construction ancillary facilities are described in **Section 5.3.2**.

Daily worst case light vehicle and heavy vehicle numbers associated with spoil and waste removal, material deliveries and arrival and departure of construction workers are summarised in **Table 5-19**. Wherever possible, access and egress routes are proposed to be from major arterial roads.

Table 5-19 Construction traffic management and access

Site	Proposed access route	Daily heavy vehicle	Daily light vehicle
Windsor Road compound (C1)	Torr Street	20	85
Darling Mills compound (C2)	Hills M2 Motorway eastbound carriageway and Ventura Street.	50	20
Barclay Road compound (C3)	Perry Street	50	52
Yale Close compound (C4)	Hills M2 Motorway westbound carriageway.	50	20
Southern interchange (C5)	Eaton Road (left in, right out)	740	165
Wilson Road compound (C6)	Pennant Hills Road (left in, left out; heavy vehicles only) Wilson Road (light vehicles only)	600	100
Trelawney Street compound (C7)	Loch Maree Avenue (left in; heavy vehicles only) Pennant Hills Road (left out; heavy vehicles only) Loch Maree Avenue (separate light vehicle only access)	570	100
Pioneer Avenue compound (C8)	Lymore Avenue Pioneer Avenue (secondary)	12	650
Northern interchange (C9)	M1 Pacific Motorway / Pennant Hills Road connector (left in, left out; heavy vehicles only) Eastbourne Avenue (light vehicles only)	720	100
Bareena Avenue compound (C10)	M1 Pacific Motorway (left in, left out) Woonona Avenue North	20	25
Junction Road compound (C11)	Coonanbarra Road	1	100

5.3.15 Construction workforce and construction work hours

Construction workforce

Around 1,250 jobs are expected to be directly created during the peak construction period of the project. This would include both the staff and labour workforce. Further jobs in the local area are likely to be indirectly supported by the project.

Construction work hours

The proposed construction hours for surface, tunnelling and traffic management at each of the construction sites are summarised in **Table 5-20**.

The majority of above ground construction works would be undertaken between the following hours:

- 7 am to 6 pm Monday to Friday.
- 8 am to 1 pm Saturdays.
- No works on Sundays or Public Holidays.

As tunnelling works operate continuously, below ground tunnelling and the associated surface support activities would be undertaken up to 24 hours per day and seven days per week. This would include heavy vehicle movements to and from the tunnelling support compounds, and on these sites outside the acoustic sheds, up to 24 hours per day and seven days per week.

Heavy vehicle movements outside of standard construction hours associated with tunnel support works (spoil removal, concrete delivery and other truck movements) would only occur via access and egress directly to and from Pennant Hills Road or the M1 Pacific Motorway and would only occur at the following compounds:

- Southern interchange compound (C5).
- Wilson Road compound (C6).
- Trelawney Street compound (C7).
- Northern interchange compound (C9).

Spoil would be moved during the day where practical, and feasible and reasonable management strategies investigated in consultation with the NSW Environment Protection Authority to minimise the volume of heavy vehicle movements at night.

Substantial works would need to be undertaken outside of these hours to reduce inconvenience to road users and ensure the safety of construction workers and the public. This would include activities such as:

- Widening and lengthening of existing bridges.
- Road tie-in works.
- Traffic management, set-up and traffic switches.
- Utility relocations (where the relocation is in proximity to traffic).
- Erection of traffic signs (where erection is in proximity to traffic).
- Pavement and temporary median works.
- Asphalt works and line-marking.
- Use of construction compounds to support out of hours works.

Table 5-20 Proposed construction hours

Activity	Construction hours	Comments or exceptions
Underground construction activities		
Tunnelling works	24 hours per day, seven days per week.	<ul style="list-style-type: none"> Activities that support tunnelling works would occur 24 hours per day, seven days per week. Rock hammering and blasting in the tunnel would be avoided between 10 pm and 7 am where it may impact nearby receivers.
Surface construction activities		
Construction sites	Daytime construction hours: <ul style="list-style-type: none"> 7 am to 6 pm on weekdays. 8 am to 1 pm on Saturdays. No works on Sundays or public holidays. 	Where noise management measures have been established, the following activities would be undertaken 24 hours per day, up to seven days per week: <ul style="list-style-type: none"> Surface works supporting underground construction. Construction traffic movements for tunnel support. Excavation and spoil removal from construction shafts at the surface, conducted over two shifts per day. Temporary possession of roads may need to be undertaken outside standard construction hours to avoid elevated safety impacts and inconvenience to commuters.
Construction traffic	24 hours per day, up to seven days per week.	<ul style="list-style-type: none"> Construction traffic would be limited and managed during peak hours and special events. Construction vehicle movements would be limited and managed during evening and night-time in residential areas or close to identified sensitive receivers. Heavy vehicle movements outside of standard construction hours associated with tunnel support works (spoil removal, concrete delivery and other heavy vehicle movements) would only occur via access and egress directly to and from Pennant Hills Road or the M1 Pacific Motorway and would only occur at the following compounds: <ul style="list-style-type: none"> Southern interchange compound (C5). Wilson Road compound (C6). Trelawney Street compound (C7). Northern interchange compound (C9). <p>Spoil would be moved during the day where practical, and feasible and reasonable management strategies investigated in consultation with the NSW Environment Protection Authority to minimise the volume of heavy vehicle movements at night.</p>

Other works which would be undertaken outside of standard daytime construction hours without any further approval would include any of the following circumstances:

- Works which are determined to comply with the relevant Noise Management Level at the nearest sensitive receiver.
- The delivery of materials as required by the Police or other authorities for safety reasons.
- Where it is required to avoid the loss of lives, property and / or to prevent environmental harm in an emergency.
- Where agreement is reached with affected receivers.

Out of hours work may also be undertaken where explicitly approved through an environment protection licence.

5.3.16 Plant and equipment

The equipment listed in **Table 5-21** are likely to be used during the construction the project.

Table 5-21 Indicative construction plant and equipment

Plant / equipment	Hills M2 Motorway integration	Southern interchange compound (C5)	Wilson Road compound (C6)	Trelawney Street compound (C7)	Northern interchange compound (C9)	Bareena Avenue compound (C10)
Surface						
100 tonne / 10 tonne gantry crane			✓	✓	✓	
160 kilowatt fan		✓(4)	✓(4)	✓(4)	✓(4)	
20 tonne excavator		✓	✓	✓		✓
24 tonne excavator		✓(2)	✓	✓	✓	
30 tonne excavator	✓(6)	✓	✓	✓		✓
Backhoe	✓(6)	✓	✓	✓		
Bobcat		✓	✓	✓		
80 tonne piling rig	✓(3)	✓	✓	✓		✓
Dozer	✓(6)					✓
Dump truck						✓(4)
25 tonne mobile crane		✓	✓	✓		✓
50 tonne mobile crane	✓(6)	✓	✓	✓		✓
100 tonne mobile crane		✓	✓	✓		✓
Hiab truck		✓	✓	✓		✓
10 tonne smooth drum vibrating roller	✓(6)	✓	✓	✓		✓
Compactor						✓
Grader	✓(6)					
Concrete saw / cutter	✓(4)					
Rock saw	✓(4)					
Hydraulic hammer / rock breaker	✓(6)					
Jackhammer	✓(6)					
Rock crusher	✓(6)					

Plant / equipment	Hills M2 Motorway integration	Southern interchange compound (C5)	Wilson Road compound (C6)	Trelawney Street compound (C7)	Northern interchange compound (C9)	Bareena Avenue compound (C10)
Asphalt laying machine	✓(2)					
Truck	✓(10)					
Line marking machine	✓(2)					
Paving machine	✓(2)					
30 tonne gantry crane			✓	✓	✓	
60 kilowatt fan		✓				
Air compressor		✓(2)	✓(2)	✓(2)	✓(2)	
Bucket loader		✓(2)	✓	✓	✓	✓
100 tonne crawler crane		✓(2)	✓	✓	✓	
Grout plant / paddle mixer		✓(2)	✓	✓	✓	
Jumbo drill (shaft)		✓(2)	✓	✓	✓	
Road sweeper truck		✓	✓	✓	✓	✓
Skid steer loader		✓	✓	✓	✓	✓
Submersible pump		✓(8)	✓(6)	✓(6)	✓(6)	✓
Sump pump		✓(3)	✓(2)	✓(2)	✓(2)	✓(3)
Water cart	✓(2)	✓	✓	✓	✓	✓
Water treatment plant		✓	✓	✓	✓	
100 kilovolt ampere generator	✓(4)	✓	✓	✓		✓
Underground						
12 tonne mini excavator with hammer		✓	✓	✓	✓	
24 tonne excavator		✓	✓	✓	✓	
24 tonne excavator with diamond cutting tool		✓(2)	✓	✓	✓	
Booster pumps		✓	✓	✓	✓	
Bucket loader		✓(3)	✓(3)	✓(3)	✓(3)	
Colloidal grout mixer		✓	✓	✓	✓	
Concrete agitator		✓(4)	✓(4)	✓(4)	✓(4)	
Deduster (dry type) and fan		✓(4)	✓(5)	✓(5)	✓(5)	
25 tonne articulated dump truck		✓(7)	✓(6)	✓(6)	✓(6)	
Gate end box		✓(4)	✓(4)	✓(4)	✓(4)	
200 kilowatt roadheader (for cross passages)			✓	✓	✓	
300 kilowatt roadheader		✓(4)	✓(4)	✓(4)	✓(4)	
Rockbolting rig		✓(3)	✓(3)	✓(3)	✓(3)	
Shotcrete robot		✓(3)	✓(3)	✓(3)	✓(3)	
Skid steer loader			✓	✓	✓	
Water cart					✓	

5.3.17 Construction materials

Construction would require various materials and pre-cast elements. The major construction materials required would include:

- General fill and select fill for earthworks. This would be sourced from within the project cutting and from tunnel spoil where the material is of suitable quality.
- Pavement materials, including road base and sub-base.
- Materials for lining drainage channels.
- Aggregate used for concrete and asphalt.
- Cement and concrete.
- Steel for reinforcement.
- Wood for use in formwork and other temporary structures.
- Water.
- Pre-cast concrete including pipes, culvert segments, and roadside barriers.
- Mechanical and electrical equipment for tunnel fit out.

Construction material would generally be sourced from off-site suppliers. This would include the balance of fill material to address shortfalls in required volumes in the event that material sourced from on-site is unsuitable. Wherever possible, local sources of construction materials would be preferred in order to minimise haulage distances.

5.3.18 Spoil and waste disposal

Based on the concept design, the project would generate around 2.6 million cubic metres of spoil. The anticipated volume from each site is shown in **Table 5-22**.

Table 5-22 Anticipated spoil generation

Site	Spoil volume (cubic metres)
Southern interchange compound (C5)	613,900
Wilson Road compound (C6)	441,950
Trelawney Street compound (C7)	492,200
Northern interchange compound (C9)	743,150
Northern portals	281,200
Hills M2 Motorway integration works	39,800
Total	2,612,200

Other waste streams which would be generated during construction of the project include:

- Demolition waste from existing structures and properties.
- Contaminated soil which may be encountered during construction.
- General construction waste such as concrete, steel and timber formwork off-cuts.
- Vegetation waste from clearing and grubbing.
- Plant and vehicle maintenance waste such as oils and lubricants.
- General office waste such as paper, cardboard, plastics and food waste.
- Sewage waste.

Disposal sites

A number of potential sites have been identified with the necessary capacity to receive the spoil generated by the project. These include:

- The ADI site, St Marys with a capacity for between two and 2.5 million cubic metres.
- Gosford Quarry with a capacity of around 2.5 million cubic metres.
- Hornsby Quarry with a capacity of around 3.3 million cubic metres.
- The CSR Quarry with a capacity of around 1.16 million cubic metres.
- The Defence precinct Schofields (HMAS Nirimba) with a capacity of 500,000 cubic metres.
- The Great Southern Rock Quarry Sandy Point with an anticipated capacity of around five million cubic metres.

Other disposal / re-use sites may be used depending on need at the time spoil is generated. Further details regarding spoil generation and management are provided in **Section 7.1** (Traffic and transport) and **Section 8.3** (Resource management and waste minimisation).

5.3.19 Resource consumption

Indicative quantities of the major sources of materials required for construction are detailed in **Table 5-23**.

Table 5-23 Indicative resource requirements

Material	Estimated quantity required
Plain shotcrete	41,000 cubic metres
Steel fibre reinforced shotcrete – concrete	221,000 cubic metres
Steel fibre reinforced shotcrete – steel	8,200 tonne
Polypropylene reinforced shotcrete – polypropylene	136 tonne
No-Fines – concrete	64,000 cubic metres
Base paving – concrete	66,400 cubic metres
New jersey kerbs – concrete	26,000 cubic metres
Piles – concrete	59,000 cubic metres
Retaining walls – concrete	54,000 cubic metres
Bridges – concrete	1,300 cubic metres
Noise walls -	1,400 cubic metres
Rock bolts	5,000 tonne
Reinforcing steel	5,280 tonne
Asphalt	25,000 tonne
Crushed aggregate	21,500 tonne
Conduit – PVC	810,000 metres
Copper cables	1,880 tonne
Concrete drainage pipes	18,000 metres
Power	80 million kilowatt hours
Water	3,000 mega litres

Construction power

Power supply would be required during the construction works, at the majority of construction ancillary facilities. In particular, high voltage power would be required at the tunnel support sites. Prior to the connection of mains power supply to the tunnel support sites, road headers would be powered by diesel generators. The power supply for each site would be sourced from outside the project area. **Table 5-24** summarises the power supply for construction ancillary facilities including supply source, likely supply route and power demand. The construction power supply routes shown below are for information purposes only and do not form part of this assessment. Further assessment would be required in consultation with the relevant power supply authority.

Table 5-24 Construction power supply

Construction site	Supply source substation	Distance to worksite (kilometres)	Supply route	Connected load (mega volt ampere)
Southern interchange compound (C5)	Pennant Hills Zone Substation	5	Victoria Road into Loftus Road then Pennant Hills Road to the southern interchange site	7
Wilson Road compound (C6)	Pennant Hills Zone Substation	0.5	Victoria Road into Loftus Road then to Killaloe Avenue and along Wilson Road to the site	5
Trelawney Street compound (C7)	Pennant Hills Zone Substation	4	Victoria Road across Loftus Road to Boundary Road then into Belamy Street. Up Stevens Street to Yarrara Road which becomes the Esplanade to Duffy Road. Along Duffy Road to Pennant Hills Road then to Loch Maree Avenue and into the site.	5
Northern interchange compound (C9)	Hornsby Zone Substation	4.5	Bridge Road to Sherbrook Road, Edgeworth David Avenue to the M1 Pacific Motorway corridor. Along the motorway corridor to the construction site	5

Note: These routes are indicative only and subject to change during detailed design and consultation with relevant power authorities.

Construction water

Tunnelling works would require significant volumes of water for excavation and would generate wastewater requiring treatment and disposal. Further details are provided in **Section 7.9** (Surface water).

Construction water supply would also be required for the following construction activities:

- Interchange construction and road widening activities, including earthworks, concreting and dust suppression for surface works.
- Building construction activities.

Estimated volumes of water required for construction are provided in **Table 5-25**.

Table 5-25 Indicative construction water supply

Source		Southern interchange compound (C5)	Wilson Road compound (C6)	Trelawney Street compound (C7)	Northern interchange compound (C9)	Road works	Total
Total potable water supply (mega litres)	Sydney Water mains	635	485	450	600	80	2,250
Total non-potable water supply (mega litres)	Collected rainwater	35	10	10	15	-	70
	Treated groundwater	190	160	150	235	-	735
Total		860	655	610	850	80	3,055