Chapter 29
Environmental risk analysis

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29. Environmental risk analysis

This chapter details the environmental risk analysis (ERA) undertaken for the Moorebank Intermodal Terminal (IMT) Project (the Project). The ERA identifies the key environmental risks of the Project, based on the detailed assessments of specific impacts and mitigation measures summarised in previous chapters of this Environmental Impact Statement (EIS) (refer to Chapters 11 to 28 in this volume).

As part of the ERA, the significance of potential risks (if unmitigated) was evaluated, based on the detailed assessments outlined in this EIS. The significance of these 'residual' risks was then assessed assuming that the proposed mitigation or management measures were implemented (as summarised in Chapter 28 – *Environmental management framework*). This process sought to ensure that any risks that remain following mitigation and management could be prioritised and addressed during the detailed design and Stage 2 State significant development (SSD) approval(s) phases.

The ERA also provides an opportunity to identify any potential environmental risks not incorporated into the Commonwealth Department of the Environment (DoE)'s Environmental Impact Statement (EIS) Guidelines and the Secretary of the NSW Department of Planning and Environment (NSW DP&E)'s Environmental Assessment Requirements (NSW SEARs) for the Project. Table 29.1 details the Commonwealth EIS Guidelines and NSW SEARs relevant to this chapter.

Table 29.1 Relevant Commonwealth EIS Guidelines and NSW SEARs

Requirements	Where addressed
Commonwealth EIS Guidelines under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) EPBC Act	
• An assessment of the degree of uncertainty in relation to each impact including statements of whether any impacts are likely to be unknown, unpredictable or irreversible	Section 29.2 (Table 29.6)
NSW SEARs under the Environmental Planning and Assessment Act 1979 (NSW) (EP&A Act)	
• The EIS must include an environmental risk analysis to identify potential environmental impacts associated with the development (construction and operation), proposed mitigation measures and potentially significant residual environmental impacts after the application of proposed avoidance and mitigation measures. Where additional key environmental impacts are identified through this environmental risk analysis, an appropriately detailed impact assessment of additional key environmental impacts must be included in the EIS.	Sections 29.1 and 29.2

29.1 Risk analysis approach

The ERA involved two phases: impact screening, followed by a detailed assessment of potential risks evaluated as 'potentially significant'. The following sections discuss these phases.

29.1.1 Impact screening

The impact screening process involved a number of steps that assisted in the progressive identification and refinement of potential key risks. Initially, preliminary investigations of the Project and Project site were undertaken. These investigations informed the options assessment and concept development process for the Project. The investigations, options assessment and concept development process then supported or informed the development of the Project through the *Moorebank Intermodal Terminal Preliminary Project Overview Report* (Parsons Brinckerhoff 2011c).

An impact risk workshop for the Project was held in late 2010, with attendees including key representatives from the Moorebank IMT Project team. This workshop included identification and qualitative assessment of potential risks, followed by a discussion of potential mitigation approaches or options.

The screening process identified the following key impacts:

- traffic and transport (network access, capacity and safety);
- noise and vibration;
- biodiversity;
- contamination;
- stormwater and flooding;
- air quality;
- heritage (Aboriginal and European);
- visual environment;
- social and economic environment; and
- human health.

A number of other potentially significant issues were also recommended for further investigation during the EIS process:

- hazard and risks (including bushfires);
- water and hydrology (surface water and groundwater);
- waste management; and
- ecologically sustainable development.

As detailed in Chapter 6 – *Project development and alternatives*, the Project was further developed in 2013 and 2014 following additional demand analysis and consultation with industry parties. This led to some substantial changes to the proposed Project development phasing, and the incorporation of three rail access options (and associated IMT layouts) into the Project and the EIS process. In June 2014, a further review and workshop of the potential environmental risks associated with the Project was undertaken, including input from key technical specialists and the Moorebank IMT Project team. This review and workshop confirmed the potential risks listed above.

The outlined investigations and studies, coupled with ongoing stakeholder consultation activities, have shaped the Commonwealth EIS Guidelines and NSW SEARs developed for this Project. Together, these processes ultimately informed the relevant detailed impact assessments undertaken for this EIS (Volumes 3 to 9) and summarised in Chapters 11 to 28 in this volume. This ERA is based on the outcomes of these detailed assessments, focusing on impacts identified to be potentially significant.

29.1.2 Risk analysis framework

This ERA was undertaken in accordance with the principles of the Australian and New Zealand standard AS/NZS ISO 31000:2009 *Risk Management – Principles and Guidelines*. This risk analysis approach involves:

- ranking the risk of each identified potential impact by identifying the consequences of that impact and the likelihood of it occurring; and
- considering the probable effectiveness of proposed mitigation measures to determine the likely residual risk of each impact.

Definitions of the 'consequence' and 'likelihood' of the impacts are discussed in the subsections below.

Consequence

By definition, consequence is 'the outcome of an event affecting objectives' (AS/NZS/ISO 31000:2009). Consequence is informed by a number of factors, including:

- spatial extent – local (Project site and nearby surrounding areas), council (local government area (LGA)), region (south-west Sydney) or state (NSW);
- duration – short-term, medium-term, or long-term; and
- nature – whether an impact is:
  - > reversible or irreversible;
  - > direct, indirect or cumulative; or
  - > positive, negative or neutral.

Assessment of the consequence of an impact may be informed by some of the above factors, with assessments based on available evidence, previous experience and professional judgement. Table 29.2 outlines the definitions of consequence used for the ERA for the Project.

Table 29.2 Consequence definitions for risk analysis

Consequence	Definition
Critical	Impact likely to be long-term and irreversible Impact may be local or wider (including up to a state-wide spatial extent) Impact likely to be of a high level of concern amongst most stakeholders
Major	Impact likely to be medium- to long-term and potentially irreversible Impact may be local or wider (most likely no greater than a regional spatial extent) Impact likely to be of concern to key stakeholders
Moderate	Impact likely to be medium-term and reversible Impact may be local or wider (most likely no greater than nearby LGAs) Impact may be of concern to select stakeholders
Minor	Impact likely to be short-term and reversible Impact may be local or wider (most likely no greater than nearby LGAs)
Negligible	Impact likely to be very short-term and readily reversible (insignificant) Impact may be local or wider (most likely no greater than nearby LGAs)

Likelihood/certainty

Likelihood is defined as 'the chance of something happening' (AS/NZS/ISO 31000:2009). Like consequence, likelihood is determined by available evidence, previous experience and professional judgement. Table 29.3 outlines the definitions of likelihood used for the ERA for the Project.

Table 29.3 Likelihood definitions for risk analysis

Likelihood	Definition
Almost certain	Expected to occur in the course of most normal circumstances
Likely	Could occur in the course of most normal circumstances
Possible	May occur in the course of normal circumstances
Unlikely	Is possible, but not likely to occur in the course of normal circumstances
Remote	May occur in exceptional circumstances

Certainty of impacts (i.e. whether they are unknown, unpredictable or irreversible) is closely linked to likelihood. Comments have been included in the 'likelihood' column in Table 29.6 to note the potential for the impacts to be unknown, unpredictable or irreversible, based on consideration of available evidence, previous experience and professional judgement.

Significance of (unmitigated) risks

The significance of a risk, in an unmitigated scenario, was determined by combining the consequence and likelihood determinations of an impact in accordance with the matrix illustrated in Table 29.4.

Table 29.4 Risk definition matrix

		Consequence				
		Negligible	**Minor**	**Moderate**	**Major**	**Critical**
Likelihood	**Almost certain**	Moderate	Moderate	High	Major	Major
	Likely	Low	Moderate	High	High	Major
	Possible	Low	Moderate	Moderate	High	High
	Unlikely	Low	Low	Moderate	Moderate	High
	Remote	Low	Low	Low	Moderate	High

Residual (mitigated) risk

Residual risk was determined by considering the significance of an impact and the manageability of that impact (the ability of the impact to be managed or mitigated using proposed measures). Similar to consequence ratings, a number of factors were considered in determining the rating. Table 29.5 details the definitions and ratings used to determine the residual risk of impacts associated with the Project.

Table 29.5 Residual risk definition matrix

Residual risk rating	Definition
High	Sensitive receiving environment/population Impact not well understood (high level of uncertainty) High level of ongoing stakeholder concern New or complex set of mitigation measures/controls required Effectiveness of safeguards not certain/proven
Moderate	Resilient or disturbed receiving environment/population Impact understood Some ongoing stakeholder concern Standard set of mitigation measures required Effectiveness of safeguards known
Low	Resilient or disturbed receiving environment/population Impact well understood/common Little to no ongoing stakeholder concern Standard, few or no mitigation measures required

29.2 Environmental risk analysis (ERA)

Table 29.6 details the findings of the ERA undertaken for the Project. This analysis was undertaken following a review of relevant specialist studies (refer to Volumes 3 to 9 and Chapters 11 to 27 in this volume), and in consideration of mitigation and management measures (refer to Chapter 28 – *Environmental management framework*). The assessments were based on evidence, experience and professional judgement of potential risks, and their consequence, likelihood and significance (with and without mitigation and management strategies). This risk assessment is a live document that will be reviewed periodically during the detailed design and Stage 2 SSD approval(s) processes. The assessment focused on risks during the main construction phases of the Project, as well as the Project operations. No additional risks would be expected during the Early Works phase of the Project.

The 'Applicability' column in Table 29.6 identifies which component of the Project the ERA applies to (i.e. the main IMT site, the northern rail access connection, the central rail access connection and/or the southern rail access connection).

Table 29.6 Environmental risk analysis assessment

Impact/risk	Description of potential risk (without mitigation)	Consequence (unmitigated)	Likelihood/ certainty (unmitigated)	Risk significance (unmitigated)	Key design and mitigation measures (NB: refer Chapter 28 for the full list of measures)	Residual risk rating	Applicability			
							Main IMT site	Northern rail access connection	Central rail access connection	Southern rail access connection
Increase in road traffic volumes and congestion during construction or operation	• Increased traffic volumes from construction activities would temporarily reduce the performance of the existing intersections along Moorebank Avenue. However, once Moorebank Avenue is upgraded as part of the Project in Phase A, the upgraded intersections would operate better than the existing road network. • With the Project fully operational in 2030, minimal changes are forecast to the performance of the local road intersections in the AM and PM peaks. • Project traffic (during construction and operation) is expected to have an overall negligible impact on the operation of the M5 Motorway. • Operation of the Project would result in a small increase in traffic volumes at some locations on the M5 Motorway close to the Project site; however, the Project's overall impact on traffic on the M5 Motorway would be positive. • High level of concern expressed by numerous stakeholders and local community.	Minor–Moderate	Almost certain Impacts fairly well known and predictable; no irreversible impacts	Moderate–High	• Ongoing community consultation; • Upgrade of Moorebank Avenue included as part of Phase A, including expansion of Moorebank Avenue and Anzac Road intersection. • Preparation of detailed construction traffic management plans for each construction phase (including Early Works) as part of the construction environmental management plans. • Minimising construction vehicle movements during peak periods; • Monitoring traffic in peak periods on Moorebank Avenue during Early Works and construction, to ensure queuing at intersections does not impact on other road users. • Detailed staging and timing of any rail closedown works to be further developed in consultation with the Australian Rail Track Corporation (ARTC), and staged to ensure that impacts to regular rail operations are minimised.	Low to Moderate	●	N/A	N/A	N/A
Reduction in road safety during construction or operation	• The proposed upgrade of Moorebank Avenue would have a positive impact on overall road safety and should reduce the likelihood of vehicle accidents on this road. • The Project would reduce the vehicle kilometres travelled (VKT) by trucks on the Sydney road network, leading to a potential reduction in heavy vehicle-related crashes. • Potential for some road safety risks during construction of Moorebank Avenue upgrade works and works west of the Georges River (for northern and central rail access connection options). • Concern expressed by stakeholders regarding the potential for reduced road safety due to increase in road traffic generated by the Project.	Major (during construction only)	Possible Impacts fairly well known and predictable; some potential for irreversible impacts	High (during construction only)	• Upgrade to Moorebank Avenue includes road safety treatments such as full controlled right-turn lanes and midblock treatments. • During construction, implementation of construction traffic management plans would include road safety measures such as implementing a communications plan, traffic control plans and an emergency response plan.	Low	●	●	●	●
Impact on rail infrastructure and operations during construction or operation	• Construction of the rail access connections to the operating Southern Sydney Freight Line (SSFL) would cause some temporary disruption to the operation of this freight corridor during rail closedown periods. • Operation of the Project would not affect the operation of the SSFL, as it would operate within the already approved capacity of the SSFL, and the track speeds for entry/exit onto the SSFL have been designed to avoid impact. • The projected IMEX and interstate train movements	Minor	Almost certain	Moderate	• Detailed staging and timing of any rail closedown works would be further developed in consultation with the Australian Rail Track Corporation (ARTC), and staged to ensure that impacts to regular rail operations are minimised. • The Project team will continue to liaise with ARTC, Transport for NSW (TfNSW) and other	Low		●	●	●

Impact/risk	Description of potential risk (without mitigation)	Consequence (unmitigated)	Likelihood/ certainty (unmitigated)	Risk significance (unmitigated)	Key design and mitigation measures (NB: refer Chapter 28 for the full list of measures)	Residual risk rating	Applicability			
							Main IMT site	Northern rail access connection	Central rail access connection	Southern rail access connection
	for the Project may be affected by the SSFL's current configuration capacity constraints.				stakeholders regarding the capacity of the network for the SSFL and beyond (including for interstate rail transport).					
Increase in ambient noise levels at sensitive receivers and exceedance of applicable noise goals/criteria	• Some construction and operation activities associated with the Project would increase local noise levels. Any increases as a result of construction would be temporary. • In some cases, the predicted noise levels during Project operations (without mitigation) would exceed the applicable noise criteria for residential receivers. • Residential receivers in Wattle Grove, Casula and North Glenfield are of particular concern. • High level of concern expressed by numerous stakeholders, particularly in relation to direct and cumulative noise impacts and human health.	Moderate to major (Impacts reversible and local, but likely to be of concern)	Likely (depending on meteorological conditions) Impacts fairly well known and predictable (subject to further assessment during detailed design); no irreversible impacts	High	• Construction works would be limited to standard daytime construction hours, unless essential and approved (e.g. required for safety) or where not above acceptable levels. • Where noise-generating construction works are outside standard hours, additional mitigation would be implemented (e.g. localised acoustic screens, restricting simultaneous use of noisy plant). • Development of Project design/layout to minimise noise (e.g. procurement of mechanical plant with lowest available noise emissions, use of noise reduction barriers, restricting track turn radii). • Ongoing community consultation/ complaints management system. • Ongoing monitoring to continually evaluate Project noise emissions and, as required, implement additional noise mitigation.	Moderate (With mitigation, there may be a residual increase to existing ambient noise levels but this would be within permitted limits.)	●	●	●	●
Loss or disturbance of Threatened flora and fauna species during construction and operation	• Establishment of a conservation area alongside the Georges River is proposed as part of the Project. • Predicted loss of approximately 17 hectares of Castlereagh Scribbly Gum Woodland vegetation from the Project site, which includes a number of Threatened flora species. • Some predicted impacts on 25 Threatened fauna species known or likely to occur on the Project site. Impacts include potential loss of habitat and breeding resources, noise and light disturbance, and potential for direct mortality (in some species only). • No Commonwealth EPBC Act or *Threatened Species and Conservation Act 1995* (NSW) listed Threatened species, population or ecological community is likely to be significantly affected by the Project. • Concern expressed by some stakeholders.	Major	Almost certain Vegetation clearing is irreversible; impacts well known and predictable	Major	• The proposed retention (as a conservation area) of substantial areas of vegetation along the Georges River. • Identification of vegetation clearing exclusion zones for sensitive areas. • Presence of a trained ecologist to accompany clearing crews to ensure disturbance is minimised and any native fauna are relocated. • Long-term weed removal/riparian vegetation restoration within conservation area. • Pre-clearing surveys and clearing of hollow-bearing trees prior to vegetation clearing. • Development of a biodiversity offset strategy in accordance with regulatory requirements.	Moderate	●	●	●	●

Impact/risk	Description of potential risk (without mitigation)	Consequence (unmitigated)	Likelihood/ certainty (unmitigated)	Risk significance (unmitigated)	Key design and mitigation measures (NB: refer Chapter 28 for the full list of measures)	Residual risk rating	Applicability			
							Main IMT site	Northern rail access connection	Central rail access connection	Southern rail access connection
Hazards and risks associated with hazardous materials/ dangerous goods	• Some hazardous materials would be legally stored on site (principally fuel for equipment, trucks and locomotives). Materials would also need to be transported to the Project site. Without mitigation, there is potential for offsite impact, such as an explosion, that would significantly affect members of the public. • Prohibited dangerous goods are unlikely to be present in such quantities, or for such periods of time, that they would cause a significant offsite risk. • Customs screening of containers would occur at Port Botany to reduce the impact of hazardous materials and goods being transported to the Project site.	Major	Unlikely	Moderate	• Appropriate storage and transport of hazardous materials in accordance with regulatory guidelines. • Secondary containment measures and runoff controls for hazardous materials and significant separation distances to residences and other assets.	Low	●	●	●	●
Bushfire (impact of bushfires on the Project)	• Project site mapped by Liverpool City Council (LCC) as having bushfire prone land around the boundary, with key bushfire threats (vegetation/slope characteristics) occurring from the western boundary (Georges River riparian zone) and south-eastern corner. • Project has the potential to be affected by bushfires and/or to exacerbate bushfires (e.g. flammable substances such as fuels would be present on the Project site).	Moderate	Unlikely Impacts are somewhat unpredictable, but not irreversible	Moderate	• Hazardous materials would be appropriately stored in locations that minimise risks (e.g. away from vegetation). • Relevant buffer zones would be incorporated into Project design. • Management plans for fuel, the landscape, and fire safety and evacuation would be developed as part of wider environmental management framework.	Low	●	●	●	●
Bushfire (impact of Project on bushfires)		Moderate	Unlikely Impacts well known and predictable; no irreversible impacts	Moderate		Low	●	●	●	●
Contamination of natural resources during construction and operation	• Various potential sources of land/water contamination exist on the main IMT site, including buried/stockpiled wastes, leakages and loss of containment of hazardous materials (during storage, handling, transport or disposal), or contamination from past land uses (e.g. from unexploded ordnance and other military activities such as munitions training), asbestos and wider land uses (such as the Glenfield Landfill). • Southern rail access connection option crosses the Glenfield Landfill site, which has high potential for contamination. • Project construction works could result in liberation of existing sources of contamination, or generate new contamination (e.g. from potential spills/leaks). Contamination of soils/surfaces could result in downstream or groundwater quality impacts. • Project operations such as storage and use of fuels, and maintenance of utilities, could also lead to contamination impacts. • Contamination of natural resources has the potential to have various flow-on effects for human and ecological health. • Concern expressed by some stakeholders.	Moderate	Possible Moderate level of unpredictability and irreversibility	Moderate	• Completion of detailed remediation action plan. • Completion of a contaminated soil management plan to address management requirement if unexpected contamination encountered during construction. • Strict processes for storage/treatment/transportation of any hazardous materials, contaminated soil, asbestos, etc. (in accordance with regulatory requirements). • Physical traps to contain contaminated material. • Further contamination investigations to be undertaken for the selected rail access option.	Low; potential for some positive impacts due to remediation activities (i.e. removal of existing contamination)	●	●	●	●

Impact/risk	Description of potential risk (without mitigation)	Consequence (unmitigated)	Likelihood/ certainty (unmitigated)	Risk significance (unmitigated)	Key design and mitigation measures (NB: refer Chapter 28 for the full list of measures)	Residual risk rating	Applicability			
							Main IMT site	Northern rail access connection	Central rail access connection	Southern rail access connection
Adverse impacts on downstream water quality during construction or operation	• Various construction activities have the potential to affect water quality (e.g. piling activities in the Georges River, accidental spills of hazardous materials and mobilisation or erosion of soils due to vegetation clearing). • During operation, key risks include accidental spills or leaks of fuels or hazardous substances and an increase in stormwater pollutants. • Concern expressed by some stakeholders.	Minor to Major (depending on type and source – e.g. erosion is likely to be minor; hazardous materials such as fuels are likely to be major)	Possible Impacts fairly well known; low level of unpredictability and irreversibility	Moderate to High	• A stormwater treatment system would be implemented, incorporating sedimentation and bio-filtration basins upstream of stormwater detention basins. • Use of on site infiltration through the distribution of swale drains and rain gardens across the Project site. • Specific treatment measures may be required on the Glenfield Landfill site if landfill cells are to be affected. • Development of erosion and sediment control plan. • Appropriate storage, use and disposal processes (e.g. use of impervious, bunded storage facilities for fuels and hazardous materials). • Physical traps to contain contaminated material.	Low	●	●	●	●
Adverse impacts on regional flooding during construction and operation	• The main IMT site is within low or no flood risk zones; however, the proposed rail access connection and Georges River bridge(s) are located within medium and high risk flood zones. • Potential for an increase in local flood levels upstream and/or release of debris, if a large flood occurred during construction of the Georges River bridge and rail access connection. • Central and northern rail access bridge options would present new hydraulic restrictions across the Georges River floodplain. The central option has the greatest potential for an increase in flood levels upstream. • Preliminary flood modelling indicates that none of the three bridge options would increase the flood risk to upstream properties during a 1% annual exceedance probability (AEP) event, and no significant increase in flood extent is predicted. Flow velocities in the river are also unlikely to be affected. • Climate change is an additional consideration that may exacerbate flooding risks. • Concern expressed by some stakeholders.	Moderate to Major (particularly when considering climate change)	Possible Impacts fairly well known and predictable; no irreversible impacts	Moderate to High	• Construction phase mitigation measures include locating site compounds, stockpiles and storage areas above the design flood level; and implementing a staged construction plan for the Georges River bridges that minimises temporary obstruction of flow in the main channel and floodplain. • Operation phase mitigation measures include designing bridge piers to minimise obstruction to flow and associated afflux; and further design of the central rail access bridge structures and their alignment and/or consideration of compensatory measures to reduce the impact. • No major construction in 1 in 100 year flood zone (excluding rail access connection and stormwater drainage channels).	Moderate	N/A	●	●	●
Adverse impact on local stormwater catchment flooding during construction or operation	• The Project would involve a considerable increase in impervious surfaces at the IMT site compared to current conditions. This would result in more than a 300% increase in peak flows for each subcatchment. • Without mitigation this would potentially increase flooding on the Project site itself and downstream in the Georges River.	Major	Likely Impacts fairly well known and predictable; no irreversible impacts	High	• Detailed drainage strategy and stormwater management plan are proposed as part of the Project. • The proposed on site detention system would detain flow and control discharge rates to the Georges River at pre-development discharge rates.	Low	●	N/A	N/A	N/A

Impact/risk	Description of potential risk (without mitigation)	Consequence (unmitigated)	Likelihood/ certainty (unmitigated)	Risk significance (unmitigated)	Key design and mitigation measures (NB: refer Chapter 28 for the full list of measures)	Residual risk rating	Applicability			
							Main IMT site	Northern rail access connection	Central rail access connection	Southern rail access connection
Adverse impact on local air quality during construction or operation	• The Project's construction and operation activities would generate additional particulate matter (PM) and other emissions (e.g. carbon monoxide, oxides of nitrogen, sulphur dioxide, and volatile organic compounds, polycyclic aromatic hydrocarbons). • Excluding the contribution of existing ambient air quality (which sometimes exceeds guidelines), incremental air pollutant concentrations and dust deposition rates associated with the Project were predicted to be within NSW Environment Protection Authority (EPA) criteria and the National Environmental Protection Measure (NEPM) advisory reporting goals for all modelled scenarios. • Taking elevated background airborne PM concentrations into account, the maximum cumulative 24-hour average PM_{10} and $PM_{2.5}$ concentrations exceed the applicable NSW EPA criteria and NEPM advisory reporting goals at one receptor. However, the peak ambient concentrations are already above the goals due to the influence of extensive bushfire activity in late 2013. No additional exceedance events are predicted as a result of construction or operational emissions at the Project site. • High level of concern among numerous stakeholders, particularly in relation to the impacts on human health.	Moderate	Likely Impacts fairly well known and predictable; no irreversible impacts	High	• Implementation of dust and air quality management plans. • During construction – best practice measures for dust management, including screening and watering processes (e.g. of stockpiles/exposed surfaces), avoidance of dust generating activities during dry and windy conditions, and monitoring. • During operation – maintenance and inspection program for all equipment, use of cleaner fuel technology as available/feasible, and ongoing monitoring of air quality.	Low to Moderate	●	●	●	●
Emissions of greenhouse gases (GHGs) from construction and operation	• Various construction and operation activities would result in the emission of GHGs, including carbon dioxide, methane nitrous oxides and other synthetic gases. At a global level, these emissions are known to be directly linked to climate change. • Sources from the Project construction and operations include direct emissions such as transportations of materials; and indirect emissions such as consumption of purchased electricity from the grid. • The GHG emissions from the Full Build of the Project are predicted to be equivalent to a very small proportion of national (approximately 0.02%) and NSW (approximately 0.09%) GHG emissions. • The Project as a whole would result in reductions in freight transport emissions that outweigh the predicted increase in background traffic emissions.	Minor	Likely Impacts somewhat uncertain and unpredictable; no irreversible impacts	Moderate	• Mitigation measures centre on improving operational efficiencies and using best practice technologies to reduce energy consumption and emissions.	Low	●	●	●	●
Direct disturbance or destruction of Aboriginal heritage	• The Project site contains sites and artefacts of known or potential Aboriginal cultural heritage significance. • Where matters of Aboriginal cultural heritage occur within the Project's development footprint, all or part of these sites or artefacts would be potentially destroyed – particularly during construction activities. • While the majority of identified Aboriginal recordings would be directly impacted, the areas of highest sensitivity (along the Georges River riparian corridor) would be largely conserved. • Concern expressed by key stakeholders.	Major	Likely Some potential for unknown, unpredictable and/or irreversible impacts	High	• Avoidance of development of riparian land (predicted to be of high sensitivity). • Development of Aboriginal heritage interpretation strategy in consultation with stakeholders, particularly registered Aboriginal parties. • Archaeological salvage program for surface objects and deposits. • Application of Unanticipated Discoveries Protocol during	Low to Moderate	●	●	●	●

Impact/risk	Description of potential risk (without mitigation)	Consequence (unmitigated)	Likelihood/ certainty (unmitigated)	Risk significance (unmitigated)	Key design and mitigation measures (NB: refer Chapter 28 for the full list of measures)	Residual risk rating	Applicability			
							Main IMT site	Northern rail access connection	Central rail access connection	Southern rail access connection
					construction. • Ongoing consultation with RAPs over the life of the Project.					
Direct disturbance or destruction of European heritage	• As part of Defence's Moorebank Units Relocation (MUR) Project, several existing heritage items would be relocated from the current School of Military Engineering (SME) site before construction of the Project. • There would be residual European heritage values, archaeological deposits and items at the Project site with the potential to be affected by the Project. The residual values are associated with the broader landscape setting, as well as more tangible elements of the landscape such as the archaeological deposits, the CUST Hut, the Transport Compound Workshop (B99), the RAAF STRARCH Hangar, the dog cemetery and the commemorative garden. • Potential impacts include building, garden and memorial demolition, disturbance to archaeological deposits, destruction of the landscape setting and vistas, loss of and/or reduced historical associations, loss of existing internal street layouts and associated names, and loss of access to these items. All remaining heritage items would be directly affected by the Project, along with all remaining intangible heritage values. • Concern expressed by key stakeholders.	Moderate	Almost certain Impacts well known and predictable; potential for irreversible impacts	High	• Investigating, documenting and archiving those deposits identified as having the greatest research potential. • Additional investigations, historical research and a comprehensive salvage program. • Further consideration of adaptive reuse and relocation options for key items, with archival recording as a minimum.	Low to Moderate	●	●	●	N/A
Adverse impact on visual amenity during construction or operation	• Development of the Project would alter the existing landscape and change visual amenity, including an increase in light spill and vegetation clearance beyond the riparian corridor/conservation area. • Potential visual impacts are predicted to be moderate to high for some public park and residential receivers. • Residential receivers that overlook the Project site would experience a noticeable change in the brightness of the area on clear nights. • Concern expressed by some stakeholders, particularly in relation to amenity, light spill and property values.	Moderate to Major	Almost certain Impacts well known and predictable; potential for irreversible impacts	High to Major	• Incorporation of urban design principles into Project design, including height controls that limit building heights to 21 metres. • Visual mitigation measures such as landscaping, screening/ buffering of less attractive activities/infrastructure. • Designing lighting to minimise light spill. • Monitoring of light spill.	Moderate	●	●	●	●
Impact on existing services and infrastructure during construction or operation	• The Project would result in the need for upgrades to or augmentation of some infrastructure and services (including energy, water, wastewater, stormwater). • The northern and central rail access options would necessitate the realignment of Powerhouse Road, which provides access to the Casula Powerhouse Arts Centre. NB: The Moorebank Avenue upgrade is covered separately under the 'Traffic, transport and access' category. • During construction, some services would experience disruptions.	Minor to Moderate	Likely Impacts well known and predictable; no irreversible impacts	Moderate	• Mitigation measures include implementing 'dial before you dig' protocols, consultation with infrastructure and service providers, and incorporation of services augmentation plans into the Project concept.	Low	●	●	●	●

Impact/risk	Description of potential risk (without mitigation)	Consequence (unmitigated)	Likelihood/ certainty (unmitigated)	Risk significance (unmitigated)	Key design and mitigation measures (NB: refer Chapter 28 for the full list of measures)	Residual risk rating	Applicability			
							Main IMT site	Northern rail access connection	Central rail access connection	Southern rail access connection
Direct impact on property (for acquisition)	• Construction and operation of the Project would permanently affect some small areas of LCC land. • In addition, depending on the rail access option selected, construction and operation of the rail access connection would affect some land that is Council-owned, Sydney Trains (formerly RailCorp)-owned, Roads and Maritime Service-owned and/or privately owned (e.g. on the Glenfield Landfill site).	Major	Almost certain Impacts well known and predictable; no irreversible impacts	Major	• Landholders would be compensated in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991*. Alternatively, access easements may be entered into with the subject landholders to authorise the construction and operation of the rail link on private land.	Low	●	●	●	●
Indirect impact on property and land use	• Some amenity impacts predicted in relation to traffic/transport, visual, light spill, air quality and noise for adjacent properties and land uses during construction and operation. • Adjacent commercial and industrial developments likely to benefit from upgrade to Moorebank Avenue and some could benefit commercially from operation of the Project.	Moderate	Likely Impacts well known and predictable; no irreversible impacts	High	• Mitigation for amenity impacts associated with noise, visual, air quality and light spill (as described in rows above).	Low	●	●	●	●
Social impacts during construction and operation	• No substantial shift in the local demographics or population expected during construction or operation. • Minor recreation impacts expected, including closure of RAE Golf Club at the southern end of the Project site, and some potential disruption to activities by the NSW Barefoot Water Ski Club on the Georges River (northern rail access option only) during construction. • Potential for the northern rail access connection to increase the visual severance between the Casula Powerhouse Arts Centre and the surrounding community. • No substantial impact on social and community infrastructure expected.	Minor to Moderate	Likely Impacts fairly well known and predictable; no irreversible impacts	Moderate to High	• Ongoing community consultation program (including phone number and website) to establish and maintain a good relationship with local residents and business owners. • Complaints line and resolution process during construction and operation. • Establishment of conservation area (visual buffer between the Project site and adjacent residents). • A citizens' jury has been established to develop a public benefits package that aims to share more of the benefits of the IMT with the local area.	Low to Moderate	●	●	●	●
Economic impacts during construction and operation	• Most economic impacts positive due to job creation and benefits of improved freight transport efficiency. • Some minor adverse impacts on local businesses during construction – although some would benefit from increased trade.	Minor	Possible Impacts fairly well known and predictable; no irreversible impacts	Moderate	• Ongoing community consultation program (including phone number and website) to establish and maintain a good relationship with local residents and business owners. • Complaints line and resolution process during construction and operation.	Low	●	●	●	●

Impact/risk	Description of potential risk (without mitigation)	Consequence (unmitigated)	Likelihood/ certainty (unmitigated)	Risk significance (unmitigated)	Key design and mitigation measures (NB: refer Chapter 28 for the full list of measures)	Residual risk rating	Applicability			
							Main IMT site	Northern rail access connection	Central rail access connection	Southern rail access connection
Risk to human health (community)	• Exposure to particulate matter (PM) emissions can be linked to various health impacts such as respiratory illnesses. However, the impact assessment concluded that any exposure–effect relationships are not measurable or statistically significant, and that health risks or impacts are low and acceptable. • Noise can have a range of health impacts such as sleep disturbance and cardiovascular health problems. Without mitigation, construction and operational noise has potential for health impacts. • Traffic congestion has the potential to contribute to health impacts such as stress and anxiety. This would notably affect users of Moorebank Avenue during construction.	Major	Almost certain However, interaction between air quality and human health subject to uncertainty. Potential for irreversible impacts.	Major	• Air quality, noise and traffic mitigation measures listed above. • Regular review of monitoring data for air quality, noise and traffic against the relevant guidelines. Should exceedances be identified, then a further and more targeted monitoring and management program would be developed as required. This feedback loop is part of the overall environmental management framework described in Chapter 28 – *Environmental management framework*.	Low to Moderate	●	●	●	●
Project specific workplace health and safety risks	• Short-term, reversible impacts such as injury or illness. • Long-term, permanent or irreversible impacts such as disablement and loss of life.	Major	Possible Workplace impacts fairly well known and predictable	High	• Adoption of strict on site health and safety practices in accordance with regulatory requirements (NSW *Occupational Health and Safety Act 2000*) and MIC's zero harm health and safety goal, including requirement to wear applicable personal protection equipment, use of reversing alarms on vehicles, specific handling, storage, transport and disposal procedures for plant, equipment and hazardous and non-hazardous materials, and established emergency and safety procedures. • Workers within or near to rail corridors would be highly trained in accordance with Rail Industry Safety Induction requirements.	Low	●	●	●	●
Generation of waste during construction and operation	• Project activities would generate waste during both construction and operation. • Waste streams would include demolition waste, warehousing waste, packaging waste, administrative waste, green waste, sewage, recyclables, and contaminated or hazardous materials (e.g. from refuelling). Waste needs to be minimised and requires careful management or it can lead to other impacts (e.g. contamination, health impacts). • Concern expressed by some stakeholders.	Moderate	Almost certain Impacts well known and predictable; no irreversible impacts	High	• Development of a waste management plan (based on the waste management hierarchy). • Actions include reusing/recycling materials and wastes within Project to minimise landfill, use of practices that maximise opportunities for waste recovery, appropriate separation, treatment and/or disposal of solid, liquid, and hazardous waste, use of water sensitive urban design.	Low	●	●	●	●

29.2.1 Summary of analysis and recommendations

The ERA undertaken in this chapter has identified that no risks of adverse environmental impact have a residual significance rating higher than Moderate. Following the analysis, four impacts were identified as key considerations as the Project proceeds:

- increase in ambient noise levels at sensitive receivers;
- loss or disturbance of Threatened flora and fauna species;
- potential for increase in flood levels (afflux) upstream of the Georges River bridge; and
- adverse impact on visual amenity.

The above impacts were identified as risks that retain a Moderate significance rating despite mitigation and management, suggesting the need for an ongoing and targeted focus on these considerations as the Project enters its next stages (i.e. detailed design and Stage 2 SSD approval(s)). In each case, the residual risk rating of 'moderate' was reflective of the need for a relatively complex set of mitigation measures/controls to reduce the predicted impacts to an acceptable level, and also the likelihood of ongoing community concern in relation to these issues. The ratings do not indicate that these issues cannot be mitigated effectively through the measures proposed.

In addition to the above key risks, six impacts were identified as having a Low to Moderate residual significance rating:

- increase in road traffic volumes and congestion;
- adverse impact on local air quality;
- direct disturbance or destruction of Aboriginal heritage;
- direct disturbance or destruction of European heritage;
- social impacts during construction and operation; and
- risks to human health (community).

Risks with a Low residual significance rating are:

- reduction in road safety (construction only; operation is negligible);
- impact on rail infrastructure and operations;
- hazards and risks associated with hazardous materials and dangerous goods;
- bushfire (impact of bushfires on the Project);
- bushfire (impact of the Project on bushfires);
- contamination of natural resources;
- adverse impacts on downstream water quality;
- adverse impact on local stormwater catchment flooding;

- emissions of greenhouse gases (GHGs);
- impact on existing services and infrastructure;
- direct impact on property;
- indirect impact on property and land use;
- economic impacts; and
- generation of waste.

Pending the implementation and anticipated effectiveness of the mitigation and management strategies, a Low or Low to Moderate residual significance rating is considered to be acceptable. It is important to note, however, that for all potential risks, ongoing monitoring and evaluation is recommended to investigate and implement new or additional measures as required.