Transport for NSW

Chapter 19
Hazards and risk

NSW GOVERNMENT

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19. Hazards and risk

This chapter considers the potential hazards, safety and risk impacts associated with the project, and how these would be mitigated and managed during construction and operation.

19.1 Approach

Constructing and operating major transport projects have the potential to cause hazards and risks to public safety and the environment. The urban setting of the project means that there is the potential for the community to be impacted by hazards and risks if construction and operation activities are not properly managed. An assessment of potential hazards and risks associated with constructing and operating the project has been undertaken. This included a preliminary hazard analysis in accordance with *Hazardous Industry Planning Advisory Paper No. 6 – Guidelines for Hazard Analysis* (Department of Planning, 2011a) and *Multi-level Risk Assessment* (Department of Planning, 2011b), as the key guiding documents to completing preliminary hazard analysis for projects in NSW. The assessment has also been undertaken in accordance with:

- the SEARs (see Appendix A (SEARs compliance table))
- State Environment Planning Policy (Resilience and Hazards) 2021 (the Resilience and Hazards SEPP) and *State Environmental Planning Policy No. 33 – Hazardous and Offensive Development Application Guidelines: Applying SEPP 33* (Department of Planning, 2011c) ('Applying SEPP 33')
- Hazardous Industry Planning Advisory Paper No. 10 – Land Use Safety Planning (Department of Planning, 2011c)
- other relevant policies and guidelines, including hazardous industry planning advisory papers and risk assessment procedures.

An overview of the approach to the assessment is provided below.

19.1.1 Study area

The study area for the assessment is the project site, as described in Chapter 2 (Location and setting), and surrounding areas with the potential to be affected by hazards and risks associated with the project.

19.1.2 Key tasks

The assessment involved the following:

- reviewing the relevant regulatory framework and applicable guidelines
- identifying sensitive receivers within the existing environment
- identifying significant utilities within the project site, including high pressure dangerous goods or gas pipelines subject to the Australian Standard (AS) 2885 series of standards for gas and liquid petroleum pipelines (AS 2885)
- identifying the classes, quantities, and indicative storage locations of dangerous goods likely to be used on site

- identifying construction and operational activities with the potential to cause risks to receivers or change the risk rating of potentially hazardous facilities in the vicinity of the project site
- undertaking a preliminary hazard analysis, including a preliminary risk screening, in accordance with the SEARs (described further below)
- qualitatively assessing potential impacts to public health and safety
- identifying measures to mitigate the potential hazards and risks identified.

The assessment focused on those activities with the potential to result in hazards and risks to surrounding communities, land uses, and the environment (also known as 'off-site receivers'). This is in addition to the potential impacts considered by other chapter in Part C of the EIS. The assessment does not take into account potential health and safety risks to on-site workers associated with normal construction operations, as these are regulated by workplace health and safety legislation (including the *Work Health and Safety Act 2011*) and are not relevant to approval of the project under Division 5.2 of the EP&A Act. Site management would be the responsibility of the construction contractor, who would be required (under the Work Health and Safety Act) to manage the site in accordance with relevant regulatory requirements.

Preliminary hazard analysis

Risk screening undertaken in accordance with Applying SEPP 33 typically concentrates on the storage of specific dangerous good classes that have the potential for significant off-site effects. Specifically, the assessment involves the identification of classes and quantities of all dangerous goods to be used, stored or produced on site with an indication of storage locations. The quantities of dangerous goods are then assessed against the Applying SEPP 33 threshold quantities. If any of the threshold quantities are exceeded, then a preliminary hazard analysis is required.

The potential for hazards is not limited to the consideration of dangerous goods. Where there is potential for an activity to cause significant potential for harm the level of risk must be understood through completion of a preliminary hazard analysis. This involves an initial task of undertaking a desktop assessment to identify the possible hazards that could lead to a possible off-site incident. The hazards are then analysed in terms of their impact to people and the environment and their likelihood of occurrence, and the resultant risk is then quantified.

Applying SEPP 33 identifies three levels of preliminary hazard analysis. The preliminary risk screening identified that the project has the potential to cause a significant but not serious potential for harm due to the presence of high pressure dangerous goods pipelines in and adjacent to the project site. As result a level 1 preliminary hazard analysis was undertaken, which involves a qualitative risk assessment. The risk assessment complied with the requirements for a level 1 preliminary hazard described in the *Hazardous Industry Planning Advisory Paper No. 6 – Guidelines for Hazard Analysis* (Department of Planning, 2011a) and *Multi-level Risk Assessment* (Department of Planning, 2011b). The approach to the risk assessment was informed by the principles of Australian/New Zealand Standard *AS/NZS ISO 31000:2009 Risk management – Principles and guidelines* (Standards Australia, 2009a) and Transport for NSW's risk criteria (see Appendix G (Preliminary hazard analysis)).

The level 1 preliminary hazard analysis identified the class, quantity and location of all dangerous goods and hazardous materials associated with the project. It also analysed the risk of pipeline releases during construction and operation.

19.1.3 How potential impacts have been avoided or minimised

The approach to design development included a focus on avoiding and/or minimising the potential for impacts during key phases of the design process. As described in Chapter 5 (Alternatives and options) a project corridor and alignment options assessment process was undertaken to identify the preferred alignment. This process considered a range of factors, including:

- the location of critical utilities within and adjacent to the project site, and confirmation of constraints and design requirements in relation to utilities
- the potential for conflicts with heavy vehicles
- light rail operational risks
- proximity to sensitive receivers.

The design and construction methodology has been refined to minimise hazards and risks to public safety and critical utilities as far as practicable, including:

- proposing to relocate the Sydney Water drinking trunk mains (trunk mains) within off peak usage periods (see section 7.8)
- locating the alignment over the Parramatta River so that impacts to critical utilities are avoided
- locating the alignment in Camellia on the northern side of Grand Avenue to minimise impacts to utilities
- designing the alignment (including stop locations) to ensure sufficient levels of safety
- aligning the track so that acute angles between cycle paths are avoided
- minimising the potential for uncontrolled shared use environments
- locating compounds to minimise risks to public safety.

19.1.4 Consultation with utility providers

Consultation with utility service providers has been ongoing during the design process with the aim of better understanding potentially affected utilities and service providers' requirements (such as clearance distances). This has included consultation with Ampol, Jemena and Viva Energy Australia as operators of high pressure dangerous goods and gas pipelines within and adjacent to the project site (see section 19.2.2).

As described in section 8.8 this consultation has informed the design undertaken to date, including preliminary proposals in relation to the approach to utilities with the potential to be affected by the project.

Most recently, a 'Letter of Assurance' has been sought from key impacted utility providers (including Sydney Water, Ausgrid, Telstra, Endeavour Energy, Ampol, Viva Energy and Jemena), asking that they confirm:

- that they are aware of the project
- have received a copy of the latest alignment
- understand the potential on their assets
- that potential impacts can be addressed
- that they remain supportive of the project.

All other utility providers would be issued with an 'information pack' notifying them of the level of potential impact on their assets.

Consultation with the owners and operators of utilities with the potential to be affected would be ongoing throughout the design development and construction planning process. Works with the potential to affect utilities directly or indirectly would be coordinated with relevant utility providers. This would include consideration of any proposed utility upgrades and access requirements, to ensure that access to utilities within the project site is maintained, where required.

19.2 Existing environment

19.2.1 Sensitive receivers

The project site is located in a developed urban area, with a mix of transport, commercial, residential, industrial and recreational land uses. Sensitive receivers include the following:

- residents living near the project site
- members of the community travelling through the study area or located close to the project site
- local businesses and commercial properties.

Sensitive receivers close to the project site are described in chapters 10 (Noise and vibration), 13 (Land use and property) and 17 (Biodiversity). Detailed mapping of sensitive receivers is provided in section 2.2.2 of Technical Paper 3 (Noise and Vibration).

In addition to receivers close to the project site, the assessment considered utility customers who could be affected by a disruption in delivery of the service.

19.2.2 Critical utility infrastructure

As described in section 7.8, there are a range of utilities within and close to the project site. These include the following critical utilities:

- drinking water trunk mains (Sydney Water)
- high voltage electricity transmission lines (Ausgrid)
- high pressure gas mains (Jemena)
- high pressure fuel lines (Viva Energy Australia and Ampol).

Key utility infrastructure located within and close to the project site is listed in Table 7.4 and shown on Figure 7.13 and Figure 7.14.

The fuel pipelines are licensed under the *Pipelines Act 1967* and the gas mains are operated in accordance with the *Gas Supply Act 1996*. The pipelines are required to be operated and maintained in accordance with AS 2885.

19.3 Assessment of construction impacts

Key potential hazards and risks during construction would be associated with:

- on-site storage, use and transport of dangerous goods and hazardous materials, including chemicals and fuels
- on-site handling and transport of contaminated soil, contaminated groundwater and hazardous waste
- impacts to utilities
- interactions with potentially hazardous facilities
- risk of ground subsidence

- improper management of construction works and compounds.

The potential for contaminated soil, groundwater and/or hazardous waste to be encountered during construction is considered in Chapters 17 (Water), 18 (Soils and contamination) and 22 (Waste and resources). Mitigation measures are provided in those chapters to minimise hazard and risks from the handling, transport and disposal of those materials. Other key potential hazards and risks are considered below.

19.3.1 Storage, handling and transport of dangerous goods and hazardous materials

Dangerous goods are substances that pose acute risks to people, property and the environment due to their physical or chemical characteristics, while hazardous substances are chemicals or materials that can pose a significant risk to health and safety if not managed correctly. Leaks and spills from inappropriate storage and handling of dangerous goods have the potential to impact the surrounding community and environment. Excessive amounts of stored or transported dangerous goods would exacerbate the potential for fire, explosion or inhalation risks.

Dangerous goods can be corrosive, flammable, combustible, explosive, oxidising or water-reactive or have other hazardous properties. Dangerous goods are defined by the *Australian Code for the Transport of Dangerous Goods by Road and Rail* (edition 7.6) (National Transport Commission, 2018) ('the Dangerous Goods Code'). Most dangerous goods are also classed as hazardous substances.

Hazardous materials are those that meet the classification criteria specified by the Work Health and Safety Regulation 2017 and the Globally Harmonised System of Classification and Labelling of Chemicals (an internationally agreed system of chemical classification).

The thresholds in Applying SEPP 33 represent the maximum quantities of dangerous goods that can be stored or transported without causing a significant off-site risk. Although Applying SEPP 33 is not applicable to State significant infrastructure projects, the guidelines have been applied to inventories of dangerous goods likely to be stored at construction sites to assess the potential risk of the project to the environment and public safety.

An indicative list of the types of dangerous goods and hazardous materials anticipated to be used during construction is provided in Table 19.1 along with the relevant storage and transport thresholds.

In general, low volumes of dangerous goods would be stored at construction compounds, with the quantity of goods stored being commensurate with the demand for those goods so that excess goods are not sitting idle and the potential to exceed the Applying SEPP 33 storage thresholds is minimised. As the potential for the storage thresholds to be exceeded is considered negligible, a preliminary hazard analysis for the storage of dangerous goods is not considered to be required. Measures relating to storage requirements and handling protocols would be included in the CEMP (see section 19.6). This would minimise the risk of health and safety impacts.

Table 19.1 Construction dangerous goods volumes and thresholds

Dangerous good	Australian Dangerous Good Class	Storage location	Expected maximum storage quantity	Applying SEPP 33 thresholds	
				Storage volumes	Transport (weekly movements)
Spray paint, marker paint	2.1 – flammable pressurised aerosol	All compound sites	20 kg	100 kg	More than 30 for all class 2.1 chemicals combined
Acetylene gas for metal/rail cutting and welding	2.1 – flammable liquified gas	All compound sites	200 kg	500 kg	
LPG (liquid petroleum gas)	2.1 – flammable gas	All compound sites	200 kg	10 tonnes	

Dangerous good	Australian Dangerous Good Class	Storage location	Expected maximum storage quantity	Applying SEPP 33 thresholds	
				Storage volumes	Transport (weekly movements)
Fuels (petrol, 2-stroke)	3-II – flammable liquid	All compound sites	1,000 kg	5 tonnes	More than 45
Epoxy and resin based concrete repair and adhesives	3-III – flammable liquid	All compound sites	500 kg	5 tonnes	More than 60 for all class 3-III chemicals combined
Mechanical fluids for plant and equipment (oils, lubricants, grease, degreaser, coolants, etc.)	3-III – flammable liquid	All compound sites	1,000 kg	5 tonnes	
Oxygen gas for metal/rail cutting and welding	5.1 – oxidisers	All compound sites	200 kg	5 tonnes	More than 30
Cleaning products	8-III – corrosives	All compound sites	100 kg	50 tonnes	More than 30
Fuels (diesel) – not stored with class 3 flammable liquids	9-III – miscellaneous	All compound sites	2,000 kg	No threshold	More than 60 for all class 9 chemicals combined
Bitumen	9-III – miscellaneous	All compound sites	Used on demand	No threshold	
Cement, grout, ready-mix concrete	NA	All compound sites	Bags or pallets	Not applicable	Not applicable

Dangerous goods would be transported to and from construction compounds using the haulage routes described in Chapter 6 (Project description – operation). Dangerous goods transport would be in accordance with the *Dangerous Goods (Road and Rail Transport) Act 2008* and the Dangerous Goods (Road and Rail Transport) Regulation 2014. The quantities of dangerous goods transported would be below the Applying SEPP 33 transport screening thresholds. Given that movement of dangerous goods would be low, the potential risks during transportation are not considered significant.

19.3.2 Impacts to utilities

The potential rupture of underground utilities during excavation (either through direct contact or working near aged, unstable utilities) or the collision of plant and equipment with above ground services, could pose risks to public safety. Rupture or contact with services could also result in short-term outages, as could relocation of utilities and services. This risk would be greatest for utilities conveying dangerous goods, such as high pressure gas and fuel pipelines, located within/close to the project site.

Preliminary investigations indicate that some sections of the Jemena gas and Viva Energy fuel pipelines would need to be relocated.

As described in section 7.8, it is also proposed to relocate and/or protect sections of the underground Sydney Water trunk mains located within and adjacent to the project site in Camellia, Rydalmere, Ermington and Melrose Park. These mains carry the water supply to Sydney's northern suburbs and, at some locations, are over 100 years old.

Given the presence of a number of critical utilities within the project site, preliminary risk screening identified that potential interaction with these utilities could be considered 'potentially hazardous'. As a result, these were considered further by the preliminary hazard analysis. A summary of the findings is provided in Table 19.2 and the complete preliminary hazard analysis is included in Appendix G.

Table 19.2 Construction hazard identification and preliminary hazard analysis

Event	Causes	Potential results	Risk
Telecommunication utility strike	Impact during construction	1. Telecommunication service disruption, including customer complaints	1. Low
Water utility strike – water main	Impact during construction	1. Flooding, including environmental damage/ sink holes	1. High
		2. Water service disruption, including customer complaints	2. Medium
Power utility strike – gas	Impact during construction, high pressure in pipeline	1. Flammable gas release, no ignition but area evacuation.	1. Low
		2. Flammable gas release, immediate ignition, and multiple fatalities	2. High
		3. Flammable gas release, delayed ignition, and multiple fatalities	3. High
		4. Flammable gas release, ignition, and third-party property damage	4. Medium
		5. Gas service disruption, including customer complaints	5. Medium
Power utility strike – fuel	Impact during construction, high pressure in pipeline	1. Flammable liquid release, no ignition but area evacuation.	1. Low
		2. Flammable liquid release, immediate ignition, and multiple fatalities	2. High
		3. Flammable liquid release, ignition, and third-party property damage	3. Medium
		4. Soil contamination	4. Medium
		5. Fuel service disruption, including customer complaints	5. Low
Power utility strike – electricity (below ground)	Impact during construction	1. Electrocution and single fatality	1. High
		2. Electricity service disruption, including customer complaints	2. Low
Power utility strike – electricity (above ground)	Impact during construction	1. Electrocution and single fatality	1. High
		2. Electricity service disruption, including customer complaints	2. Low
Loss of containment of chemicals	Damage/ impact, wear & tear, spill during construction	1. Soil/ water contamination	1. Medium
Power utility – gas release	Release during operation, high pressure in pipeline	1. Flammable gas release, no ignition but area evacuation.	1. Low
		2. Flammable gas release, immediate ignition, and multiple fatalities	2. High
		3. Flammable gas release, delayed ignition, and multiple fatalities	3. High
		4. Flammable gas release, ignition, and third-party property damage	4. Medium

Event	Causes	Potential results	Risk
		5. Gas service disruption, including customer complaints	5. Medium
Power utility– fuel release	Release during operation, high pressure in pipeline	1. Flammable liquid release, no ignition but area evacuation.	1. Low
		2. Flammable liquid release, immediate ignition, and multiple fatalities	2. High
		3. Flammable liquid release, ignition, and third-party property damage	3. Low
		4. Soil contamination	4. Medium
		5. Fuel service disruption, including customer complaints	5. Low

Investigations involving pot holing and non-destructive digging are currently underway to further understand the exact location of utilities within the project site so that the potential risks associated with utility-related hazards are minimised. In addition, a Sydney Water accredited contractor has been engaged to undertake a detailed condition assessment to ascertain the existing condition of the Sydney Water trunk mains. Construction methodologies for construction works near utilities, including the high pressure gas and fuel pipelines, would be developed to comply with relevant standards, in consultation with utility providers.

All design, construction, inspection, testing, and any required alterations or relocations of sections of the gas and fuel pipelines, would comply with the requirements of relevant legislation and standards, including the *Pipelines Act 1967*, *Gas Supply Act 1996* and AS 2885. A safety management study (in accordance with AS 2885) would be undertaken as required prior to construction to identify appropriate measures to minimise potential safety risks (see section 19.6).

Measures to minimise the potential for safety impacts associated with utility adjustments are provided in section 19.6. As described in section 19.1.4, preliminary consultation with utility providers is ongoing. The nature and extent of adjustments required would be confirmed during design development and in consultation with the utility providers. With the addition of measures arising from consultation and ongoing design development, the risk to public safety is considered low.

Ongoing design development, construction planning, and implementation of the measures provided in section 19.6 would ensure that construction would not lead to non-compliance of the existing high pressure pipelines with AS 2885.

19.3.3 Interaction with potentially hazardous facilities

Potentially hazardous industry is defined by section 3.2 of the Resilience and Hazards SEPP as:

> *'...development for the purposes of any industry which, if the development were to operate without employing any measures (including, for example, isolation from existing or likely future development on other land) to reduce or minimise its impact in the locatlity or on the existing or likely future development on other land, would pose a significant risk in relation to the locality –*
>
> *a) to human health, life or property, or*
>
> *b) to the biophysical environment,*
>
> *and includes a hazardous industry and a hazardous storage establishment'.*

In relation to the project site, potentially hazardous industries could include facilities where large amounts of dangerous goods are produced and/or stored. Potentially hazardous facilities would also include the high pressure fuel and gas pipelines noted in section 19.2.2.

As described in Chapter 13 (Land use and property), industrial land uses are located within and close to the project site in Camellia, the south-western part of Rydalmere (close to the Parramatta River), the eastern part of Ermington and Melrose Park. Potentially hazardous areas (including areas of historical contamination) are also located in Sydney Olympic Park (see Chapter 18 (Soils and contamination)).

As noted in *Hazardous Industry Planning Advisory Paper No. 10 - Land Use Safety Planning*, risks from potentially hazardous facilities, particularly those with a potential for a major accident, should be controlled to such a degree that there need be no restriction on the surrounding development on safety grounds. There are industries or facilities that could be considered as potentially hazardous located in the vicinity of the project site. In addition, there are high pressure dangerous good pipelines located within and adjacent to the project site (see section 19.3.2).

Where construction activities have the potential to impact on these potentially hazardous facilities these have been considered by the EIS and mitigation measures have been provided to minimise the potential for impacts.

With the implementation of the mitigation measures provided in the EIS it is considered construction would comply with the risk criteria for development near potentially hazardous facilities, and construction activities would not be expected to intensify the risk of major hazard events such that additional controls would be required.

19.3.4 Ground subsidence

As described in Chapter 17 (Water) the potential for dewatering during construction is low, due to the shallow depth of excavation in most locations and the low potential for groundwater to be encountered in significant volumes at these depths. Where there is the potential for groundwater inflow, such as at the Boronia Street cutting, the area of drawdown would be limited and would not result in any noticeable changes to groundwater levels such that there is the potential for subsidence.

The project would also not involve the excavation of any tunnels or other sub-surface cavities. Based on the nature of the works and the existing environment, the risk of subsidence as a result of construction is considered negligible.

19.3.5 Other health and safety risks

Although unlikely, other construction activities could result in risks to the safety of the local community if improperly managed. These include:

- items falling off vehicles during the transportation of equipment and material to and from site
- construction failures or incidents resulting in flooding, inundation or excavation collapse
- potential for risks to public safety resulting from unauthorised access to construction work areas, including where these areas are located adjacent to the Parramatta River foreshore.

Safety risks during construction and transportation of materials by road would be managed by implementing standard workplace health and safety requirements, including the requirements of the Dangerous Goods Code.

The potential for unauthorised access resulting in safety risks is considered to be low, assuming the implementation of appropriate safety controls in accordance with NSW workplace safety laws. This requires construction sites to have adequate site security, which includes appropriate fencing and lighting. The construction contractor would need to ensure that construction sites are safe and secure at all times, and take all possible actions to prevent entry by unauthorised persons. Where the works are located within or adjacent to publicly accessible areas, such as the Parramatta Valley Cycleway and parks/recreation reserves, alternative access arrangements would be provided to ensure safe access around the project site.

Health and safety risks during construction would be managed by the implementation of standard workplace health and safety requirements. A work health and safety management plan and safe work method statements would be developed in accordance with regulatory requirements.

19.4 Assessment of operation impacts

The key potential for hazards and risks during operation would be associated with:

- on-site storage, use and transport of chemicals, fuels and materials
- public safety and security issues, including potential for safety risks to customers and pedestrians
- operation of substations and electrical wiring.

19.4.1 Storage, handling and transport of dangerous goods and hazardous materials

The types of dangerous goods and hazardous materials used during maintenance would be similar to those listed in Table 19.1 although much smaller quantities would be used compared with those required during construction. Dangerous goods and hazardous materials would be stored at the stabling and maintenance facility in Camellia and transported in vehicles/trucks to areas requiring maintenance. As a result, the potential for impacts during operation associated with the storage and handling of hazardous materials and dangerous goods is considered to be negligible. Potential risks would be managed by implementing standard management measures defined by the operator's operational environmental management plan, and the existing approval conditions for operating the stabling and maintenance facility.

19.4.2 Interaction with potentially hazardous facilities

Once operational, interaction with potentially hazardous facilities would be minimal. Operating the project would be similar to existing conditions. People would continue to move through those areas containing potentially hazardous facilities, albeit in a light rail vehicle instead of a car, with no risk intensification.

No direct impacts to utilities, including high pressure pipelines, are anticipated during operation. Any maintenance works would be undertaken in areas of the project site where existing utilities would have been either protected or relocated during construction. Where operation of the project has the potential to impact on the high pressure pipelines, this would be identified as part of the safety management study (in accordance with AS 2885) and the design would be refined or appropriate controls identified in consultation with the relevant utility providers to minimise the potential for impacts.

Ongoing design development, and implementation of the measures provided in section 19.6, would ensure that operation would not lead to non-compliance of the high pressure pipelines with AS 2885. As a result, it is considered that operating the project would comply with the risk criteria for development located near potentially hazardous facilities.

19.4.3 Customer and public safety and security

Operating light rail vehicles is associated with the potential for public safety and security risks, including the potential for collision with light rail vehicles and pedestrians, cars or cyclists. This potential risk is increased where the alignment needs to cross the road corridor and where it operates in a shared, mixed-use environment. As described in section 6.2.2, a shared light rail and pedestrian zone is proposed along Dawn Fraser Avenue between Australia Avenue and Carter Street in Sydney Olympic Park.

The operator's management system would include a comprehensive risk and safety management strategy and incident and emergency response plans. Light rail vehicles would be fitted with warning bells that are used on approach to and departure from each stop, except at night when they are used only where the driver considers there is a danger to public safety. The light rail vehicle drivers would also be required to give due consideration to traffic flows and pedestrian movements, assessing light rail vehicles speeds and braking requirements against actual or potential hazards.

Ongoing design development would be subject to detailed safety reviews to identify requirements for mitigation to manage and reduce the risk of incidents arising from collisions. Hazards associated with the movement of light rail vehicles through the existing road network and highly pedestrianised areas have been successfully managed for other light rail projects in Sydney (including along George Street in the Sydney CBD and Eat Street in the Parramatta CBD for the Sydney Light Rail and Parramatta Light Rail Stage 1 projects respectively). A similar approach would be applied to managing potential hazards or risks associated with the project.

The project has been, and would continue to be, designed to incorporate features that would ensure sufficient levels of safety. This would include inclusion of emergency help points and CCTV cameras linked to the Parramatta Light Rail operations control centre to ensure passenger security and to assist with deterring anti-social behaviour and vandalism. Further information is provided in Chapter 6 (Project description – operation).

19.4.4 Operation of substations and electrical wiring

The project includes operating new substations, electrical feeders and overhead wiring. Potential issues include the possibility of adverse health effects due to the electro-magnetic fields associated with electrical equipment, including traction substations and overhead wiring.

The design, construction, and operation of the project's power supply would be undertaken in accordance with standard industry guidelines and codes of practice, such that conductive and semi-conductive materials effectively shield electrical fields. With regard to magnetic fields, the separation distance would be maximised between substations and public areas to minimise the potential to alter electro-magnetic field strength within the surrounding area.

Low frequency electro-magnetic fields can also be considered a potential health hazard with long term exposure if emission levels are high. The possibility of adverse health effects due to electro-magnetic fields associated with electrical equipment has been the subject of extensive research throughout the world. To date, adverse health effects have not been established, but the possibility that they may exist has not been ruled out.

The project would be designed to comply with the limits of exposure set out in the *International Commission for Non-Ionising Radiation Protection Guidelines for Limiting Exposure to Time Varying Electric and Magnetic Fields* (ICNIRP, 2010). This would minimise the risk associated with electric and magnetic field exposure. Electric and magnetic fields are therefore not expected to pose a significant risk to public safety.

As described in section 6.7.4, wiring, tracks and other infrastructure would be designed to mitigate risks associated with high voltage cabling.

19.5 Cumulative impacts

Cumulative impacts relating to storage and transportation of hazardous goods and utilities relocation during construction are possible where other development projects are located adjacent to the project's work areas. However, co-ordination of activities (where relevant) and implementing the mitigation measures in section 19.6 would help to reduce these impacts and result in a low overall risk.

Potential cumulative health and safety impacts during operation are not anticipated.

19.6 Mitigation and management measures

19.6.1 Approach to mitigation and management

The key potential hazards and safety impacts identified in sections 19.3 and 19.4 relate to the potential for incidents during utility works, risks to public safety during emergency situations and operation, and the management of dangerous goods, including spills.

As described in section 19.3.2 investigations are currently underway to further understand the exact location of utilities within the project site and the required works to utilities. In addition, a Sydney Water accredited contractor has been engaged to undertake a detailed condition assessment of all Sydney Water pipes to ascertain their existing condition. Valve shut downs on the Sydney Water trunk mains would also be undertaken prior to construction to enable confirmation of the location of the nearest valves to the project site in the event of an incident. This information would form an important part of detailed construction planning, which would be undertaken in consultation with Sydney Water.

As described in Chapter 13 (Land use and property) (mitigation measure LP8), the location of all utilities and services, and requirements for access to, diversion, protection and/or support, would be confirmed prior to construction. This would include (as required) undertaking utilities investigations, including intrusive investigations, and consultation and agreement with service providers,

A safety management study would be undertaken in accordance with Australian and New Zealand Standard *AS/NZS 2885.1:2018 Pipelines – Gas and liquid petroleum, Part 1: Design and construction* and in consultation with the high pressure gas and fuel pipeline operators to identify how the pipelines would be managed during construction. The safety management study would require identification of all relevant risks, and assessment of likelihood and consequence, to determine a risk ranking. Management measures would be identified to reduce the risk to 'as low as reasonably practicable'. The safety management study would include a workshop with all relevant stakeholders, including pipeline owners and operators.

An incident and emergency response plan would be developed as part of the CEMP to manage emergency situations with threats to public safety during construction. Measures relating to dangerous good storage requirements and handling protocols would be included in the CEMP.

19.6.2 List of mitigation measures

Measures that will be implemented to address the potential for hazards and risk are listed in Table 19.3.

Table 19.3 Hazards and risk mitigation measures

Impact/issue	Ref	Mitigation measure	Timing
Electro-magnetic fields	HR1	The project will be designed in accordance with *Non-Ionising Radiation Protection Guidelines for Limiting Exposure to Time Varying Electric and Magnetic Fields* (ICNIRP, 2010) and Australian Standard *AS 2067:2016 Substations and high voltage installations exceeding 1 kV a.c* to minimise the risk associated with electro-magnetic field exposure. Wiring, tracks and other infrastructure will be designed to mitigate risks associated with high voltage cabling and potential earth leakage.	Design
Public safety	HR2	Ongoing design development will be subject to detailed safety reviews through the Safety in Design process, to identify measures to mitigate, manage and reduce the risk of incidents arising from collisions during operation.	Design

Impact/issue	Ref	Mitigation measure	Timing
Managing the potential for hazards during construction	HR3	The CEMP will detail processes, responsibilities and measures to manage hazards, and incident and emergency situations during construction.	Pre-construction, construction
	HR4	The soil and water management plan will include a spill response procedure. The procedure will detail measures to manage hazardous substances and dangerous goods, including storage, handling and spill response, in accordance with legislative requirements.	Pre-construction, construction
Impacts on services and utilities	HR5	Valve shut downs on the Sydney Water drinking water trunk mains will be undertaken to confirm the condition and functionality of the nearest valves to the project site and whether any repairs or rectification works are required to the existing assets.	Pre-construction, construction
	HR6	An incident and emergency response plan will be prepared to include the process to be followed in the event of an incident involving critical utilities such as the Sydney Water drinking water trunk mains, Jemena high pressure gas pipelines and Viva Energy fuel lines. The plan will be developed in consultation with the service providers and incorporate the findings from the utility investigations and Sydney Water condition assessment.	Pre-construction, construction
	HR7	A safety management study will be undertaken for proposed alterations to the gas and fuel pipelines in accordance with Australian and New Zealand Standard *AS/NZS 2885.6:2018 Pipelines – Gas and liquid petroleum, Part 6: Pipeline safety management*. The outcomes of the safety management study will be incorporated in construction planning. Management measures identified will be included in the incident and emergency response plan and implemented during construction.	Pre-construction, construction
Transport of dangerous goods and hazardous materials	HR8	The transport of dangerous goods will be undertaken in accordance with the Dangerous Goods (Road and Rail Transport) Regulation 2009 and the *Australian Code for the Transport of Dangerous Goods by Road and Rail* (National Transport Commission, 2017).	Construction
Public safety during operation	HR9	Targeted safety campaigns to raise awareness about the operation of light rail vehicles will be undertaken in the lead up to the opening of the project and during operation to promote safe operation. This will focus on raising awareness and promoting safe behaviours around light rail vehicles.	Operation