12. Hazard and Risk

This section describes the hazards and risks to sensitive receptors that may be associated with the Project (Rail) during construction and operation. The assessment was undertaken in accordance with the requirements of the Terms of Reference (ToR) and a table cross-referencing these requirements is provided in Volume 4 Appendix C ToR Cross Reference Table.

12.1 Introduction

12.1.1 Overview

The objective of the hazard and risk assessment is to identify potential hazards and risks, inclusive of health and safety considerations, relevant to the Project (Rail) and describe actions to mitigate the level of risk.

12.1.2 Methodology

This assessment of hazards and risks associated with the Project (Rail) is based on a Preliminary Hazard Analysis (PHA). The purpose of PHA is to identify high levels of hazards and risk associated with the Project (Rail). This allows for identification and prioritisation of risks based on the current level of project planning, and to guide more detailed analysis when detailed design progresses. The outcome of the PHA serves to assist with mitigation of risks, but is not intended to provide a comprehensive quantitative assessment of risks.

The methodology employed includes:

- Review of Federal, State and local regulatory framework
- Review of relevant standards, guidelines and codes
- Identification and description of sensitive receptors
- Review of the Project (Rail) activities throughout the construction, operations and decommissioning phases
- Review of the hazardous substances that will be used during the phases of the Project (Rail)
- Review of the natural hazards that pose a risk to the Project (Rail)
- Evaluation of the risk associated with each hazard
- Development of proposed mitigation measures
- Review of residual risk with mitigation measures in place
- Development of a risk management plan, particularly emergency management planning procedures

12.1.3 Regulatory Requirements, Standards, Codes and Guidelines

A number of key regulatory requirements and standards, codes and guidelines are applicable to the Project (Rail) PHA. Key legislation and policy that may be relevant to the Project (Rail) is as follows.

- Transport Infrastructure (Dangerous Goods by Rail) Regulation 2008
- Transport Operations (Road Use Management Dangerous Goods) Regulation 2008
- Transport (Rail Safety) Act 2010
- Transport (Rail Safety) Regulation 2010
- Work Health and Safety Act 2011
- Work Health and Safety Regulation 2011
- State Planning Policy 1/03, Mitigating the Adverse Impacts of Floods, Bushfire and Landslide

Standards, codes, manuals and guidelines reviewed as a part of this risk assessment include:

- Australian and New Zealand Standards *AS/NZS ISO 31000:2009 Risk management – Principles and guidelines*
- Urban Stormwater Quality Planning Guidelines (DERM, 2010)
- Australian Standard AS 1940, 2004, The storage and handling of flammable and combustible liquids, Standards Australia
- Australian/New Zealand Standard AS/NZS 4801:2001, Occupational health and safety management systems—Specification with guidance for use
- Australian Standard HB 203, 2006, Handbook: Environmental risk management - Principles and process, Standards Australia
- AS 1692-2006 Steel tanks for flammable and combustible liquids
- Australian Dangerous Goods Codes
- Australian Code for Transport of Dangerous Goods by Road and Rail 7th edition (ADG Code)

Key legislation and policy were reviewed where relevant to the Project (Rail)

In accordance with the requirements of the Australian and New Zealand Standards *AS/NZS ISO 31000:2009 Risk management – Principles and guidelines*, a qualitative risk assessment for all identified hazards has been performed and a risk register prepared. The risk register identifies the Project (Rail) risks for the construction, operations and decommissioning phases.

The risk assessment process is based on the assumption that there will be ongoing hazard and risk assessments throughout the life cycle of the Project (Rail). Workplace health and safety issues were not included in the risk assessment as it was assumed that statutory processes and other state health and safety legislation is in place to manage workplace hazards and risks.

Table 12-1 outlines the Adani Project Risk Matrix, used to rank each of the hazards. Table 12-2 outlines the consequence scale description and Table 12-3 outlines the likelihood scale description. The risk ranking is applied from the consequence and likelihood scale. This risk matrix used is consistent with the AS/NZS ISO 31000: 2009 Risk management – Principles and guidelines.

Table 12-1 Adani Risk Matrix

Likelihood	Consequence				
	Major (5)	Severe (4)	Moderate (3)	Minor (2)	Insignificant (1)
Almost certain (5)	Extreme	Extreme	High	Medium	Medium
Likely (4)	Extreme	Extreme	High	Medium	Medium
Possible (3)	High	High	Medium	Medium	Low
Unlikely (2)	High	Medium	Medium	Low	Low
Rare (1)	Medium	Medium	Medium	Low	Low

Table 12-2 Consequence Scale Description

Descriptor (Rating)	Environment	Health and Safety	Community and Reputation
Insignificant (1)	Negligible, reversible environmental effect. Any impacts are contained within the mining lease/ rail corridor and are short term in nature. Minimal resources required to respond to an incident.	First aid treatment or medical treatment in hospital.	No media coverage. No community complaints.
Minor (2)	Minor, unplanned localised environmental impact, contained within the mining lease/ rail corridor or with negligible off site effects. Planned or unplanned impacts do not result in degradation of overall conservation status of ecosystems. Minor resources required to respond to the incident. Impacts are reversible within a year.	Medium term, largely reversible injury or illness to one or more persons. Restricted work injury. Lost time injury < 2 weeks.	Local media coverage. Complaint to site and/or regulator.

Descriptor (Rating)	Environment	Health and Safety	Community and Reputation
Moderate (3)	Moderate, unplanned environmental impact contained within the mining lease/ rail corridor or minor impact that is off-site. Unplanned impacts do not result in degradation of overall conservation status of ecosystems. Resources will be required for responding to the incident and implementing mitigation measures over a period of time. Impacts are reversible within 1 to 5 years.	Serious bodily injury or illness (e.g. fractures) and/or lost time injury > 2 weeks.	Local media coverage over several days or State media coverage. Negative impact on local economy. Persistent community complaints.
Severe (4)	Major or widespread, unplanned environmental impact on- or off-site. Degradation of overall conservation status of ecosystems. Significant resources required to respond and rehabilitate. Impacts are reversible within 5 to 10 years.	Single fatality and/or severe disability (permanent disabling injury) or illness to one or more persons	National media coverage over several days. Community / NGO legal actions. Impact on local economy.
Major (5)	Extensive long term environmental harm and/or harm that is extremely widespread. Significant resources required to respond to the incident and rehabilitate. Impacts unlikely to be reversible within 10 years.	Multiple fatalities and/or significant irreversible effects to 10's of people	Prominent negative international media coverage over several days. Significant negative impact on share price for months.

Table 12-3 Likelihood Scale Description

Descriptor (Rating)	Definition
Rare (1)	Frequency of occurrence expected to be < 1% Only likely to occur in exceptional circumstances Not likely to occur in the next 30 years
Unlikely (2)	Frequency of occurrence expected to be 1% to 20% May occur in some circumstances but not anticipated Could occur once in the next 5 to 30 years
Possible (3)	Frequency of occurrence expected to be 20% to 50% May occur some of the time but a distinct possibility it won't Could occur in the next 2 to 5 years
Likely (4)	Frequency of occurrence expected to be 50% to 99% Will probably occur in many circumstances Could occur annually
Almost certain (5)	Frequency of occurrence expected to exceed 99% Impact is occurring now or Could occur within months

12.1.4 Project (Rail) Sensitive Receptors

Identification and description of the sensitive receptors was undertaken through a desktop review. Each of the relevant Project EIS specific reports were reviewed, during which sensitive receptors within the vicinity of the Project (Rail) were identified. These were then classified as either human sensitive receptors or environmentally sensitive receptors.

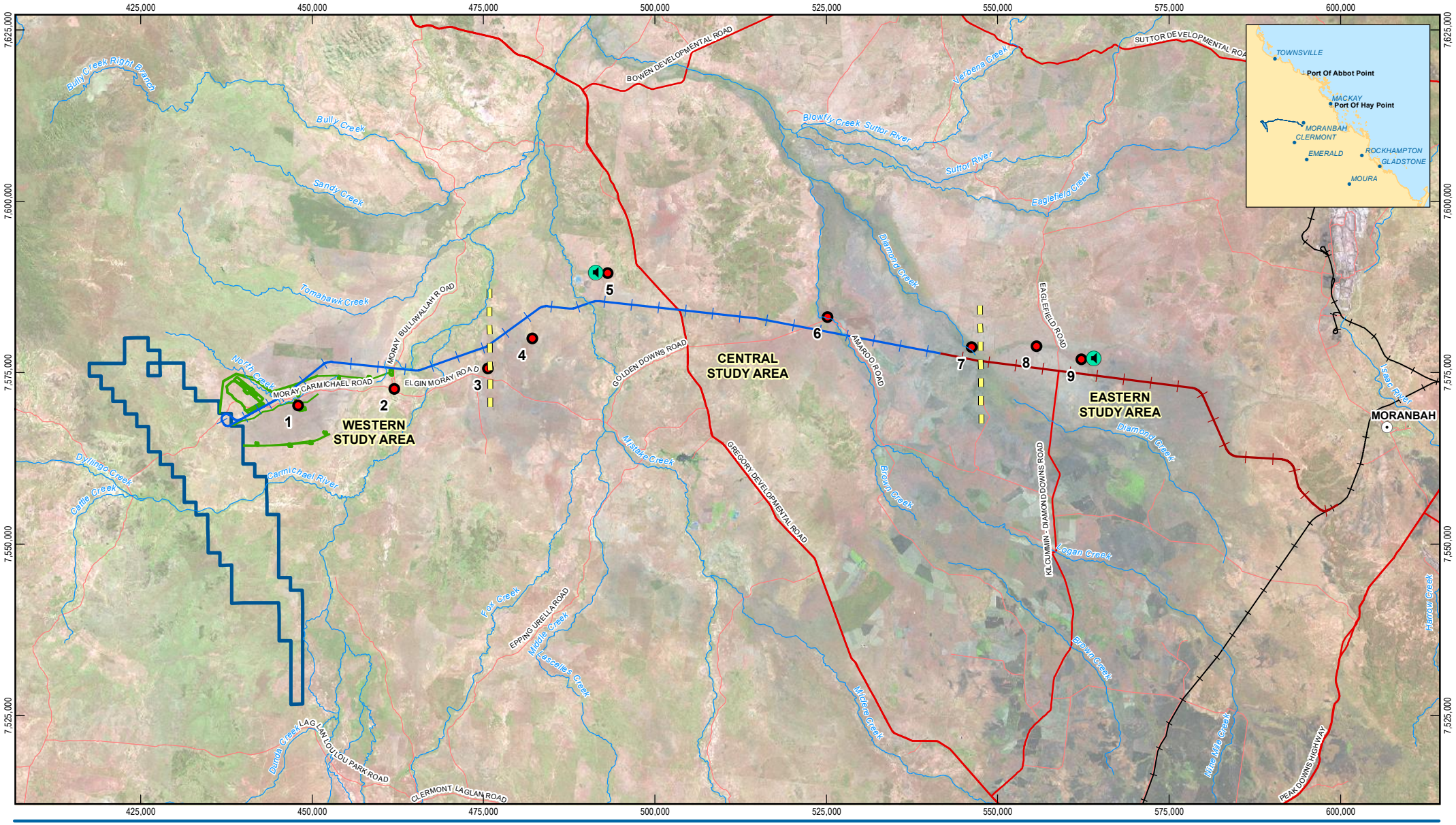
The key potential human sensitive receptors include eight homesteads and residential dwellings and the Project (Mine) workers accommodation village located within the vicinity of the Project (Rail) corridor. The nearest identified sensitive receptor is the homestead at Lambing Lagoon, which is approximately 1.6 km from the Project (Rail).

The key environmentally sensitive receptors identified through a review of the Project (Rail) EIS technical reports include terrestrial and aquatic ecology (Refer Volume 4 Appendix AA Rail Ecology Report). Within the Project (Rail) in the order of approximately 367 ha of REs will be cleared. Four nature refuges are located within 50 km of the Project (Rail). Doongmabulla Springs, a wetland of national significance is located approximately 14 km west of the western extent of the Project (Rail).

Potential human sensitive receptors are listed in Table 12-4 and shown in Figure 12-1. Receptors potentially impacted by the Project (Rail) are shown in Figure 12-2. Other potentially sensitive environments and protected areas are shown in Figure 12-3.

Table 12-4 Potential Human Sensitive Receptors

ID	Potential Receptors	Approximate Distance from the Project (Rail) (m)	Description/Comment
1	Moray Downs	3,300	Homestead
2	Cassiopeia	3,000	Homestead
3	Twelve Mile Outstation	3,000	Homestead
4	Disney	4,200	Homestead
5	Avon Downs	2,000	Homestead
6	Lambing Lagoon	1,600	Homestead
7	Myra	3,000	Homestead
8	Mullawa	1,900	Homestead
9	Mine Workers Accommodation Village	2,450	Mine Village



1:750,000 (at A4)

0 5 10 15 20 25

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

LEGEND

- Town
- Sensitive Receptor
- Noise Logger
- Study Extent
- Watercourse
- State Road
- Local Road
- Other Rail Network
- Rail (West)
- Rail (East)
- Mine (Onsite)
- Mine (Offsite)

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Carmichael Coal Mine and Rail Project

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Revision B
Date 11-09-2012

Project (Rail) Study Area and Potential Sensitive Receptors

Figure 12-1

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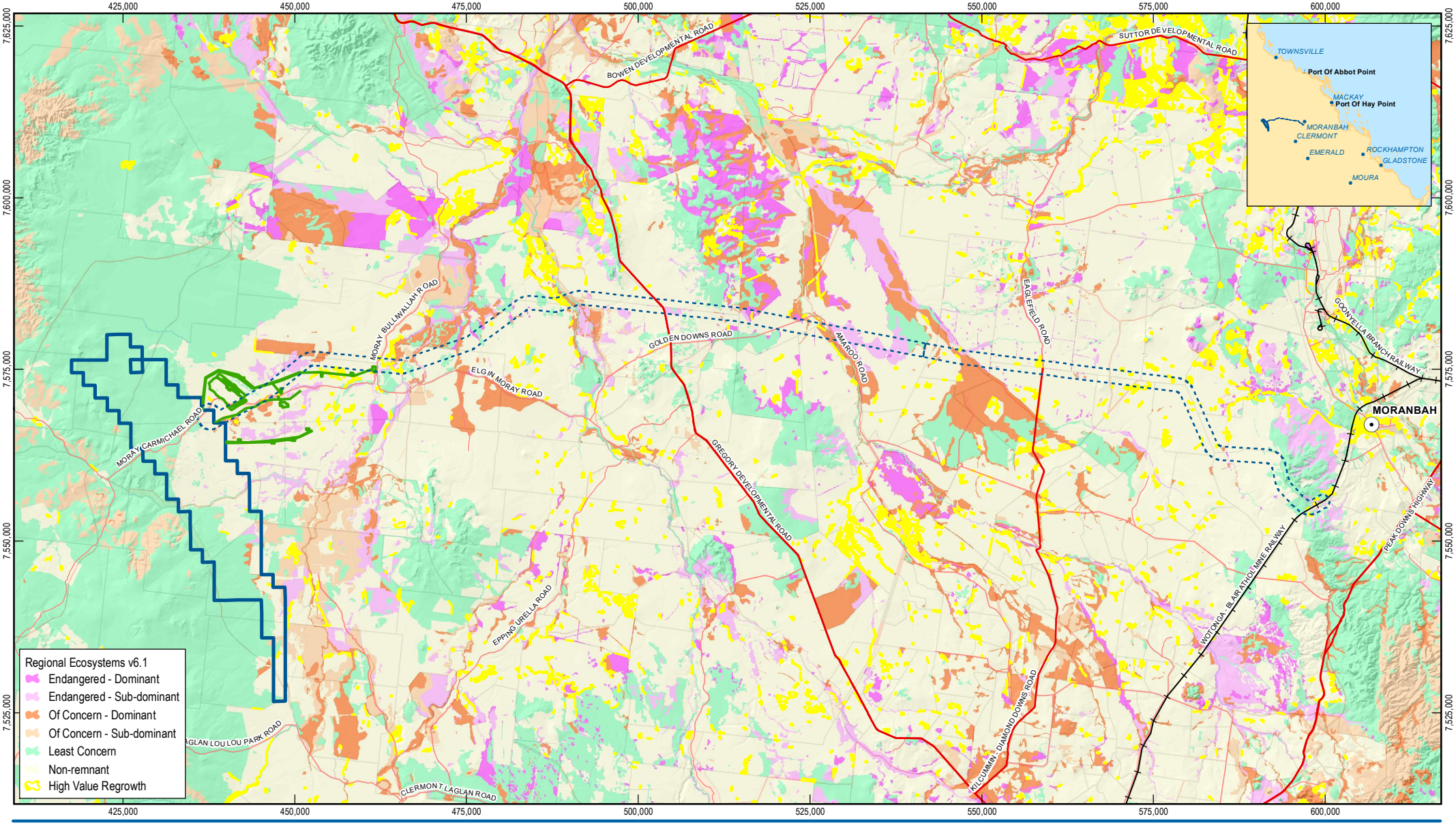
Data source: GHD: Noise Logger/Sensitive Receptor Locations,Study Extent(2012); DERM: DEM (2008); DME: PC1690 (2010), EPC1080 (2011); © Commonwealth of Australia (Geoscience Australia): Localities, Railways, Roads, Watercourse (2007); Adani: Alignment Opt9 Rev3 (SP1&2) (2012); Gassman/Hyder: Mine (Offsite) (2012). Created by: AF, JVC.MS



1:750,000 (at A4)

0 5 10 15 20 25

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

LEGEND

- Town
- State Road
- Local Road
- Other Railway
- Cadastral Parcel
- Road Reserve
- Watercourse Reserve
- Mine (Onsite)
- Mine (Offsite)
- Study Area

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DERM Certified Regional Ecosystems v 6.1 and Regulated Regrowth v 2.1 Mapping Figure:12-2

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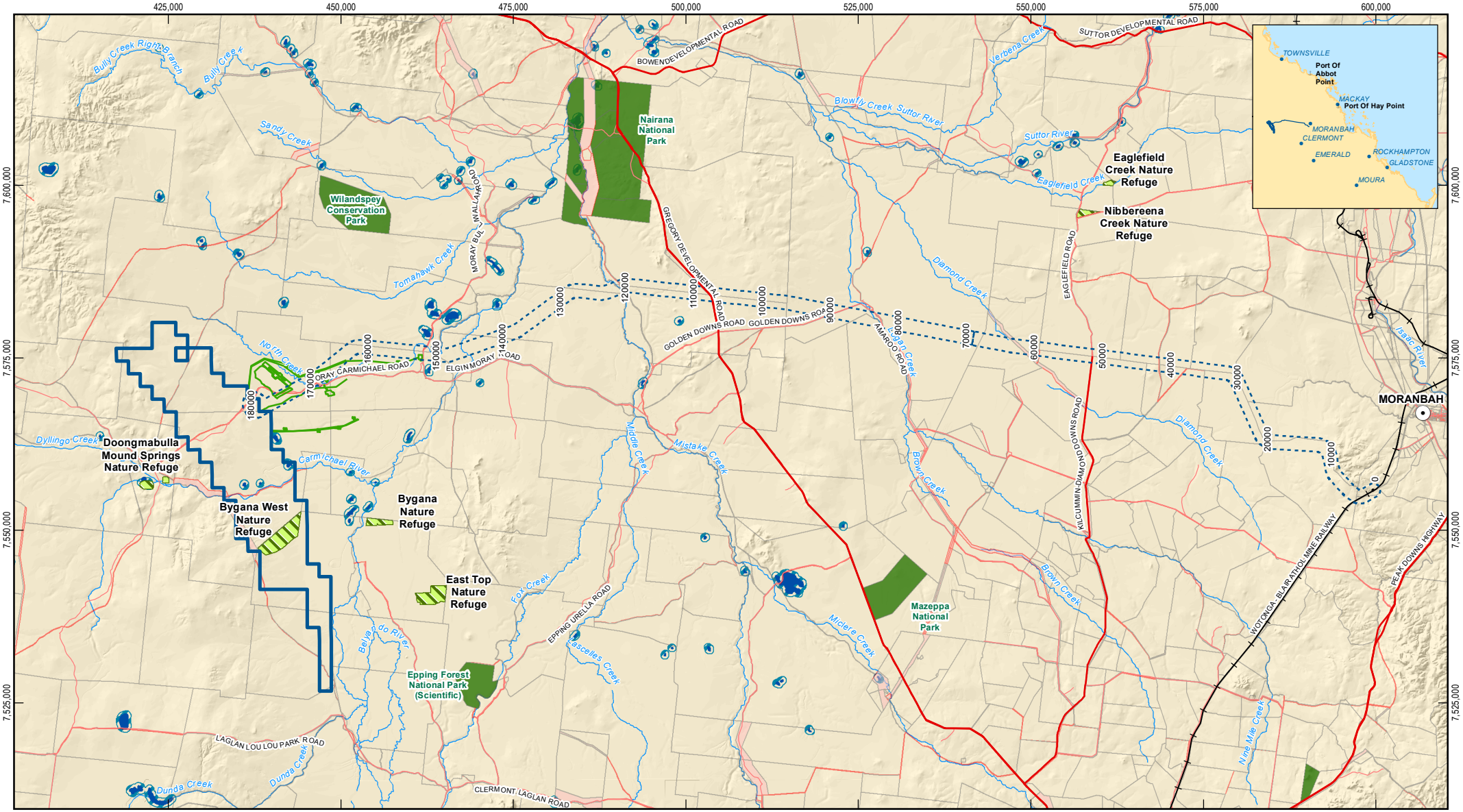
Data source: DERM: DEM (2008), DCDB (2010), RE v6.1 (2011), High Value Regrowth (2011); DME: EPC1690 (2010) / EPC1080 (2011); © Commonwealth of Australia (Geoscience Australia): Localities, Railways, Roads (2007); Adani: Alignment Opt9 Rev3, (2012); Gassman/Hyder: Mine (Offsite) (2012); GHD: Northern Missing Link (2011). Created by: BW, CA



1:750,000 (at A4)

0 5 10 15 20 25

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

LEGEND

- Town
- Watercourse
- Other Rail Network
- State Road
- Local Road
- Road Reserve
- Cadastral Parcel
- Mine (Onsite)
- Mine (Offsite)
- Study Area
- Nature Refuge
- National Park
- Great Barrier Reef Wetland Protection Area
- Great Barrier Reef Wetland Protection Trigger Area

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Carmichael Coal Mine and Rail Project

Great Barrier Reef Wetland Protetions Areas and Other Protected Areas within and adjacent to the Study Area

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Figure 12-3

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Level 4, 201 Charlotte St Brisbane QLD 4000 T +61 7 3316 3000 F +61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data source: DERM: DEM (2008), DCDB (2010), GBR Wetland Protection Areas (2010), Nature Refuge (2010), National Park (2010); DME: EPC1690 (2010), EPC1080 (2011): © Commonwealth of Australia (Geoscience Australia): Localities, Railways, Roads (2007); Adani: Alignment Opt9 Rev3 (2012); Gassman/Hyder: Mine (Offsite) (2012); GHD: Northern Missing Link (2011). Created by: NR, CA

12.2 Project (Rail) Hazards and Risks

12.2.1 Overview

The Project (Rail) hazards and risks are described as Project (Rail) activities, hazardous substances (which are risks to sensitive receptors), and risks to the Project (Rail). These risks may occur during the construction, operation and decommissioning phases of the Project (Rail).

12.2.2 Rail Activities

12.2.2.1 Overview

The PHA is based on the Project (Rail) description with respect to activities throughout the construction, operations and decommissioning phases of the Project (Rail). It is noted that the concept design will continue to be refined as more field work and associated data becomes available and further community and agency feedback is attained.

Hazard identification focuses on non-routine events that may result in impacts on identified sensitive receptors. The focus is therefore based on abnormal hazardous events and conditions. Potential impacts arising from the day-to-day normal construction and operational activities were not considered as a risk event given that they would be managed by reasonable environmental practices in combination with environmental requirements, approvals and licences. The hazard identification process applied therefore assumed compliance with regulatory requirements and did not consider deliberate exposure of hazards, for example, deliberate releases of pollutants. As such, the following aspects have been identified as that which may pose a hazard:

- Wastewater management
- Surface water management
- Power supply
- Water supply
- Roads and traffic

For some hazards, there is currently insufficient information to clearly determine the potential impact and as such, the management and mitigation to be employed. However, as outlined in Section 12.1.2, the purpose is to identify hazards and risks associated with the Project (Rail), allowing for identification and prioritisation of risks based on available information and as detailed design progresses.

12.2.2.2 Wastewater Management

Potential Impact

Sewage will be produced from on-site amenities and can pose a hazard to humans and the environment if poorly managed.

It is proposed that waste water from each temporary construction camp will be treated on site using portable treatment plants (four 40 foot containers per camp). Subject to further discussions with regulatory authorities, treated effluent may be:

- Reticulated to a ground area (in the order of 2 ha)

- Leached underground by seepage pipes
- Pumped to an appropriate evaporation pond area

Mitigation and Management

A Sewage Treatment Plant (STP) will be constructed and operated on-site to treat sewage from the maintenance yard. Package STP's will also be provided at the temporary construction camps and the flash butt welding yard. The STP's will be operated and managed in accordance with operational procedures. Spillages and unplanned events will be managed in accordance with emergency response procedures.

12.2.2.3 Water Supply Management

Potential Impact

A maintenance yard is proposed at the western extent of the Project (Rail) near the Mine (between chainage 164.5 km and 166 km) with a footprint of approximately 280 ha. It will include traffic and workshop tracks, locomotive provisioning facilities, a locomotive and wagons workshop, and administration and crew depots. Locomotives and wagons will be cleaned on site.

Mitigation and Management

The wash water used to clean locomotives and wagons will be treated and reused. Stormwater will be collected, treated and reused for industrial purposes. Rainwater will be collected and reused as potable water. The Project will develop and implement water supply management plans to address water usage, treatment of the recycled water and compliance with the requirements of Queensland Water Recycling Guidelines.

12.2.2.4 Fatigue of Operational Personnel

Potential Impact

The Project will have dedicated inbound and outbound crews. On average six train crew will be working on any 24 hour cycle.

Mitigation and Management

All trains will be operated by two drivers. The use of fatigue managing through appropriate rostering codes, will reduce potential driver fatigue issues which can result in accidents.

12.2.2.5 Roads and Traffic

Potential Impacts

Transport of hazardous substances constitutes off site Project (Rail) activities and form a part of the risk assessment. All substances will be transported by road to the Project (Rail). All hazardous substances will be transported by road from Townsville via Flinders Highway and the Gregory Developmental Road. If transporting from Mackay, the trucks can use the Bruce Highway, Marlborough - Sarina Road, Peak Downs Highway, Suttor Developmental Road and Bowen Developmental Road.

Site access for trucks will be from the following primary access roads:

- The Kilcummin Diamond Downs Road, at chainage 51 km
- Amaroo Road, at chainage 82.5 km, or Avon Road at chainage 87.5 km
- The Gregory Developmental Road, at chainage 108 km
- Moray Bulliwallah Road, at chainage 152.7 km

Construction traffic has been assessed in the Volume 2 Section 12.

The Project (Rail) will cross dedicated public road reserves (constructed and unconstructed) and private (farm) trails, and stock crossings which may impact on the operation of those networks. The following have been identified as being affected by the Project (Rail):

- Six public dedicated roads
- 68 private (farm) trails
- Three stock crossings
- Four easements

Traffic hazards resulting from noise and dust emissions during construction were not assessed as part of the risk assessment and have been addressed in Volume 3 Section 7.

Mitigation and Management

Transportation will comply with the Australian Code for Transport of Dangerous Goods by Road and Rail 7th edition (ADG Code). The Project (Rail) Transport Report (refer Volume 4 Appendix AG Rail Transport Report) indicates that the expected increase from construction traffic can be adequately accommodated and will not impact the operating performance of the existing road network.

Each crossing location has been assessed to determine whether the respective individual crossing should be retained or closed, and in the case of the retained crossings, to identify the appropriate treatment option, which may include separation (rail under road or rail over road), at-grade active control, at-grade passive control or road realignment.

The Project (Rail) will comply with the requirements under the Department of Transport and Main Roads (DTMR), namely the *Road Planning and Design Manual, DTMR Manual of Uniform Traffic Control Devices, Austroads Guide to Traffic Management* and *Australian Rail Track Corporation Level Crossings – Configuration Standards*.

12.2.3 Hazardous Substances

The Project (Rail) will use a number of hazardous substances during construction and operations including those listed in the Australian Dangerous Goods Codes. Table 12-5 is an indicative list of substances to be used, likely quantities to be stored on site and indicates the project phase during which the substance will be used. Material Safety Data Sheets (MSDS) will be available at appropriate locations where these substances are stored or used. Table 12-5 shows the likely location where dangerous goods will be stored.

The potential impact of these substances is outlined below, along with the management and mitigation of the risks associated with transport, storage and handling of the substances.

Table 12-5 Indicative List of Hazardous Substances

Chemical Name / Shipping Name	Raw Conc. %wt	Operation Storage Conc. %wt	D.G. Class	UN No	Packaging group	Indicative Maximum Inventory on site		Purpose/ Use
						Construction	Operation	
Diesel	N/A	N/A	3 (Class C1)*	1202	III	70 kL	1,050 kL	Fuel for locomotive and vehicle operations
						10 kL	10 kL	Power generation during construction and back-up power generation during operations.
Lubrication/ Hydraulic oils	N/A	N/A	3 (Class C2)**	N/A	N/A	10 kL	200 kL	Lubricate plant and equipment and replenish hydraulic systems
Nitrogen gas	>99%	>99%	2.2	1066	N/A	144 m^3	60 m^3	Pneumatic equipment
Acetylene	> 98%	> 98%	2.1	1001	N/A	245 m^3	80 m^3	Welding / Oxy-acetylene cutting
Oxygen	> 98%	> 98%	2.2	1072	N/A	245 m^3	80 m^3	Welding / Oxy-acetylene cutting
Aluminium sulphate	47%	47%	N/A	N/A	N/A	N/A	4 kL	Water treatment
Sodium hypochlorite	10-15% available chlorine	10-15% available chlorine	8	1791	II or III	2 kL	2 kL	Water treatment
Herbicides and Pesticides	NA	NA	NA	NA	NA	< 200 kL	< 200 kL	Pest and weed control
Car batteries (sulphuric acid)	15-51	15-51	8	2796	II	0.25 tonne	0.5 tonne	Spent batteries from vehicles
Waste oil	N/A	N/A	N/A	N/A	N/A	0.5 tonne	1 tonne	From vehicles / equipment

* Class C1 – a combustible liquid that has a flashpoint of 150°C or less.

** Class C2 – a combustible liquid that has a flashpoint exceeding 150°C.

Hazchem Code: Description as per ADG Code

N/A Not Applicable / None Allocated.

12.2.3.1 Diesel

Potential Impact

Diesel is a combustible liquid with a flash point of > 61.5^{o}C, vapour pressure < 1 mm Hg @ 25^{o}C and specific gravity 0.85 at 15^{o}C. Diesel has very low solubility in water and is incompatible with strong oxidising agents. Due to the properties of diesel, there is no risk of an explosion with a diesel fire.

Diesel is toxic to plants and animals. Contact with skin and eyes will cause irritation. Inhalation by humans in high concentrations will result in dizziness, headaches, nausea, vomiting, drowsiness or narcosis.

Management and Mitigation

Indicative maximum diesel storage during the construction phase is 70 kL and 1,050 kL during the operational phase. For both phases the diesel will be stored in above ground tanks and day tank storage systems. In particular, during the construction phase two aboveground tanks (35 kL each) will be provided. Ten aboveground diesel storage tanks (105 kL each) will be provided at the maintenance facility during the operational phase.

Design and construction of tanks will comply with *AS 1692-2006 Steel tanks for flammable and combustible liquids*. These tanks will be installed on impervious surfaces and fully bunded. The storages will comply with the requirements of *AS 1940 – The storage and handling of flammable and combustible liquids*.

All tank transfer operations will be on impervious surfaces with a spill collection system. There will be no pipes through the bunds and valves at the outlet pipe from the bund will be locked in a closed position.

Build-up of electrostatic charges will be prevented by bonding and grounding. Spill kits will be available to assist with spill management and clean up. The material spilt will be collected and placed in a labelled container for disposal off-site through by licensed contractor.

Refuelling tanks will be provided at the maintenance area. These storages will be placed above ground and will comply with the requirements of AS 1940. Dedicated refuelling areas will be constructed adjacent to the refuelling tanks with impervious surfaces and containment using rollover bunds with a drainage sump in one corner.

Portable petroleum-product fuel containers will comply with the requirements under *AS/NZS 2901:2001 Fuel containers - Portable - Plastic and metal*. Mobile fuel trucks of 12,000 L capacity will be used to refuel equipment that is operating on the site. These trucks will be fitted with automatic shut off valves and will comply with requirements of the ADG Code.

Personal protective equipment (PPE) will be provided and will comply with the relevant Australian Standards.

Fire fighting systems will be provided. On-site emergency response teams will be trained to undertake the necessary actions to address fire and other incidents that may arise with areas used for storage of diesel.

12.2.3.2 Oils

Potential Impact

Oils are typically clear amber viscous liquids with specific gravity of 1.01 to 1.03 and a boiling point of 100 – 105^{o}C. Prolonged exposure may irritate eyes and skin. When released into the environment, they will absorb to the sediment and soil. Bioaccumulation is unlikely due to the very low water solubility and therefore bioavailability to aquatic organisms is minimal. Oils are toxic to plants/animals and coating of plants and animals with oil can cause death.

Management and Mitigation

Oils will be stored in above ground tanks and will be fully bunded. Activities involving oils will be undertaken on a hard stand area, and drip trays will be provided during transfer operations. Controls and management procedures will be adopted for servicing of machinery.

Spillages will be prevented from entering drains or water courses and absorbent material will be placed on spillages which will be collected for disposal and any contaminated soil removed for treatment and disposal. PPE will be provided and will conform to Australian Standards.

12.2.3.3 Nitrogen

Potential Impact

Nitrogen is a non-flammable, colourless and odourless gas having a vapour density of 0.967 and a boiling point of -195.8^{o}C. It is a non-toxic and non-irritating gas but in confined spaces will displace oxygen, potentially causing asphyxiation. Nitrogen is a major component of air and is non-toxic to plants except by displacing oxygen required for respiration.

Management and Mitigation

Nitrogen will be transported to site in individual cylinders. Compressed nitrogen gas cylinders will be stored at the maintenance area in a specific storage area. They will be kept upright in a secure area on a floor to prevent falling. Emergency response procedures will be developed and implemented. PPE will be provided and will conform to the relevant Australian Standards.

12.2.3.4 Acetylene

Potential Impact

Acetylene is a highly flammable and explosive gas that is colourless with a garlic-like odour. It has a vapour pressure of 4700 kPa at 25^{o}C and a flash point of < 23^{o}C. Acetylene has a lower explosion limit of 2.5 %. It is a non-toxic and non-irritating gas but in confined spaces will displace oxygen, potentially causing asphyxiation.

Management and Mitigation

Acetylene will be transported to site in individual cylinders. Acetylene bottles will be kept upright, in a secure area within the stores compound on a floor to prevent falling. Bottles will not be stored near sources of ignition, oxidising agents, poisons, flammable liquids or combustible materials.

Emergency response procedures will be developed and implemented for leaks from a cylinder. Personnel will be trained in safe use and emergency response. These procedures will minimise the

risk of fire resulting from an incident involving acetylene. PPE will be provided and will comply with Australian Standards.

12.2.3.5 Oxygen

Potential Impact

Oxygen is an oxidizing, colourless and odourless gas. Contact with combustible material may cause a fire. It is not toxic to humans or other organisms.

Management and Mitigation

Oxygen will be transported to site in individual cylinders. Compressed oxygen gas cylinders will be stored in a specific storage area. The gas bottles will be kept upright in a secure area on a floor to prevent falling. PPE will be provided and will comply with relevant Australian Standards.

12.2.3.6 Aluminium Sulphate

Potential Impact

Aluminium sulphate is used as a water treatment chemical. It is a colourless odourless liquid with specific gravity of 1.30 to 1.32. Aluminium sulphate is slightly corrosive and incompatible with alkalis (e.g. sodium hydroxide) and may be corrosive to most metals. It is non-flammable but may evolve toxic aluminium/sulphur oxides when heated to decomposition. Prolonged exposure to aluminium sulphate can cause chronic toxicity effects in aquatic organisms.

Management and Mitigation

Aluminium sulphate will be transported in bulk containers and stored in a dry well-ventilated bunded area and away from alkalis and most metals. Dosing at the water treatment plant will be automated to minimise risk of human contact and accidental release. PPE will be provided and will comply with relevant Australian Standards.

12.2.3.7 Sodium Hypochlorite

Potential Impact

Sodium hypochlorite is a pale yellow-green coloured liquid that is alkaline and miscible with water. It is stable under normal storage and handling conditions. It is incompatible with acids and metals. It is toxic to humans and will cause severe eye irritation and can result in permanent injury. It is a severe skin irritant and corrosive contact may cause skin burns. Sodium hypochlorite is soluble in water and causes acute toxic effects to aquatic organisms.

Management and Mitigation

Sodium hypochlorite will be transported in bulk containers by road and stored in a secured, bunded, cool, dry, well-ventilated area and away from incompatible materials. Dosing at the water and wastewater treatment plants will be automated to minimise risk of human contact and accidental release.

12.3 Risks to the Project (Rail)

12.3.1 Overview

While the Project (Rail) activities and substances pose hazards and risks to sensitive receptors, there are potential natural disasters that also pose a risk to the Project (Rail). State Planning Policy 1/03 states that a natural hazard is a naturally occurring situation or condition with the potential for loss or harm to the community or environment. Natural disasters identified as a risk include tropical cyclones, flooding, earthquakes, bushfire and climate change.

12.3.2 Tropical Cyclones

The Project (Rail) is 189 km long and extends from Moranbah to the Project (Mine). Tropical cyclones have the potential to impact coal transportation operations. A total of 17 cyclones passed within 200 km of the Project area since 1906 (Bureau of Meteorology, 2011). The cyclones reached intensities of Category 1 to Category 3. However, most of these cyclones developed into a low by the time they made landfall.

It is considered that cyclones represent a low risk to the Project. The main impacts from cyclone activity in the Project (Rail) area are most likely heavy rainfall resulting in flooding and damage to rail infrastructure.

During detailed design the Project will evaluate the risk of tropical cyclones and appropriate design standards will be adopted to ensure that all structures, including those that contain hazardous materials, are designed to withstand wind and rain associated with cyclonic events.

12.3.3 Flooding

Flood plains, particularly those associated with the Belyando River, Mistake Creek and Diamond Creek, are located along the length of the Project (Rail) alignment. Maintaining the formation level so that it minimises the fill material required, while satisfying hydrological requirements is critical to the Project (Rail) design. Preliminary rail design accounted for 50 year ARI flood immunity at formation level and 100 year ARI flood immunity at rail level. Preliminary hydrological studies have been undertaken (refer Volume 4 Appendix AB Rail Hydrology Report) using a range of opening sizes. Ongoing and more detailed hydrological studies will be undertaken during detailed design to confirm the size of waterway crossings.

12.3.4 Earthquake

Geoscience Australia defines significant earthquakes as all earthquakes above 3.5 on the Richter scale. A review of the data provided by Geoscience Australia (2011) for historical data of earthquakes occurring in the region since 1955 found records of four earthquakes of magnitude 1.2 to 3.1. All of these earthquakes are not considered to be of significance.

Earthquake risk, as identified by the Commonwealth Government – Geoscience Australia report on the Mackay area, is assessed as low to moderate.

The development of a rail line and associated infrastructure is considered to be at low risk from potential seismic activity.

12.3.5 Bushfire

Bushfires have a low to medium risk of occurring on and/or adjacent to the rail corridor (Bushfire Risk Analysis map prepared in June 2008 for Isaac Regional Council by the Queensland Fire and Rescue Service). The Project will impose restrictions on operational activities at the maintenance yard, flash butt welding facility and temporary construction camps.

12.3.6 Climate Change

Climate change projections that may potentially affect the rail line and associated infrastructure have been identified and described. These projections are based on the 'upper level' scenarios (refer to Section 3 Climate, Natural Hazard and Climate Change which outlines the impacts and management plans).

12.3.7 Hazard Analysis and Risk Assessment

Table 12-6 provides an analysis of potential hazards to sensitive receptors as a result of the Project (Rail) activities, hazardous substances and risks posed to the Project (Rail). It describes these as hazard events, and then assesses them against the risk assessment matrix along with description on the consequence and likelihood of occurrence (as described in Section 12.1.2). The assessment has been undertaken in accordance with the *AS/NZS ISO 31000: 2009 Risk management – Principles and guidelines.*

Table 12-6 Hazard Analysis and Evaluation

Item	Hazard Event	Potential Impacts (Consequence)	C[1]	Likelihood of Occurrence	L[2]	Overall Risk	Preventative Measures	Responsive Measures	Residual		
									C	L	Risk
1	Fuel tanker crash – single vehicle with rupture of one or more tanks Construction, Operation and Decommissioning phase (C,O,D phase)	Release of diesel to soils if tank ruptures, resulting in soil contamination and vegetation health impacts.	2	Number of truck trips is 9 trips per week during construction phase. Road sealed and contains few hazards, except in wet weather. Average number of truck trips during operation phase is 47 trips per week. Road is sealed and contains few hazards, except in wet weather. Number of truck trips has been estimated to be one per quarter during the decommissioning phase. Based on the above it is possible that this event will occur.	3	Medium	Safety induction to staff and contract workers which will include awareness regarding traffic rules. All vehicles conform to ADG Code. Drivers with valid driving permit. Drivers trained in safe driving of the vehicle. Fatigue management strategies for drivers. First aid, spill response and fire fighting equipment will be available with each fuel truck. Drivers trained in spill response.	Responsive measures will be the primary responsibility of the fuel delivery contractor. Emergency Response Plan to include diesel spills. Containment and immediate clean-up of spills. Removal of contaminated soils and sediments and rehabilitation of damaged vegetation. Notify Emergency Services in case of spills on public roads. Notification to DEHP as required under the Environmental Authority (EA) conditions.	2	1	Low
2	Fuel tanker crash – single vehicle with rupture of one or more tanks (C,O,D phase)	Release of diesel to creeks in the Belyando River/ Suttor River/ Isaac River catchment resulting in contamination downstream. Aquatic organisms may be killed or harmed.	3	Number of truck trips is 9 trips per week during construction phase. Road sealed and contains few hazards, except in wet weather. Average number of truck trips during operation phase is 47 trips per week. Road is sealed and contains few hazards, except in wet weather. Number of truck trips has been estimated to be one per quarter during the decommissioning phase. Based on the above it is possible that this event will occur.	3	Medium	Safety induction to staff and contract workers which will include awareness regarding traffic rules. All vehicles conform to ADG Code. Drivers with valid driving permit. Drivers trained in safe driving of the vehicle. Fatigue management strategies for drivers. First aid, spill response and fire fighting equipment will be available with each fuel truck. Drivers trained in spill response.	Responsive measures will be the primary responsibility of the fuel delivery contractor. Emergency Response Plan to include diesel spills. Containment and immediate clean-up of spills. Removal of contaminated soils and sediments and rehabilitation of damaged vegetation. Notify Emergency Services in case of spills on public roads. Notification to DEHP as required under the Environmental Authority (EA) conditions.	3	1	Medium
3	Vehicle carrying lubricating oils crashes and ruptures oil container (C,O,D phase)	Release of oil to soils if tank ruptures, resulting in soil contamination and vegetation loss. Impacts as per item 1, but more localised due to lower volumes likely to be released and more viscous nature of material.	2	Number of truck trips is low – 12 trips per year during operation phase and one trip per quarter during construction and decommissioning phase. Road is sealed and contains few hazards, except in wet weather. Based on the above it is possible that this event will occur.	3	Medium	As for item 1	As for item 1	2	1	Low

[1] Consequence

[2] Likelihood

Item	Hazard Event	Potential Impacts (Consequence)	C[1]	Likelihood of Occurrence	L[2]	Overall Risk	Preventative Measures	Responsive Measures	Residual		
									C	L	Risk
4	Vehicle carrying waste oil crashes and ruptures waste oil container (C,O,D phase)	Release of oil to soils if tank ruptures, resulting in soil contamination and vegetation loss. Impacts as per item 1, but more localised due to lower volumes likely to be released and more viscous nature of material.	2	Number of truck trips is four trips per year during operation phase and two trips per year during construction and decommissioning phase. Road is sealed and contains few hazards, except in wet weather. Based on the above it is possible that this event will occur.	3	Medium	As for item 1	As for item 1 Use licenced contractor for removal and disposal of spilled and clean-up material.	2	1	Low
5	Spills or leaks of untreated sewage during storage or transfer. (C,O,D phase)	Potential impacts will be dependent on size of spill or leaks and the receiving environment. Likely impacts will be limited, however will include pollution of soil with nutrients and pathogenic organisms.	2	Likelihood greatest for spills associated with transfers. Based on the above it is therefore considered that this event is unlikely to occur.	2	Low	Design storage, pumping and transmission systems designed to Australian Standards. Monitoring of untreated sewage tanks and pipes for leaks.	Prompt cessation of transfer operations and clean-up of affected areas.	2	1	Low
6	Spills or leaks of untreated sewage during storage or transfer. (C,O,D phase)	Nuisance odour generation. Potential impacts will be dependent on size of spill or leak.	2	Likelihood greatest for spills associated with transfers. Based on the above it is therefore considered that this event is unlikely to occur.	2	Low	Design storage, pumping and transmission systems designed to Australian Standards. Monitoring of untreated sewage tanks and pipes for leaks.	Prompt cessation of transfer operations and clean-up of affected areas.	2	1	Low
7	Vehicle carrying acetylene, oxygen or nitrogen gas cylinders crashes and results in gas leakage. (C,O,D phase)	Very localised and very short term impact only. Release volumes will be negligible. Damage to plants and animals unlikely. Release of acetylene/ oxygen may result in fire and explosion in presence of an ignition source.	2	Number of truck trips is very low. Cylinder design minimises risk of rupture, even in accident situations. The trucks will comply with the requirements for transporting dangerous materials, including compatibility requirements. Based on the above it is therefore considered that this event is unlikely to occur.	2	Low	All vehicles conform to ADG Code. Drivers trained in safe driving of the vehicle. First aid equipment will be available with each truck.	None required - quantities of gas small and will dissipate quickly.	2	1	Low

Item	Hazard Event	Potential Impacts (Consequence)	C[1]	Likelihood of Occurrence	L[2]	Overall Risk	Preventative Measures	Responsive Measures	Residual		
									C	L	Risk
8	Traffic accident on Bowen Developmental Road, Gregory Developmental Road, Suttor Developmental Road, Flinders Highway, Peaks Down Highway, primary access roads or other public road. (C,O,D phase)	Death or injury to occupants of the other vehicle. Potential impacts would be reduced due to availability of emergency services in Bowen, Collinsville, Townsville, Mackay, Clermont, Charters Towers and Moranbah.	5	Accident statistics for the period from 2005 to 2009 had 1% - 6% fatalities on roads used for traffic are associated with the rail line construction and operations. Based on the above it is possible that this event will occur.	3	High	Project generated traffic will operate mostly daylight hours; however some trips may be done at night time. Develop Traffic Management Plan in consultation with DTMR and Council. Drivers with valid driving permit. First aid kits in all Project related vehicles. Safety induction to staff and contract workers which will include awareness regarding traffic rules. In-vehicle communication. Fatigue management strategies for drivers. Specific traffic management plan for oversized loads.	Incorporate vehicle accident response in emergency response plan. Develop the plan in conjunction with emergency services. Notify emergency services of any accidents.	5	2	High
9	Pedestrian accident with project related buses or trucks through Mackay, Townsville, Newlands, Mount Coolon, Mount Cotton, Charters Tower and other township enroute to the mine and accommodation village. (C,O,D phase)	Injury or death to member of the community. Potential impacts would be reduced due to availability of emergency services in Townsville, Mackay, Clermont, Charters Towers and Moranbah.	4	Considering the number of trips for truck and bus, likelihood of interactions between members of community and truck/bus activities. Based on the above it is unlikely that this event will occur.	2	Medium	Designated travel route through townships for heavy vehicles. Project generated traffic will operate mostly daylight hours; however some trips may be done at night time. Develop Traffic management plan in consultation with DTMR and Council. Drivers with valid driving permit. First aid kits in all Project related vehicles. Safety induction to staff and contract workers which will include awareness regarding traffic rules. In-vehicle communication. Fatigue management strategies for drivers. Specific traffic management plan for oversized loads.	Incorporate vehicle accident response in emergency response plan. During detailed design phase, develop the plan in conjunction with emergency services. Notify emergency services of any accidents.	4	1	Medium

Item	Hazard Event	Potential Impacts (Consequence)	C[1]	Likelihood of Occurrence	L[2]	Overall Risk	Preventative Measures	Responsive Measures	Residual		
									C	L	Risk
10	Spill or leak from diesel storage tanks. (C,O,D phase)	Contamination of soil in the vicinity of storages. . Extent of contamination will depend on the quantity released.	3	All storages will comply with AS1940 requirements, thus minimising the likelihood of rupture or leak that results in release to the environment. Spills or leaks may be during the transfer operations. Based on the above it is possible that this event will occur.	3	Medium	Design, construction and operation of tanks, bunds and transfer facilities to comply with AS1940 requirements. Procedures will be developed for fuel transfer operations. Personal protective equipment and spill response equipment available on site Personnel trained in procedures and use of equipment.	Emergency response plan to include diesel spills. Contaminated spill clean-up material to be contained for regulated waste disposal. Clean out sumps as required.	2	1	Low
11	Spill or leak from diesel storage tanks. (C,O,D phase)	Potential contamination of surface waters either by direct release or leaching through soil. Contamination of surface waters may result in damage to aquatic ecosystems. Extent of damage will depend on the quantity released.	3	All storages will comply with AS1940 requirements, thus minimising the likelihood of rupture or leak that results in release to the environment. Spills or leaks may be during the transfer operations. Based on the above it is possible that this event will occur.	3	Medium	Design, construction and operation of tanks, bunds and transfer facilities to comply with AS1940 requirements. Procedures will be developed for fuel transfer operations. Personal protective equipment and spill response equipment available on site Personnel trained in procedures and use of equipment.	Emergency response plan to include diesel spills. Contaminated spill clean-up material to be contained for regulated waste disposal. Clean out sumps as required.	2	1	Low
12	Spill or leak of diesel from plant and equipment or a mobile fuel tanker. (C,O,D phase)	Contamination of soil. Quantities involved will be small, typically less than 400-500 L.	3	Spills may occur. Most spills will occur within the project areas with contamination of soils within the project areas. Based on the above it is therefore considered that this event is unlikely to occur.	2	Medium	Spill response procedures, provision of personal protective equipment and spill response equipment and adequate training to personnel.	Emergency response plan to include diesel spills. All contaminated soil to be collected for treatment at bioremediation pad. Contaminated spill clean-up material to be contained for regulated waste disposal. Clean out collection sumps as required.	2	1	Low
13	Spill or leak of diesel from plant and equipment or a mobile fuel tanker. (C,O,D phase)	Potential contamination of surface waters either by direct release or leaching through soil. Quantities involved will be small, typically less than 400-500 L.	3	Minor spills may occur. Most spills will occur within the project areas where surface runoff will be drained to local collection sumps. Impacts on the environment are unlikely due to small quantities. Spills may have potential to reach creeks directly especially if spills occur from the mobile plant and equipment near creek/river crossings. Based on the above it is therefore considered that this event is unlikely to occur.	2	Medium	'Clean' catchment areas of the site to be segregated from dirty areas to prevent offsite contaminant flows. Spill response procedures, provision of personal protective equipment and spill response equipment and adequate training to personnel.	Emergency response plan to include diesel spills. All contaminated soil to be collected for treatment at bioremediation pad. Contaminated spill clean-up material to be contained for regulated waste disposal. Clean out collection sumps as required.	2	1	Low

Item	Hazard Event	Potential Impacts (Consequence)	C[1]	Likelihood of Occurrence	L[2]	Overall Risk	Preventative Measures	Responsive Measures	Residual		
									C	L	Risk
14	Spill or leak from oil or waste oil storage. (C,O,D phase)	Contamination of soil. Quantities are likely to be small (less than 200L) and material is viscous, reducing likelihood of flows to creeks.	2	It is considered unlikely that the spills will enter environment as oils and waste oils will be handled and stored in contained areas.	2	Low	Storages comply with AS 1940 requirements. Procedures developed for storing and handling oils and waste oils. Spill clean-up equipment available at workshop and other oil/waste oil storage areas. Personnel trained in use.	Collect any contaminated materials and place in secure containers for disposal through licenced contractor as a regulated waste. Clean out/surface drains and collection sumps as required.	2	1	Low
15	Spill or leak from oil or waste oil storage. (C,O,D phase)	Contamination of surface waters either by direct release or leaching through soil. Quantities are likely to be small (less than 200L) and material is viscous, reducing likelihood of flows to creeks.	2	It is considered unlikely that the spills will enter environment as oils and waste oils will be handled and stored in contained areas.	2	Low	Storages comply with AS 1940 requirements. Procedures developed for storing and handling oils and waste oils. Spill clean-up equipment available at workshop and other oil/waste oil storage areas. Personnel trained in use.	Collect any contaminated materials and place in secure containers for disposal through licenced contractor as a regulated waste. Clean out/surface drains and collection sumps as required.	2	1	Low
16	Spills from wagons of coal trains. (Operation phase – O Phase)	Release of coal to land. Depending on location of spills, coal may flow to one of the creeks or rivers. Coal fines would contain metals in inorganic form and would not release any toxic components when in contact with water. Sediment release would cause direct smothering of aquatic and riparian ecosystems adjacent to discharge location, and would also impact downstream water quality. Severity of impacts would depend on quantity released.	2	With properly loaded wagons and wagons in good condition, the spills are unlikely when wagons are stationary. During the journey some coal fines are likely to get airborne. Empty wagons will be washed at the maintenance yard. Based on the above it is possible that this event will occur.	3	Medium	Consider wagon washing to reduce emissions from empty wagons on the return trip to mine. Minimise gaps between release doors of coal wagons. Avoid overloading of wagons. If required, treat coal surface in rail wagons with a chemical (from approved suppliers) which forms a crust over the coal surface, minimising coal dust over the journey.	Liaise with QR on coal dust management. Clean-up any major spills as required along the proposed rail spur.	1	2	Low
17	Spills from wagons of coal trains. (O phase)	Coal dust obscuring windows and entering homes of residents in the vicinity of the rail track.	2	With properly loaded wagons and wagons in good condition, the spills are unlikely when wagons are stationary. During the journey some coal fines are likely to get airborne. Empty wagons will be washed at the maintenance yard. The nearest house is 1.6 km and is unlikely to be affected.	2	Low	Consider wagon washing to reduce emissions from empty wagons on the return trip to mine. Minimise gaps between release doors of coal wagons. Avoid overloading of wagons. If required, treat coal surface in rail wagons with a chemical (from approved suppliers) which forms a crust over the coal surface, minimising coal dust over the journey.	Liaise with QR on coal dust management. Clean-up any major spills as required along the proposed rail spur.	1	2	Low

Item	Hazard Event	Potential Impacts (Consequence)	C[1]	Likelihood of Occurrence	L[2]	Overall Risk	Preventative Measures	Responsive Measures	Residual		
									C	L	Risk
18	Major rain event. (C,O,D phase)	A major rain event would flood the rail infrastructure resulting in disruption to transport of coal.	3	The formation level will be designed for 50 year ARI, rail level for 100 year ARI and the rail bridges will be designed for a 100 year ARI discharges. Based on the above it is possible that this event will occur.	3	Medium	As deemed appropriate, secure and evacuate site if significant flood events predicted. If feasible stop rail traffic in the event of flooding predicted.	Communicate with Queensland police in relation to evacuation of workers. Clean-up of contaminated areas as required. Dispose of accumulated waters in accordance with EP Act / EPP (Water) in consultation with Department for Environment and Heritage Protection (DEHP).	2	1	Low
19	Major rain event. (C,O,D phase)	In a major rainfall and flood event the coal train may derail resulting in significant degradation of surface water quality and aquatic ecosystem.	3	The formation level will be designed for 50 year ARI, rail level for 100 year ARI and the rail bridges will be designed for a 100 year ARI discharges. Based on historical data, the area has potential for flooding. Based on the above it is possible that this event will occur.	3	Medium	As deemed appropriate, secure and evacuate site if significant flood events predicted. If feasible stop rail traffic in the event of flooding predicted.	Communicate with Queensland police in relation to evacuation of workers. Clean-up of contaminated areas as required. Dispose of accumulated waters in accordance with EP Act / EPP (Water) in consultation with DEHP.	2	1	Low
20	Bushfire at maintenance yard, temporary construction camp or flash butt yard. (C,O,D phase)	Burning of cleared vegetation to be part of the rehabilitation strategy. Loss of vegetation, including vegetation outside project areas that would otherwise be undisturbed.	3	Current grazing land use on the rail corridor and adjacent properties. Isaac Regional Council bushfire overlay map identifies the rail corridor as low to medium risk for bushfires. Based on the above it is possible that this event will occur.	3	Medium	Clear vegetation in all working areas and manage growth in other areas to prevent excessive fuel load accumulation. Maintain fire breaks around areas identified as being potential sources of bushfire risk. Incorporate bushfire response in the site incident management plan and maintain fire fighting capability at site. Educate staff in relation to bushfire prevention, including management of cigarettes and other sources of ignition. Develop and train staff in procedures for welding and any other activities with high risk of starting fires.	Implement bushfire response procedures as per Emergency Response Plan. Should bushfire threaten areas outside Project, provide warnings. Communicate with Queensland Police in relation to need for road closure. Burnt areas should naturally regenerate.	2	2	Low

Item	Hazard Event	Potential Impacts (Consequence)	C[1]	Likelihood of Occurrence	L[2]	Overall Risk	Preventative Measures	Responsive Measures	Residual		
									C	L	Risk
21	Train derailment. (O phase)	Potential for injury or fatality resulting in temporary stoppage to movement of coal trains depending on the severity of the incident.	4	Poorly maintained track. Excessive speed. Shunting error. Broken or misaligned rails which could be due to wheelburn or wheelflat. Subsidence/washout due to rain or flooding beyond design consideration. Based on the above it is possible that this event will occur.	3	High	Rail safety accreditation will be obtained and maintained. Routine inspection and maintenance of tracks. Follow speed restrictions. Training and assessment of rail safety works. Routine inspection and maintenance of wagons and locomotives.	Emergency response plans will be developed. Workers will be trained to respond during emergencies.	4	1	Medium
22	Landslides along the railway line. (O phase)	Contamination of surface water bodies.	3	Potential for landslides especially during and after heavy rains. These sections are those where heavy earthworks cutting is involved such as foothills of Mt Dilingen. Based on the above it is rare that this event will occur.	1	Medium	Conduct geotechnical investigation. Design to address issues around landslides. Track inspection.	Emergency response plans will be developed. Workers will be trained to respond during emergencies.	2	1	Low
23	Landslides along the railway line. (O phase)	Temporary stoppage to movement of coal trains depending on the severity of the incident resulting in loss of revenue for the Project.	3	Potential for landslides especially during and after heavy rains. These sections are those where heavy earthworks cutting is involved such as foothills of Mt Dilingen. Based on the above it is rare that this event will occur.	1	Medium	Conduct geotechnical investigation. Design to address issues around landslides. Track inspection.	Emergency response plans will be developed. Workers will be trained to respond during emergencies.	2	1	Low
24	Landslides along the railway line. (O phase)	Potential for injuries to workforce, public or livestock.	3	Potential for landslides especially during and after heavy rains. These sections are those where heavy earthworks cutting is involved such as foothills of Mt Dilingen. Based on the above it is rare that this event will occur.	1	Medium	Conduct geotechnical investigation. Design to address issues around landslides. Track inspection.	Emergency response plans will be developed. Workers will be trained to respond during emergencies.	2	1	Low

Item	Hazard Event	Potential Impacts (Consequence)	C[1]	Likelihood of Occurrence	L[2]	Overall Risk	Preventative Measures	Responsive Measures	Residual		
									C	L	Risk
25	Train collisions with pedestrians/ vehicles. (O phase)	Potential for injury and/ or fatality resulting in temporary stoppage to movement of coal trains depending on the severity of the incident.	5	Potential for collision at the level crossings. Based on the above it is possible that this event will occur.	3	High	Routine inspection and maintenance of signalling equipment. The Project will install either passive or active controls at level crossings. Construction of grade separators for identified crossings as required by DTMR. Installation of proper signalling system. Reduced train speed of 60km/hr when crossing roads at level crossings.	Emergency response plans will be developed. Workers will be trained to respond during emergencies. Liaise with local hospitals. Notify Queensland Police, Queensland Ambulance and local Council. Transport injured person using services of Queensland Ambulance to nearby hospital.	5	2	High
26	Train collisions with livestock. (O phase)	Potential for injury resulting in temporary stoppage to movement of coal trains depending on the severity of the incident.	2	Crossings have been identified. Requirement to cross stock on an infrequent basis. Based on the above it is unlikely that this event will occur.	2	Low	Fencing to be erected along the railway corridor progressively during construction, and for operations. Provide adequate underpass throughout the alignment as required in consultation with the land owners. Appropriate treatment will be provided at all three stock crossings as per discussions and negotiations with DEHP and IRC.	Emergency response plans will be developed. Workers will be trained to respond during emergencies. Notify Queensland Police. Transport injured livestock to nearest veterinary hospital.	2	1	Low
27	Hypochlorite spill from storage at water treatment plant. (O phase)	Potentially severe impacts on ecosystems if released to surface waters or land.	4	Storage and handling will comply with Australian Standards. Dosing will be automated, minimising risk of operator error. Likelihood of exposure is low and considered unlikely due to absence of sensitive receptors in vicinity of the storage area. Quantity of hypochlorite to be stored and used is very low and it is unlikely that, in the event of the spill, any would enter a surrounding waterway.	2	Medium	Storages to comply with Australian Standards. Store and handle as per manufacturer's instructions. Minimise inventory on-site. Conduct routine inspections.	Address hypochlorite spills and leaks in Emergency Response Plan	2	1	Low

Item	Hazard Event	Potential Impacts (Consequence)	C[1]	Likelihood of Occurrence	L[2]	Overall Risk	Preventative Measures	Responsive Measures	Residual		
									C	L	Risk
28	Persons accessing the rail construction site/ operating rail line/ associated infrastructure without authorisation. (O,C,D phase)	Accidental death or injury to intruder.	4	It is considered unlikely that this event will occur.	2	Medium	Restricted access to locations such as flash butt weld yard, maintenance yard and rail corridor. High risk parts of rail infrastructure area will be securely fenced, for example access to maintenance yard, flash butt weld yard and fuel storages. Dedicated security personnel for each construction camp. Security personnel to patrol the construction site after hours. Legitimate persons working at the project to wear clear identification. Install warning signs along any roads and tracks in the vicinity of the rail line stating that access is prohibited without authorisation.	Remove any unauthorised persons from site immediately. Notification of Police / Emergency Services for evacuation and/or arrest of persons.	4	1	Medium
29	Persons accessing the rail construction site/ operating rail line/ associated infrastructure without authorisation. (O,C,D phase)	Intruder causes environmental incident, for example deliberately breaches fuel storage tanks and associated infrastructure.	2	It is considered unlikely that this event will occur.	2	Low	Restricted access to locations such as flash butt weld yard, maintenance yard and rail corridor. High risk parts of rail infrastructure area will be securely fenced, for example access to maintenance yard, flash butt weld yard and fuel storages. Dedicated security personnel for each construction camp. Security personnel to patrol the construction site after hours. Legitimate persons working at the project to wear clear identification. Install warning signs along any roads and tracks in the vicinity of the rail line stating that access is prohibited without authorisation.	Remove any unauthorised persons from site immediately. Notification of Police / Emergency Services for evacuation and/or arrest of persons.	2	1	Low

Item	Hazard Event	Potential Impacts (Consequence)	C[1]	Likelihood of Occurrence	L[2]	Overall Risk	Preventative Measures	Responsive Measures	Residual		
									C	L	Risk
30	Track obstruction. (O phase)	Potential for injury if obstruction due to an animal.	2	Crossings have been identified. Gates left open or damaged fence. Based on the above it is possible that this event will occur.	3	Medium	Railway corridor will be fenced. Install adequate warning signs along the corridor. Routine inspection and maintenance. Grade separated crossings will be provided at all three stock crossings.	Emergency response plans will be developed. Workers will be trained to respond during emergencies. Notify Queensland Police. Transport injured livestock to nearest veterinary hospital.	2	2	Low
31	Track obstruction. (O phase)	Temporary stoppage to movement of coal trains depending on the severity of the incident resulting in loss of revenue to the Project.	4	Crossings have been identified. Based on the above it is possible that this event will occur.	3	High	Railway corridor will be fenced. Install adequate warning signs along the corridor. Routine inspection and maintenance. Grade separated crossings will be provided at all three stock crossings.	Emergency response plans will be developed. Workers will be trained to respond during emergencies. Notify Queensland Police. Transport injured livestock to nearest veterinary hospital.	2	2	Low
32	Wildlife hazards such as snake bite. (C and D phase)	Potential for injury or death.	4	Field visits identified presence of snakes. Based on the above it is possible that this event will occur.	3	High	Fauna spotter/catchers present on site during clearing, when snake-related incidences are expected to be highest. Provide adequate warning signs in areas with potential for presence of snakes. Provide adequate illumination if working at night in these areas. Wear adequate PPE while working in these areas. All personnel to carry snake-bandages and be trained in snake-bite response.	Provide immediate first aid to the victim. Transport to the hospital for further medical attention.	4	2	Medium

Item	Hazard Event	Potential Impacts (Consequence)	C[1]	Likelihood of Occurrence	L[2]	Overall Risk	Preventative Measures	Responsive Measures	Residual		
									C	L	Risk
33	Vehicle interactions with pedestrians at maintenance yard. (O and, D phase)	Potential for injury or death.	4	Historically such incidents have happened elsewhere. It is possible that this event will occur.	3	High	Traffic within yard on defined roads. Adequate lighting within the maintenance yard during night time. Provide appropriate and adequate traffic signs along the roads. Comply with requirements under *AS 1742 Manual of uniform traffic control devices*. Traffic management plan will be developed during the detailed design phase for vehicular traffic. Drivers with valid driving permit. Consider no go zones for workers. First aid kits in all Project related vehicles.	Incorporate vehicle accident response in emergency response plan. Notify emergency services and regulators of any accidents immediately. Provide training to workers and visitors. Provide PPE to workers such as high visibility vests.	4	2	Medium
34	Coal Train Fire (O phase)	Potential for injury and/ or fatality.	4	Historically such incidents have happened in Australia. It is possible that this event will occur.	3	High	Coal wagon of suitable design. Coal loader operator and workers will monitor the condition of coal.	Emergency response plans will be developed. Workers will be trained to respond during emergencies. Notify Queensland Police.	2	2	Low
35	Rail construction activities impact on cultural heritage. (C phase)	Damage to cultural heritage items/objects. Adverse opinion amongst members of community.	2	Rail line across 189 km within a corridor of 95 m has potential for occurrence of cultural heritage. No surveys to date, but desktop searches have not revealed significant cultural heritage, and damage to cultural heritage is considered unlikely.	2	Medium	Cultural heritage survey and management. Communication with traditional landowners.	Cultural Heritage Management Plan. Cultural Heritage awareness training for all staff. Site inductions to workers and visitors.	1	1	Low
36	Unsuitable land management during operations and decommissioning. (O and D phase)	Uncontrolled outbreaks of new weeds or an increase in existing weeds which destroy local land use and native vegetation.	2	Over the operating life of the project, the proponent will gain knowledge on how to achieve appropriate weed control. Based on the above it is possible that this event will occur.	3	Medium	Washing of ground engaging vehicles entering and leaving site during operation and decommissioning. Manage fencing, tree guards to protect against stock and wildlife.	Develop weed management program during operations to ensure weeds are controlled at the time of closure process. Ongoing rehabilitation management to include weed control. Routine inspection for weeds.	2	2	Low

Item	Hazard Event	Potential Impacts (Consequence)	C[1]	Likelihood of Occurrence	L[2]	Overall Risk	Preventative Measures	Responsive Measures	Residual		
									C	L	Risk
37	Unsuitable land management during operations and decommissioning. (O and D phase)	Post closure of rail infrastructure the area becomes a waste dumping ground for local community and others.	2	Over the operating life of the project, the proponent will gain knowledge on how to achieve appropriate weed control. Based on the above it is possible that this event will occur.	3	Medium	Retain access restriction until decommissioning complete.	Develop decommissioning plan inclusive of rehabilitation plan. Routine inspection until decommissioning and rehabilitation complete.	2	2	Low
38	Fire at temporary construction camps. (C phase)	Damage to assets and infrastructure.	3	May result from an electrical fault or from the kitchen at the accommodation village. Based on the above it is possible that this event will occur.	3	Medium	Provide fire extinguishers. Design accommodation and infrastructure to Australian Standards and Building Codes. Provide adequate egress arrangements.	Emergency response plan. Adequate signage to provide warnings, exit points and emergency assembly areas. Information on first aid providers and fire wardens displayed on community notice boards.	2	2	Low
39	Fire at temporary construction camps. (C phase)	Potential for injury or fatalities.	4	May result from an electrical fault or from the kitchen at the accommodation village. Based on the above it is possible that this event will occur.	3	High	Provide fire extinguishers. Design accommodation and infrastructure to Australian Standards and Building Codes. Provide adequate egress arrangements.	Emergency response plan. Adequate signage to provide warnings, exit points and emergency assembly areas. Information on first aid providers and fire wardens displayed on community notice boards.	4	2	Medium

In summary, prior to the implementation of mitigation measures a range of hazardous risks have the potential of occurring, as outlined below.

High risks associated with the Project (Rail) may include:

- Traffic accidents on public roads (refer Table 12-6 item 8)
- Train derailment resulting in a fatality (refer Table 12-6 Item 21)
- Train collision with pedestrians or vehicles (refer Table 12-6 Item 25)
- Obstruction on rail track which could be in the form of a livestock- two scenarios (refer Table 12-6 Item 31)
- Wildlife hazards such as snake bite (refer Table 12-6 Item 32)
- Vehicle interaction with pedestrian at maintenance yard (refer Table 12-6 Item 33)
- Coal train catching fire- two scenarios (refer Table 12-6 Item 34 and Item 35)
- Fire at temporary construction camp (refer Table 12-6 Item 40)

Medium risks comprised 23 hazard events, and low risks comprised eight hazard events.

As described in Table 12.6, the implementation of preventative and responsive mitigation measures reduces the overall risk for all but two of the high risk items being the consequence of a traffic accident (Item 8) and train collision with pedestrians or vehicles (Item 25). These items remain following the implementation of management measures however, the likelihood of the incident is significantly reduced.

Seven hazard events have a residual risk rating of medium, with the remaining 31 hazard events regarded as having a low residual risk.

The qualitative criteria considered in the assessment of hazards and risks were as follows:

- All ‘avoidable’ risks have been avoided
- The risks from a major hazard are reduced wherever practicable
- The consequences (effects) of the more likely hazardous events (i.e. those of high probability of occurrence) are where possible contained within the boundaries of the mine

12.4 Management Plans

12.4.1 Overview

A risk management plan (RMP) has been developed for the risks that have been identified through the PHA. The RMP will be periodically updated and expanded throughout the life cycle of the Project (Rail) as more information is available, design progresses and risks further defined.

The Project (Rail) will develop and implement a Safety Management System (SMS) for the mitigation of risk so far as is reasonably practicable (SFAIRP). The SMS will provide a systematic way to identify hazards and control risks while maintaining assurance that the risk controls are effective, to provide a safe and healthy work environment to its employees, contractors and visitors. The overall management of safety will include appropriate organizational structure, planning activities, responsibilities, practices, procedures, processes and resources for developing, implementing, achieving, reviewing and

maintaining the workplace health and safety policy, and so managing the risks associated with the business of the organization.

12.4.2 Safety in Design

The Project (Rail) will incorporate the following safety in design measures:

- Storage areas for fuel, oil and chemicals will be designed, constructed and maintained in accordance with relevant Australian Standards
- Rail infrastructure will be developed to identified 100 and 50 ARI's flood immunity levels for rail and formation levels respectively
- Development of water management structures to contain rainfall events, up to an appropriate design level
- Development of fire detection and response systems as per Australian Standards
- Design of buildings to in accordance with Australian building codes

The Project (Rail) will incorporate the provision of:

- In-vehicle communication systems as per Australian Standards
- Radio communication systems
- Transponders/GPS
- Rail track signalling systems
- Adequate lighting at the maintenance yard, flash butt weld area
- Suitable design for coal wagons
- Appropriate fencing along the rail corridor

These measures will be identified in the design specifications in the engineering feasibility stage.

12.4.3 Fire Safety

A Fire Management Pan (FMP) will be developed during the detailed design phase with an approach to safety. The FMP and SMS will link to the RMP. Typically the FMP will address the following:

- Identification of fire hazard which will include fuel sources, ignition (heat) sources and oxygen sources
- Fire risk assessment and risk control for activities at the maintenance facility and construction camps
- Safe systems of work through use of tools such as Job Safety and Environmental Analysis
- Provision of adequate information, instruction, training and supervision on fire hazards and fire risk controls
- Consultation with all stakeholders
- Monitoring, review and revision of the fire risk management process

- A fire risk management assessment will be carried out in accordance with Australian and New Zealand Standards AS/NZS ISO 31000:2009 Risk management – Principles and guidelines

An Emergency Response Plan (ERP) will be prepared for construction, operations and decommissioning phase. In addition to the requirements for workplace health and safety, it is expected that this plan will incorporate both requirements and community and environmental hazard management. Hazards identified for the Project (Rail) will be addressed in the ERP.

The Bushfire Risk Analysis map prepared in June 2008 for *Isaac Regional Council* by the QFRS indicates the Project (Rail) area has been classified as having a low to medium bushfire hazard.

The Project (Rail) will ensure the safety of any person in a building associated with the construction and operation of the Project (Rail) in the event of a fire or hazardous material emergency. The Project (Rail) will implement a strategy to manage the provision of fire safety and reduce the likelihood and severity of fire hazards. This will include fire management systems (as described above), building fire safety measures, details of emergency response plans, onsite fire fighting equipment, appropriate maps and plans and an outline of any dangerous goods stored.

Appropriate design and layout of the facility and operating procedures and arrangements are essential to fire prevention. The Project will ensure compliance with the QFRS guidelines for rail infrastructure.

The buildings will be designed with attention to:

- Occupancy limits for buildings
- Means of escape from building - evacuation routes, exit doors, fire/smoke doors, evacuation signs/diagrams
- Maintenance of fire safety installations - exit signs/emergency lighting, fire extinguishers, fire hose reels, fire detection and alarm system, evacuation system, sprinkler system, hydrant system, smoke and ventilation system, standby power supply
- Housekeeping
- Evacuation planning, instructions and practice - fire and evacuation plans, fire and evacuation instructions

All buildings, structures and fixed plants will be protected with a suitable water supply, water reticulation and hydrant system. For buildings and occupied facilities, a fire hose system or a fire hydrant system, and/or pump sets will be in compliance with the Building Code of Australia (BCA).

The fire safety systems installed in a building will be any one or combination of the methods in a building to warn people of emergency, provide for safe evacuation, restrict the spread of fire and extinguish fire. Fire detection measures proposed include the provision of:

- Smoke or other fire detection systems
- Use of plant monitoring systems such as bearing temperatures, vibrations, infra-red sensors, brake release, belt tracking, belt slip and other systems
- Effective inspection and corrective action system
- Communications with people within mine and with external response agencies

An adequate supply of water for fire fighting purposes will be provided at the rail maintenance facility. The acceptable sources of water supply will be in accordance with Section 4 Water Supplies of Australian Standard AS 2419.1-2005 Fire hydrant installations Part 1: System design, installation and commissioning (AS 2419.1), as applicable.

Water storage tanks and their capacities will be in accordance Section 5 Water Storage of AS 2419.1, as applicable. Maintenance of onsite storages will be carried out during periods of least risk, e.g. non-production and kept to a minimum time frame.

Fire protection pump sets will be installed in accordance with *Australian Standard AS 2941-2008 Fixed fire protection installations - Pumpset systems*. All fire extinguishers will be maintained in accordance with *Australian Standard AS 1851-2005 Maintenance of Fire Protection Systems and Equipment*.

A fire station, fully equipped with fire truck and other fire fighting equipment will be constructed at the Mine, and will be available to attend to emergencies within the Project (Rail). During the detailed design phase, the Project will consult the emergency services (including QFRS) to comply with their requirements.

The Project will develop a fire and evacuation plan with adequate instructions to people concerning the action to be taken by them in the event of fire will be provided in a building as required under the *Fire and Rescue Service Act 1990*. The *Building Fire Safety Regulation 2008* sets of the requirements for a fire and evacuation plan and will contain information such as:

- Name of the building
- Contact details for occupier of the building
- Evacuation coordination procedures for the building
- Instructions for evacuating the building safely in accordance with the evacuation coordination procedures for the building in the event of a fire or hazardous material emergency
- Method of operation of fire fighting equipment and manually operated fire alarms in the building
- Procedures for giving fire and evacuation instructions to people working in the building

12.4.4 Training

All personnel will undergo a generic induction training which will include both preventative and responsive measures in relation to environmental and community hazards. Personnel will undergo specific training in hazard prevention and response in relation to their work area. Training will be updated as required throughout the duration of employment.

12.4.5 Services Provided by Contractors

A number of contractors will provide services during operation. These may include transportation of diesel fuel and other potentially hazardous substances, concrete batching plants and transport to site, general materials transportation and waste management and disposal. The Project will incorporate incident prevention and response requirements into contracts which will be signed with these contractors.

12.4.6 Emergency Management

Following emergency response priorities have been identified by the Project (Rail):

- Safety and well-being of all on-site personnel and community members
- Minimise the environmental harm
- Minimise impacts on business assets as well as assets in the neighbourhood

12.4.7 Emergency Response Team

An Emergency Response Team will be established to ensure trained and equipped personnel are available in the event of an incident. The team will consist of personnel trained in emergency response as well as volunteers from each operation shift and on-duty maintenance staff.

Members of the internal emergency services will be trained in the following in relation to environmental and community hazards:

- Chemical/ Diesel/ Oil spill response and clean-up
- Fire fighting
- Bushfire rescue
- Response to intrusion by people
- Responding to vehicular accidents
- First aid and resuscitation
- Rescue – heights, water, confined spaces, vehicles and remote locations
- Handling chemicals and explosives
- Response to electrocution
- Response to snake bite

Trained first aid personnel will be employed on-site. Refresher training will be provided to these personnel. Onsite emergency services will be stationed at each construction camp site as well as at the Mine during the operational phase and will be available and have the capacity to respond to Project (Rail) incidences.

12.4.8 External Emergency Services

The Project (Rail) will interface with the following external emergency services to assist in emergency response:

- Queensland Ambulance Service – in relation to evacuation of injured persons
- Queensland Police Service – in relation to road closures, evacuations and unauthorised entry
- Queensland Fire and Rescue Service – in relation to support in bushfire or coal seam fire fighting where required
- Queensland Health – acute and emergency services

The interface and roles and responsibilities including communication protocols will be outlined in the various management plans.

12.4.9 Emergency Response Equipment

The following equipment will be available to support incident response:

- A fully equipped first aid kit in each light vehicle
- Oil and chemical spill response equipment suitable for spills to land and creeks
- Personnel protective equipment as required to protect personnel involved in incident response activities
- Suitable communication equipment to communicate during emergencies
- Emergency response equipment
- A central first aid room equipped with response facilities such as oxygen cylinder, defibrillators and basic medical supplies

12.4.10 Contractor Emergency Response Plan

Before construction commences, all contractors will be required to prepare an ERP, incorporating preparedness and response measures for bushfires, and other types of fires such as fuel farm and office fires. The contractors ERP will identify the incident control points, access and egress points and locations of fire fighting equipment.

12.4.11 Emergency Event Report

An Emergency Event Report will be prepared post any emergency for the Project (Rail). This report will contain a description of the event, description of any damage, photographs, planning actions to respond to the incident, details of communication which took place during the incident, comment on the ERP adequacy and any recommendations or suggested changes to the ERP.

12.4.12 Specific Emergency Response and Plans

12.4.12.1 Vehicle Accident Response

A response plan will be developed to address any occurrences of vehicle accidents. This plan will be developed prior to activities commencing on the site, and will include measures to minimise impacts associated with the vehicular accidents, including notification of emergency services with calling ‘000’ established as the first priority response.

12.4.12.2 Spill Response

An emergency spill response plan will be developed in accordance with the requirements of the *Environmental Protection Act* (EP Act) *1994* and will include reporting of the spill to the Incident Controller. The spill will be assessed to identify the type of oil (lube oil, diesel, chemical or other), location of the spill source, the quantity of oil spilled and its environment, community, health and safety impact. The Incident Controller will undertake immediate steps to spill containment/control, recovery of

spill material and waste management. Recovery operations are then commenced which includes provision of welfare, reconstruction/clean up and replenishment of material stocks.

12.4.12.3 Natural Hazard Response

The ERP will include responses for natural events such as cyclones and earthquakes.

12.4.13 Construction Safety

The Project (Rail) will undertake construction safety studies which will relate to:

- The construction program
- The safety and emergency procedures
- Safeguards required ensuring safety on site and in surrounding areas during the construction phase of the Project (Rail)

The construction safety studies will include the following key elements:

- Assessment of the proposed construction activities and preliminary review of the construction program
- Further identification of hazards specific to construction operations and assessment of associated safeguards. Assessment of operational safeguards for the construction period
- Develop and/or review of safety assurance system
- Finalisation of construction programs
- Review of procedures for management of change during construction

12.5 Decommissioning

At the completion of the construction activities for civil and track work, all temporary construction facilities and areas will be rehabilitated. These include but are not limited to:

- Temporary construction camps
- Borrow areas
- Temporary access tracks and haul roads
- Turkey nest dams

After completion of the planned life of the Project (Rail) infrastructure it may be decommissioned if no further demand exists. Appropriate rehabilitation strategies will be planned for the decommissioning phase which will facilitate the long term stability of the area. This includes providing a revegetation cover that is expected to minimise the erosion and silt load to the environment. The Project (Rail) will ensure that any dangerous substances and/or empty tanks will be removed from the site and any contaminated areas remediated to eliminate or minimise danger to the environment and public. If required some of the areas will be fenced off and warning signs placed prohibiting access to public. The Project (Rail) will gather more information during the operational phase and conduct a detailed evaluation of these risks. Relevant authorities will be consulted as a part of the Project closure process so as to comply with the applicable rules and regulations.

12.6 Health and Safety

12.6.1 Overview

The health and safety assessment identifies the existing health and safety values of the:

- Community
- Project (Rail) workforce
- Contractors and suppliers
- Other stakeholders

The assessment describes the environmental factors that can affect human health, public safety and quality of life for the holders of these values, including:

- Air quality, including dust and odour
- Lighting and amenity
- Noise
- Traffic and roads
- Water
- Disease vectors

The objectives and practical measures for protecting or enhancing health and safety community values have been outlined and provide a framework for protecting health and safety values.

12.6.2 Health and Safety Values

The community values for public health and safety that may be affected by the Project (Rail) are listed in Table 12-7 and subsequently assessed. Sensitive receptors for the Project (Rail) are illustrated in Figure 12-1. In addition, the occupational health and safety for the Project (Rail) workforce and suppliers has also been assessed. Lighting and amenity impacts on community are discussed Section 4 Land.

Table 12-7 Health and Safety values

Aspects	Community Health and Safety Values
Air environment	Air quality that is conducive to human health and well-being. Air quality that supports agricultural activities. Absence of dust and odour.
Disease Vectors	Construction activities not leading to increases in local populations or spread of biting insects or pests that are known disease vectors.
Noise environment	The qualities of the acoustic environment are those conducive to human health and wellbeing. This includes provision of a suitable acoustic environment for individuals to sleep, study, learn or be involved in recreation, including relaxation and conversation. The qualities of the acoustic environment are those conducive to protecting

Aspects	Community Health and Safety Values
	the amenity of the community.
Traffic and Road Safety	Roads supporting traffic volumes appropriate to their design standard. Roads free from congestion and safe from speeding drivers, dangerous loads etc.
Water	Biological integrity of an aquatic ecosystem in moderately disturbed waters. Stock watering and Irrigation. Cultural and spiritual values of the water.

12.6.3 Potential Impact and Mitigation

12.6.3.1 Air Quality

Potential Impact

The existing source of dust is natural windblown dust. The assessment considers background concentrations of TSP as 22 – 37.6 µg/m^3, PM_{10} as 11 – 18.8 µg/m^3 and $PM_{2.5}$ as 3.3 – 5.6 µg/m^3 for the Project (Rail).

The construction of the Project (Rail) will result in dust emissions along the corridor as a result of disturbance to the natural environment. The predicted maximum incremental dust deposition level is less than the NSW Approved Methods impact assessment deposition guideline equivalent of 2 g/m^2/month at and beyond 40 m from the track centerline. Dust impacts are therefore unlikely, given a minimum distance of 1.6 km to the nearest sensitive receptor (refer to Appendix AD Rail Air Quality Assessment).

Potential sources of air emissions from the operation phase of the Project (Rail) include exhaust from diesel locomotive engines and fugitive coal dust emissions from uncovered coal wagons. The highest level of NO2 at any Project fence line was 58% of its assessment criterion with all other products of combustion constituents being lower fractions of their respective assessment criteria. Predicted TSP, PM10 and PM2.5 concentrations from the operation of the diesel locomotives with coal train fugitive dust emissions included are within the assessment criteria at sensitive receptors.

Potential sources of odours include storage of sewage, sewage treatment plant operations, application of treated wastewaters for irrigation and temporary waste storages on site.

Vehicle exhaust emissions apart from particulate matter include oxides of sulphur and nitrogen, other organic compounds and carbon monoxide. However these will be negligible given the relatively short construction period and geographical spread of the vehicles during construction and operations. Impact on community is therefore unlikely.

Mitigation and Management

Section 7 Air Quality and Volume Appendix AD Rail Air Quality Assessment provides further detail on air quality. In summary, no adverse impacts are predicted.

In order to minimise odours from sewage treatment plant operations, proper operations and maintenance programs will be developed and raw sewage will not be stored for an excessive period of time which will

allow the matter to decompose and subsequently liberate odorous gases such as hydrogen sulphide. Sewage will be treated to a quality suitable for reuse on-site.

Further, in order to minimise the generation of odorous gases from waste, waste receptacles will be emptied and cleaned regularly. Waste will be transported offsite by a licenced contractor for disposal at a licenced landfill.

Due to the distance of the Project from sensitive receptors, it is unlikely that the health of sensitive demographic groups such as children and the elderly will be adversely impacted by the air emissions from the Project (Rail) activities. Air quality at the nearby sensitive receptors will be monitored in accordance with the DERM guidelines and Australian Standards and limit "trigger level" events. A register of complaints will be maintained with information on corrective actions.

12.6.3.2 Noise

Potential Impact

Baseline monitoring at potential sensitive receptors indicates an ambient daytime noise level L_{Aeq} 45 to 48dB(A), evening L_{Aeq} 41 to 47 dB(A) and nighttime L_{Aeq} 43 to 44 dB(A). Noise levels are influenced by natural sources, primarily fauna including birds, insects and cattle.

The World Health Organisation's criteria for night-time sleep disturbance has been adopted by the Project. This value is 55 dB(A) Lmax and is predicted to be met at all receptors, except for when impact piling is used. Hence it is recommended that the use of impact piling is restricted to day-time hours. Vibration levels produced by rail corridor construction activities are expected to be well below the most stringent structural damage criteria of 3 mm/s at all identified receptors. The assessment indicates that rail noise levels from the proposed corridor are expected to meet the noise targets at all identified sensitive receptors.

Predicted noise levels indicate that operational rail noise levels are under the 65 $L_{Aeq,24hr}$ dB(A)and 87 L_{max} dB(A) criteria at all existing identified sensitive receivers. Results indicate the QRN criteria are expected to be met at all assessed sensitive receivers by a considerable margin. Operational vibration targets will also readily be met at all identified receptors. Therefore, the risks are considered low for rail related noise and vibration impacts.

Due to the distance of the Project from sensitive receptors, it is unlikely that the health of sensitive demographic groups such as children and the elderly will be adversely impacted by the noise levels from the Project (Rail) activities.

Mitigation and Management

Sound proofing will be implemented at the residential blocks to minimise the impact of noise on sleep patterns. Back-up power generators will be located within suitable enclosures to reduce noise levels.

The construction activities will be conducted in accordance with general building work hours as described under Chapter 8 Section 440R – "Building Work" of the EP Act. The time restrictions are designed to strike a balance between protecting noise amenity and the need to start construction activities early in the morning.

The need for blasting has not yet been determined. Further geotechnical investigations will be conducted and if blasting is required, compliance with applicable legislations and guidelines such as the Ecoaccess guideline, *Noise and Vibration from Blasting, 2006* and *Australian and New Zealand Environment Council Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration, 1990* will be maintained.

Noise levels will be monitored at the nearby sensitive receptors in accordance with the DERM guidelines and Australian Standards and limit "trigger level" events. A register of complaints will be maintained with information provided regarding any proposed corrective actions.

12.6.3.3 Traffic and Road

Potential Impact

Health and safety risks relating to traffic and road use include driver fatigue for workers travelling to and from worksites and site risks during the construction and operations of the Project (Rail).

The Project may increase the likelihood of traffic accidents occurring. This in turn may potentially impact on the health and safety of those using the road network.

Mitigation and Management

The location of the construction camps and the workers accommodation village within proximity minimises travel for the construction and operational workforce respectively. Workers based at the workers accommodation village will commute to the site via car or bus. All vehicles will be fitted with radios for two way communications. Licensed transporters will be employed to transport dangerous goods with vehicles in compliance with ADG Code. Work travel plans will be required to be submitted by all contractors and employees.

Workers operating vehicles on site will be trained and licensed for vehicles driven. Drivers will be responsible for safe driving for all mine related vehicles. Speed restrictions will be strictly enforced. Zero tolerance for drug and alcohol use will be enforced. Water will be used to supress dust and improve visibility. Road markings and signage will minimise impact and improve road safety. A traffic management plan will be developed and implemented.

12.6.3.4 Water

Potential Impact

The proposed rail alignment crosses the Belyando River, Eight Mile Creek, North Creek, Moray Downs Farm Dam, Mistake Creek, Gowrie Creek, Logan Creek, Grosvenor Creek and a number of other unnamed Creeks. Almost all of the waterways are ephemeral except for some of the tributaries of the Belyando River.

Potential impacts as a result of the Project (Rail) may include:

- Increased flood intensity and duration as a result of afflux
- Degradation of water quality as a result of spills and increased erosion and sedimentation as a result of scouring and land disturbance (vegetation clearing)

Mitigation and Management

A package sewage treatment plant (STP) will be constructed at the construction camps. A permanent STP will be installed at the maintenance yard. Both STPs will be capable of producing recycled water effluent of an appropriate quality. Treated effluent will be irrigated on-site via a sub-surface irrigation system. Sludge will be removed by a licensed contractor to a licensed disposal facility.

Wastewater from maintenance yards will be treated and reused. The beneficial reuse for the treated effluent will be undertaken in accordance with the latest edition of the *Queensland Recycled Water Management Plan and Validation Guidelines.*

Sediment control measures will be implemented. Dirty water will be segregated for on-site treatment and reuse. Sufficient on-site storages will be provided to contain any wastewater generated.

Ongoing consultation with affected land and asset owners in addition to continued and iterative flood modelling through detailed design will assist in further refinement of the project design to mitigate flood intensity and duration. Compensation to land and asset owners will be considered in relation to excessive afflux.

12.6.3.5 Disease Vectors

Potential Impacts

Mosquitoes have been identified as carriers of malaria, dengue fever, Ross River virus (RRv), amongst others. Environmental factors such as the temperature and humidity influence the life cycles of mosquitoes Various studies have indicated that residents who live within 3 km of major breeding sites of the mosquito vector of RRv have a higher risk of contracting the disease than those residing further away.

Potential suitable breeding sites for mosquitoes are habitats which are located within the creeks and rivers which cross the rail alignment. However, almost all of the waterways are ephemeral except for Belyando River and its major tributaries. Other potential breeding grounds are the STP and raw water storage dam. There are no major populations in close proximity to these locations.

Potentially sensitive receptors, Lambing Lagoon, Avon Downs and Mullawa are within 3 km from creek crossing or a drainage structure on the rail line. Other sensitive receptors are more than 3 km away from potential breeding sites and as such potential health issues at these would be minimal. No kindergartens, schools, hospitals, aged care facilities exist within the 3 km radius of the identified potential breeding sites. The workers accommodation village will be located approximately 1km south of the closest potential breeding site (North Creek). The construction camps are also located more than 3 km from the nearest river.

Management and Mitigation

Adequate drainage arrangements will be provided to avoid ponding of water which has the potential to result in breeding grounds for disease vectors.

Workers and visitors will wear appropriate PPE in the field and where appropriate use insect repellent. Adequate first aid kits will be provided at multiple locations so that these are easily available to the workers.

Rainwater tanks are potential sources for disease vector breeding. If installed, maintenance of rainwater tanks will include checks to:

- Cleaning of the first flush device
- Mosquito-proof screens and flap valves for rips, holes or any other defects
- Roof and gutters for accumulated debris
- Evidence of animal, bird or insect access and checks inside the tank for accumulated sediment

Table 12-8 outlines the Management and Mitigation techniques to be employed for disease vectors. With implementation of relevant mitigation measures identified, it is not expected that the workers, visitors and communities will be exposed to disease vector.

Table 12-8 Mosquito/Biting Midge Management Plan

Elements	Potential hazards due to mosquito and biting midges.
Management Objectives	To avoid ponding of water that promotes local populations of potential mosquitoes and biting midges.
Performance Criteria	No outbreaks of disease from associated with mosquitoes/midges attributed to the Project (Rail).

Implementation Strategy	**Responsibility**
Stormwater drainage not to cause ponding of water. Provide culverts of sufficient size on roads across the drainage lines to prevent upstream flooding for periods that will enable mosquito/biting midge breeding. Provide erosion prevention structures on the downstream side of culverts provided.	Design Contractor during the design phase. Construction Contractor during the construction phase and Adani Site Manager during the operation phase.
Repair of open channels, culverts and any other structure that collect water or has potential to collect water, to prevent ponding.	Construction Contractor during the construction phase and Adani Site Manager during the operation phase.
For sediment traps, provide erosion protection at both the inflow and overflow.	Design Contractor during the design phase.
Ensure that water does not remain in sediment traps for a period of more than five days after flooding.	Construction Contractor during the construction phase and Adani Site Manager during the operation phase.
Silt and vegetation will be removed from the sediment traps on bi-annual basis.	Construction Contractor during the construction phase and Adani Site Manager during the operation phase.
Sample the sediment traps for mosquito larvae monthly and implement appropriate mosquito control programs.	Construction Contractor during the construction phase and Adani Site Manager during the operation phase.

Implementation Strategy	Responsibility
Where possible design and construct the dams/ponds with relatively steep sides (45^{o} slope minimum) to discourage the establishment of semi-aquatic vegetation that will provide suitable habitats for mosquito/biting midge breeding.	Design Contractor during the design phase.
Remove all vegetation in the zone of water fluctuation in the dams/ponds (groundwater, treated effluent, etc.) and inspect for the presence of mosquito larvae on a weekly basis by the Environmental Representative.	Construction Contractor during the construction phase and Adani Site Manager during the operation phase.
Storage containers capable of ponding water will be either discarded after use or stored under roof or stored in an inverted position when empty or emptied on a weekly basis.	Construction Contractor during the construction phase and Adani Site Manager during the operation phase.
At waste storage areas, care will be taken so as to ensure that there is no ground surface or water filled receptacle with pooling of water more than five days to prevent the formation of mosquito/ biting midge breeding sites.	Construction Contractor during the construction phase and Adani Site Manager during the operation phase.
Rainwater tanks if provided must be adequately screened.	Design Contractor during the design phase.
Conduct regular inspection of rainwater tanks and roof drains to prevent the formation of mosquito/ biting midge breeding sites.	Construction Contractor during the construction phase and Adani Site Manager during the operation phase.
For storing Class A+ quality treated effluent, provide three day storage capacity tanks with cover. The storage to be designed at average flows.	Design Contractor during the design phase.
Ensure that the treated sewage is not stored for more than three days in this tank at average flow rates.	Construction Contractor during the construction phase and Adani Site Manager during the operation phase.
Disposal of treated sewage to irrigation areas must ensure that water does not pool.	Construction Contractor during the construction phase and Adani Site Manager during the operation phase.
If larvae are detected in large numbers, contact Queensland Health for assistance in choosing a suitable treatment method. Treatment could either be aerial, ground or adulticiding (fogging)	Construction Contractor during the construction phase and Adani Site Manager during the operation phase.
As a Project closure commitment, the rehabilitation must be done in a manner that ensures there are no actual or potential artificial mosquito breeding sites.	Adani Site Manager during the operations and closure phase.

Implementation Strategy	Responsibility
Monitoring	The Environmental Representatives will inspect any potential mosquito breeding areas following rain to monitor the presence of mosquito larvae. The representative will also monitor the frequency of mosquito bites at the Project site and temporary construction camps. Through consultation with residential sensitive receptors identify where mitigation measures are not currently successful and to see whether eradication programs should be implemented.
Reporting	The Environmental Representative will record when and where any larvae or mature mosquitoes are found on-site, as well as when and where any incidences of bites may occur. Should a large number of larvae or bites be experienced, the local Council will be contacted for advice on appropriate remedial measures.
Auditing	The Environmental Representative to conduct annual audits.
Corrective Action	Should an incident or failure to comply occur, a selection of the following actions will be taken: ◗ Conduct investigations into why directives are not being carried out. ◗ Re-educate employees on desired practices. ◗ Change work policies and procedures to improve the situation.

With the management measures in place, the Project (Rail) is not expected to impact on water bodies or drainage in any way that would cause an increase in local populations of biting insects or increase the spread of biting insects.

12.6.3.6 Occupational Health and Safety

Potential Impact

Potential occupational health and safety issues at the Project (Rail) include exposure to hazardous substances and dangerous goods, mechanical hazards, risks to food and waste.

Management and Mitigation

Hazardous substances and dangerous goods will be stored and handled in accordance with relevant legislations and Australian Standards. Qualified persons will be employed to work at these locations. Appropriate training will be provided to workers. Safe work method statements will be developed during the detailed design phase for storage, handling and disposal of all types of the waste generated as a result of the Project (Rail). Licensed contractors will be employed to handle, store and transport explosives in accordance with relevant legislation and Australian Standards.

Mechanical hazards would include electrocution, drawing-in or trapping, entanglement, shearing, cutting, impact, crushing, stabbing and puncturing, friction and abrasion, hot or cold and concurrent hazards. Machinery and plant will be designed and installed to provide safe working environment to the workers.

Through appropriate risk management processes during the operation, workers will not be exposed to hazards and risks that could arise from the machinery and plant.

Kitchen facilities at the construction camps will be provided in accordance with statutory requirement, which will be operated in compliance with food legislation by qualified contractors. Appropriate publications regarding personal hygiene will be provided.

Appropriate waste receptacles will be provided for collection and storage of waste. Waste will be removed and transported off-site by a licenced contractor for disposal at a licenced facility.

Construction and operational site risks will be managed through standard risk assessment procedures, training, mitigation measures identified during the process of risk assessment and monitoring. Site-specific safety management plans will be developed in accordance with relevant legislation and standards for controlling the potential health and safety risks to the construction and operational workforce. This will be within a system for safe work culture which will include use of Job Safety and Environment Analysis (JSEA), appropriate safety management plans, routine safety inspections and safety audits. Continuous monitoring and implementation of corrective actions will be undertaken as a part of the safe work culture. Trained personnel will be recruited or trained appropriately.

12.7 Summary of Hazard and Risk Assessment

The hazard and risk assessment has identified the nature and scale of hazards associated with the Project (Rail) during the construction, operation and decommissioning phases.

The study identified a total of 40 hazards which resulted in nine high risks, 23 medium risks and eight low risks in the absence of management and mitigation. After mitigation measures have been implemented, the residual risks arising comprise two high risks, seven medium and 31 low risks: Preventative and responsive measures are identified as listed in Table 12-6.

Based on the studies conducted, it can be concluded that there are no hazards during normal operations which have offsite impacts from the proposed rail line, maintenance yard and other associated infrastructure. The proposed controls identified and outlined in this assessment adequately safeguard against risks associated with the Project (Rail).

There are potential risks to health and safety of the workforce and community from the Project (Rail). The implementation of workplace health and safety procedures and the mitigation measures identified will minimise the potential risks to acceptable levels.