Chapter 14
Hazards and risks

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14. Hazards and risks

Chapter 14 describes the potential hazards and risks arising from construction and operation of the Moorebank Intermodal Terminal (IMT) Project (the Project), including the handling and storage of dangerous goods and hazardous materials within the Project site. A Preliminary Risk Assessment (PRA) was prepared by Parsons Brinckerhoff and is presented in Volume 4 of this Environmental Impact Statement (EIS). The PRA, as summarised in this chapter, addresses the relevant Commonwealth Department of Environment (DoE)'s EIS Guidelines and the Secretary for the NSW Department of Planning & Environment (NSW DP&E)'s Environmental Assessment Requirements (NSW SEARs), listed in Table 14.1.

Table 14.1 Relevant Commonwealth EIS Guidelines and NSW SEARs

Requirement	Where addressed
Commonwealth EIS Guidelines under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)	
• Provide an assessment of the likely and potential impacts on all aspects of the environment associated with spills, floods, fire and release of contaminants. The assessment needs to consider all hazardous items that will or could potentially be transported and/or stored at the intermodal terminal. Discuss the likelihood of hazardous materials being illegally transported using rail infrastructure and stored at the Moorebank IMT.	Section 14.2 to section 14.5 (this chapter). (Chapter 16 – *Hydrology, groundwater and water quality* covers potential water quality impacts).
• Full details of risk assessments which have been undertaken regarding potential threats from flood and fire, rehabilitation works, construction and operational storage of flammable and other hazardous materials and strategies to address these risks.	Section 14.3 – section 14.6 (this chapter). (Chapter 16 – *Hydrology, groundwater and water quality* covers potential flood impacts)
NSW SEARs under the NSW Environmental Planning and Assessment Act 1979 (EP&A Act)	
• Potential hazards and risks associated with the sites as a whole and offsite, taking into account activities that have the potential to cause harm to people and/or the environment, including potential impacts associated with storing and handling dangerous goods onsite and transporting such goods to and from the site consistent with the Department's guideline *Applying SEPP 33* and taking into account the *Hazardous Industry Planning Advisory Paper No 10: Land Use Safety Planning.*	Section 14.2 to section 14.5 (this chapter) and sections 2 to 3 in Technical Paper 4 – *Preliminary Risk Assessment* in Volume 4 of this EIS.
• A Preliminary Hazard Analysis, if relevant, in accordance with the *Hazardous Industry Planning Advisory Paper No. 6 Guidelines Hazard Analysis* (DoP).	Section 14.3 and section 14.4 (this chapter) and section 4 in Technical Paper 4 – *Preliminary Risk Assessment* in Volume 4 of this EIS.
• Bushfire protection, taking into account *Planning for Bushfire Protection* (Rural Fire Service (RFS)).	Section 14.5 and section 14.6.1 (this chapter).

14.1 Assessment approach

The risk assessment process used in the PRA prepared for the Project involved the following steps, which are consistent with the standard AS/NZS ISO 31000:2009 *Risk Management – Principles and Guidelines*:

- Identification of possible hazardous incidents arising from the sources of risk that are likely to be relevant to the Project, including:
  - > identification of hazardous materials;
  - > identification of credible adverse events that may arise from those materials;
  - > application of a screening process to determine which materials might lead to an unacceptable level of risk given the quantities involved;
  - > an analysis of the risk that results from the combination of estimated consequences and frequencies, including a preliminary hazard analysis, if required by the results of the screening process;
  - > an evaluation of the estimated risks against relevant criteria; and
  - > recommendation of mitigation measures, where required, to reduce risks to acceptable levels.

The Project would be constructed in phases, from Early Works through to Full Build. The potential hazards and risks were assessed for the combined construction and operation during all project development phases (as explained in Chapter 10 – *Impact assessment approach*). In this process, the final '2030 Full Build' is identified as the phase associated with the worst case operational scenario for the Project (i.e. representing the fully developed Project in terms of footprint and other operational impacts).

The hazard and risk analysis was carried out in accordance with the NSW Department of Planning and Environment (NSW DP&E) *State Environmental Planning Policy 33 – Hazardous and Offensive Development* (SEPP 33), *Hazardous Industry Planning Advisory Paper* (HIPAP) No. 4 – *Risk Criteria for Land Use Planning*, HIPAP No. 6 – *Guidelines for Hazard Analysis* and HIPAP No. 10 – *Land Use Safety Planning*.

A separate bushfire risk assessment was also prepared, as explained in section 14.1.5.

Potential differences in hazard and risk between the indicative IMT layouts for the three rail access option layouts were considered in the assessment.

14.1.1 Hazard identification

Potentially hazardous processes and materials associated with the Project operations have been identified. The main hazardous materials to be stored or transported to the Project site were classified in accordance with the *Australian Dangerous Goods* (ADG) *Code* (National Transport Commission 2011). The hazards identified for the Project are summarised in section 14.2.2.

14.1.2 Hazard screening

Hazardous materials associated with operation of the Project were screened according to the method outlined in the *Applying SEPP 33 Guidelines* (Department of Planning 2011d). These guidelines determine whether the Project falls within the definition of 'potentially hazardous industry' or 'potentially offensive industry' under SEPP 33. This initial hazard screening also identified whether hazards could be caused by accidents involving the materials stored on, or transported to, the Project site. Where the likely quantity of a hazardous material or dangerous good to be stored on site, or transported to the Project site, exceeds the screening limits, a preliminary hazard assessment (PHA) is required to show that the risk is not significant (refer to section 14.1.3 below).

14.1.3 Preliminary hazard assessment

Risks associated with the Project were assessed in accordance with the International Atomic Energy Agency (IAEA)'s *Manual for the classification and prioritisation of risks due to major accidents in the process and related industries* (IAEA Manual) (IAEA 1996). The IAEA Manual provides one of the methods recommended for multi-level risk assessment to be used in land use planning assessments against the criteria outlined in HIPAP No.4. This method is risk-based and relies on broad estimations of consequences and likelihood of accidents.

14.1.4 Risk matrix

A qualitative risk assessment using a risk matrix method was conducted to assess the key hazards during operation of the Project (refer to Table14.2 to Table 14.4). Due to the preliminary level of design for the Project, a quantitative risk assessment was not considered appropriate.

Table 14.2 Qualitative measures of consequence used for this assessment

Severity	Public health and safety	Biophysical environment	Social, economic, property
I	No medical treatment required, no health effects.	Minor effects only, no irreversible effects or effects on ecosystems.	No loss of significant assets or property value, minor short term social effects.
II	Medical treatment required, reversible disability.	Moderate short-term impacts not involving ecosystem function.	Ongoing social effects, minor loss of assets.
III	Permanent partial disability or long term hospitalisation.	Significant medium term impacts on species or ecosystems.	Serious ongoing social impacts, loss of significant assets.
IV	Fatality or severe permanent disability. Ongoing public health effects.	Serious long term reversible effects on ecosystems.	Major, permanent social disruption, major loss of assets or economic values.
V	Multiple fatalities, major chronic or acute public health effects to a significant population.	Major, long-term, irreversible effects on ecosystem function.	-

Source: Table 3.4 in Technical Paper 4 – *Preliminary Risk Assessment* in Volume 4 of the EIS.

Table 14.3 Qualitative measures of likelihood used for this assessment

Level of likelihood	Descriptor	Description
A	Almost certain	Almost certain to occur when relevant conditions are met. Frequent or continuous. At least a monthly occurrence.
B	Likely	Will probably occur when relevant conditions are met. Might occur annually.
C	Possible	Might occur at some time. May occur a few times in a person's lifetime.
D	Unlikely	Could occur at some time. Not expected to occur more than once in a lifetime.
E	Remote	Not expected to occur even when relevant conditions are met. Only in exceptional circumstances. Not expected to be observed in a lifetime.

Source: Table 3.5 in Technical Paper 4 – *Preliminary Risk Assessment* in Volume 4 of the EIS

Table 14.4 Risk matrix

Likelihood	Consequences				
	I Insignificant	II Minor	III Moderate	IV Major	V Catastrophic
A – Almost certain	H	H	E	E	E
B – Likely	M	H	H	E	E
C – Possible	L	M	H	H	E
D – Unlikely	L	L	M	M	H
E – Remote	L	L	M	M	H

Source: Table 3.6 in Technical Paper 4 – *Preliminary Risk Assessment* in Volume 4

Notes: L = Low; M = Medium; H = High; E = Extreme

Extreme risk items require immediate action to reduce risk before development can proceed. High risk items require attention to manage risk as part of the design process or management of the operation. Moderate and low risk items are generally managed through standard procedures and systems.

14.1.5 Bushfire risk assessment

The bushfire risk assessment followed the *Planning for bushfire protection guidelines* (RFS 2006). A desktop review of available information was carried out and considered the following data:

- current bushfire prone land mapping (Liverpool City Council (LCC));
- vegetation mapping of the Project site and surrounds (NSW National Parks and Wildlife Service 2002; Parsons Brinckerhoff 2011b; Tozer 2003);
- biodiversity of the Project site (Parsons Brinckerhoff 2011b);
- aerial photographs;
- topographic maps; and
- preliminary site layout.

14.1.6 Cumulative assessment

In accordance with the NSW SEARs, this EIS includes a cumulative assessment of the hazards and risks of the Project in combination with development of the Sydney Intermodal Terminal Alliance (SIMTA) site and other planned developments within the surrounding region. The findings of the cumulative assessment are provided in Chapter 27 – *Cumulative impacts*.

14.2 Hazard identification and screening

14.2.1 Hazardous materials

'Hazardous materials' are defined as substances (including dangerous goods) that have potential to cause harm to human life and health, or to the environment. 'Dangerous goods' are types of hazardous materials that may be corrosive, flammable, explosive, toxic, oxidising or water-reactive and which can be deadly and damaging to property and the environment.

Dangerous goods have been explicitly excluded from the types of freight that the Project would handle (i.e. they would not be accepted), and would therefore also be excluded from the Project's warehouse, freight container storage and transit areas. Therefore, risks arising from dangerous goods in freight, transit or storage were not assessed quantitatively in the PRA. It is possible that some dangerous goods may be processed or stored on the Project site as a result of human error or intentional deception. The nature and quantities of any hazardous goods that might be transported to and/or enter the Project site as freight (contrary to the exclusion) cannot be predicted with any certainty; however, it is considered highly unlikely that significant quantities of dangerous goods would be present.

For operation of the Project, a range of hazardous materials would be stored and used on site for refuelling, commercial use and maintenance/fire-fighting purposes. The likely hazardous materials for storage and use are listed in Table 14.5. Their properties are discussed further in section 2.6.3 of the PRA.

Table 14.5 Potential hazardous materials on site

Hazardous material	Use	Dangerous goods (DG)	Approx. quantity	Likely storage type
Diesel	To refuel locomotives	No but C1 combustible liquid	485 kL (total)	5 x 97 kL category 5 tanks
Diesel	Fuel for sale at the service station	No but comprises a C1 combustible liquid	<30 kL (total)	1 x 30 kL category 4 tank
Unleaded petrol	Fuel for sale at the service station	Yes	<30 kL (total)	1 x 30 kL category 4 tank
Liquefied petroleum gas (LPG)	Fuel for sale at the service station	Yes	<50 kL	1 x 50 kL tank
Liquefied natural gas (LNG)	To refuel mobile equipment on site	Yes	<100 kL	1 x 100 kL tank
Natural gas	Commercial use on site	Yes	N/A	Pipeline only
Lubricants, oils and associated waste	For maintenance purposes	Not generally classed as a DG, but combustible	<5000 L	Drums and <50 L containers in workshop
Solvents and other cleaners	For maintenance purposes	Yes	<5,000 L	Drums and <50 L containers in warehouses

Notes: N/A =Not applicable; C1= combustible liquid class 1; kL = kilolitres; L = litres; kg = kilograms

Source: Table 2.2 in Technical Paper 4 – *Preliminary Risk Assessment*

14.2.2 Hazard identification

All credible hazards for the Project were identified in relation to the following activities that would be carried out as part of the Project operations:

- construction and commissioning activities;
- transport of equipment and materials to site;
- rail traffic and logistics;
- road traffic and logistics;
- container loading and unloading;
- container storing;
- equipment maintenance;
- mobile plant refuelling;
- locomotive refuelling;
- service station;
- waste disposal; and
- transport of material (including waste) off site.

These activities are also described in Chapter 7 – *Project built form and operations* and Chapter 8 – *Project development phasing and construction*.

The potential hazards that might arise from these activities are:

- gas leaks (natural gas, LNG and LPG) as a result of weld/cylinder failure, equipment failure, impact, corrosion, drive-away during loading or refuelling, other operational error, malicious damage or sabotage;
- loss of containment of flammable/combustible or corrosive liquids as a result of impact, unloading, operational error or equipment failure;
- vehicle accident during the transport of a potentially hazardous material to the Project site, caused by poor road access or visibility, road conditions, other vehicles, vehicle or tank fault or driver fatigue;
- flooding as a result of extreme weather; and
- inappropriate waste disposal as a result of lack of safety training and/or use of uncertified contractors.

These activities and potential incidents have been summarised in Table 14.6, which describes the credible hazards relevant to the Project. Waste dangerous goods would mainly comprise those dangerous goods that are used by the Project, such as solvents. The types of risk are similar, but because the quantities involved would be much less than for the main dangerous goods storages, the risks are significantly lower.

Table 14.6 Possible hazardous incidents

Materials activities	Natural gas, LPG and LNG	Diesel and unleaded petrol underground storage	Flammable liquids	Combustible liquids	Hazardous waste
Transport to site	Vehicle accident. Loss of containment, liquid or gas leak and gas venting.	Vehicle accident. Loss of containment.	Vehicle accident. Loss of containment.	Vehicle accident. Loss of containment.	Vehicle accident. Loss of containment.
Unloading	Loss of containment, liquid or gas leak and gas venting.	Loss of containment.	Loss of containment.	Loss of containment.	N/A
Transport off site	N/A	N/A	N/A	N/A	Vehicle accident. Loss of containment. Improper disposal.
Storage on site	Loss of containment, liquid or gas leak and gas venting.	Loss of containment.	Loss of containment. Flooding	Loss of containment. Flooding.	Loss of containment. Flooding.
Construction/ commissioning	Loss of containment, liquid or gas leak and gas venting.	Loss of containment.	Loss of containment.	Loss of containment.	Loss of containment.
Operation	Loss of containment, liquid or gas leak and gas venting.	Spill from mis-operation: drive-away etc.	Loss of containment. Flooding.	Loss of containment. Flooding.	Loss of containment. Flooding.
Equipment maintenance	Loss of containment, liquid or gas leak and gas venting.	N/A	See below.	Loss of containment.	Poor housekeeping, waste management practices. Loss of containment.
Waste storage/ onsite disposal	N/A	Improper disposal of spill and contaminated stormwater.	Loss of containment. Improper disposal of spills.	Loss of containment. Improper disposal of waste and spills.	Loss of containment. Fire.
Main consequences for above scenarios	Formation of vapour cloud. If source of ignition present, boiling liquid expanding vapour explosion (BLEVE), pool or jet fire, vapour cloud explosion. WHS issue.	Environmental harm, WHS issue. If source of ignition present, pool fire.	Environmental harm, WHS issue. If source of ignition present, pool fire.	Environmental harm, WHS issue.	Environmental harm, WHS issue.

Note: N/A = not applicable; WHS = work health and safety

Source: Table 3.2 in Technical Paper 4 – *Preliminary Risk Assessment*

14.2.3 Initial screening under SEPP 33

The SEPP 33 screening assessment is based on various criteria which, if met or exceeded, trigger the need for a PHA. These criteria are summarised in Table 14.7.

For this Project, this assessment showed that LNG is the only material that would be stored or handled on site in sufficient quantities to exceed the screening limits under SEPP 33, triggering the requirement for a PHA. This is discussed in section 14.3.

Natural gas is subject to a risk screening under SEPP33 if it is stored in a fixed installation; however, for this Project, natural gas would not be stored on site because a gas reticulation network would be in place to deliver natural gas to its point of use. Risks arising from dangerous goods transport via a pipeline are also covered by SEPP 33, but are analysed using the IAEA Manual (refer to section 14.3).

Combustible liquids, when not stored in bulk with any flammable liquids, are not considered to be potentially hazardous. This would be the case for the proposed diesel storage.

Overall, the preliminary risk screening indicated that the storage of diesel and flammable and combustible liquids would not pose an unacceptable level of risk to the surrounding community and would be within the recommended risk levels set by the SEPP 33 guidelines. As no major effects would be felt outside the Project site from these materials, there is little likelihood of fatality or risk to individuals or society.

Table 14.7 Determination of the level of screening for the Project

Product	Total capacity (kL)	Total capacity (tonnes)	SEPP 33 screening criteria	SEPP 33 movement criteria	SEPP 33 screening result
LNG	<100	<42	200 m to sensitive use 150 m to other use	30/week 500/year	Above screening threshold
LPG (service station)	<50		N/A (for service stations)		N/A
Natural gas	N/A		N/A (pipeline)		N/A
Combustible liquid (diesel) (service station)	<30	<25	N/A (if stored separately from Class 3)	N/A	Below screening threshold
Flammable liquid Unleaded petrol (service station)	<30	<22	5 tonnes (25 tonnes for underground tanks)	45/week 750/year	Below screening threshold for underground tank
Combustible liquid (workshop)	<5	<5	5 tonnes (if stored with Class 3)	N/A	Below screening threshold
Flammable liquid (workshop)	<5	<5	5 tonnes (Class 3 PGII or III)	30/week 500/year	Below screening threshold

Note: kL = kilolitres, N/A = not applicable

Source: Table 3.3 Technical Paper 4 – *Preliminary Risk Assessment* (Volume 4)

14.2.4 Risk matrix ranking

The results of the qualitative risk assessment are summarised in Table 14.8 below (and provided in more detail in Table 3.7 of the PRA). For each risk presented, appropriate engineering controls and management systems would need to be considered to ensure that residual risks are maintained at an acceptable level. These measures are identified in section 14.6.

Table 14.8 Risk matrix (summary)

Hazard	Possible consequences	Mitigation/controls	Residual risk rating (with mitigation in place)		
			Public health and safety	Biophysical environment	Social, economic, property
Natural gas and LNG					
Leak of natural gas to atmosphere from pipe system due to weld failure, impact, corrosion, operational error, sabotage	Release of gas leading to gas cloud flash or jet fire if source of ignition or static electricity present.	Refer to the appropriate standard for gas reticulation network, including AS 2944-1 (2007) and AS 2944-2 (2007). Use correct schedule pipe. Install fire protection system if necessary for gas users. Ensure that cathodic protection for external corrosion is installed if appropriate.	Low	Low	Low
Leak of LNG during transport	Release of gas leading to gas cloud flash or jet fire if source of ignition or static electricity present.	Transport according to ADG Code, relevant standards and regulations. Ensure that contractor delivering the gas is trained, competent and certified by relevant authorities.	Low	Low	Low
Leak of LNG to atmosphere from tank or pipe system due to weld failure, impact, corrosion, operational error, sabotage	Release of gas leading to pool or jet fire and BLEVE if ignition source is present.	Use pipe of robust design, emergency isolation valves and pressure relief system. Design the LNG storage to AS 3961-2005. Excess flow control, emergency isolation valves, gas detection. Secure site to prevent unauthorised access. Significant separation distances to residences and other assets.	Low	Moderate	Moderate
Gas venting	Discharge of venting vapours from pressure relief device. If ignition source present, potential to ignite and impinge on adjacent tank or piping.	Design the LNG storage to AS 3961-2005. Secure site to prevent unauthorised access. Significant separation distances to residences and other assets.	Low	Low	Low

Hazard	Possible consequences	Mitigation/controls	Residual risk rating (with mitigation in place)		
			Public health and safety	Biophysical environment	Social, economic, property
LPG					
Leak of LPG during transport	Release of gas leading to toxic gas cloud flash or jet fire if source of ignition or static electricity present.	Transport according to ADG Code, relevant standards and regulations. Ensure that contractor delivering the gas is trained, competent and certified by relevant authorities.	Low	Low	Low
Leak of LPG to atmosphere from pipe system due to weld failure, impact, corrosion, operational error and sabotage etc.	Release of gas leading to toxic gas cloud, pool or jet fire or BLEVE, if source of ignition present. If located above low lying area, possible risk of asphyxiation in high concentration.	Use pipe of correct schedule, emergency isolation valves, pressure relief system. Design the LPG storage to AS/NZS 1596-2008. Install fire protection system. Use a minimum number of flanges. Secure site to prevent unauthorised access.	Low	Moderate	Moderate
Gas venting	Discharge of venting vapours from pressure relief device. If ignition source present, potential to ignite and impinge on adjacent tank or piping.	Design the LNG storage to AS/NZS 1596-2008. Secure site to prevent unauthorised access. Design with significant separation distances to residences and other assets.	Low	Low	Low
Flammable liquids and combustible liquids					
Flammable/combustible liquids: spills/leaks during transport	Contamination of soil, watercourses; water quality degraded; aquatic ecosystems adversely affected; potential loss of economic value of water.	Transport according to ADG Code, relevant standards and regulations.	Low	Moderate	Moderate
Flammable/combustible liquids: spills/leaks from storage	Potential pool fire if source of ignition is present. Contamination of soil, watercourses; water quality degraded; aquatic ecosystems adversely affected; potential loss of economic value of water.	Store in accordance with AS 1940, with secondary containment for all storages, and location away from drainage paths.	Low	Moderate	Moderate

Hazard	Possible consequences	Mitigation/controls	Residual risk rating (with mitigation in place)		
			Public health and safety	Biophysical environment	Social, economic, property
Flammable/combustible liquids: spills/leaks from operating equipment	Potential pool fire if source of ignition is present. Contamination of soil, watercourses; water quality degraded; aquatic ecosystems adversely affected.	Use secondary containment for generators and transformers. Place oil coolers generally in areas where leaks and runoff are appropriately controlled at source or in a detention basin.	Low	Moderate	Moderate
Inappropriate waste disposal failure of waste containment or inappropriate waste disposal, and/or poor containment design	Contamination of land, contamination of watercourses or groundwater, degraded water quality, aquatic ecosystems adversely affected, potential loss of economic value of water.	Do not dispose of hazardous or regulated wastes on site. Undertake all offsite disposal via approved transport operators and to approved facilities.	Low	Moderate	Moderate

Source: Table 3.7 Technical Paper 4 – *Preliminary Risk Assessment* (Volume 4)

Note: * Health/safety risk is to persons inside the Project site but the risk to public health is negligible.

14.3 Preliminary risk assessment

The results of the PRA using the IAEA method and quantitative modelling are summarised below. These results are also discussed further in section 4 of the PRA.

14.3.1 Risks from the natural gas pipeline

The IAEA method indicates that the likely maximum effect distance or area (representing the maximum number of people likely to be killed or injured in an accident) for the proposed gas pipeline and reticulation network is 25 metres (m). As reticulated gas would not be stored on site and the inventory is small, it would not pose a great risk to any nearby sensitive receivers. The nearest residential area is located well outside the 25 m effect area. The assessment has not identified any potential impacts on sensitive land uses or residential areas that would constrain the development, because the potential area of impact is small.

14.3.2 Risks from LNG and LPG storage

LNG fuel is likely to be stored on the Project site at the equipment maintenance and storage areas. The effect distance for the quantity of LNG that would be used on the Project site is between 25 and 50 m. The indicative IMT layouts (refer to Figure 7.4 to Figure 7.6 in Chapter 7 – *Project built form and operations*) demonstrate that LNG fuel could be stored within the equipment and maintenance storage areas while remaining at least 50 m from the nearest residential area. This means that the LNG impact area would not extend into any residential or sensitive use area, and no offsite fatalities would be expected from an accident involving LNG storage. While the IMT layouts are indicative only, and will be subject to a more detailed design process, this criterion will continue to be applied to ensure that the impact area avoids residential or sensitive areas.

A service station is proposed as part of the Project, off Moorebank Avenue and near to the entry to the warehousing precinct. LPG storage may be located at this service station; however, LPG stored in a service station is not included in the SEPP 33 assessment.

14.3.3 Risks from an LNG or LPG transport incident

The risks of transporting LNG to the Project site (and also LPG to the service station) were also assessed. The maximum quantity of LNG in any load is likely to be 25 tonnes. This puts it into the same effect category as the LNG storage, with the same effect radius (25 to 50 m) and area (0.4 hectares (ha)).

The only areas where any residential area or sensitive land use would be located within this effect distance would be on the public road network, in particular the M5 Motorway to the north of the Project site. Dangerous goods are prohibited from travelling through Sydney's tunnels; therefore, the potential impacts associated with the tunnel section of the M5 Motorway have not been considered.

Although residences are typically set back from the M5 Motorway, in some places the separation is less than the minimum effect distance of 25 m. However, this transport corridor (along with all other major roads in the network) is already used by a large number of vehicles carrying a wide range of dangerous goods, including some similar to LNG. Many movements of LPG would also occur along this section of the M5 Motorway.

Overall, the relatively small number of deliveries of LNG and LPG to the Project site and the service station would not be expected to increase the risk to residential or other land uses along the M5 Motorway, or any other part of the road network.

The probability of a major accident involving the transport of LPG to the proposed service station on the Project site was calculated (refer to section 4.1.3 of the PRA). The risk of fatality of the most 'at risk' person as a result of an accident involving LPG or LNG transport to the Project is quite low (in the order of $1x10^{-8}$ per km a year, i.e. a 1 in $1x10^{8}$ chance of a fatality as a result of a LPG transport accident) assuming an effect distance of up to 1 km and a 100% likelihood of fatality. This is below the most stringent land use criterion detailed in *HIPAP No. 10 – Land use safety planning*. The numbers provided from this assessment indicate that the contribution to overall risk from the Project is not significant.

14.4 Overall risk assessment

14.4.1 Individual risk

As discussed in section 14.3.1, the IAEA method determined that the Project is not likely to cause fatalities outside the Project site as a result of natural gas or LNG accidents (also refer to section 4.1 of the PRA). The increased risks associated with the transport of LNG and LPG to the Project site are also likely to be insignificant, relative to existing risk levels along transport routes. Injuries (rather than fatalities) are more likely to be related to small leaks from flanges, small diameter pipework and valves and appliances, which are much more likely to occur than catastrophic pipeline or LNG tank failure. For these less serious but more frequent events, the risk of injury is higher than the risk of fatality. These risks are posed to Project personnel, and not to the public.

For potential injuries offsite as a result of materials stored on the site, the risks were assessed as extremely low, given the distance of the Project site boundary from the main operation and fuel storage areas. Offsite injuries are assessed as unlikely because, as noted in section 14.3.1, all the measured injury risk distances are well within the Project site boundaries. The transport of LNG to the Project site (and also of LPG to the service station) has the potential to increase the risk to people living or working along the route, but the IAEA method has shown that the increased frequency of accidents arising from Project operations is likely to give rise to only a negligible increase in risk compared to existing risk levels.

The risk of prohibited dangerous goods being stored on site was assessed as low, given the short periods during which they would be likely to be present, the small quantities involved, and their likely separation across the Project site. These factors reduce both the likelihood and the consequences of any accident that might occur. The large separation distances to the nearest residential areas further limit the potential for any adverse consequences.

14.4.2 Societal risk

The nearest residential area is well outside the effect distances calculated for the Project. The IAEA method (described in the PRA and discussed in 14.4.1) and limited quantitative modelling determined that it is unlikely that there would be any fatalities outside the Project site as a result of accidents involving the natural gas reticulation network or LNG storage. Therefore, societal risk is not expected to increase.

The transport of LNG to the Project site has the potential to increase the risk to people living or working along the route, but as previously noted, the very small increase in the risk of an accident is considered to fall within the negligible range, based on the societal risk criteria detailed in HIPAP10 for land use planning.

Offsite property damage would be highly unlikely, as the quantitative model suggests that no explosion is likely on site (refer to the PRA).

14.4.3 Environmental risk

Natural gas (principally methane) is not considered toxic for the environment. As it is lighter than air, any leak is likely to disperse quite quickly without affecting the surrounding area unless it is in a confined area. Methane is a powerful greenhouse gas, but the relatively small quantities that could potentially escape from the Project reticulation network would have a minor impact on the environment.

It is estimated that <100 kL of LNG would be stored onsite. Although this quantity is not small, the impact radius (the radius at which there is likely to be a human fatality) estimated in the PRA does not extend outside the site and an event is not likely to affect any environmental factors (refer to Table 14.5 for approximate quantities of potential hazardous materials used on the Project site).

Other dangerous goods, including any waste materials present on the Project site, would be suitably contained, with secondary containment and runoff controls proposed where appropriate (refer Chapter 16 – *Hydrology, groundwater and water quality*) to prevent leaks or spills migrating to environmentally sensitive areas, in particular via stormwater systems to the Georges River.

Overall, any significant damage to the biophysical environmental is assessed as unlikely.

14.4.4 Hazard and risks summary

The PRA identified that none of the hazardous materials legally stored on site (principally fuel for equipment, trucks and locomotives), or related activities (such as transportation of these materials), could create an offsite impact that would significantly affect members of the public.

Prohibited dangerous goods that are introduced into the Project are unlikely to be present in such quantities, or for such periods of time, that any credible accident would result in an offsite risk approaching the land use risk criteria specified in the HIPAP No. 10 – *Land use safety planning*.

A SEPP 33 screening assessment has shown that, with the exception of LNG, none of the material present on site would be stored or handled in quantities that trigger any of the screening criteria. Reticulated natural gas would not be stored on site, and the inventory in the pipework would be small. A risk assessment of reticulated natural gas showed that the potential area of impact is small, and no potential impact to sensitive land uses or residential areas was identified. The existing risk arising from the gas distribution pipeline running along Moorebank Avenue would not change as a result of the Project.

LPG storage at the potential service station off Moorebank Avenue would be in accordance with the Australian Standard for the storage and handling of LPG (AS/NZS 1596:2008). The potential effect area for the LPG storage does not extend to any residential or sensitive use area.

The proposed size and location of the LNG storage tank on the Project site is such that the available buffer distance to the Project site boundary would prevent any significant consequence outside the Project site. The LNG storage in the final detailed design for the IMT can be located to ensure that the separation from any offsite sensitive land uses is greater than the estimated effect distance and the design standard for LNG storage. This would apply equally for all three indicative rail access option IMT layouts. Furthermore, there is no notable difference in hazard/risk between the three indicative rail access option IMT layouts; and this hazard and risk assessment applies equally to all three options.

Other dangerous goods likely to be used on the Project site would not be present in quantities that would give rise to risks to the public or offsite assets, but they could create occupational health and safety (OHS) risks for personnel on site or risks to the biophysical environment. These risks can be managed within safe levels by the appropriate use of engineering design and controls, good management practices and appropriate disposal methods for wastes.

A number of design and mitigation measures are proposed to manage the hazards and risks described above (refer to section Table 14.6). If these are implemented, the residual hazards and risks of the Project's development should be managed to an acceptable level.

14.5 Bushfire risk assessment

14.5.1 Existing risk

The Project site has been identified as containing bushfire prone land around the boundary, as mapped by the Liverpool City Council (LCC) (refer to Figure 14.1). The key bushfire threats to the Project site occur from the:

- south-eastern corner of the Project site: extensive bushland vegetation occurs in this area and includes the Holsworthy Military Area; and
- western boundary: the Georges River corridor and proposed conservation zone, extending north-south along the western boundary of the Project Site is heavily vegetated.

Vegetation

The vegetation in the Project site and surrounding areas is described in Chapter 13 – *Biodiversity*. This vegetation formation is consistent with a Dry Sclerophyll Forest formation and typically has a fuel load of 20/25 tonnes per hectare (rate of spread/total fuel load).

Topography

The slope of a site generally influences the rate of spread of fire, with a doubling of the rate of spread for every increase of 10 degrees. As a consequence, a bushfire hazard downslope of a site would pose a greater risk as a fire would travel upwards, with both the flame height and intensity increasing.

The Project site is generally flat, with a short steep slope up from Georges River to the Project site and a gentle downward slope to the east of the Project site. The effective slope of the existing Project site in relation to bushfire hazard is summarised in Table 14.9.

Table 14.9 Effective slope (existing) within 100 m of the Project site

Aspect	Slope (degrees)
Western boundary	5–10 degrees downslope (approximately 7–8 degrees)
South-eastern corner of the Project site	0.5 degrees downslope (approximately 0.3 degrees)

Source: Parsons Brinckerhoff (2012)

Fire weather area

'Fire weather' is assessed based on a credible worst case scenario and an absence of any other mitigating factors relating to aspect or prevailing winds. The 1:50 year weather scenario for the greater Sydney region (NSW Fire Area 4) has a Fire Danger Index (FDI) of 100.

14.5.2 Bushfire risk with the Project

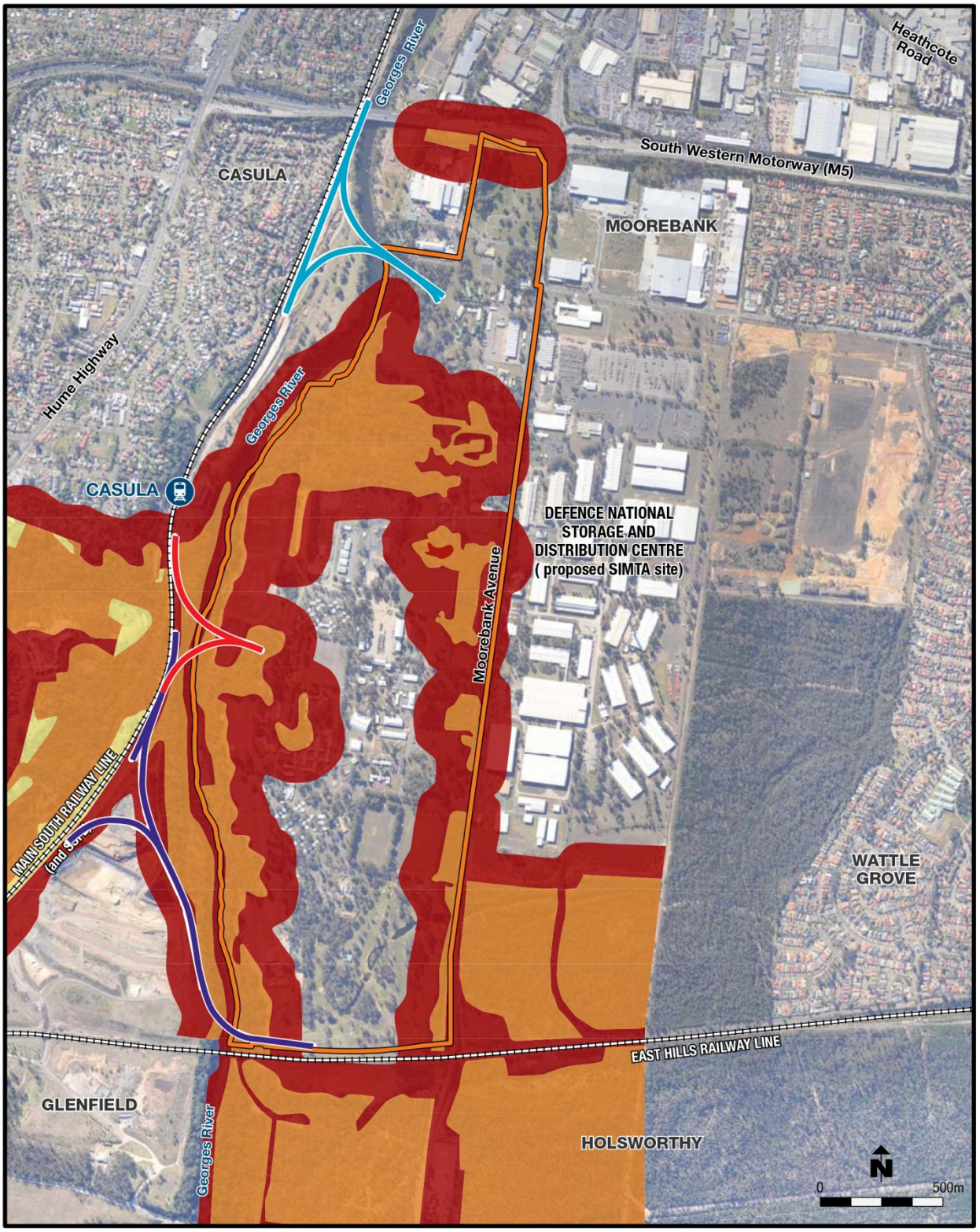
The potential for a bushfire to affect the Project site was determined by assessing the vegetation type, topography and fire weather. This is summarised in Table 14.10.

Table 14.10 Risk of bushfire attack to Project

Location	Slope	Bushfire attack level	
		At site boundary	For development
Western boundary (from Georges River and conservation area)	5–10 degrees downslope	Flame zone	Flame zone. Bushfire attack low beyond 100 m from the conservation area.
South-eastern corner	0–5 degrees downslope		12.5 for administration buildings in south-east corner for the indicative IMT layouts for the central and southern rail access options (approximately 75 m from hazard). 12.5 for southern most warehouse for the northern rail access option indicative IMT layout (approximately 75 m from hazard). Bushfire attack low – 100 m from site boundary.

Notes: Flame Zone = Significant radiant heat and significant higher likelihood of flame contact from the fire front will threaten building integrity and result in significant risk to residents, heat flux >40 kW/sq. m; Low = minimal attack from radiant heat and flame due to the distance of the site from the vegetation, although some attack by burning debris is possible. There is insufficient threat to warrant specific construction requirements. 12.5 = attack by burning debris is significant with radiant heat (not greater than 12.5 kW/m^2). Radiant heat is unlikely to threaten building elements (e.g. unscreened glass).

Source: Parsons Brinckerhoff (2012)



Project Site boundary
Northern rail access option
Central rail access option
Southern rail access option

Bushfire Prone Land
Vegetation category 1
Vegetation category 2
Vegetation buffer

Fig 14.1 Bushfire prone land

The Project is proposed on bushfire prone land, with the key bushfire threats to the Project site from the south-eastern corner of the Project site (extensive bushland offsite including Holsworthy Military Area) and from the western boundary (Georges River corridor and onsite conservation zone). Some restoration of vegetation would be implemented within the conservation zone as part of the Project. Remnants of vegetation in the eastern section of the Project site are proposed to be cleared for the development and would therefore no longer pose a bushfire threat.

The indicative IMT site layout options in this EIS (refer Figures 7.4 to 7.6 in Chapter 7 – *Project built form and operations*) provide some suitable measures to minimise bushfire risk; in particular, the provision of a perimeter road and location of commercial development and warehouses away from the main bushfire threat. Additional measures for site design and layout are proposed (refer to section 14.6.2), including the development of landscaping/vegetation management and fire safety and evacuation plans, as well as safety provisions relating to access, water and services.

Contingency scenario if no vegetation clearing is undertaken

As discussed in section 14.5.2, the Project is proposed on bushfire prone land. If no vegetation clearing was undertaken within the construction footprint (refer Figure 8.12 to Figure 8.14), the potential bushfire threats to the Project would remain. This would require the bushfire risk assessment in this chapter and the eventual bushfire management plan (yet to be prepared) to be updated with any changes to the IMT site layout or areas proposed for vegetation clearing, and appropriate mitigation measures to be provided in the design of the IMT.

Any additional measures would need to take into account the *Planning for bushfire protection guidelines* (RFS 2006) which has recommended key bushfire protection measures to be considered in the site layout and detailed design stage. Such measures are discussed further in section 14.6.2 and include:

- the provision of clear separation of buildings and bush fire hazards, in the form of a fuel-reduced Asset Protection Zone;
- construction standards and design;
- appropriate access standards for residents, fire fighters, emergency service workers and those involved in evacuation;
- adequate water supply and pressure;
- emergency management arrangements for fire protection and/or evacuation; and
- suitable landscaping, to limit fire spreading to a building.

14.6 Management and mitigation

14.6.1 Hazardous materials

The following safeguards would be put in place for the Project to minimise the potential for hazards and risks:

- To minimise the risk of leakages involving natural gas, LNG and flammable and combustible liquids to the atmosphere:
  - appropriate standards for a gas reticulation network, including AS 2944-1 (2007) and AS 2944-2 (2007), would be applied in the detailed design process;
  - correct schedule pipes would be used;
  - fire protection systems would be installed if necessary for gas users;
  - cathodic protection would be installed for external corrosion if appropriate; and
  - access to the Project site would be secure.
- To minimise the risks of leakage of LNG and LPG and flammable liquids during transport:
  - materials would be transported according to the ADG Code and relevant standards and regulations; and
  - contractors delivering the gas would be trained, competent and certified by the relevant authorities.
- To minimise hazards associated with venting of natural gas, LNG and LPG:
  - LNG storage would be designed to AS/NZS 1596-2008 standards;
  - access to the Project site would be secure; and
  - significant separation distances to residences and other assets would be maintained.
- Storage of flammable/combustible liquids would be carried out in accordance with AS 1940, with secondary containment in place and location away from drainage paths.
- Standby or emergency generators and transformers would all have secondary containment.
- Oil coolers would generally be in areas where leaks and runoff are appropriately controlled at source or in a retention basin.
- All systems would be designed in accordance with good engineering practice.
- Appropriate testing, alarm systems and work, health and safety (WHS) precautions would be implemented.
- No hazardous or regulated wastes would be disposed of on site.
- All offsite disposals would be carried out by approved transport operators and to approved facilities.

- Other dangerous goods, including any waste materials present on the Project site, would be suitably contained, with secondary containment and runoff controls implemented where appropriate to prevent leaks or spills migrating to environmentally sensitive areas, in particular via stormwater systems that drain to the Georges River.

14.6.2 Bushfire risks

The NSW RFS has reviewed the assessment of bushfire risks undertaken by Parsons Brinckerhoff for the EIS, and confirmed that the assessment was thorough in its view (refer to consultation details in Appendix D, Volume 2 of this EIS). The RFS also advised that the aims and objectives of the *Planning for Bush Fire Protection 2006* apply to building construction in association with the Project.

The following measures are proposed to further minimise bushfire risk.

Design measures (during detailed design)

- The aims and objectives of the *Planning for bushfire protection guidelines* (RFS 2006) would be further considered and consultation with the RFS would continue during detailed design.
- A bushfire management plan would be prepared for the Project site to develop the bushfire management measures in detail, in consultation with the RFS. The bushfire management plan would detail the interaction between the Project footprint and biodiversity offset areas (as identified in section 13.4.3 in Chapter 13 – *Biodiversity*).
- In the event that no vegetation clearing is undertaken, the bushfire risk assessment and bushfire management plan would be updated and appropriate mitigation measures provided in the design of the IMT.
- Internal roads would be designed to enable safe access for emergency services and allow crews to work with equipment aboard the vehicle, including providing:
  - > two-wheel drive and sealed all weather roads;
  - > internal perimeter road at least two lanes wide (8 m kerb to kerb);
  - > a minimum vertical clearance of 4 m;
  - > curves with a minimum inner radius of 6 m; and
  - > roads with capacity to carry fully loaded fire-fighting vehicles (15 tonnes).
- Options would be considered to relocate administration buildings in the south-eastern corner of the Project site to an area further from the bushfire hazard.
- Water supplies for fire-fighting would be easily accessible and located at regular intervals, including:
  - > reticulated water supply using a ring main system for the perimeter road;
  - > fire hydrant spacing, sizing and pressures complying with AS 2419.1–2005;
  - > location of hydrants outside of any road carriageway; and

  - ensuring all above ground water pipes external to building are metal, including and up to any taps.

- Locate electricity services to limit the possibility of ignition of surrounding bushland or the fabric of buildings, including:
  - where practicable, locating electrical transmission lines underground;
  - where overhead electrical transmission lines are proposed, installing lines with short pole spacing (30 m); and
  - ensuring no part of a tree is closer to a power line than the distance set out in accordance with the specifications in *Vegetation Safety Clearances* issued by Energy Australia (NS179, April 2002).
- Locate gas services to avoid ignition of surrounding bushland or the fabric of buildings, including:
  - ensuring all aboveground gas service pipes external to buildings are metal (including connections); and
  - ensuring reticulated or bottled gas is installed and maintained in accordance with AS 1596 and the requirements of relevant authorities.

Risk management

- A fuel management plan would be developed for the conservation zone and offset areas (as identified in section 13.4.3 in Chapter 13 – *Biodiversity)*, taking into consideration the ecological values of this area, including the presence of threatened biodiversity.
- A landscape management plan would be developed for any landscaped gardens within the Project site.
- A fire safety and evacuation plan would be developed. This would:
  - include training requirements for staff about fire prevention and safety;
  - provide a fire escape plan (designated meeting points and escape routes), and require regular fire drills;
  - outline provision of a functional fire alarm system;
  - outline equipment use restrictions during fire bans; and
  - outline measures for arson prevention, including provision of adequate lighting and security to deter trespassers.
- A more detailed bushfire risk assessment would be undertaken following finalisation of design and layout, in consultation with the RFS.

14.7 Summary of key findings

In summary, the PRA has determined that the key risks/hazards associated with the Project during the construction and operation phases include: gas leaks (natural gas, LNG and LPG); loss of containment of flammable/combustible or corrosive liquids; vehicle accidents; flooding as a result of extreme weather; and inappropriate waste disposal. These hazards may arise from a number of activities including rail and road logistics, storage of hazardous materials, refuelling, waste disposal and equipment maintenance. Table 14.11 identifies the key hazards and risks associated with the Project during Full Build for each rail access option.

In terms of bushfire risks, the Project is proposed on bushfire prone land, with the key threats located in the south-eastern corner of the Project site.

Table 14.11 Summary of potential hazards and risks associated with the Project at Full Build, without mitigation

Impact	IMT layout and associated rail access connection option		
	Northern	Central	Southern
Potentials hazards arising from gas leaks (natural gas, LNG, LPG)	•	•	•
Potential hazards arising from loss of containment of flammable/combustible or corrosive liquids	•	•	•
Vehicle accident during the transport of a potentially hazardous materials to the Project site	•	•	•
Flooding as a result of extreme weather	•	•	•
Inappropriate waste disposal	•	•	•
Bushfire threat to the Project	•	•	•
Potential bushfire risks exacerbated by the Project (e.g. flammable substances such as fuels)	•	•	•

Key: • = impact, - = no impact

A number of design and site management measures have been identified and would be put in place to minimise the potential for hazards and risks. This includes measures relating to:

- storage, transport and venting of natural gas, LNG and LPG;
- storage of flammable/combustible liquids;
- design and construction of containment areas for storage;
- disposal of hazards wastes; and
- testing, alarm systems and WHS precautions.

In terms of bushfire risks, mitigation measures relating to site design and layout are proposed, including the development of landscaping/vegetation management and a fire safety evacuation plan. A bushfire management plan would also be prepared during detailed design to development the bushfire management measures in detail in consultation with the RFS.

Overall, the PRA concluded that there would be no significant increase in risk to the public and a result of the Project and, with the mitigation measures described above, the residual hazards and risks of the Project would be managed to an acceptable level.