8.2 Hazards and risk

Environmental hazards resulting from the construction and operation of the project, and the identification of measures to avoid, mitigate or manage these risks, are addressed throughout **Chapter 7** and **Chapter 8** of this environmental impact statement.

Hazards arising from incidents during project construction and operation could pose a risk to the surrounding community, as well as that of the environment. Such potential risks and appropriate management measures are discussed below.

8.2.1 Assessment of potential impacts

Construction

During construction, the following hazards and risks may be associated with the project:

- Potential hazards resulting from accidental releases or improper handling and storage of dangerous goods and hazardous substances within construction sites.
- Potential hazards resulting from releases of hazardous substances from vehicles transporting dangerous goods and hazardous substances to and from the construction sites in the event of an accident.
- Workplace and public health and safety hazards, such as dangers to construction workers, road users and the general public.
- Potential rupture or interference with underground services.
- Potential risks from bushfires.

Storage and handling of dangerous goods and hazardous substances

The types of dangerous goods and hazardous substances that would be stored and used within the construction sites are outlined **Table 8-18** (construction sites are detailed in **Chapter 5** Project description). Minor quantities of other materials (less that 1,000 litres or 1,000 kilograms) may also potentially be used at the construction sites from time to time. Types and quantities of dangerous goods and hazardous substances stored and / or used within the project would be typical of tunnel construction projects of this scale.

While *State Environmental Planning Policy No. 33 – Hazardous and Offensive Development* (SEPP 33) does not apply to the project (refer to **Chapter 2** Assessment process), the principles of SEPP 33 have nonetheless been followed to consider potential hazards associated with the project. The screening thresholds specified in Hazardous and Offensive Development Application Guidelines: Applying SEPP 33 (Department of Planning, 2011) have been applied to inventories of dangerous goods to be stored at each construction site. These screening thresholds represent the level at which dangerous goods may present a credible off-site consequence requiring further, more detailed assessment of risks. Application of the screening thresholds is included in **Table 8-18.**

The storage, handling and use of dangerous goods and hazardous substances would be undertaken in accordance with the *Work Health and Safety Act 2011* (WHS Act), the Storage and Handling of Dangerous Goods Code of Practice (WorkCover NSW, 2005) and relevant Australian Standards.

Table 8-18 Indicative dangerous goods and hazardous substances stored on-site during the construction period

Material	Australian Dangerous Goods Code class	Storage method	Construction site[1]						Assessment against Applying SEPP 33 inventory thresholds
			Southern interchange compound (C5)	Wilson Road compound (C6)	Trelawney Street compound (C7)	Northern interchange compound (C9)	Bareena Avenue compound (C10)	Junction Road compound (C11)	
Diesel	C1, PG III	Self bunded fuel tank	15,000L	15,000L	15,000L	15,000L	1,000L	3,000L	Diesel would not be stored with Class 3 materials and would therefore not be subject to the Applying SEPP 33 thresholds.
Lubricating and hydraulic oils and grease	C2	200L drums	3,000L	3,000L	3,000L	3,000L	1,000L	3,000L	Lubricating and hydraulic oils and grease would not be stored with Class 3 materials and would therefore not be subject to the Applying SEPP 33 thresholds.
Industrial grade oxygen	2.2	8.9m^3 cylinders	178m^3	178m^3	178m^3	178m^3	17.8m^3	178m^3	Industrial grade oxygen is a class 2.2 dangerous good and is therefore not subject to the Applying SEPP 33 thresholds.
Industrial grade acetylene	2.1	3.2m^3 cylinders (13 kg)	64m^3 (250kg)	64m^3 (250kg)	64m^3 (250kg)	64m^3 (250kg)	6.4m^3 (25kg)	64m^3 (250kg)	Individual cylinders containing acetylene would not trigger the Applying SEPP 33 thresholds (100kg). Maximum stored inventories (250 kilograms) would also be located more than 25 metres away from the nearest construction site boundary and would therefore also not trigger the Applying SEPP 33 thresholds if considered in aggregate.

Material	Australian Dangerous Goods Code class	Storage method	Construction site[1]						Assessment against Applying SEPP 33 inventory thresholds
			Southern interchange compound (C5)	Wilson Road compound (C6)	Trelawney Street compound (C7)	Northern interchange compound (C9)	Bareena Avenue compound (C10)	Junction Road compound (C11)	
Accelerator for shotcrete	3.2	1,000L intermediate bulk containers (IBC)	20,000L	20,000L	20,000L	20,000L	1,000L	N/A	Individual IBCs containing accelerator fluid would not trigger the Applying SEPP 33 thresholds (five tonnes). Maximum stored inventories (20,000litres) would also be located more than eight metres away from the nearest construction site boundary and would therefore also not trigger the Applying SEPP 33 thresholds if considered in aggregate.
General purpose Portland cement	N/A	20kg bags	1,000kg	5,000kg	5,000kg	5,000kg	1,000kg	1,000kg	General purpose Portland cement is not a dangerous good and therefore does not trigger the Applying SEPP 33 thresholds.
Road and joint sealants	N/A	12L boxes	240L	N/A	N/A	N/A	N/A	240L	Road and joint sealants are not dangerous goods and therefore do not trigger the Applying SEPP 33 thresholds.
Concrete curing compounds	N/A	1,000L IBC	6,000L	N/A	N/A	N/A	N/A	6,000L	Concrete curing compounds are not dangerous goods and therefore do not trigger the Applying SEPP 33 thresholds.
Pavement layers curing compound	N/A	1,000L IBC	3,000L	N/A	N/A	N/A	N/A	3,000L	Pavement layers curing compound is not a dangerous good and therefore does not trigger the Applying SEPP 33 thresholds.

Material	Australian Dangerous Goods Code class	Storage method	Construction site[1]						Assessment against Applying SEPP 33 inventory thresholds
			Southern interchange compound (C5)	Wilson Road compound (C6)	Trelawney Street compound (C7)	Northern interchange compound (C9)	Bareena Avenue compound (C10)	Junction Road compound (C11)	
Paint for tunnel roof	N/A	1,000L IBC	8,000L	N/A	N/A	N/A	N/A	8,000L	Paint for the tunnel roof is not a dangerous good and therefore does not trigger the Applying SEPP 33 thresholds.
Paints	N/A	50L drums	200L	N/A	N/A	N/A	N/A	200L	Paints are not dangerous goods and therefore do not trigger the Applying SEPP 33 thresholds.
Retardants for concrete	3 PGIII	205L drums	410L	N/A	N/A	N/A	N/A	410L	Retardants for concrete would not trigger the Applying SEPP 33 thresholds if considered as individual containers or in aggregate.
Epoxies	3 PGIII	20L drums	200L	N/A	N/A	N/A	N/A	200L	Epoxies would not trigger the Applying SEPP 33 thresholds (five tonnes) if considered as individual containers or in aggregate.
Coagulants	N/A	1,000L IBC	2,000L	2,000L	2,000L	2,000L	N/A	N/A	Coagulants are not dangerous goods and therefore do not trigger the Applying SEPP 33 thresholds.
Acids	8 PGII	1,000L IBC	2,000L	2,000L	2,000L	2,000L	N/A	N/A	Acids would not trigger the Applying SEPP 33 thresholds (25 tonnes) if considered as individual containers or in aggregate.
Bases	8 PGII	1,000L IBC	2,000L	2,000L	2,000L	2,000L	N/A	N/A	Bases would not trigger the Applying SEPP 33 thresholds (25 tonnes) if considered as individual containers or

Material	Australian Dangerous Goods Code class	Storage method	Construction site[1]						Assessment against Applying SEPP 33 inventory thresholds
			Southern interchange compound (C5)	Wilson Road compound (C6)	Trelawney Street compound (C7)	Northern interchange compound (C9)	Bareena Avenue compound (C10)	Junction Road compound (C11)	
									in aggregate.
Disinfectant	8 PGIII	500L IBC	1,000L	1,000L	1,000L	1,000L	N/A	N/A	Disinfectant would not trigger the Applying SEPP 33 thresholds (50 tonnes) if considered as individual containers or in aggregate.
Anti-scalent	N/A	100L drums	200L	200L	200L	200L	N/A	N/A	Anti-scalent is not a dangerous good and therefore does not trigger the Applying SEPP 33 thresholds.
Membrane preservative	8	10L drums	20L	20L	20L	20L	N/A	N/A	Membrane preservative would not trigger the Applying SEPP 33 thresholds (50 tonnes) if considered as individual drums or in aggregate.

[1] Quantities are indicative only.

The assessment of inventories of dangerous goods to be located at each construction site presented in **Table 8-18** demonstrates that the Applying SEPP 33 inventory thresholds would not be exceed for any material on any site. The storage and use of dangerous goods and hazardous materials on the project construction sites would therefore not pose an elevated risk of harm beyond the construction site boundary.

A register and inventory of the dangerous goods and hazardous substances to be stored on-site would be kept as part of the Pollution Incident Response Management Plan and Material Safety Data Sheets for each would need to be obtained prior to their arrival.

Storage would occur in accordance with supplier's instructions and may include bulk storage tanks, chemical storage cabinets / containers or impervious bunds. Impervious bunds would be of sufficient capacity to contain at least 110 per cent of the volume of the largest stored container. Storage areas would be located away from natural or built drainage lines to minimise the likelihood of pollutants entering any adjacent watercourses in the unlikely event of a spill or leak escaping the bunded area.

Implementation of environment management measures regarding the storage and handling of these dangerous goods and hazardous substances, as detailed in **Table 8-22**, would reduce the risk to the environment, construction personnel and the public.

Transport of dangerous goods and hazardous substances

Dangerous goods and hazardous materials that would be transported to each construction are outlined in **Table 8-19**. Potential transportation hazards and risks have been considered through comparison of the type, quantity and frequency of dangerous goods and hazardous materials transportation with the thresholds presented in the Applying SEPP 33 guideline. In all cases, the transportation of dangerous goods and hazardous materials to project construction sites would be well below the Applying SEPP 33 thresholds. This indicates that risks associated with transport of dangerous goods and hazardous materials are unlikely to be significant.

Table 8-19 Dangerous goods and hazardous substances transported to construction sites

Material	Australian Dangerous Goods Code class	Transport frequency	Transport quantity[1]	Construction site destination	Assessment against Applying SEPP 33 transport thresholds
Diesel	C1, PG III	Weekly	15,000L in bulk	• Southern interchange compound (C5) • Wilson Road compound (C6) • Trelawney Street compound (C7) • Northern interchange compound (C9)	Diesel is not a dangerous good and would not be transported with Class 3 dangerous goods. It is therefore not subject to the Applying SEPP 33 transportation thresholds.
			3,000L in bulk	• Junction Road compound (C11)	
			1,000L in bulk	• Bareena Avenue compound (C10)	
Lubricating and hydraulic oils and grease	C2	Weekly	3,000L in 200L drums	• Southern interchange compound (C5) • Wilson Road compound (C6) • Trelawney Street compound (C7) • Northern interchange compound (C9) • Junction Road compound(C11)	Lubricating and hydraulic oils and grease are not dangerous goods and would not be transported with Class 3 dangerous goods. They would therefore not be subject to the Applying SEPP 33 transportation thresholds.
			1,000L in 200L drums	• Bareena Avenue compound (C10)	

Material	Australian Dangerous Goods Code class	Transport frequency	Transport quantity[1]	Construction site destination	Assessment against Applying SEPP 33 transport thresholds
Industrial grade oxygen	2.2	Weekly	178m^3 in 8.9m^3 cylinders	• Southern interchange compound (C5) • Wilson Road compound (C6) • Trelawney Street compound (C7) • Northern interchange compound (C9) • Junction Road compound (C11)	Industrial grade oxygen is not subject to the Applying SEPP 33 transportation thresholds.
			17.8m^3 in 8.9m^3 cylinders	• Bareena Avenue compound (C10)	
Industrial grade acetylene	2.1	Weekly	64m^3 in 3.2m^3 cylinders	• Southern interchange compound (C5) • Wilson Road compound (C6) • Trelawney Street compound (C7) • Northern interchange compound (C9) • Junction Road compound (C11)	Industrial grade acetylene would not trigger the Applying SEPP 33 transportation thresholds for minimum transport load or transport frequency (two tonnes, more than 30 times per week).
			6.4m^3 in 3.2m^3 cylinders	• Bareena Avenue compound (C10)	

Material	Australian Dangerous Goods Code class	Transport frequency	Transport quantity[1]	Construction site destination	Assessment against Applying SEPP 33 transport thresholds
Accelerator for shotcrete	3.2	Weekly	20,000L in 1,000L IBCs	• Southern interchange compound (C5) • Wilson Road compound (C6) • Trelawney Street compound (C7) • Northern interchange compound (C9) • Junction Road compound (C11)	Accelerator for shotcrete would not trigger the Applying SEPP 33 transportation thresholds for minimum transport load or transport frequency (three tonnes, more than 45 times per week).
			1,000L in a single IBC	• Bareena Avenue compound (C10)	
General purpose Portland cement	N/A	Weekly	2,000kg in 20kg bags	• Wilson Road compound (C6) • Trelawney Street compound (C7) • Northern interchange compound (C9)	General purpose Portland cement is not subject to the Applying SEPP 33 transportation thresholds.
			1,000kg in 20kg bags	• Bareena Avenue compound (C10)	
			500kg in 20kg bags	• Southern interchange compound (C5) • Junction Road compound (C11)	
Road and joint sealants	N/A	Monthly	240L in 12L boxes	• Southern interchange compound (C5) • Junction Road compound (C11)	Road and joint sealants are not subject to the Applying SEPP 33 transportation thresholds.

Material	Australian Dangerous Goods Code class	Transport frequency	Transport quantity[1]	Construction site destination	Assessment against Applying SEPP 33 transport thresholds
Concrete curing compounds	N/A	Fortnightly	3,000L in 1,000L IBCs	• Southern interchange compound (C5) • Junction Road compound (C11)	Concrete curing compounds are not subject to the Applying SEPP 33 transportation thresholds.
Pavement layers curing compound	N/A	Monthly	3,000L in 1,000L IBCs	• Southern interchange compound (C5) • Junction Road compound (C11)	Pavement layers curing compound is not subject to the Applying SEPP 33 transportation thresholds.
Paint for tunnel roof	N/A	Weekly	4,000L in 1,000L IBCs	• Southern interchange compound (C5) • Junction Road compound (C11)	Paint for the tunnel roof is not subject to the Applying SEPP 33 transportation thresholds.
Paints	N/A	Monthly	50L in a single drum	• Southern interchange compound (C5) • Junction Road compound (C11)	Paints are not subject to the Applying SEPP 33 transportation thresholds.
Retardants for concrete	3 PGIII	Every two months	205L in a single drum	• Southern interchange compound (C5) • Junction Road compound (C11)	Retardants for concrete would not trigger the Applying SEPP 33 transportation thresholds for minimum transport load or transport frequency.
Epoxies	3 PGIII	Monthly	40L in 20L drums	• Southern interchange compound (C5) • Junction Road compound (C11)	Epoxies would not trigger the Applying SEPP 33 transportation thresholds for minimum transport load or transport frequency (ten tonnes, more than 60 times per week).

Material	Australian Dangerous Goods Code class	Transport frequency	Transport quantity[1]	Construction site destination	Assessment against Applying SEPP 33 transport thresholds
Coagulants	N/A	Weekly	1,000L in a single IBC	• Southern interchange compound (C5) • Wilson Road compound (C6) • Trelawney Street compound (C7) • Northern interchange compound (C9)	Coagulants are not subject to the Applying SEPP 33 transportation thresholds.
Acids	8 PGII	Every two months	1,000L in a single IBC	• Southern interchange compound (C5) • Wilson Road compound (C6) • Trelawney Street compound (C7) • Northern interchange compound (C9)	Acids would not trigger the Applying SEPP 33 transportation thresholds for minimum transport load or transport frequency (two tonnes, more than 30 times per week).
Bases	8 PGII	Every two months	1,000L in a single IBC	• Southern interchange compound (C5) • Wilson Road compound (C6) • Trelawney Street compound (C7) • Northern interchange compound (C9)	Bases would not trigger the Applying SEPP 33 transportation thresholds for minimum transport load or transport frequency (two tonnes, more than 30 times per week).

Material	Australian Dangerous Goods Code class	Transport frequency	Transport quantity[1]	Construction site destination	Assessment against Applying SEPP 33 transport thresholds
Disinfectant	8 PGIII	Monthly	500L in a single IBC	• Southern interchange compound (C5) • Wilson Road compound (C6) • Trelawney Street compound(C7) • Northern interchange compound (C9)	Disinfectant would not trigger the Applying SEPP 33 transportation thresholds for minimum transport load or transport frequency (two tonnes, more than 30 times per week).
Anti-scalent	N/A	Monthly	100L in a single drum	• Southern interchange compound (C5) • Wilson Road compound (C6) • Trelawney Street compound(C7) • Northern interchange compound (C9)	Anti-scalent is not subject to the Applying SEPP 33 transportation thresholds.
Membrane preservative	8	Monthly	10L in a single drum	• Southern interchange compound (C5) • Wilson Road compound (C6) • Trelawney Street compound (C7) • Northern interchange compound (C9)	Membrane preservative would not trigger the Applying SEPP 33 transportation thresholds for minimum transport load or transport frequency (two tonnes, more than 30 times per week).

[1] Quantities are indicative only.

Construction workplace hazards

Tunnelling works present a number of specific hazards to construction workers, members of the public and equipment, including partial or complete tunnel collapse with associated surface impacts, rock fall at cuttings, and exposure to airborne pollutants, such as dust during tunnelling and potential asbestos fibres during demolition works.

In accordance with the requirements of the Work Cover Code of Practice for Tunnels, work methods for excavation and support installation would ensure that no persons would be required to work under unsupported ground without an adequate overhead protection structure. Primary support for the project tunnels would be installed as the excavation progresses, as recommended by an appropriately qualified geotechnical or tunnel engineer. A 'Permit to Tunnel' system would also be developed and implemented to ensure that design, construction and survey are taken into consideration and ground support conditions modified if required before the excavation advances. This system requires the methodology and approach for any proposed tunnelling works to be reviewed and approved before the proposed work stage to proceed.

The structural integrity of the tunnel would be assured during construction through the implementation of appropriate construction methodology for the tunnelling conditions and ongoing tunnel support by way of rockbolts and / or shotcrete lining. The majority of the main alignment tunnels would be constructed at significant depth within Hawkesbury Sandstone with minimal risk of surface effects. For on and off-ramps, and where the main alignment tunnels come to the surface, tunnel components would be progressively constructed and stabilised to ensure that surface deformations do not occur.

The tunnel depth, generally around 20 metres to 60 metres below ground level with shallower sections approaching the portals, also enhances the structural integrity of the tunnel. The geology of the area was influential in determining the tunnel vertical alignment. Hawkesbury Sandstone is considered an excellent tunnelling and excavation medium as it is high strength with infrequent and relatively widely spaced defects. In comparison, Ashfield Shale is also of high strength but has a deeper soil profile, closer spaced defects (commonly affected by faulting) and the fresh shale can readily deteriorate on exposure. As a result, the tunnel has been designed to maximise the length of tunnel within Hawkesbury Sandstone and minimise the length within Ashfield Shale.

Rock fall hazards may occur around cuttings, the interchange dive structures and along the M1 Pacific Motorway tie-in works and the Hills M2 Motorway integration works. A rock fall could potentially injure construction personnel and cause damage to construction equipment. Steep slopes may pose an additional risk for construction personnel, who could slip and fall, or be injured by unsecured equipment. Standard construction practices and mitigation measures, including the use of appropriate personal protective equipment, properly secured equipment, safety fencing and overhead protection would minimise the risks associated with rock falls and steep slopes.

Tunnelling construction would generate dust within the tunnel at the cutting face. Dust generation may cause risks to human health of construction workers within the tunnel environment. The generation of dust within the tunnel would be minimised by wetting down the cutting face. Temporary fans and dry dust scrubbers would also be provided within the tunnel to remove dust from the working environment.

There is potential that demolition works, and the relocation of utilities, may encounter asbestos containing materials. If asbestos containing materials is disturbed or broken and the microscopic fibres become airborne, they can become a health risk if breathed into the lungs. Provided appropriate management measures are adopted prior to and during the demolition process, the risks associated with asbestos containing materials can be adequately controlled. The management of potential asbestos waste is described further in **Section 8.3** (Resource minimisation and waste management).

Underground services

The potential rupture of underground services when excavating could pose a hazard in the form of electrocution, release of sewage from a sewer main or fire if a gas main is impacted. The risk associated with these hazards would be minimised by undertaking utility checks (such as dial before you dig), consulting with the relevant service infrastructure providers and if required, relocating and / or protecting utilities in and around the project prior to the commencement of construction. Consultation with service infrastructure providers would commence during the design and continue during the construction to mitigate the risk of unplanned and unexpected disturbance of utilities. The relocation of utilities may result in short term outages of certain utilities to surrounding areas. Services which would be directly impacted and require protection and / or relocation are detailed in **Section 8.1** (Land use and property).

Bushfires

A bushfire risk assessment has been prepared in order to assess potential bushfire implications of the project. The assessment has been undertaken in accordance with the Bush Fire Risk Management Planning Guidelines for Bush Fire Management (RFS, 2008). Based on bushfire prone land mapping developed and published by the relevant local councils, the following construction sites would be located on or in proximity to bushfire prone land:

- The Junction Road compound and the M1 Pacific Motorway tie-in works on the east side of the existing M1 Pacific Motorway.
- The Hills M2 Motorway integration works.

Temporary construction sites and construction infrastructure would be generally less sensitive to bushfire risks than operational facilities, given the temporary nature of the construction sites and the absence of critical infrastructure within the sites. Notwithstanding, detailed design of temporary construction sites and particularly those in the locations listed above would be developed having regard to:

- Establishment of appropriate asset protection zones (APZ) within and around temporary construction sites.
- Provision of a principal and an alternative site access point, to be used in the event of an emergency.
- Use of fire resistant materials in the construction of site infrastructure where feasible and reasonable to do so, having regard to the relevant provisions of AS3959-2009: Construction of a Building in Bush Fire Prone Areas (Standards Australia, 2009).
- Storage and management of dangerous goods and hazardous materials in a safe, secure location consistent with the requirements of applicable Australia Standards.

Temporary construction sites would be maintained in a tidy and orderly manner, with the aim of minimising potential fuel loads in the event that the sites are affected by a bushfire.

If not properly managed, construction activities involving flammable materials and ignition sources (for example, welding) have the potential to increase fire and bushfire risks. These types of activities would be proactively managed to ensure that fire risks both within temporary construction sites and potentially affecting surrounding land are effectively minimised. High risk construction activities, such as welding and metal work, would be subject to a risk assessment on total fire ban days and restricted or ceased as appropriate.

Measures to mitigate and manage bushfire risks would be developed and included as part of site-specific hazard and risk management measures within Construction Environmental Management Plan.

Operation

During operation, the following potential hazards and risks may be associated with the project:

- Hazards resulting from accidental releases or improper handling and storage of dangerous goods and hazardous substances in the water treatment plant, located within the motorway operations complex adjacent to the southern interchange.
- Hazards resulting from releases of hazardous substances from vehicles transporting dangerous goods and hazardous substances to and from the motorway operations complex in the event of an accident.
- Accidents and incidents within the main alignment tunnels or on and off-ramp tunnels.
- Accidents and incidents on surface roads, including improvements to traffic safety on Pennant Hills Road.
- Risks from electric and magnetic fields from the project substations.
- Risks from bushfires.

Storage and handling of dangerous goods and hazardous substances

Dangerous goods and hazardous materials would be stored and used during operation of the water treatment plant, located within the motorway operations complex adjacent to the southern interchange (refer to **Figure 5-11**). The types and quantities of dangerous goods and hazardous materials to be stored on-site during operation are summarised in **Table 8-20.** Additional small quantities of other materials may be required on-site from time to time to support occasional maintenance activities.

Comparison of the types and quantities of dangerous goods and hazardous materials to be stored on-site with the thresholds in the Applying SEPP 33 guideline demonstrates that operational inventories would not pose a significant risk of harm beyond the site boundary.

Table 8-20 Indicative dangerous goods and hazardous substances stored on-site during operation

Material	Australian Dangerous Goods Code class	Storage method[1]	Assessment against Applying SEPP 33 inventory thresholds
Coagulant	N/A	10,000L feed tank in an undercover bunded area.	Coagulant is not subject to the Applying SEPP 33 thresholds.
Polymers	N/A	10,000L feed tank in an undercover bunded area.	Polymers are not subject to the Applying SEPP 33 thresholds.
Acid	8 PGII	10,000L feed tank in an undercover bunded area.	Acid would not trigger the Applying SEPP 33 thresholds (25 tonnes).
Base	8 PGII	10,000L feed tank in an undercover bunded area.	Base would not trigger the Applying SEPP 33 thresholds (25 tonnes).

[1] Quantities are indicative only.

Transport of dangerous goods and hazardous substances

Dangerous goods and hazardous materials that would be transported to the project during operation are outlined in **Table 8-21**. Transportation of both acid and base (alkaline) materials to the project during operation exceeds the quantity thresholds for these materials under the Applying SEPP 33 guideline, but the frequency of transportation falls well short of the frequency threshold. This indicates that risks associated with transport of dangerous goods and hazardous materials are unlikely to be significant.

Table 8-21 Dangerous goods and hazardous substances transported during operation

Material	Australian Dangerous Goods Code class	Transport frequency	Transport quantity[1]	Assessment against Applying SEPP 33 transport thresholds
Coagulant	N/A	Every eight months	10,000L	Coagulant is not subject to the Applying SEPP 33 transportation thresholds.
Polymers	N/A		10,000L	Polymers are not subject to the Applying SEPP 33 transportation thresholds.
Acid	8 PGII	Every four months	10,000L	Acid would exceed the volume threshold but not the transport frequency threshold under the Applying SEPP 33 guideline (two tonnes, 30 times per week).
Base	8 PGII		10,000L	Base would exceed the volume threshold but not the transport frequency threshold under the Applying SEPP 33 guideline (two tonnes, 30 times per week).

[1] Quantities are indicative only.

Incidents in the project tunnels

The nature of the project means that there is an inherent risk of vehicle collision associated with its operation. The potential for incidents and accidents to occur is a function of:

- The design of the project.
- The type and volumes of traffic using the project.
- Driving conditions, including light conditions and meteorology.
- Human factors, including compliance with road rules, attention to driving conditions and fatigue.
- Vehicle failure and breakdown.

The project has been designed to provide for efficient, free flowing traffic with physical capacity to accommodate predicted traffic volume. The preferred design has incorporated all feasible and reasonable design measures including in relation to geometry, pavement, lighting and signage, consistent with current Australian Standards, road design guidelines and industry best practice. In doing so, the design of the project has been developed to inherently minimise the likelihood of incidents and accidents.

To minimise the likelihood of an incident associated with over height vehicles within the tunnel an over height detection system has been included in the project comprising:

- Electronic over height detectors prior to the tunnel portals.
- Vehicle presence detectors.
- Warning signs with lanterns installed that would light up upon detection of an over height vehicle.

Detectors would be installed prior to divergence points to the tunnels to allow over height vehicles to divert to an alternative route. Secondary detectors would also be installed after the divergence point to detect over height vehicles that have not diverted. The detection of over height vehicles would be alarmed to the motorway operator and the nearest camera switched onto the incident monitors so that the operator can control traffic management devices such as moveable physical barrier and portal variable message signs to stop the vehicle from entering the tunnel.

Notwithstanding, human factors in particular cannot be entirely removed during operation of the project and there would remain a residual risk of incidents and accidents, albeit the likelihood of such events would be low.

In the event of incidents and accidents, the project has been designed to meet appropriate fire and life safety requirements. The key fire and life safety aspects included in the project are:

- Wide shoulders to accommodate breakdowns and access by recovery and emergency vehicles.
- Each project tunnel would be one directional, reducing the risk of vehicle accidents through head-on collisions and simplifying smoke management and egress requirements.
- The transport of dangerous goods and hazardous substances would be prohibited through the main alignment tunnels and on and off-ramp tunnels, reducing the risk of very large fires or the release of toxic materials.
- State of the art CCTV and audible systems to detect incidents and manage evacuation processes.
- Emergency pedestrian exits from the main alignment tunnels and on and off-ramp tunnels.
- Multiple pedestrian cross passages between the main alignment tunnels.
- Two cross passages between the main alignment tunnels for emergency vehicles.
- Automatic fire and smoke detection within the tunnels.
- A ventilation system designed to manage emergency situations.
- Longitudinal ventilation would direct smoke in the direction of traffic flow from the fire source towards an emergency smoke extraction point or tunnel portal.
- A water deluge system would be activated manually or automatically at the fire source.
- Structures, linings and services would be fire hardened to protect them prior to the activation of the deluge system, or in the event that the deluge system fails.
- In the event of an incident, approaching traffic would be prevented from entering both the incident main alignment tunnel and the non-incident main alignment tunnel.
- Occupants involved in the fire event, or upstream of the fire source, would be instructed to stop their vehicles, and exit in the opposite direction along the carriageway (as this region would be protected by the smoke management system), or through an exit door to a cross passage leading to the non-incident main alignment tunnel.
- Occupants downstream of the fire source would be encouraged to continue driving out of the tunnel. If this is not possible and they are forced to evacuate on foot, egress would be provided via an exit door to a cross passage leading to the non-incident carriageway.
- Emergency services would be able to reach the fire source via the non-incident tunnel (by vehicle or foot), or from the upstream direction in the incident tunnel (by foot).

The project has been designed to minimise the likelihood of and manage incidents within the tunnel in accordance with the following standards:

- Australian Standard AS4825 – Tunnel fire safety.
- National Fire Protection Association (NFPA) 502 - Standard for Road Tunnels, Bridges and Other Limited Access Highways.
- Permanent International Association of Road Congress (PIARC) including:
  - Systems and equipment for fire and smoke control in road tunnels, 2007.
  - Road tunnels: Vehicle emissions and air demand for ventilation, 2012.
  - Fire and Smoke Control in Road Tunnels, 1999.
  - Operational Strategies for Emergency Ventilation, 2008.

During emergency conditions the ventilation system would extract smoke from the tunnel. Depending on the location of the incident, smoke would be emitted from one or more of the following locations:

- The southern ventilation facility.
- Wilson Road tunnel support facility.
- Trelawney Street tunnel support facility.
- The northern ventilation facility.
- The tunnel portals.

Emergency smoke extraction would be achieved through management of the project's ventilation system for a short duration until such time as the tunnel deluge system and / or emergency services have extinguished the fire.

Incidents on surface roads

As with underground components of the project, surface roads and infrastructure have been designed to provide an efficient and safe road network.

An important road safety opportunity facilitated by the project is an overall improvement in road safety performance of Pennant Hills Road, as a consequence of reduced traffic volumes (particularly heavy vehicles).

Pennant Hills Road currently carries large volumes of traffic with a large proportion of these vehicles being heavy vehicles, given the corridor's importance as a national freight corridor. Between 2008 and 2013, the section of Pennant Hills Road north of the Hills M2 Motorway had a total of 980 crashes, with one fatal and 342 injury crashes. Around half of these accidents were a result of rear-end collisions.

Due the anticipated reduction in heavy vehicles utilising Pennant Hills Road, the project would improve travelling conditions on Pennant Hills Road and the surrounding network, which would result in the following traffic related benefits:

- Improved traffic flow and intersection performance.
- Reduced crash rates.
- Improved road safety for pedestrians, cyclists and motorists.
- Improved travel times for bus services and motorists.

These traffic related benefits would result in an improved road safety environment and a reduction in incidents along this corridor.

Further details of the expected changes in traffic volumes on existing and new road infrastructure is provided in **Section 7.1** (Traffic and transport). Impacts and improvements to noise and air quality / and human health risks are discussed in **Section 7.2** (Noise and vibration), **Section 7.3** (Air quality) and **Section 7.4** (Human health) respectively.

Electric and magnetic fields

The Interim Guidelines on Limits of Exposure to 50 / 60 Hz Electric and Magnetic Fields (National Health and Medical Research Council, 1989) has remained an important Australian guideline on limits of exposure to power frequency and magnetic fields, despite the fact that the guideline has been rescinded and never replaced. In 1996, the Australian Radiation Protection and Nuclear Safety Agency with its responsibility for the management and review of the National Health and Medical Research Council's Radiation Health Series publications, released Draft Radiation Standard - Exposure Limits for Magnetic Fields (Australian Radiation Protection and Nuclear Safety Agency, December 2006). The Draft Radiation Standard drew on a large body of scientific research into the possible health effects of electromagnetic fields undertaken since 1989, and proposed a series of exposure standards to replace the National Health and Medical Research Council Interim Guidelines from 1989.

The Draft Radiation Standard also expanded on the National Health and Medical Research Council Interim Guidelines to include the entire Extreme Low Frequency range from 0 Hz to 3 kHz, whereas the National Health and Medical Research Council Interim Guideline only ever covered 50Hz / 60 Hz. While the Draft Radiation Standard has never been finalised and published, the exposure limits it presents are typically applied when considering electric and magnetic fields from new developments. The Draft Radiation Standard suggests the exposure limits for the general public (including vulnerable groups) and for the controlled activity or controlled circumstance (where exposure to electric and magnetic fields may reasonably be expected to exceed the public exposure reference level).

The project would include the provision of four aboveground substations located at the:

- Motorway operations complex.
- Wilson Road tunnel support facility.
- Trelawney Street tunnel support facility.
- Northern ventilation facility.

The detailed design of the project substations would ensure that the exposure limits for the general public suggested by the Draft Radiation Standard would not be exceeded at the boundary of the substation sites.

Bushfires

Based on bushfire prone land mapping developed and published by the relevant local councils, the following operational facilities would be located on or in proximity to bushfire prone land:

- The M1 Pacific Motorway tie-in works on the east side of the existing M1 Pacific Motorway and the northern ventilation facility.
- The Hills M2 Motorway integration works.

Most of the project's operational infrastructure is invulnerable to bush fire attack due to its incombustible nature (road surface materials, retaining walls, road barriers) and / or location underground. Infrastructure critical to the ongoing safe operation of the project, including the motorway operations complex, would be located outside of bushfire prone areas.

As with the development of designs for temporary construction sites, operational infrastructure would be subject to detailed design taking into account:

- Establishment of appropriate asset protection zones (APZ) within and around operational facilities.
- Provision of a principal and an alternative site access point, to be used in the event of an emergency.
- Use of fire resistant materials in the construction of site infrastructure where feasible and reasonable to do so, having regard to the relevant provisions of AS3959-2009: Construction of a Building in Bush Fire Prone Areas (Standards Australia, 2009).
- Storage and management of dangerous goods and hazardous materials in a safe, secure location consistent with the requirements of applicable Australia Standards.

In the event of a bushfire affecting surrounding land, there is potential for smoke and embers to be drawn into the main alignment tunnels and ventilation system. Emergency planning and development of incident response plans for the operation of the project would include specific provisions relevant to the management of a bushfire with direct or indirect impacts on the project. Emergency planning for bushfires would consider:

- Trigger points and control strategies to prevent access in the event of a tunnel or road closure.
- Smoke ingestion into the tunnel complexes and operational ventilation systems form surface bushfires.
- Closure of aboveground parts of road infrastructure by emergency services due to bushfires in the vicinity of or impacting on the road system.

8.2.2 Environmental management measures

The project has been designed to provide for efficient, free flowing traffic with physical capacity to accommodate predicted traffic volume. The preferred design has incorporated all feasible and reasonable design measures including in relation to geometry, pavement, lighting and signage, consistent with current Australian Standards, road design guidelines and industry best practice. In doing so, the design of the project has been developed to inherently minimise the likelihood of incidents and accidents.

Construction of the project would require the storage and use of dangerous goods and hazardous substances. These would be transported to site, stored and used in accordance with manufacturer's instructions and Australian Standards. Tunnelling works would occur in accordance with the Work Cover Code of Practice for Tunnels, including the implementation of a 'permit to tunnel' process to ensure the ongoing structural integrity of the tunnels.

Environmental management measures relating to hazards and risk for the construction and operation of the project are provided in **Table 8-22.**

Table 8-22 Environmental management measures – hazards and risk

Impact	No.	Environmental management measure	Timing
Construction			
General	HR1	Site-specific hazard and risk management measures would be included within the Construction Environmental Management Plan (CEMP), which may include items such as: • Details of the hazards and risk associated with construction activities for both surface and subsurface works. • Procedures to comply with legislative and industry standard requirements. • Contingency plans, as required. • Site-specific Work Health and Safety plans and Safe Work Method Statements. • Training for relevant personnel (including subcontractors) and site inductions, including the recognition and awareness of site hazards and locations of relevant equipment.	Pre-construction / construction
Storage of dangerous goods and hazardous substances	HR2	Storage of dangerous goods and hazardous materials would occur in accordance with supplier's instructions and relevant Australian Standards and may include bulk storage tanks, chemical storage cabinets / containers or impervious bunds.	Construction

Impact	No.	Environmental management measure	Timing
	HR3	Storage, handling and use of dangerous goods and hazardous substances would be in accordance with the *Occupational Health and Safety Act 2000* and the Storage and Handling of Dangerous Goods Code of Practice (WorkCover NSW, 2005).	Construction
	HR4	Secure, bunded areas would be provided around storage areas for oils, fuels and other hazardous liquids. Impervious bunds would be of sufficient capacity to contain at least 110 per cent of the volume of the largest stored container.	Construction
	HR5	Bunds would be provided around activities such as vehicle refuelling, servicing, maintenance or wash-down, where there is a potential for spills and contamination.	Construction
	HR6	Material Safety Data Sheets would be obtained for dangerous goods and hazardous substances stored on-site prior to their arrival.	Construction
Transportation of dangerous goods and hazardous substances	HR7	Transport of dangerous goods and hazardous substances would be conducted in accordance with relevant legislation and codes, including the *Road and Rail Transport (Dangerous Goods) (Road) Regulation 1998* and the Australian Code for the Transport of Dangerous Goods by Road and Rail (National Transport Commission, 2008).	Construction
Operation			
Fire and life safety	OpHR1	The fire and safety systems and measures adopted for the project would be equivalent to or exceed the fire safety measures recommended by NFPA502 (American), PIARC (European), AS4825 (Australian) and Roads and Maritime standards.	Detailed design
Storage of dangerous goods and hazardous substances	OpHR2	Storage of dangerous goods and hazardous materials would occur in accordance with supplier's instructions and relevant Australian standards and may include bulk storage tanks, chemical storage cabinets / containers or impervious bunds.	Operation
	OpHR3	Storage, handling and use of dangerous goods and hazardous substances would be in accordance with the *Occupational Health and Safety Act 2000* and the Storage and Handling of Dangerous Goods Code of Practice (WorkCover NSW, 2005).	Operation

Impact	No.	Environmental management measure	Timing
	OpHR4	Secure, bunded areas would be provided around storage areas for oils, fuels and other hazardous liquids. Impervious bunds would be of sufficient capacity to contain at least 110 per cent of the volume of the largest stored container.	Operation
	OpHR5	Bunds would be provided around activities such as vehicle refuelling, servicing, maintenance or wash-down, where there is a potential for spills and contamination.	Operation
	OpHR6	Material Safety Data Sheets would be obtained for dangerous goods and hazardous substances stored on-site prior to their arrival.	Operation
Transportation of dangerous goods and hazardous substances	OpHR7	The transport of dangerous goods and hazardous substances would be prohibited through the main alignment tunnels and on and off-ramp tunnels.	Operation
Incident response	OpHR8	An Incident Response Plan would be developed and implemented in the event of an accident or incident.	Operation
	OpHR9	The response to incidents within the motorway would be managed in accordance with the memorandum of understanding between Roads and Maritime and the NSW Police Service, NSW Rural Fire Service, NSW Fire Brigade and other emergency services	Operation
Electric and magnetic fields	OpHR10	The detailed design of the project substations would ensure that the exposure limits for the general public suggested by the Draft Radiation Standard (Australian Radiation Protection and Nuclear Safety Agency, 2006) would not be exceeded at the boundary of the substation sites.	Detailed design