



19 Hazard and Risk



19.1 Introduction

Railway construction and operation involves significant risks. Risk is a function of likelihood (frequency/probability) of an undesired event or accident and its consequences (magnitude). Risks may have external sources such as meteorological and other natural events, including wind, fog, ice, ground slides, earthquakes, heatwaves or may result from man-made events such as fire, spills and explosions. The focus in this chapter is on human factors that are one of the major causes of accidents. The potential impacts of natural disasters on the project are described in more detail in Chapter 17, *Climate and natural disasters*. Accidents could result in the following undesired outcomes: fatality, injuries, environmental damage, disruption of traffic and damage to assets.

This chapter aims to identify the risks associated with the design, construction and operation of the railway and assess their significance. It aims to identify appropriate mitigation strategies.

This chapter documents the Hazard and Risk Assessment (HRA) that has been undertaken for the project EIS and the

measures to be adopted in managing these hazards and risks. The HRA considered sources of risk related to natural hazards, human activity, and technological or technical issues, and the potential impact of these risks to persons, the environment or the community and property. In this context, natural hazards refer to flood, bushfire or landslide. The HRA has not considered commercial risks associated with the construction or operation of the project. Also included is a description of health and safety measures for the project and emergency management procedures to be employed.

This hazard and risk assessment undertaken for the purposes of the EIS is broad and qualitative and will form part of the larger risk management process which will need to be continued throughout the life of the project and be linked to the Department of Transport and Main Roads and QR Limited risk management processes.

19.1.1 Relevant legislation and policy

Table 19.1.1 outlines the relevant legislation, policy and Australian standards for this chapter.

Table 19.1.1: Relevant legislation

Legislation, policy or standard	Requirement
AS/NZS Risk Management Standard 4360:1999	Establishes and implement a risk management process that involves the identification, analysis, evaluation, treatment and ongoing monitoring of risks.
AS/NZS 4084:2001 Occupational Health and Safety Management Systems – General Guidelines on Principles, Systems and Supporting Techniques	Provides guidance on the development and implementation of occupational health and safety management systems (OHSMS) and principles, and their integration with other management systems.
<i>Workplace Health and Safety Act 1995</i> (Qld) and <i>Workplace Health and Safety Regulation 1995</i> (Qld)	To prevent a person's death, injury or illness being caused by a workplace, by a relevant workplace area, by work activities, or by plant or substances for use at a workplace.
<i>Transport Infrastructure Act 1994</i>	Provides the statutory requirements for rail safety accreditation within Queensland.
Australian Standard AS4292 Railway Safety Management	Provides a resource for the development of a Safety Management System within Australia.
<i>The Inter Governmental Agreement on Rail Safety 1996</i>	Establishes the framework for the development of a consistent approach to the regulation of rail safety within Australia.
Transport Infrastructure Dangerous Goods by Rail Regulation 2002	Gives effect to the standards and requirements of the Australian Dangerous Goods code. It also promotes consistency between rail and other modes of transport in relation to the transport of dangerous goods.
<i>Rail Safety Management within Queensland 2001</i>	Provides the rail safety policy of the Department of Transport and Main Roads.
<i>Rail Safety Principles and Guidance 1996</i>	Provides safety principles and implementation factors for the construction of railways.
<i>ZERO Harm</i>	QR Limited's strategy for safe working and operation.
<i>National Standard for Health Assessment of Rail Safety Workers 2004</i>	This provides a system for monitoring the health of rail safety workers. The standard will enable consistent application of health standards across the Australian rail industry. It aims to make the national rail system safer for everyone and to help rail workers stay fit and healthy.

Table 19.1.1: continued

Legislation, policy or standard	Requirement
<i>The National Rail Safety Accreditation Guideline 2005</i>	This Rail Safety Management System Audit Checklist has been developed by the Rail Safety Regulators Panel. The audit checklist was developed to provide a consistent basis for the audit of accredited railway operator safety management systems and the assessment of applications for accreditation by State and territory rail safety regulators.
<i>National Rail Safety Accident/Incident Reporting Requirements June 2008</i>	The State and territory rail safety regulators have agreed on an amended set of occurrence categories and definitions to ensure national consistency in the notification and exchange of occurrence data. The Department of Transport and Main Roads implemented these new requirements on 1 July 2008.
<i>Dangerous Goods Safety Management Act 2001 (Qld) and Dangerous Goods Safety Management Regulation 2001 (Qld)</i>	The objective of the <i>Dangerous Goods Safety Management Act 2001</i> is to protect people, property and the environment from harm caused by hazardous materials, and dangerous goods.
<i>Explosives Act 1999 (Qld) and Explosives Regulation 2003 (Qld)</i>	To ensure the safe utilisation, storage, handling and disposal of explosive material so as not to endanger persons, property or the environment.
<i>Fire and Rescue Services Act 1990 (Qld) and Fire and Rescue Service Regulation 2001 (Qld)</i>	Establish effective relationships with Queensland Fire and Rescue Service (QFRS) and to provide for the prevention of and response to fires and certain other incidents endangering persons, property or the environment.
<i>SPP 1/03 Mitigating the Adverse Impacts of Flood, Bushfire and Landslide</i>	Minimise the potential adverse impacts of flood, bushfire and landslide on people, property, economic activity and the environment.
<i>Disaster Management Act 2003 (Qld)</i>	This Act provides the framework for effective disaster management planning at State, district and local levels.
AS/NZS 2187 Explosives – Storage, Transport and Use	This standard provides measures for the storage, transport and use of explosives.
AS/NZS 1940 2004 The Storage and Handling of Flammable and Combustible Liquids	This standard provides measures for the storage and handling of flammable and combustible liquids.

19.1.2 Assumptions and limitations

Assessment of hazard and risks associated with the project was undertaken as part of the route identification process used for the selection of the preferred route for the project. As a result, the risks and hazards identified are based on existing information about the project at the time of writing, and proposed construction and operational features. Further risks and hazards may be identified in future stages or identified risks could be downgraded or upgraded in terms of the level of risk they pose. Additional mitigation measures as required will be developed and documented in the Construction and Operational and Risk Management Plans for the project which will need to remain live documents throughout the relevant project phases.

The consideration of natural hazards is based on existing information about the project area including overlay mapping from the former Caloundra and Maroochy Shire Councils (now amalgamated with Noosa Shire Council as the Sunshine Coast Regional Council). This enables a high level assessment to be made of the risk of natural hazards in the project area, however, detailed modelling or prediction of natural hazards has not been undertaken. This chapter considers flood, landslide and bushfire. Chapter 17, *Climate and natural disasters*, provides information on cyclones, storms and heat waves.

Emergency Management measures described in this chapter are also based on existing knowledge about the possible emergency

situations that could arise during construction or operation of the project and will be further detailed in the Construction and Operational Management Plans.

19.2 Description of Existing Conditions

19.2.1 Natural hazards

State Planning Policy 1/03 *Mitigating the Adverse Impacts of Flood, Bushfire and Landslide* (the SPP) aims to minimise potential adverse impacts of flood, bushfire and landslide on people, property, economic activity and the environment. The SPP has effect when development applications are assessed, when planning schemes are made or amended and when land is designated for community infrastructure. Cyclones and earthquakes are also considered to be natural hazards but are not addressed in the SPP.

The SPP is relevant to the project on the basis that the former local government areas of Caloundra City and Maroochy Shire which the project will traverse are listed in Annex 2 of the SPP as areas in which the SPP is applicable. The planning schemes for these shires identify natural hazard management areas in accordance with Section 5.1 (Annex 3) of the SPP. These areas are shown in Figure 19.2.

Generally, 'natural hazard management areas' include:

- areas identified as reflecting medium and high bush fire

risk (the project passes through areas that are classified as medium bushfire risk in the relevant planning schemes)

- land of 15 percent and greater slope and land known or suspected of being geologically unstable
- areas subject to flood inundation.

Bushfire hazard

A review of the Caloundra City Council Bushfire Hazard Management Code (overlay Map 7.3) shows that the project crosses areas identified as 'high bushfire hazard areas' at Rose Road and the Pinch Lane.

Similarly, a significant proportion of the project traverses areas identified as *Bushfire Prone Areas* on the *Bushfire Prone Areas Special Management Area Regulatory Map 1.7*, based on a review of the Maroochy Plan 2000.

Given that a significant proportion of the project is located in areas identified as at potential risk from bushfire hazards, this will be a consideration for construction and operation of the project. A bushfire management plan will need to be developed for the project, specifying appropriate clearance distances, and emergency service access requirements during construction. The preliminary design of the project has allowed for the provision of access and maintenance tracks, except where the project is on structure, or where the local road network can facilitate emergency access.

Railways generally provide a linear corridor of cleared vegetation, and can act as a firebreak. QR Limited controls vegetation within the corridor, conducting clearing (and/or controlled burns) to reduce risks.

There is a potential risk of fire damaging infrastructure. QR Limited has an established policy for bushfire management. This would apply to the operational phase of the project to protect infrastructure and minimise damage or loss.

During the construction phase of the project, construction work will occur in areas identified as being of bushfire risk in former Caloundra City and Maroochy Shire. As construction workers may be present at the site for long periods, and there is the potential for hazardous materials to be stored in bulk, the SPP is considered likely to apply in relation to bushfire hazard. Construction activities do have the potential to temporarily increase the risk of bushfires; however this is considered a low risk. No burning off of cleared vegetation would be permitted as part of construction activities.

Landslide hazard

Landslide hazard areas have been identified in Maroochy Shire Planning Scheme overlay maps, with areas of high hazard located in the vicinity of the Pinch Lane. There is no specific overlay map for landslide hazards in Caloundra City. However, a review of the topography of the project area identifies that the Rose Road area could also be potentially a landslide hazard area. Tunnels are proposed in these areas, both with extensive areas

of cut and cover. The method for construction of the tunnels has not yet been determined.

The construction works for the project will involve earthworks exceeding 50 cubic metres and vegetation clearing. The SPP is therefore applicable. The SPP requires a development to which the SPP applies to be compatible with the nature of the natural hazard. The specific outcome to achieve this is that the development maintains the safety of people, property and hazardous materials manufactured or stored in bulk from the risk of landslide. Solutions to achieve this outcome for this project are the undertaking of a geotechnical study so that measures are implemented during the detailed design to ensure the long-term stability of the site (see **Chapter 5, Geology and soils**). Also, as the site is on a ridge, it is not likely to be adversely affected by landslide activity originating on sloping land above the development site.

Flood hazard

Chapter 14, Water resources describes the existing flood plains crossed by the project, and the required conveyance structures so as to not significantly affect existing flood levels.

The project crosses the following floodplains:

- South Mooloolah River
- Mooloolah River
- Eudlo Creek
- Paynter Creek.

Due to the geometry of the floodplains, the lateral spread of the 100 year ARI design flood is significant.

The project runs parallel to Petrie Creek.

An outcome sought for flood hazard areas in the SPP is to minimise risk to persons and property and facilitate evacuation in the event of any flood threat. Outcome 3 of the SPP states that, wherever practicable, community infrastructure is located and designed to function effectively during and immediately after a natural hazard event. The project itself has been designed with a flood immunity of ARI 100, and therefore is considered to comply with the requirements of the SPP. Wherever possible, where they are to be realigned or re-provided as a result of the project, roads have been designed so as to improve upon existing flood immunity. Outcome 3 is considered to be met as the project would be able to function effectively during and immediately after a natural hazard event.

19.2.2 Dangerous goods

Given the nature of the construction works, there is the potential for dangerous goods including explosives to be used or stored onsite during the construction phase. The most likely source of any chemical spill during construction would be oil or diesel from plant and machinery or from small quantities stored at construction areas.

Explosives may be required during the construction of the tunnels; however a preferred construction method will be determined at a later stage of the project. Explosives are classified as Class 1 dangerous goods (in the Australian Code for the Transport of Dangerous Goods by Road and Rail¹ [the code]).

The North Coast Line (NCL) is used for the transport of Dangerous Goods. The operator of the railway is responsible for the preparation of management plans for these events.

Any dangerous goods used during construction or operation would be handled and transported in accordance with the code to minimise the risk of spill or leaks occurring or causing harm. Chemical use will be limited wherever possible, and the minimum practicable volume stored on site. Those chemicals that are required will be stored in a suitable bunded area with appropriate spill equipment made available on site.

19.2.3 Rail safety historical data

An analysis of Queensland and national statistics for rail safety is included in Table 19.2.3. It is important to note that this summary table presents an analysis for the whole of Queensland and Australia.

Table 19.2.3: Australian rail safety occurrence data, 1 January 2001 to 30 June 2008²

Nature of incident	QLD statistics	National statistics
Fatalities	35	337
Serious personal injuries	123	746
Running line derailments	289	1,283
Collisions with trains	22	111
Collisions with rollingstock	19	69
Collisions with person	56	391
Collisions with infrastructure	111	637
Collisions with road vehicle	23	108
Road vehicle collisions at level crossings	141	578
Level crossing collisions with person	10	77
Signals passed at danger (SPAD)	952	3,056
Driver misjudged, completely missed and starting against signal (human error)		
Signals passed at danger (SPAD)	2,105	5,008
Signal restored as train approaches		
Loading irregularities	1,261	3,226
Track and civil infrastructure irregularities	2,132	9,211

¹ National Transport Commission 2007 *Australian Code for the Transport of Dangerous Goods by Road and Rail Seventh Edition*, Australian Transport Council

² Source: Australian Transport Safety Bureau, ATSB Transport Safety Report, Australian Rail Safety Occurrence Data, 1 January 2001 to 30 June 2008

The Department of Transport and Main Roads and the Australian Transport Safety Bureau publish investigations into serious rail incidents, which are available online. No safety reports related to the section of the NCL between Landsborough and Nambour were identified.

19.3 Hazard and Risk Assessment (HRA)

The project is believed to be both a safe and efficient for passenger and freight transport. All developments present some level of risk however, which can be identified through a HRA so that appropriate management measures can be implemented to reduce or remove the risk.

The HRA for the project has been carried out in accordance with the principles set out in AS/NZS Risk Management Standard 4360:2004 (which supersedes 4360:1999). The HRA seeks to identify risks during the construction, operational and decommissioning phases of the project and to document proposed mitigation and management measures.

19.3.1 Methodology for the HRA

In adopting the recommended methodology for implementing risk assessments in line with AS 4360, the following steps have been followed:

- **establish context** – define the basic parameters within which the risk must be managed and set the scope for the process
- **identify risks** – identify the risks to be managed using an identification and analysis process
- **analyse risks** – develop an understanding of risks which provides an overview of whether the risks should be treated and how they should be treated
- **evaluate risks** – focus decisions based on the outcomes of risk analysis and identify which risks need treatment and treatment priorities
- **treat risks** – identify options for treating risks, assess options and propose appropriate treatment plans
- **review risks** – ensure that any changes to project scope are re-examined and the risk assessment amended accordingly if required.

A description of these steps undertaken for the project is included in the following sections.

Establish context

The objectives relevant to the HRA include:

- to minimise or prevent potential environmental impacts associated with the project's construction or operation
- to undertake the construction and operation in a safe environment with minimal risk of injury to personnel or the public

19 Hazard and Risk

This includes providing appropriate measures to reduce the risks posed by natural events, and consideration of safe construction methods and environs through safety in design principles

- to minimise or prevent the loss of or damage to public or private property.

The HRA undertaken for the project has considered hazards and risks associated with natural and man-made risks during construction, operational and decommissioning phases of the project. For the purposes of the EIS, the HRA has considered the sources of risk and areas of impact that are outlined in Table 19.3.1a.

Table 19.3.1a: Sources of risk and areas of impact

Sources of Risk	Area of Impact			
	Project Personnel (Health and Safety risks)	Community and Property	Environment	Surrounding Land Uses
Natural events	✓	✓	✓	✓
Human activity	✓	✓	✓	✓
Accidents and hazards associated with operations	✓	✓	✓	✓
Interface with other infrastructure	✓	✓	✓	✓

The spatial scope of the HRA includes all areas directly affected by the project and associated infrastructure as well as surrounding areas such as residential properties, agricultural activities, road crossings and rail crossings, which could potentially be affected by project activities. General risks relevant to all aspects of the project have been identified, as well as those risks specific to certain elements such as the rail stations, level crossings or bridges.

Decommissioning risks have been considered, however, due to the length of time until this occurs, they have not been addressed in detail. Decommissioning risks for the existing and future railway would include the removal of rail infrastructure, removal of ballast and mitigation or treatment of contaminated areas. Risk registers and management plans for the project will need to be updated as the project progresses, thus risk assessment is focused on design, construction and operation.

It should be noted that this chapter of the EIS aims to identify risks and hazards arising from the project and does not include political or commercial risks to the project or the proponent which would need to be considered in a separate process that will remain ongoing throughout the project.

The assessment has considered normal and abnormal operations and also possible emergency conditions that may arise during the project and the impact of these risks. The mitigation measures or controls that are to be implemented to reduce the likelihood and severity of hazards, consequences and risks to persons and fauna are also documented.

Identify risks

Risks have been identified for the project in the context described above and are related to the following activities:

Construction

The main risks identified during the construction of the railway are the following:

- tunnelling and excavation
- track construction
- hazardous materials
- risk to wildlife during clearing
- commissioning of the electrical system
- construction in the vicinity of powerlines (including 33kV, 132kV and local feeder services)
- road incidents due to temporary side tracking detours
- environmental incidents such as fuel spills, sedimentation of waterways and erosion
- delivery of pre-cast products by road (e.g. bridge girders).

Operation

The risks associated with the operation of the proposed railway are similar to the risks listed for the existing operation. Additional tracks will increase safety, in particular as rail traffic could be redirected while maintenance is conducted on one track. However, the additional tracks and subsequent capacity increase will result in an increase of traffic on the line. This increase could potentially result in greater risks. Conversely, the provision of two tracks will allow for the separation of train movements, as the existing single track line has services running in both directions, which operationally presents greater risks than two separate tracks facilitating movement in each direction.

The project and improved design standards are likely to reduce other operational risks including:

- reduced trespass opportunities (modern standard fencing and station design)
- improvement of poor standard road crossings (i.e. where low height road underpasses are replaced as a result of the project)
- lengthening and raising of platforms, which would significantly improve passenger safety at stations (currently stations at Mooloolah, Eudlo, Palmwoods and Woombye do not cater for a full train length).

Over time, grade separation is likely to be introduced in place of the existing open level crossings at Gympie Street North and Mooloolah Connection Road/ Bray Road, which should result in a risk reduction of train accident involving other vehicles, pedestrians or cyclists. Where grade separation is not immediately constructed, the number of tracks and the speed of the trains passing through these crossing points will need to be a consideration in the decision on the timing of the grade separation.

The project crosses areas of steep slopes and significant cuttings are required. Tunnels are proposed to reduce the risk of landslips, however detailed geotechnical investigations are required to determine the extent of the risk and the most appropriate construction methods in the conditions identified. The project is on structure in the areas most likely to be affected by flooding and therefore it is less sensitive to flood risk compared to the existing alignment.

The tunnels would be longer in the project and therefore the consequences associated with the risk of fire, explosion, flooding and earthquakes are likely to be more severe. Mitigation measures would include the design of a safe escape route and the provision of appropriate ventilation, drainage and lighting.

Analyse and evaluate risks

The objectives of the risk analysis are to separate minor acceptable risks from the major risks and to provide data to assist in the evaluation and treatment of risks. The residual risk is analysed by combining the estimates of consequences and likelihood after mitigation measures have been applied. The analysis of risks has been undertaken using the defined consequence and likelihood criteria shown in **Table 19.3.1b** and **Table 19.3.1c**. These criteria are then used to define the risk level as outlined in **Table 19.3.1d**. The risk evaluation criteria used in the HRA are shown in **Table 19.3.1e**. The risk analysis did not identify any extreme or high level risks which would require immediate attention. All risks identified were categorised as medium or low level risks, which will require ongoing monitoring and review, or can be managed by routine procedures.

19 Hazard and Risk

Table 19.3.1b: Consequence look-up table

Descriptor	Insignificant	Minor	Moderate	Major	Catastrophic
Project Personnel	No injuries	First aid treatment or out-patients	A number of injuries or hospitalisation	Extensive injuries or hospitalisation or long-term treatment	Fatality or significant irreversible effects to a number of persons
Community and Property	Negligible social or cultural impacts, negligible damage to or loss of assets	Minor, medium-term social impacts on local population, mostly repairable with appropriate management/remediation Minor damage to or loss of assets, some repairs required	Ongoing social issues or permanent damage to structures or items of cultural significance Moderate to high damage to or loss of assets – requires specialist or contract equipment to repair or replace	Ongoing, serious social impacts or significant items of cultural significance Significant or permanent damage to assets and/or infrastructure	Widespread, ongoing, significant serious, irreversible social impacts Widespread, substantial or permanent damage to assets and/or infrastructure
Environment	No effects or effects which are below levels of perception, within normal bounds of variation or within the margin of forecasting error	These effects may be raised as local issues but are unlikely to be of importance in the decision making process. However, they are of relevance in enhancing the subsequent design of the project and consideration of mitigation measures.	Important considerations at a local level but are not likely to be key decision making issues. Mitigation measures and detailed design may ameliorate some of the consequences upon the affected communities or interests.	Important considerations at a local or regional scale. Mitigation measures and detailed design work are unlikely to remove all of the effects upon the affected communities or interests.	Associated with sites and features of national or State importance. Typically mitigation measures are unlikely to remove such effects.
Surrounding Land Uses	No effects or effects which are below levels of perception, within normal bounds of variation or within the margin of forecasting error	These effects may be raised as local issues but are unlikely to be of importance in the decision making process. However, they are of relevance in enhancing the subsequent design of the project and consideration of mitigation measures.	Important considerations at a local level but are not likely to be key decision making issues. Mitigation measures and detailed design may ameliorate some of the consequences upon the affected communities or interests.	Important considerations at a local or regional scale. Mitigation measures and detailed design work are unlikely to remove all of the effects upon the affected communities or interests.	Associated with sites and features of national or State importance. Typically mitigation measures are unlikely to remove such effects.

Table 19.3.1c: Likelihood look-up table

Likelihood Scale		
Descriptor		Description of frequency
Rare	A	May occur only in exceptional circumstances – can be assumed not to occur during the period of the project (or life of the facility)
Unlikely	B	Event is unlikely to occur, but it is possible during the period of the project (or life of the facility)
Possible	C	Event could occur during the period of the project (or life of the facility)
Likely	D	Event likely to occur once or more during the period of the project (or life of the facility)
Frequent or almost certain	E	Event occurs many times during the period of the project (or life of the facility)

The product of the consequence and likelihood is the risk level as defined by the qualitative risk analysis matrix shown in Table 19.3.1d.

Table 19.3.1d: Qualitative risk analysis matrix

Consequences						
Likelihood		Insignificant	Minor	Moderate	Major	Catastrophic
		1	2	3	4	5
Rare	A	L	L	L	M	M
Unlikely	B	L	L	M	M	H
Possible	C	L	M	M	H	E
Likely	D	M	M	H	E	E
Frequent or almost certain	E	M	H	E	E	E

Table 19.3.1e: Risk evaluation criteria

Level of Risk	Recommended level of management attention
E – Extreme	Immediate senior management attention needed. Action plans must be developed with clear assignment of individual responsibilities and timeframes
H – High	Senior management attention needed. Action plans must be developed with clear assignment of individual responsibilities and timeframes
M – Medium	Risk requires specific ongoing monitoring and review, to ensure level of risk does not increase. Otherwise manage by routine procedures
L – Low	Risk can be accepted or ignored. Manage by routine procedures, however unlikely to need specific application of resources

Treat/manage risks

The risk analysis matrix and risk evaluation criteria have been used for the identified risks in order to identify those requiring further management. Table 19.3.1f summarises the identified risks for the project and the likelihood, consequence and risk level for these risks. Only key activities relevant to design, construction and operation risks identified in this EIS are addressed in this table. None of the risks identified have been classified as more than a medium level of risk and therefore risks are considered to be adequately managed through existing management measures.

The proposed management measures for environmental and community impacts are further described in the other chapters of the EIS and specifically Chapter 22, **Environmental management plans**. Table 19.3.1f therefore includes reference to the relevant section of the Environmental Management Plan (EMP) which is based on the principles outlined in the various chapters for further information about proposed management measures to be put in place. Mitigation measures which will be managed through other procedures e.g. health impacts associated with the handling of dangerous goods will be addressed in a Health and Safety Plan.

Table 19.3.1f: Hazard and risk assessment

Activity	Potential Risk Scenario	Consequence	Risk Assessment (without mitigation measures)			Mitigation and Management Measures			Risk Assessment (Residual)		
			Likelihood	Consequence	Risk Ranking	Likelihood	Consequence	Risk Ranking	Likelihood	Consequence	Risk Ranking
Tunnelling and general earth works	Soil Disturbance during construction or maintenance activities	Erosion and sedimentation of waterways	E	3	Extreme	EMPs (See Chapter 22)	B	2	Low		
			E	5	Extreme	Health and safety management system	A	5	Medium		
Working in confined spaces	Death or injury to personnel		E	5	Extreme	Operation and construction safety plans					
			C	3	Medium	EMPs (See Chapter 22)	A	2	Low		
Disturbance of Cultural Heritage	Loss of cultural heritage		C	3	Medium	EMPs (See Chapter 22)	A	2	Low		
			D	3	Extreme	EMPs (See Chapter 22)	C	2	Medium		
Disturbance of Acid Sulfate Soils	Damage to infrastructure		D	4	Extreme	EMPs (See Chapter 22)	B	4	Medium		
			D	3	High	EMPs (See Chapter 22)	B	2	Low		
Disturbance of contaminated land	Death or injury to personnel		D	5	Extreme	Construction safety plan	B	4	Medium		
			E	3	Extreme	EMPs (See Chapter 22)	C	2	Medium		
Excessive Noise	Loss of amenity		E	3	Extreme	Health and safety management system					
			E	3	Extreme	EMPs (See Chapter 22)	B	3	Medium		
Weed Spread	Loss of agricultural productivity		E	3	Extreme	Health and safety management system					
			E	3	Extreme	EMPs (See Chapter 22)	B	3	Medium		
Use of explosives	Impacts to native fauna or flora		E	3	Extreme	EMPs (See Chapter 22)	B	3	Medium		
			D	5	Extreme	Construction safety plan	A	5	Medium		
Road Realignments during construction or maintenance	Changed access	Inability to access properties	E	2	High	EMPs (See Chapter 22)	B	2	Low		
			E	2	High	Design features					
Road Realignments during construction or maintenance	Traffic congestion and travel delays		E	2	High	EMPs (See Chapter 22)	B	2	Low		
			E	2	High	EMPs (See Chapter 22)	B	2	Low		

Table 19.3.1f: continued

Activity	Potential Risk Scenario	Consequence	Risk Assessment (without mitigation measures)			Mitigation and Management Measures			Risk Assessment (Residual)		
			Likelihood	Consequence	Risk Ranking	Likelihood	Consequence	Risk Ranking	Likelihood	Consequence	Risk Ranking
Construction or maintenance near operational railway	Interference with power supply or other utilities	Death or injury to personnel	D	5	Extreme	Operation and construction safety plans	A	5	Medium		
		Loss of utility supply	D	4	Extreme	Operation and construction safety plans	A	3	Low		
	Rail line obstruction	Death or injury to personnel	D	5	Extreme	Operation and construction safety plans	A	5	Medium		
		Train delays	D	3	High	Operation and construction safety plans	B	3	Medium		
Construction or maintenance near operational road	Interference with power supply or other utilities	Death or injury to personnel	D	5	Extreme	Operation and construction safety plans	A	5	Medium		
		Loss of utility supply	D	4	Extreme	Operation and construction safety plans	A	3	Low		
	Road obstruction	Traffic delays	D	3	High	Operation and construction safety plans	B	2	Low		
		Interference with emergency access	E	2	High	EMPs (See Chapter 22)	B	2	Low		
		Death or injury to personnel	D	5	Extreme	Operation and construction safety plans	A	5	Medium		

19 Hazard and Risk

Table 19.3.1f: continued

Activity	Potential Risk Scenario	Consequence	Risk Assessment (without mitigation measures)		Mitigation and Management Measures	Risk Assessment (Residual)			
			Likelihood	Consequence		Likelihood	Consequence		
Transport of goods and materials during construction or operation	Road or rail accident	Death or injury to personnel or public	D	5	Operation and construction safety plans	A	5	Medium	
		Interference with emergency access	E	2	EMPs (See Chapter 22)	B	2	Low	
		Spill of hazardous substances/dangerous goods	E	3	EMPs (See Chapter 22) Health and safety management system	A	3	Low	
Storage and use of hazardous materials	Spill, inhalation or explosion	Overall increase in Green House Gas emissions	D	3	EMPs (See Chapter 22) Design features	A	3	Low	
		Reduction in air quality	E	3	EMPs (See Chapter 22) Health and safety management system	C	2	Medium	
Vegetation clearance	Loss of vegetation	Public health impact							
		Death or injury of personnel, community members or wildlife	D	5	Extreme	Construction safety plan	A	5	Medium
Vegetation clearance	Loss of vegetation	Contamination of soil or water environment	E	3	Extreme	EMPs (See Chapter 22)	B	3	Medium
		Wildlife mortality or injury	D	3	High	Construction safety plan	A	4	Medium
Vegetation clearance	Loss or damage to protected vegetation and biodiversity	Loss or damage to protected vegetation and biodiversity	D	4	Extreme	Construction safety plan	A	4	Medium

Table 19.3.1f: continued

Activity	Potential Risk Scenario	Consequence	Risk Assessment (without mitigation measures)		Mitigation and Management Measures	Risk Assessment (Residual)			
			Likelihood	Consequence		Likelihood	Consequence		
Commissioning of the electrical system	Interference with electrical system	Death of injury to personnel	D	5	Extreme	Construction safety plan	A	5	Medium
	Loss of power supply	Loss of power supply	D	4	Extreme	Operation and construction safety plans	A	3	Low
	Train delays	Train delays	D	4	Extreme	Operation and construction safety plans	A	3	Low
Natural Hazards	Bushfire	Death of injury to personnel, public or wildlife	C	5	Extreme	Operation and construction safety plans	A	5	Medium
		Loss of property	C	3	High	Operation and construction safety plans	A	3	Low
		Damage to infrastructure	C	3	High	Operation and construction safety plans	A	2	Low
		Disruption of rail service	C	3	High	Operation and construction safety plans	A	2	Low
		Death or injury to personnel or public	D	5	Extreme	Operation and construction safety plans Design features	A	5	Medium
Flooding	Disruption of rail service	Disruption of rail service	D	3	High	EMPs (See Chapter 22) Operation and construction safety plans	A	2	Low
		Death or injury to personnel, public or wildlife	C	5	Extreme	Operation and construction safety plans Design features	A	5	Medium
Landslide	Disruption to rail service	Disruption to rail service	C	3	Medium	Operation and construction safety plans	A	3	Low
		Death or injury to personnel, public or wildlife	C	5	Extreme	Construction safety plans	A	3	Low
Extreme Heat	Damage to infrastructure	Damage to infrastructure	C	3	Medium	Operation safety plans	A	3	Low
		Death or injury to personnel	C	5	Extreme	Construction safety plans	A	3	Low

19 Hazard and Risk

Table 19.3.1f: continued

Activity	Potential Risk Scenario	Consequence	Risk Assessment (without mitigation measures)		Mitigation and Management Measures	Risk Assessment (Residual)		
			Likelihood	Consequence		Likelihood	Consequence	
Train Operation	Derailment	Death of injury to personnel or public	C	5	Design features	A	5	Medium
					Operation safety plans			
Station Operation	Safety of staff and passengers	Death or injury to staff and public	D	5	Design features	A	5	Medium
					Operation safety plans			
Third party interference to railway or construction equipment	Damage to construction equipment	Financial Loss	D	3	Construction safety plans	B	2	Low
		Construction delays	C	2	Health and safety management system	B	2	Low
Damage to track	Financial Loss	Financial Loss	D	3	Construction safety plans	B	2	Low
		Train delays	C	2	Health and safety management system	B	2	Low
Use of road or rail crossings	Accident	Death or injury to personnel or public	C	5	Design features	A	5	Medium
		Overall increase in emissions			Operation safety plans			
Malfunction	Train delays	Train delays	C	2	Health and safety management system	B	2	Low
		Traffic congestion	E	2	Operation safety plans	B	2	Low
					Design features			

19.4 Health and safety

All construction and operational works carry with them a level of potential health and safety risk both to the project personnel and to other stakeholders such as landowners and road users.

The output generated by the project will support approximately 659 jobs directly in the SEQ economy on average over the construction period. With a significant number of construction staff and an average expected workforce numbering approximately 12 operational employees (assuming no more than two staff at in attendance at stations), along with the increased passenger and freight driver requirements, there is a duty of care to manage the health and safety interests of all those working on the various project stages and living within the vicinity of the project.

As QR Limited is anticipated to be the operator of the project upon commissioning, the QR Limited occupational health and safety processes have been referred to. QR Limited is committed to continually improving occupational health and safety performance. The QR Limited Zero Harm strategy focuses on the journey towards

- *zero incidents*
- *zero injuries*
- *zero work-related illnesses*
- *zero environmental incidents.*

QR Limited places a strong emphasis on employee safety and well being, passenger safety and well being and public safety and wellbeing.

Health and safety risks specific to this project have been identified through the risk assessment and with reference to the *Queensland Workplace Health and Safety Act 1995*.

A Safety in Design assessment will also need to be undertaken prior to the detailed design of the project to provide information regarding existing and future health and safety risks to designers, constructors and operators. Issues for Safety in Design review have been considered throughout the process of selection a project and preliminary design. In particular, this applies to the areas where grade separation options are proposed, but no firm commitment to construction has been provided by the proponent.

The risks are to be managed through the documentation detailed in **Table 19.4.1**. A key element in the management of risks during construction and operation is the monitoring and review of the risks and control measures and updating of the relevant plans and procedures accordingly. It is also critical that the requirements of the workplace health and safety documentation are communicated to all project personnel so that they are aware of their roles and responsibilities.

19.4.1 Relevant documentation

The management of workplace/occupational health and safety risks for the project is undertaken through the range of systems, plans and policies outlined in **Table 19.4.1**. This provides a framework for the Department of Transport and Main Roads, QR Limited and the construction contracting company to meet their obligations under the *Queensland Workplace Health and Safety Act 1995*.

All of the plans and statements outlined have not yet been developed for the project but will need to be in place prior to the commencement of works and will be developed in line with existing occupational health and safety management systems in place within QR Limited and/ or the relevant authorities, and the construction contracting company.

19 Hazard and Risk

Table 19.4.1: Minimum requirements to be included in plans and procedures

Health and safety management systems	Operational and construction safety plans	Work method statements and Job Hazard Analysis
Responsibility: corridor manager and the construction contractor	Responsibility: corridor manager and the construction contractor	Responsibility: corridor manager and the construction contractor
<ul style="list-style-type: none"> ▪ health and safety policy ▪ management commitment ▪ responsibilities and accountability ▪ controls for suppliers, sub-contractors and purchasing ▪ health and safety consultation ▪ hazard identification, evaluation and control. ▪ training and competence ▪ incident reporting and investigation ▪ measuring and evaluating workplace health and safety performance 	<ul style="list-style-type: none"> ▪ workplace address ▪ name and address of the principal contractor ▪ principal contractor's ABN ▪ WHS committee ▪ WHS officer appointed ▪ expected start date and duration of the work ▪ induction and consultation procedures ▪ type of construction ▪ plant provided for common use ▪ site rules ▪ site hazards and risks and proposed control measures ▪ how the controls will be implemented ▪ identification of major hazards and corresponding Work Method Statements ▪ personal protective equipment ▪ first aid ▪ contractor management ▪ monitor and review procedures ▪ emergency procedures ▪ public safety strategies ▪ site housekeeping ▪ site security and access 	<ul style="list-style-type: none"> ▪ nature of the high risk construction/ operational activity ▪ the control measures to be used ▪ the way the activity will be performed ▪ how the control measures will be monitored and reviewed ▪ any relevant prescribed occupations

19.5 Emergency management planning

19.5.1 Introduction

Potential emergency situations that could arise during the construction and operation of the project have been determined through the hazard and risk assessment in Table 19.3.1f and could include the following:

- natural hazards such flood, landslide, fire or cyclone
- spills of hazardous materials during construction
- accidents involving explosives during construction
- accidents at road or rail crossings, particularly if grade separation does not occur as part of the initial construction of the project
- derailments
- accidents involving spills of hazardous materials or other materials
- accidents involving spills of hazardous materials or other materials on a bridge or structure over waterways or public thoroughfares

- third party damage
- assaults at stations.

The HRA did not identify any of the risks to be of a high level. However, risk identification is an ongoing process throughout the life of the project as new emergency risk situations could arise. Emergency situations require effective planning and management to reduce the impact arising from the situation. This information is usually documented in an Emergency Management Plan specific to the project.

QR Limited (Network Access) requires any potential operator wishing to gain access to the QR Limited network to prepare the following:

- an 'acceptable Emergency Response Plan, to be used in the event of a derailment or other emergency on the network'
- an Environment Investigation and Risk Management Report (EIRMR). The Report must include appropriate actions/responses to an incident (should one occur).

19.5.2 Emergency planning and response procedures

At this early stage of the project, it is not possible to determine the layout for plant, storage of hazardous materials, incident control points and fire fighting equipment. Future stages of detailed design and construction planning will need to address the specifics of each construction site and station design.

During construction, emergency management will need to be undertaken through an Emergency Management Plan. Chapter 22, **Environmental management plans** includes control plans for some of the issues that could be considered in an Emergency Management Plan. These include:

- handling and storage of hazardous goods
- health and safety management
- emergency incident response.

An emergency management plan for the construction phase will include an emergency response procedure, example contents of which are outlined below:

- emergency contacts and chain of command
- responsibilities
- alert systems
- identification and control of emergency sources
- access routes and transport methods
- reporting and review requirements
- involvement of State Agencies.

Relevant State agencies that could be involved during an emergency situation are listed in Table 19.5.2 with the likely nature of their involvement. There are local branches of these services, contact details of which will be incorporated into future emergency planning documentation.

Table 19.5.2: *Emergency services*

State Agency	Likely involvement in an emergency situation
Queensland Ambulance Service	<ul style="list-style-type: none"> ▪ provision of first aid ▪ transport of injured ▪ establishment of Casualty Clearing Station if required.
Queensland Fire Rescue Service	<ul style="list-style-type: none"> ▪ the control of existing fire or explosive situations ▪ the negation of possible fire or explosive situations ▪ rescue of trapped and/or injured ▪ the control of chemical emergencies.

Table 19.5.2: *continued*

State Agency	Likely involvement in an emergency situation
State Emergency Service	<ul style="list-style-type: none"> ▪ provision of personnel and equipment ▪ assistance with traffic and crowd control ▪ assistance in the evacuation of person if necessary ▪ construction of earth bunds ▪ other assistance as required.
Police	<ul style="list-style-type: none"> ▪ traffic control ▪ crowd control ▪ evacuation of persons if required ▪ coordination of rescue of trapped or injured persons if required.

19.6 Summary and conclusions

Natural hazard management areas have been identified in the relevant planning schemes of the shires through which the project passes. Areas of flood, bushfire and landslide risk occur adjacent to or within the project area and therefore require consideration under SPP 1/03 Mitigating the Adverse Effects of Bushfire, Flood and Landslide. It is considered that the project meets the requirements of this SPP and can demonstrate overriding need.

In addition to the natural hazards identified in the project area, human activity and technological issues can also present hazards. An HRA has been undertaken for the project in accordance with the principles set out in AS/NZS Risk Management Standard 4360:2004 (which supersedes 4360:1999). The risks identified in the HRA are considered to be at most a medium risk level, which in the context of the HRA means that existing measures in place for the construction or operation of the project are considered sufficient to manage the identified risks.

During construction, the construction contractor will also have a safety management plan in place and an emergency management plan which will determine day-to-day procedures and responsibilities for health and safety and emergency planning.