CHAPTER 23

Draft Outline Environmental Management Plan

HELIDON TO CALVERT ENVIRONMENTAL IMPACT STATEMENT

The Australian Government is delivering Inland Rail through the Australian Rail Track Corporation (ARTC), in partnership with the private sector.

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23.1 Introduction

The Australian Government has committed to delivering the Inland Rail Program (Inland Rail), which is significant national transport infrastructure. The Helidon to Calvert Project (the Project) is one of 13 projects that make up Inland Rail and delivers a missing link in the existing rail network between Helidon and Calvert.

This draft Outline Environmental Management Plan (draft Outline EMP) establishes the environmental management framework for delivery of the Project.

The Project has been declared a 'coordinated project for which an Environmental Impact Statement (EIS) is required' under the *State Development and Public Works Organisation Act 1971* (Qld) (SDPWO Act). The Coordinator-General will prepare a report evaluating the EIS and may state conditions and make recommendations for the Project, and imposed conditions for undertaking the Project.

The Project is also a 'controlled action' for the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act), with the controlling provisions being listed threatened species and communities (EPBC 2017/7883).

Following completion of the EIS process, and subject to approval under the EPBC Act, subsequent approvals and permits under other legislation will be required for the Project. These additional approvals and permits have been discussed in Chapter 3: Project approvals.

23.2 Purpose of the draft Outline Environmental Management Plan

The draft Outline EMP:

- Provides an environmental management framework to enable the identified environmental and social outcomes to be achieved for the detail design, pre-construction, construction and commissioning of the Project
- Establishes the process for the preparation and implementation of the Outline Construction Environmental Management Plan (Outline CEMP), the CEMP and sub-plans.

Once operational, the Project will become part of the existing ARTC national rail network, and will be subject to the laws, policies and procedures that already apply to that network. Internal ARTC policies and procedures will be reviewed to include any special operational requirements of the Project. Operational matters are included in Appendix E: Proponent commitments.

Proposed mitigation measures relevant to operation of the Project are described in Chapter 7 to Chapter 21 of the EIS.

23.2.1 Structure of the draft Outline Environmental Management Plan

The draft Outline EMP describes:

- Key elements and delivery phases of the Project
- Environmental management framework for the design, construction and commissioning of the Project
- Relationship between the draft Outline EMP, the CEMP, sub-plans and other environmental management documents
- Monitoring, reporting, auditing, review and documentation requirements
- Processes for dealing with a non-compliance, including corrective actions
- Requirements for training and awareness, community and stakeholder engagement
- Outline of the complaints management and response process.

The draft Outline EMP includes the following sub-plans:

- Land use and tenure
- Land resources, including erosion and sediment control
- Landscape and visual amenity
- Flora and fauna
- Air quality
- Surface water and hydrology
- Groundwater
- Noise and vibration
- Cultural heritage
- Traffic, transport and access
- Hazard and risk
- Waste and resource management.

23.2.2 Structure of draft Environmental Management Plan sub-plans

Table 23.1 outlines the components of each sub-plan contained in this draft Outline EMP.

TABLE 23.1: SUB-PLAN COMPONENTS

Component	Description
Environmental element	Environmental aspect to be managed through the draft Outline EMP sub-plans.
Environmental outcomes	Environmental outcomes are mandatory and must be achieved. The environmental outcomes are derived from statutory requirements or other relevant criteria and are reflected in the criteria adopted in the draft EIS.
Performance criteria	Measurable goals or indicators of the environmental outcome. Environmental outcomes are deemed to be achieved if the performance criteria are met. If the performance criteria are not met, mitigation measures must be implemented to achieve the environmental outcomes.
Proposed mitigation measures	Measures directed at achieving the environmental outcomes. The proposed mitigation measures have been identified through the EIS process, recognising that additional or different mitigation measures may be applied in order to achieve the environmental outcome. Additional mitigation measures may be developed in consultation with directly affected persons, relevant stakeholders and with the advice of the Environmental Monitor and Community Relations Monitor.
Monitoring and reporting requirements	Monitoring and reporting requirements to demonstrate that the environmental outcomes have been achieved, or corrective measures implemented, where applicable.

It is proposed that any conditions that are imposed by the Coordinator-General in the EIS evaluation report will be incorporated into future versions of the Outline EMP and corresponding sub-plans as well as the CEMP to ensure that all works are authorised and consistent with those conditions.

It is expected that the CEMP will be developed in stages, in advance of relevant Project works, and will be amended/updated as the Project proceeds.

23.3 Background

23.3.1 Proponent overview

ARTC was created after the Australian Government and state governments agreed in 1997 to the formation of a 'one-stop-shop' for all operators seeking to access the national interstate rail network. Today, ARTC plays a critical role in the transport supply chain and in the overall economic development of Australia.

ARTC manages and maintains 8,500 kilometres (km) of rail network across five states and has invested billions of dollars to build, extend and upgrade the rail network to get freight off the road and onto rail.

The ARTC network supports industries and businesses that are vital to the nation's economy by facilitating the movement of a range of commodities including general freight, coal, iron ore, other bulk minerals and agricultural products. ARTC also manage the seamless, safe transit of hundreds of freight and passenger trains across the rail network every day.

23.3.2 The Project

The Project is a new single track, dual-gauge railway, approximately 47 km in length with four crossing loops to accommodate double-stacked container freight trains. The Project's rail track commences at Helidon deviating from the existing Queensland Rail (QR) West Moreton System rail corridor along Airforce Road, and continues south-east crossing the Warrego Highway, then continues east between the highway and the existing rail corridor until it runs immediately parallel with the existing rail corridor slightly north of Placid Hills.

The rail track continues parallel to the existing rail corridor, through Gatton and the northern side of the existing Gatton rail station, through Forest Hill and then deviates from the existing rail corridor in a south-easterly direction just north of Laidley township across Laidley Plainlands Road. The Project's rail track continues toward Little Liverpool escarpment parallel to the existing rail corridor before reaching a new tunnel Section through the Little Liverpool Range.

Key components of the Project include:

- 47 km of single track, dual-gauge rail line with four crossing loops—it will initially be constructed for 1,800 m long double stacked trains, and designed so as not to preclude the future extension of some crossing loops to accommodate 3,600 m trains
- Approximately 850 m tunnel through the Little Liverpool Range, bridges and viaducts to accommodate topography and Project crossings of waterways, roads and other infrastructure
- Significant embankments and cuttings required along the length of the alignment
- Tie-ins to the existing QR West Moreton System rail corridor at the Project boundary and other potential intermediate locations to be confirmed by operational modelling

- Construction of associated rail infrastructure, including maintenance sidings and signalling infrastructure to support the train control system
- Rail crossings including level crossings, grade separations/road overbridges, occupational/private crossings, fauna crossing structures
- Ancillary works, including road and public utility crossings, realignments, signalling and communications, signage and fencing, and services and utilities within the Project corridor, excluding those undertaken as enabling works, (refer Section 23.3.4) with third-party infrastructure requirements to be determined during future Project stages
- Construction worksites, laydown areas, and access roads.

23.3.3 Proposed activities

23.3.3.1 Detailed design

Detailed design is the process of developing the Project design up to an 'Approved for Construction' stage.

Detailed design includes outputs such as 2-D and 3-D models, detailed engineering drawings, construction specifications, and a detailed bill of quantities for estimates and procurement.

The draft Outline EMP sub-plans identify proposed mitigation measures to be considered during detail design.

23.3.3.2 Ongoing activities

Some ongoing activities may occur concurrently with detailed design. These activities include, but are not limited to, corridor acquisition, obtaining environmental approvals, land surveys, geotechnical investigations, land acquisition, preparation of plans and documentation in support of secondary permits and approvals, environmental surveys and monitoring.

23.3.3.3 Project works

Project works include early works and pre-construction activities, construction and commissioning works. Project works exclude enabling works as described under Section 23.3.4.

Early works and pre-construction activities

Early works and pre-construction activities are required for construction mobilisation and to support the permanent infrastructure components. These activities must not commence until a CEMP for the relevant Project works has been endorsed by the Environmental Monitor as being consistent with the Outline CEMP and imposed conditions.

Early works and pre-construction activities may include, but are not limited to:

- Establishment of access tracks for early works and pre-construction works
- Installation of erosion and sediment control measures associated with early works and pre-construction works
- Relocation or protection of QR assets (excluding those undertaken as enabling works)
- Installation of temporary fencing
- Utility and service relocations (excluding those undertaken as enabling works)
- Establishment of some site compounds, where identified as required in support of early works/pre-construction activities
- Delivery of materials to site.

Construction

Construction activities include, but are not limited to:

- Site set out and pegging, including establishing clearing limits
- Establishment of laydowns and compounds, including vehicle inspection/workshops, washdown facilities and temporary fencing as required
- Clearing using dozers, chainsaws, excavators, trucks and similar equipment
- Bulk earthworks—major cut-to-fill operations include the winning of suitable construction material from sections of cut along the railway alignment or from approved quarries external to the site
- Construction of drainage infrastructure—cut-off drains, table drains and culvert structures
- Construction and installation of concrete railway bridges and culverts
- Ballast—supply, delivery and installation
- Concrete sleepers—supply, delivery and installation
- Installation of rail track and other items of rail infrastructure using rail-mounted equipment
- Installation of railway signalling and communications equipment
- Construction of tunnel maintenance facilities, administration and amenities buildings, car and truck parking and bulk fuel provisioning and storage areas
- Other miscellaneous activities to complete the works such as reinstatement and rehabilitation of temporary works areas and landscaping in accordance with the Project landscape design.

Additionally, transportation of equipment, materials, spoil, construction waste and workforce will also take place across the Project.

Construction may commence once the CEMP for the relevant Project works has been endorsed by the Environmental Monitor. Construction activities must be undertaken in accordance with any relevant imposed conditions.

Reinstatement and rehabilitation

A Reinstatement and Rehabilitation Plan will be implemented during the construction and commissioning phases of the Project to manage rehabilitation of land that is not required for the operations phase.

A Landscape and Rehabilitation Management Plan will be prepared and will establish the requirements for:

- Progressive installation of the Project landscape design and implementation of the Reinstatement and Rehabilitation Plan
- Establishment, maintenance and monitoring requirements
- Completion criteria for areas defined in the Project landscape design or identified in the Reinstatement and Rehabilitation Plan.

Erosion and sediment control measures will be left in place, monitored and maintained until the relevant erosion and sediment control plan catchment areas are stabilised.

Commissioning

All Project works will be subject to approved Testing and Commissioning Plans, as required, and appropriate Inspection and Test Plans.

Relevant aspects of the CEMP will remain in place until the commencement of the operation phase.

23.3.4 Works that are not part of Project works

Enabling works are those undertaken by or for third parties, primarily for the relocation or re-provision of public utilities, or existing QR rail assets. These works may be undertaken under a separate contract, or by the relevant asset owner, and are required to comply with the environmental and regulatory framework applicable to the works or public utility.

23.4 Approach to environmental management

This draft Outline EMP establishes the requirements for the development and implementation of the CEMP. This draft Outline EMP exists within a suite of documents that will guide the delivery of the Project:

- ARTC corporate policies (refer Section 23.4.1.1)
- ARTC's Environmental Management System (EMS) (refer Section 23.4.1.2)
- Inland Rail Environment and Sustainability Policy and Project Sustainability Management Plan (refer Section 23.4.1.3)
- Social Impact Management Plan (SIMP) (refer Section 23.4.2)
- Approved Cultural Heritage Management Plan (CHMP) (refer Section 23.4.3).

23.4.1 Corporate governance and policies

23.4.1.1 ARTC policies

ARTC's system of corporate governance comprises corporate policies and core values. This governance system applies across the whole of the ARTC network, including works associated with Inland Rail.

In addition to various legislative compliance requirements, all works associated with Inland Rail will be completed in accordance with the following ARTC corporate policies:

- ARTC Environmental Policy (refer Appendix F: Corporate Policies)
- ARTC Safety Policy (refer Appendix F: Corporate Policies).

The ARTC Environmental Policy provides a framework for continual improvement of ARTC's EMS and sets out commitments for managing potential environmental risks.

23.4.1.2 ARTC Environmental Management System

ARTC's EMS supports effective management of environmental risk and legal obligations during the detailed design, construction and commissioning phases of development of the Project. On the commencement of operation of the Project, ARTC's EMS and operational and maintenance procedures will apply.

23.4.1.3 Inland Rail Environment and Sustainability Policy

ARTC have developed the *Inland Rail Environment and Sustainability Policy* (refer Appendix F: Corporate Policies).

Sustainability initiatives and measures have been identified and captured in Project designs and proposed mitigation measures where relevant.

A Sustainability Management Plan will be developed for the delivery and construction of the Project. Further details are provided in Chapter 7: Sustainability.

23.4.2 Social Impact Management Plan

A Social Impact Management Plan (SIMP) has been developed in accordance with the Coordinator-General's Social Impact Assessment Guideline. The SIMP outlines the objectives, outcomes and performance measures for mitigation of social impacts, and the actions that ARTC will undertake and/or require its contractor to undertake. The SIMP is described in Chapter 16: Social and provided in Appendix Q: Social Impact Assessment Technical Report.

23.4.3 Cultural Heritage Management Plans

A CHMP (CLH017009) for the Project was developed between ARTC and the relevant Aboriginal Party in 2018. The CHMP has been approved under the *Aboriginal Cultural Heritage Act 2003* (Qld) (ACH Act) and consequently meet all the requirements for the identification, assessment and management of Aboriginal heritage under the Project's Terms of Reference (ToR) and the ACH Act. Impacts and/or risks associated with Indigenous heritage will be managed in accordance with the CHMP (CLH017009).

23.5 Roles and responsibilities

The roles and responsibilities of relevant entities for delivery of the Project works are set out in Table 23.2. These roles may be refined as contractual arrangements are finalised and subject to changing agency responsibilities.

TABLE 23.2: ROLES AND RESPONSIBILITIES

Role	Responsibilities
ARTC (Proponent)	▸ Proponent for the Project ▸ Administers the Project agreement ▸ Oversee the contractor's detailed design process to achieve the environmental outcomes ▸ Participate in community engagement activities ▸ Engage the Environmental Monitor for the duration of construction ▸ Engage the Community Relations Monitor for the duration of construction.
Contractor	▸ Prepare, maintain and implement the CEMP ▸ Deliver the Project in accordance with all laws, including conditions of approvals ▸ Provide notifications and reports as required by law, including conditions of approvals ▸ Ensure the construction workforce are properly and regularly trained in environmental responsibilities, including cultural heritage responsibilities, in accordance with the CEMP ▸ Establish and maintain a complaints management system, to receive and respond to complaints.
Coordinator-General and/or State Regulator and/or Commonwealth	▸ Administers the SDPWO Act ▸ Receives the Outline CEMP two months prior to Project works ▸ Receives reporting and notification in accordance with any imposed conditions.
Environmental Monitor—an independent, suitably skilled and qualified entity engaged by ARTC	▸ Review and endorse the contractor's CEMP (including sub-plans) and revisions against the draft Outline EMP and any imposed conditions ▸ Monitor compliance with the CEMP (including sub-plans) and any imposed conditions ▸ Maintain a current copy of the CEMP (including sub-plans) including any progressive revisions and records of modifications to the Projects construction or commissioning procedures ▸ Maintain a register of sensitive receptors ▸ Review any audit and compliance reports prepared by the contractor or the Proponent ▸ Have oversight of the implementation of the environmental monitoring requirements established in the CEMP. Review the results of the monitoring and verify these results if the Environmental Monitor considers it necessary.
Community Relations Monitor—an independent,	▸ Provide monthly reports on community issues emerging from the construction and commissioning activities in relation to any imposed conditions, the CEMP, complaints, monitoring and community relations

Role	Responsibilities
suitably skilled and qualified entity	▸ Communicate with ARTC and the Environmental Monitor about any imposed conditions, the CEMP, the SIMP, community consultation strategies and community concerns ▸ Review complaints procedures and the resolution of complaints and corrective action reporting to assess performance of the contractor's implementation of the SIMP and CEMP ▸ Facilitate discussions between the ARTC and the contractor and affected entities about management measures as required by either the ARTC or affected entity ▸ Provide advice to the Environmental Monitor in relation to complaints.
Community Reference Group (CRG)	▸ Provide feedback to ARTC and the contractor in relation to construction planning, impacts and mitigation measures.

23.6 Training and awareness

All Project personnel will be required to attend an induction session to inform them of their responsibilities under the CEMP.

A training register will be developed and maintained throughout construction and commissioning that identifies requirements in relation to:

- Qualifications and competencies
- Project-specific environmental training courses, refreshers and induction relevant for different activities/groups of personnel/locations.

This register will also be used to track the relevant qualifications held by Project personnel and subsequent completion of induction, training, and refresher sessions.

Short-term visitors to site, for purposes such as deliveries, will be required to undertake a visitor's induction and will always be accompanied by inducted personnel.

All employees, contractors and subcontractors will receive an environmental induction, which will include, but not be limited to:

- CEMP requirements
- Relevant imposed conditions
- Statutory duties regarding notification of environmental harm
- Environmental incident notification procedures
- Complaints management procedures
- Key environmental risks and issues
- Location of sensitive receptors and environmentally sensitive areas
- Cultural heritage and cultural awareness training, in consultation with the Yuggera Ugarapul People
- Permissible hours of work
- Construction traffic routes
- Key environmental contacts.

Communication to all construction personnel in relation to environmental management will occur.

The contractor, ARTC and other relevant responsible entities will ensure that the general intent, scope and relevance of this draft Outline EMP are understood by all site personnel.

Environmental education of environmental risks and issues such as: dust and air quality, erosion and sediment controls (during wet seasons or prior to forecasted events), fauna awareness during clearing phases or breeding periods, for the Project will be communicated as relevant (such as seasonal, work activity) by the following methods:

- Environmental induction programs and training
- Daily prestart meetings
- Weekly toolbox meetings
- Risk workshops
- Management meetings
- Noticeboards
- Environmental incident reports and lessons learnt.

Attendance records and any training associated with the environmental education program will be recorded and maintained by the environment team through project database recording with summaries of topics included within project environmental monthly reporting. The effectiveness of these communication methods will be subjected to periodic review.

23.7 Incidents and emergencies

Sections 320 to 320G of the *Environmental Protection Act 1994* (Qld) outline the requirements for the duty to notify of environmental harm. Pollution incidents and activities that cause or threaten to cause serious environmental harm or material environmental harm will be reported within 24 hours to the Department of Environment and Science (DES), and other stakeholders as required, so that appropriate action can be taken to prevent or limit possible environmental harm.

All staff and contractors will be required to report any environmental incidents (including complaints) or breaches of the approval conditions in accordance with the requirements and timeframes set out in the CEMP and any statutory requirements.

Project-specific Incident Management Procedures will also be developed to detail the process and resources required to respond to and manage incidents and emergencies during construction and commissioning.

23.8 Inspection, monitoring, reporting and auditing

Inspection, monitoring, auditing and reporting will be undertaken to document compliance with imposed conditions and the CEMP.

Where monitoring and auditing determines that the existing management measures are not effective, corrective and preventative measures will be revised and implemented as soon as practicable.

23.8.1 Environmental inspections

The CEMP will include requirements for inspection of construction sites to ensure compliance with imposed conditions and other Project-specific plans.

23.8.2 Environmental monitoring

Environmental monitoring programs will be developed for the pre-construction and construction phases of the Project. These monitoring programs will be designed to assess the compliance of the Project with the CEMP and determine the effectiveness of mitigation measures.

Monitoring activities will be conducted by a person who is suitably trained, qualified and experienced. Monitoring will be carried out in accordance with relevant guidelines. All monitoring equipment will be maintained and calibrated in accordance with manufacturers' instructions that will ensure reliability of equipment and data.

Environmental samples will be sent to a National Association of Testing Authorities (NATA) accredited laboratory for analysis, unless otherwise stated in a sub-plan or as approved by the Environmental Monitor. The results of the monitoring programs will be interpreted and reviewed regularly through monthly Project reporting with non-compliances investigated and resolved as per agreed timeframes.

If monitoring indicates construction or commissioning activities are not in compliance with the imposed conditions or the CEMP, necessary actions will be taken to rectify the identified issue.

23.8.3 Auditing

During construction and commissioning, environmental audits will be completed to assess compliance with all applicable environmental requirements, including the imposed conditions and the CEMP. This will include internal audits (an internal audit plan will be developed) and third-party independent audits by suitably qualified/experienced and competent auditors.

Third-party independent audits will be completed on an annual basis during the construction period.

The audits will assess compliance with the following requirements:

- Any imposed conditions determined by the Coordinator-General
- The CEMP, including sub-plans.

Audit reports will summarise the findings of the audits and include any corrective actions. The audit results, corrective actions required, and conclusions will be communicated to those responsible for implementing the corrective actions. The audit reports will be made available as required.

23.8.4 Reporting

During construction, a monthly construction compliance report will be prepared that includes:

- Summary of monitoring data and interpretation of the results
- Details of any non-compliance event, including a description of the incident, resulting effects, corrective actions, revised practices to prevent a recurrence, responsibility and timing
- Reporting of complaints, including the number of complaints, description of issues, responses and corrective actions.

For the duration of construction, an annual construction report will be prepared that includes:

- A compliance evaluation table detailing the relevant imposed condition, whether compliance with the imposed condition was achieved and how compliance was evaluated
- An evaluation of compliance with the CEMP
- A summary of any non-compliance events during the reporting period
- A summary of any non-compliance events during the previous reporting period, with details of corrective actions taken or to be taken, revised practices implemented or to be implemented and follow-up actions carried out or to be carried out (as applicable and appropriate)
- Relevant trends and interpretation as related to environmental outcomes and performance criteria for each environmental element (all periods to date).

23.9 Document control

Records that are applicable to construction and commissioning environmental management will be retained for a minimum of five years post-construction.

Environmental records will include but will not be limited to:

- Site inspection checklists
- Environmental audit reports
- Training records
- Monitoring data
- Environmental approval documentation and associated compliance reporting
- Complaints and associated records of communication
- Lessons learnt and revised controls developed as a result from learnings associated with non-compliance events
- Environmental procedures and plans
- Meeting minutes
- Regular correspondence.

23.10 Community and stakeholder engagement principles

A Community and Stakeholder Engagement Plan will be developed to guide and monitor engagement activities during the construction phase. The Community and Stakeholder Engagement Plan will include measures to address:

- Communication with potentially impacted communities regarding the EIS findings
- Engagement with Lockyer Valley Regional Council (LVRC) and Ipswich City Council (ICC) on the schedule, progress, potential impacts and mitigation for the Project, and development of partnerships to maximise social opportunities
- Working with the owners of properties that would be acquired, and those who may experience exceedances of the Project's noise criteria, to keep them updated and address property-specific impacts
- Consultation with the owners of homes and agricultural operations adjacent to the Project's work sites to discuss mitigation of property-specific impacts (such as changes to road access, surface water diversion, noise issues or dust) where necessary
- Provision of information to landowners and communities near construction works about the nature of construction, including the timing, duration and predicted impacts of the works, and the predicted effects of construction works on road, rail and pedestrian and cycle network operations, in advance of their commencement
- Establishment of a Community Reference Group (CRG) for the construction phase, to meet regularly with the purpose of providing timely, open advice, representation of community issues and concerns arising from the works
- Engagement with government agencies to develop protocols, confirm the detail of mitigation for impacts on social infrastructure and develop joint response arrangements with:
  - Department of Education e.g. school bus route safety measures
  - Queensland Health, e.g. forecasting the workforce ramp-up and agreeing the schedule for communication with the Project
  - Queensland Police Service (QPS), Queensland Ambulance Services (QAS) and Queensland Fire and Emergency Services (QFES), e.g. emergency access arrangements

    - Department of Communities, Disability Services and Seniors (DCDSS), e.g. monitoring of demands for community support services
    - Department of Housing and Public Works (DHPW) to ensure that they are aware of any support needed by Department of Transport and Main Roads (DTMR) tenants
- Cooperation with Traditional Owners and other Aboriginal parties and organisations
- Meetings and partnership discussions with local high schools and training providers, to develop training pathways for Project construction and operation
- Consultation with the Lockyer Valley Tourism Association, South Queensland Country Tourism and Ipswich Tourism Operators Network regarding major event schedules and support for the promotion of local tourism
- Engagement with local businesses, local Chambers of Commerce and Department of Employment. Small Business and Training (DESBT) to identify existing skills, gaps in local capacity to work with major projects, and capacity building programs
- Updating the Project's webpage and other locally available communication materials to include:
    - Project's CEMP and SIMP
    - Quarterly construction updates, including detailed explanations of upcoming activities, workforce ramp-up and stakeholder engagement mechanisms
    - Complaints and feedback mechanisms.

The Community and Stakeholder Engagement Action Plan prepared as part of the SIMP will inform the development of the Community Engagement Sub-plan in the CEMP.

The Project's Community and Stakeholder Engagement Plan will be reviewed annually in consultation with the CRG during the construction phase and updated as required. Further information is contained in Chapter 16: Social.

23.11 Complaints management

A Project Complaint Management Handling Procedure will be developed to ensure complaints are dealt with efficiently and effectively, and that stakeholders have confidence in the organisations complaint system.

Complaints can be lodged by any member of the public, landowner or other stakeholder.

The Complaint Management Handling Procedure will include the following steps:

- **Acknowledge:** On receiving a complaint, staff will take reasonable steps to ensure that the complaint is properly understood and seek clarification or additional information from the complainant where required. The complaint will be reported and forwarded to the relevant technical area for appropriate action or information.
- **Assessment:** A preliminary assessment of the complaint is conducted to determine whether the complaint is one which can be resolved, or needs to be referred to another appropriate agency or party (for example a local council or government agency).
- **Planning:** Complaints that are straightforward can often be resolved on first contact. If this is not the case and the complaint requires investigation, a planning process will be undertaken to identify what is to be investigated, the steps involved in investigation, the remedy the complainant is seeking and other possible remedies.
- **Investigation:** The complaint will be investigated, based on the principles of impartiality, confidentiality and transparency.
- **Response:** The progress of the complaint will be monitored and communicated to the complainant, until the outcome has been communicated to the complainant.
- **Follow-up:** Complainants will be offered the opportunity to seek review of how their complaint was handled and resolved. If a complainant is dissatisfied with an investigator's findings or decision, a review will be carried out by a representative who has not been involved in the matter.

ARTC Inland Rail will regularly monitor the quality and effectiveness of the complaints management system and revise relevant components where appropriate, based on feedback from internal and external sources.

ARTC's stakeholder management system will be used to record details of complaints and their resolution for issues analysis and reporting purposes. Further information is provided in Chapter 16: Social.

23.12 Construction hours

The proposed hours for various construction activities are set out in Table 23.3, and are reflected in the performance criteria in the draft Outline EMP Construction Noise and Vibration Management Plan.

TABLE 23.3: PROPOSED HOURS OF WORK FOR CONSTRUCTION ACTIVITIES

Description of works	Hours of work (standard hours)	
Surface Works (other than works set out below)	**Monday to Friday** 6.30 am to 6.00 pm **Saturday** 6.30 am to 1.00 pm No work on Sundays or public holidays	If the construction works comply with the Performance Criteria in Section 23.13.8.2: **Monday to Friday** 6:00 pm to 10:00 pm **Saturday** 1.00 to 5.00 pm
Tunnelling activities	24-hours a day, 7 days a week[1]	
Spoil haulage	24-hours a day, 7 days a week[1]	
Transport, assembly or decommissioning of oversized plant, equipment, components or structures	24-hours a day, 7 days a week[1]	
Delivery of 'in-time' materials such as concrete, hazardous materials, large components and machinery	24-hours a day, 7 days a week[1]	
Works that require continuous construction support, such as continuous concrete pours, pipe-jacking or other forms of ground support necessary to avoid a failure or construction incident	24-hours a day, 7 days a week[1]	
Materials and equipment delivery	24-hours a day, 7 days a week[1]	
Works in a rail corridor (track possessions)	24-hours a day, 7 days a week[1] and in accordance with the hours of work prescribed by the rail infrastructure manager.	
Works in a road	In accordance with the hours of work prescribed by the road authority in any permit under a local law (for a Local Government) or a permission under the *Transport Infrastructure Act 1994* (Qld), or if no hours of work are prescribed, then works may be undertaken Monday–Saturday (not public holidays) 6.00 am to 6.00 pm.	
Works carried out in an emergency to avoid the loss of life, damage to property or to prevent environmental harm	At any time	
Blasting	**Monday to Friday** 7.30 am to 4.30 pm **Saturday** 7.30 am to 1.00 pm No blasting on Sundays or public holidays Blasting will not to be conducted outside standard hours. Any blasting outside of standard hours must be approved by the Department of Environment and Science prior to blasting. Reduced limits may be required to be achieved.	

Table notes:

1. Works outside of standard hours will only proceed where:
   - consultation with the local community has been undertaken
   - a site-specific noise risk assessment has been undertaken to identify the environmental risks associated with the works and action required to mitigate these risks
   - justification as to why the works are required outside of the hours nominated for surface works above is provided.

23.13 Draft Outline Environmental Management Plan sub-plans

This section provides discipline-specific draft Outline EMP sub-plans, drawing on the outcomes of the discipline-specific environmental assessments of the EIS. The draft Outline EMP sub-plans establish a framework for sub-plans that will be prepared as components of the CEMP during the next phase of the Project.

Each draft Outline EMP sub-plan includes:

- Environmental outcomes
- Performance criteria
- Mitigation measures
- Monitoring requirements.

23.13.1 Land use and tenure

23.13.1.1 Environmental outcomes

Project works are designed and managed to minimise the potential adverse impacts and maximise the potential benefits to surrounding land uses.

23.13.1.2 Performance criteria

- Access to private land is maintained for the duration of construction.
- The Project disturbance footprint is refined and limited to that required to safely construct, operate and maintain the Project.
- The sub-plans for noise and vibration, air quality and traffic and the landscape design have been prepared and will be implemented considering near neighbours.
- The Reinstatement and Rehabilitation Plan and Landscape and Rehabilitation Management Plan will each be prepared and implemented with consideration to adjacent potentially affected sensitive receptors.

23.13.1.3 Proposed mitigation measures

Relevant environmental aspects and proposed mitigation and management measures for the detailed design, pre-construction and construction and commissioning phases of the Project are included in Table 23.4.

TABLE 23.4: MITIGATION MEASURES—LAND USE AND TENURE

Delivery phase	Aspect	Proposed mitigation measures
Detailed design	Property	Detailed design to further refine the Project disturbance footprint identified and assessed in the EIS, to that which is required to safely construct, operate and maintain the Project. Minimise property acquisition requirements, property severance and disruption to land use and transport networks. Project clearing extents to be surveyed and clearly defined, physically and digitally, prior to Project activities commencing. Property management agreements with directly impacted landowners to be finalised prior to Project construction activities commencing on the specific property. Interface arrangements with petroleum resource interest holders and public utility providers to be finalised prior to construction activities commencing. This includes further discussion with APT Petroleum Pipelines Pty Ltd regarding impacts to the Roma to Brisbane gas pipeline.
	Access	Detailed design and construction planning will aim to minimise alteration of the surrounding road and transport network and maintain legal property accesses—where this is not feasible or practical, alternative solutions will be developed. Develop site-specific traffic management plans with key land uses and businesses adjoining or within proximity of the Project disturbance footprint to minimise business operations disruptions (e.g. Department of Resources (former Department of Natural Resources, Mines and Energy (DNRME)) Explosive Inspectorate during construction of the proposed grade separation at Airforce Road). Road–rail interface detailed design to be undertaken in consultation with the relevant road or rail authority (QR, DTMR or Local Government).

Delivery phase	Aspect	Proposed mitigation measures
Detailed design (continued)	Reinstatement and/or rehabilitation	A Reinstatement and Rehabilitation Plan will be developed for areas within the disturbance footprint that do not form part of the permanent works (e.g. construction compounds, laydown areas, temporary access and some temporary erosion and sediment controls). The Landscape and Rehabilitation Management Plan will include and clearly specify: ▸ Location of areas subject to reinstatement and/or rehabilitation ▸ Rail safety operational requirements and constraints ▸ Details of the actions and responsibilities performance criteria and monitoring framework to progressively rehabilitate, regenerate, and/or revegetate areas no longer active. A Landscape and Rehabilitation Management Plan must be developed to define progressive and post-construction installation of the Project landscape design, its establishment and ongoing maintenance and monitoring requirements in addition to specific construction contract completion criteria for areas defined in the landscape design and/or identified in the Reinstatement and Rehabilitation Plan.
	Utilities	The location of utilities, services and other infrastructure will be identified and documented during detailed design to confirm requirements for access to, diversion/relocation, protection and/or support. Interface arrangements with impacted public utility providers will be finalised prior to construction activities commencing.
	Stakeholder engagement	A Community and Stakeholder Engagement Action Plan will be developed under the Social Impact Management Plan (SIMP) to provide Project updates and upcoming work activities to the identified landowners, occupants and operators for the duration of the Project.
Pre-construction/ construction	Fencing	Where practicable, permanent Project boundaries to be fenced in accordance with Inland Rail fencing standards.
	Reinstatement and/or rehabilitation	Progressively reinstate and rehabilitate disturbed sites that do not form part of the permanent works (e.g. construction compounds) in accordance with the draft Outline EMP.
	Stakeholder engagement	The Community and Stakeholder Engagement Action Plan will be progressively revised to provide Project updates and upcoming work activities to the identified property owners, occupants and operators for the duration of the Project.

23.13.1.4 Monitoring

Monitoring compliance of the development and implementation of the land use- and tenure-related management processes and performance criteria identified in this draft Outline EMP sub-plan will be captured in the processes identified in Section 23.8.

23.13.2 Land resources

23.13.2.1 Environmental outcomes

Project works are designed and managed to avoid, minimise or manage potential adverse impacts to soils within and adjacent to the Project works. Project works are managed to prevent contamination of soil as a result of construction and commissioning activities.

Project works are managed to minimise biosecurity risk within and on land adjacent to the disturbance footprint.

23.13.2.2 Performance criteria

- Project works do not cause erosion or contamination beyond the disturbance footprint
- Project works are undertaken in accordance with the approved Erosion and Sediment Control Plan (ESCP) reviewed by a Certified Professional in Erosion and Sediment Control (CPESC)
- Acid sulfate soils and contaminated soils are avoided or intercepted and managed to avoid adverse impacts to environmental values
- Obtain all necessary approvals and permits associated with the movement of contaminated, hazardous or biosecurity materials associated with the pre-construction, construction, maintenance and operational activities
- Storage, transport and use of hazardous materials does not cause contamination of land or waters
- Any imported fill is tested and classified to confirm it is not contaminated and suitable for use for the Project
- All contamination incidents are rectified as soon as possible, and in accordance with legislative requirements
- Minimise the import and disposal of fill material
- Minimise and manage the environmental and health impacts arising from disturbance of pre-existing contaminated and/or hazardous soil and materials (including unexploded ordnances (UXO)).

23.13.2.3 Proposed mitigation measures

Relevant environmental aspects and proposed mitigation and management measures for the detailed design, pre-construction and construction and commissioning phases of the Project are included in Table 23.5.

TABLE 23.5: PROPOSED MITIGATION MEASURES—LAND RESOURCES

Delivery phase	Aspect	Proposed mitigation measures
Detailed design	Erosion and sediment control	Project clearing extents are limited to the disturbance footprint, which will be minimised to that required to safely construct, operate and maintain the Project. An Erosion and Sediment Control Plan (ESCP) will be developed by a Certified Practitioner in Erosion and Sediment Control (CPESC) in accordance with the International Erosion Control Association Best Practice Erosion and Sediment Control (IECA, 2008) and with reference to Soil Conservation Guidelines for Queensland (DSITI, 2015) and will be implemented during construction of the Project. The plan will detail the following procedures and protocols: ▸ Soil/land conservation objectives for the Project ▸ Temporary/permanent erosion and sediment control measures ▸ Workplace health and safety requirements relating to management of contamination and UXO risk ▸ Management of problem soils (e.g. acid sulfate soils, erosive, dispersive, reactive, acidic, sodic, alkaline soils) ▸ Stockpiling and management/segregation of topsoil where it contains native plants seedbank or weed material ▸ Vehicle, machinery and imported fill hygiene protocols and documentation ▸ Requirements for training, inspections, corrective actions, notification and classification of environmental incidents, record keeping, monitoring and performance objectives for handover on completion of construction. The ESCP will be reviewed prior to the commencement of preconstruction activities, once construction methodology is finalised and to document location-specific controls.
	Hazardous materials handling and storage	A Contaminated and Hazardous Materials Management Plan will be included as a component of the CEMP to eliminate, minimise and manage spills. Design of bunding containment is to be in accordance with AS 1940:2017 *The storage and handling of flammable and combustible liquids* (Standards Australia, 2017).
	Reinstatement and/or rehabilitation	The Reinstatement and Rehabilitation Plan will align with the ESCP and will include progressive stabilisation of earth materials and soil consolidation to prevent erosion and sedimentation in areas within the Project disturbance footprint that do not form part of the permanent works (e.g. temporary construction compounds and laydown areas).

Delivery phase	Aspect	Proposed mitigation measures
Detailed design (continued)	Land and soil	Soil conditions across the disturbance footprint will be appropriately characterised at a suitable scale (1:10,000) by a qualified soil practitioner (Certified Professional Soil Scientist) through additional geotechnical surveys during the detailed design phase of the Project to inform design and environmental management measures. Soil investigations will be in accordance with the *Guidelines for surveying soil and land resources* (CSIRO/McKenzie et al., 2008), the *Australian soil and land survey field handbook* (National Committee on Soil and Terrain, 2009) and the *Guidelines for Soil Survey along Linear Features* (Soil Science Australia, 2015). The methodology for the detailed soil investigation will be developed in consultation with the Department of Resources (former DNRME). The works will include: ▸ Identification of potential/actual acid sulfate soils, acid rock, reactive soils, erosive soils, dispersive soils, salinity, acidic soils, alkaline soils, wetness, depth and contaminated land ▸ Target locations where detailed design includes: cuts; embankments; and bridge piers/abutments. Additional soil data will be incorporated into the design of structures, embankments, erosion control measures (temporary and permanent), soil treatment and management, and site rehabilitation planning are reflective of site-specific soil conditions. Minimise risks through implementation of appropriate detailed design processes where reactive or problem soils are present or suspected. Cut-and-fill balance and minimisation of transport requirements for import/disposal of spoil will be considered as part of the design process. Detailed design to demonstrate assessment and viability of opportunities for re-use of: ▸ Local sources of aggregate and treatment of dispersive and reactive materials to improve mass haul ▸ Material excavated below the rail embankment for less critical parts of infrastructure ▸ Excavated material as a stabilised structural fill ▸ Ballast as high-quality general fill or structural fill (to minimise rock import). A Soil Management Plan will be developed to provide the framework for the stripping, storage, treatment and reuse of topsoil. Where dispersive material may be allowed as part of the earth fill, adequate design and construction practices will be implemented to reduce the risk of damage to the embankment. Suitable mitigation measures may include containment of the dispersive soil by non-dispersive and low permeability outer layers, high level of compaction at optimum moisture content, lime stabilisation or other similar methods. Develop and implement a Biosecurity Management Plan as part of the CEMP to include: ▸ Compliance requirements including relevant biosecurity surveillance or prevention program authorised under the *Biosecurity Act 2014* (Qld) and any requirements of the *Vegetation Management Act 1999* (Qld) (VM Act), the *Planning Act 2016* (Qld) and the *Agricultural Chemicals Distribution Control Act 1966* (Qld) (ACDC Act) ▸ Requirement for pre-clearing survey to determine the risk of weeds or pest animals being present ▸ Map of the existing severity and extent of weed infestations and weed management requirements, including land adjacent to the disturbance footprint and construction access tracks ▸ Pest animal management (including fire ants and fire ant biosecurity zones) ▸ Site hygiene and waste management procedures to deter pest animals ▸ Weed surveillance and treatment during construction and rehabilitation activities ▸ Requirement in relation to pesticide and herbicide use and documentation, including any limitations on use, such as restrictions on use in sensitive environmental areas, agricultural areas, drainage lines that flow to waterways and aquatic habitats, and ensuring that broad-scale use does not result in an increase erosion and sediment risk ▸ Vehicle, machinery and imported fill hygiene protocol and documentation ▸ Erosion and sediment control risk from broad-scale weed removal or treatment ▸ Mitigation or remediation measures will be developed in accordance with relevant agencies and local government.

Delivery phase	Aspect	Proposed mitigation measures
Detailed design (continued)	Contamination, land and soil	As required, a Contaminated Land Management Strategy will be developed and implemented by a suitably qualified professional, as recognised under the EP Act, incorporating consultation outcomes from landowners and other relevant stakeholders. This strategy will: ▸ Be developed based on the contaminated land strategy ▸ Specify controls for works on land that is known or suspected of being contaminated and will outline the process to identify, document and manage contaminated sites ▸ Seek to minimise soil disturbance in areas listed on the EMR. A Soil Disposal Permit under the EP Act is required if contaminated soil is to be moved from a lot listed on the EMR ▸ Establish the methodology and sampling and analysis plan for environmental site investigation where soil disturbance is required on an EMR site in the potentially contaminated area ▸ Establish an unexpected finds protocol/procedure in the event that potentially contaminated materials, including UXO, are encountered during construction activities. A contamination assessment of EMR listed sites and other areas of potential contamination will be undertaken once detail design, Project footprint and the cut-and-fill balance are finalised, in accordance with the requirements of ASC NEPM. Examples of soils that will require specific design consideration include the high naturally occurring sodicity of sodosols and vertosols cracking clays. Any imported fill material will be clean, certified pest and contaminant free Where geotechnical/drilling activities require drilling fluids or muds, environmentally neutral and biodegradable materials will be selected. Mobile plant, drill rigs and equipment will be maintained in accordance with manufacturer requirements and inspected frequently to minimise breakdowns and decrease the risk of contamination.

Pre-construction	Materials handling and storage, hazardous waste	The CEMP must contain the following provisions relevant to potential impacts of land resources:
		▸ A Pollution Incident Response Plan for accidental spills, leaks and other polluting incidents. The supervisor or person in charge of the work activity will be notified immediately. The matter will be recorded on the reportable environmental incident checklist
		▸ All bunding, hydrocarbon and chemical storage areas will be routinely checked, and their integrity and functionality maintained as per design capacity
		▸ Appropriate controls to prevent environmental incidents, including leaks/spills from refuelling activities and to protect the environment if incidents occur
		▸ Personnel involved in ground-disturbing works will be familiar with the unexpected finds protocol/procedure and trained in:
		  ▸ The identification of potential contaminated soil/material and relevant controls such as how to recognise potential contaminated material (colour, texture, odour, presence of asbestos, metal, ash) from inert waste or materials
		  ▸ Stop work and corrective/ containment actions
		  ▸ Classification and notification of incidents procedures.
		Identification of contaminated, hazardous or potentially contaminated material onsite (i.e. soil/formation) will be subject to a risk assessment.
		Assessment of contaminated, hazardous or potentially contaminated material encountered during Project works will be undertaken and recorded.
		Transportation of hazardous substances wastes and/or dangerous goods will be undertaken by appropriately licensed contractors and a register of waste transfer certificates will be maintained for the Project.

	Spoil management/ excavated material	A Construction Spoil Management Plan will be developed and implemented to document and manage the stockpiling and storage, onsite reuse, removal, transport and disposal of excavated material. Any imported fill material will be clean, certified pest and contaminant-free.

Delivery phase	Aspect	Proposed mitigation measures
Pre-construction (continued)	Erosion and sediment control, land and water, water quality	The ESCP prepared during detailed design will be reviewed and updated by a CPESC, incorporating further construction methodology details as required. The ESCP will include water quality monitoring requirements as defined in the Surface Water Sub-plan to assess the effectiveness of erosion and sediment controls and reinstatement and rehabilitation programs.
	Land and soil	Closure or realignments of local roads will be undertaken in accordance with the Reinstatement and Rehabilitation Plan. Wherever practical, topsoil will be transferred directly to placement as planting media. Where stockpiling of topsoil is required, it will be carried out in accordance with the Soil Management Plan, and in a manner that ensures the properties of the topsoil are not permitted to degrade so that it becomes unsuitable as planting media. The Soil Management Plan will establish: ▸ Limitation for height of stockpiles ▸ Limits for the width of the base of stockpiles ▸ Requirements for adopting batter slopes, protective covers and drainage that reduce potential for erosion and/or segregation ▸ Limits for the period of stockpiling to a minimum practical time ▸ Requirements for carrying out herbicide spraying or other treatment of the stockpile at intervals required to prevent weed growth and ensure the stockpile faces are weed-free prior to use.
	Hazardous waste	A contaminated and hazardous material survey will be undertaken prior to demolition of structures (e.g. sheds, housing/buildings). In the event that asbestos or other hazardous materials are identified in these structures, a Contaminated and Hazardous Materials Management Plan will be developed and implemented. The Contaminated and Hazardous Materials Management Plan will contain procedures to ensure that removal is undertaken in accordance with *How to Safely Remove Asbestos Code of Practice* (Safe Work Australia, 2018a).
Construction and commissioning	Erosion and sediment control, land and water, water quality	Appropriate erosion and sediment control measures will be implemented and the ESCPs continuously reviewed and updated for effectiveness and to reflect changing site conditions as Project construction progresses.
	Contamination	For work activities undertaken within properties identified on the Environmental Management Register (EMR) within the Project disturbance footprint, or any other sites identified as part of the actions under the Contaminated Land Management Strategy, a Contaminated Site Management Plan will be developed and implemented to reduce the risk of adverse impacts to the existing and surrounding environments. If suspected contaminated land or material in drums, tanks, bags or plastic containers are encountered during excavation works, all work will stop in the affected area and measures to manage the contamination will be implemented, as per the Contaminated Site Management Plan. The reuse or retention of contaminated or potentially contaminated material encountered onsite (i.e. soil, ballast) will be subject to a risk assessment.
	Materials handling and storage	Appropriate registers and records of chemicals, hydrocarbons and hazardous substances and materials onsite will be maintained up to date (in the form of a current and accurate materials manifest and a Safety Data Sheet (SDS) Register). Where appropriate this will include a relevant risk assessment prior to the substance arriving, and being used, onsite. Where an incident occurs that threatens or causes unlawful environmental harm, all reasonable steps, including allocation of additional trained resources or specialists, will be taken to remediate and manage the incident.
	Rehabilitation	Reinstatement, stabilisation and rehabilitation of temporarily disturbed areas, such as laydown, site offices and temporary access tracks, will be undertaken progressively, consistent with the Project Reinstatement and Rehabilitation Plan and the Project Landscape and Rehabilitation Management Plan.

Delivery phase	Aspect	Proposed mitigation measures
Construction and commissioning (continued)	Unexploded ordnance	Implementation of an unexpected finds protocol/procedure will be implemented. Although unlikely, based on the UXO assessment for the Project, where a risk of encountering known or possible unexploded ordnance is identified, assessment and identification of management options will be carried out by a suitably qualified person.
	Hazardous waste	Hazardous and/or dangerous waste (e.g. asbestos, chemicals, oils) will be correctly stored and managed onsite and/or correctly disposed of by a licensed contractor to a registered waste facility and in accordance with the CEMP.

23.13.2.4 Monitoring

Monitoring compliance of the development and implementation of the land resources-related management processes and performance criteria identified in this draft Outline EMP sub-plan will be captured in the processes identified in Section 23.8.

23.13.3 Landscape and visual amenity

23.13.3.1 Environmental outcomes

Project works are designed to minimise vegetation loss and mitigate impacts through appropriate rehabilitation.

Project works are designed to minimise impacts on the visual amenity of watercourses.

The design of rail infrastructure and associated landscape treatments (including slope and stabilisation measures) responds to the natural and rural landscape, topography and landform, to the greatest extent possible, while complying with engineering design standards and legislative requirements.

Project design results in a minimal maintenance landscape.

23.13.3.2 Performance criteria

- Construction compounds and ancillary facilities are located to minimise visual impacts
- Vegetation screens and other barriers are provided or retained where practicable to minimise visual amenity impacts
- Temporary construction areas are rehabilitated progressively and in accordance with the Reinstatement and Rehabilitation Plan
- Landscape and Rehabilitation Management Plan is implemented
- Construction lighting nuisance to potentially affected landowner is avoided.

23.13.3.3 Proposed mitigation measures

Relevant environmental aspects and proposed mitigation and management measures for the detailed design, pre-construction and construction and commissioning phases of the Project are included in Table 23.6.

TABLE 23.6: MITIGATION MEASURES—LANDSCAPE AND VISUAL AMENITY

Delivery Phase	Aspect	Proposed mitigation measures
Detailed design	Landscape and visual values	**Landscape and visual impacts due to vegetation removal** Clearing extents of visually significant vegetation are further limited, where feasible, to that required to safely construct, operate and maintain the Project. Locations include the forested areas: ▸ Within Little Liverpool Range Forested Uplands (LCA H10) (approximately Chainage (Ch) 60.4 km to Ch 64.4 km) ▸ Associated with Lockyer National Park Forested Uplands (LCA H5) (approximately Ch 27.3 km to Ch 35.4 km).

Delivery Phase	Aspect	Proposed mitigation measures
Detailed design [continued]	Landscape and visual values [continued]	Develop a Reinstatement and Rehabilitation Plan for areas within the disturbance footprint that do not form part of the permanent works (e.g. construction compounds, laydown areas, temporary access tracks). The Plan will include and clearly specify: ▸ Location of areas subject to rehabilitation and/or reinstatement/stabilisation, in accordance with the landscape and rehabilitation design developed during detailed design ▸ Objectives and timeframes for rehabilitation and/or reinstatement/stabilisation works (including the biodiversity, vegetation establishment and erosion and sediment control outcomes to be achieved) ▸ Where appropriate, the plan describes how the objectives align with relevant recovery plans, threat abatement plans, conservation advices or policy guidance for target species in areas identified for rehabilitation ▸ Details of the actions and responsibilities to progressively rehabilitate, regenerate, and/or revegetate areas, consistent with the agreed objectives ▸ Native flora species endemic to the Lockyer Valley and Ipswich regions or other suitable species appropriate to the landscape context and nursery/seed stock sources ▸ Procedures, timeframes, measurable performance objectives and responsibilities for monitoring the success of rehabilitation and/or reinstatement/stabilisation areas ▸ Corrective actions if the outcomes of rehabilitation and/or reinstatement/stabilisation are not achieved. A Landscape and Rehabilitation Management Plan will be developed to define post-construction maintenance requirements, monitoring requirements and completion criteria for areas defined in the landscape design and/or identified in the Reinstatement and Rehabilitation Plan.
	Landscape and visual impacts on watercourses	Develop the detailed design to further minimise impacts to waterways, riparian vegetation and in-stream flora and habitats. Locations include Lockyer Creek (LCA B1); Sandy Creek (LCA B5); Laidley Creek (LCA B8); and Western Creek (LCA B9) i.e. associated with the corridors of Sandy Creek, Lockyer Creek, an upper tributary of Laidley Creek, Laidley Creek, Lagoon Creek and Western Creek. Aim to avoid, then minimise, the extent of waterway diversions. **Infrastructure** (such as structures, embankments/cuttings, tunnel portals, tunnel control centre and bridges) will be designed following an integrated design process with regard to landscape character and views seeking to: ▸ **Legacy:** Create consistent design treatments along the Inland Rail alignment to enhance the overall recognition and legacy of the Project ▸ **Bridges:** Bridge design considers appropriate principles at key viewpoints, including the following opportunities: ▸ Airforce Road Bridge and road realignment works associated with Air Force Road and Warrigal Road (near Viewpoint 1), Helidon (approximately Ch 26.80 km to Ch 27.5 km): Consider sensitive landscape design input to the bridge structure and embankments associated with road realignments, including buffer planting adjacent the embankments to assist in sympathetically integrating the new embankments and bridge into the landscape and minimise the impact on views from nearby isolated rural residential properties and drivers accessing Lockyer National park via the realigned Seventeen Mile Road—this includes the replacement of existing roadside vegetation impacted by the construction of the Project that provides a visual buffer to the existing rail line ▸ Warrego Highway Rail Bridge (near Viewpoint 3), Grantham (approximately Ch 34.0 km to Ch 34.2 km): Consider urban design input into bridge structure to minimise the impact on views from the Warrego Highway, part of the Warrego Way and Adventure Way Tourist Drive ▸ Philps Road Rail Bridge, Grantham (approximately Ch 36.7 km to Ch 36.9 km): Consider urban design input into bridge structure to minimise the impact on views from Philps Road and the Warrego Highway, part of the Warrego Way and Adventure Way Tourist Drive

Delivery Phase	Aspect	Proposed mitigation measures
Detailed design (continued)	Visual impact of rail infrastructure	▸ Lockyer Creek Rail Bridge and Lockyer Creek QR Rail Bridge (near Viewpoint 4), Gatton (approximately Ch 43.1 km to Ch 43.3 km): Consider urban design input into bridge structure to minimise the impact on views from nearby residential properties, local roads and views from William Kemp Park ▸ Gatton Station Pedestrian Bridge (near Viewpoint 5), Gatton (approximately Ch 43.5 km): Consider sensitive urban design inputs into the new pedestrian bridge structure, including associated stairs, throw screens and lifts to assist in sympathetically integrating the new rail bridge into its setting (i.e. respecting the existing visual character of the Gatton Station) ▸ Eastern Drive Bridge Northbound and Southbound (near Viewpoint 6), Gatton (approximately Ch 43.9 km to Ch 44.6 km): Consider sensitive urban design inputs into bridge structures and embankments associated with road realignments to minimise the impact on views from Eastern Drive, nearby residential properties, local roads and views from Gatton Caravan Park and Gatton Jubilee Golf Club ▸ Laidley Plainlands Road (near Viewpoint 8), Laidley North (approximately Ch 57.2 km to Ch 57.4 km): Consider sensitive urban design inputs into bridge structure and embankments associated with road realignments to minimise the impact on views from Laidley Plainlands Road, nearby residents of Valley Vista estate, local roads and views from Laidley Cultural Centre and the Bichel Cricket Oval ▸ Francis Road Rail Bridge (near Viewpoint 10), Laidley North (approximately Ch 57.9 km to Ch 58.0 km): Consider sensitive urban design inputs into bridge structure to minimise the impact on views from nearby residents of Valley Vista estate ▸ Luck Road Rail Bridge, Laidley (approximately Ch 58.8 km to Ch 58.9 km): Consider sensitive urban design inputs into bridge structure to minimise the impact on views from nearby rural residential properties and distant views from Paroz Road and Branell Homestead ▸ Paroz Road Rail Bridge (near Viewpoint 11), Laidley (approximately Ch 59.3 km to Ch 59.5 km): Consider sensitive urban design inputs into bridge structure to minimise the impact on views from Paroz Road, nearby rural residential properties (including Branell Homestead and luxury cabins). Paroz Road provides access to Cunningham Crest Lookout, which is a marketed tourist viewpoint ▸ Rosewood Laidley Road Rail Bridge (near Viewpoint 15) (approximately Ch 64.2 km to Ch 64.5 km): Consider urban design input into bridge structure to minimise the impact on views from the Rosewood Laidley Road, part of the Cobb and Co Tourist Drive and views from nearby isolated rural residents ▸ **Embankments:** At locations where embankments are near roads and/or adjoin bridge structures, minimise the extent to which landform (embankments) restricts views or affects views from nearby residences to the greatest extent possible, including through sensitive stabilisation, revegetation or, where appropriate, screen planting. Consider the following opportunities: ▸ Warrego Highway embankments adjacent bridge structure (near Viewpoint 3), Grantham (approximately Ch 33.7 km to Ch 34.5 km): Sensitive landscape design input to the embankments in this area, including buffer planting adjacent to the embankment to assist in sympathetically integrating the new embankment and bridge into the landscape and minimise the impact on views from the Warrego Highway, part of the Warrego Way and Adventure Way Tourist Drive ▸ Embankments to the south of the Warrego Highway, Grantham (approximately Ch 35.1 km to Ch 37.0 km): Sensitive landscape design input to the embankments in this area including tree planting to assist in sympathetically integrating the new embankment into the landscape to minimise the impact on views from the Warrego Highway, part of the Warrego Way and Adventure Way Tourist Drive and views from nearby elevated residential properties within Grantham

Delivery Phase	Aspect	Proposed mitigation measures
Detailed design (continued)	Visual impact of rail infrastructure (continued)	▸ Valley Vista Estate (near Viewpoint 10), Laidley East (approximately Ch 57.3 km to Ch 58.5 km): Sensitive landscape design input to the embankments in this area including tree planting to assist in sympathetically integrating the new embankment into the estate landscape and minimise the impact on resident's views from the streets in Valley Vista Estate surrounding this structure ▸ Paroz Road embankment and bridge (near Viewpoint 11), Laidley (approximately Ch 58.5 km to Ch 59.8 km): Sensitive landscape design input to the embankment including buffer planting adjacent to the embankment where it crosses Paroz Road to assist in sympathetically integrating the new embankment and bridge into the landscape and minimise the impact on views to the Project from Branell Homestead Luxury Cabins and resident's views from the streets in Valley Vista Estate surrounding this structure ▸ Railway Street (near Viewpoint 12), Laidley East (approximately Ch 60.5 km to Ch 61.2 km): Sensitive landscape design input to the embankments in this area including tree planting to assist in sympathetically integrating the new embankment into the landscape and minimise the impact on resident's views from the streets surrounding this area including Douglas McInnes Drive ▸ Embankments adjacent the Rosewood Laidley Road Rail Bridge structure (near Viewpoint 15), Grandchester (approximately Ch 64.0 km to 65.3 km): Sensitive landscape design input to the embankments in this area including buffer planting adjacent to the embankment to assist in sympathetically integrating the new embankment and bridge into the landscape and minimise the impact on views from the Warrego Highway, part of the Cobb and Co Tourist Drive ▸ Embankments in the vicinity of Grandchester-Mt Mort Road and School Road (near Viewpoint 16), Grandchester (approximately Ch 65.8 km to 67.6 km): Sensitive landscape design input to the embankments in this area including tree planting to assist in sympathetically integrating the new embankment into the landscape and minimise the impact on views from nearby residential properties, Grandchester State School, School Road Reserve and nearby roads such as Grandchester–Mt Mort Road and School Road ▸ **Cuttings:** Where practicable, minimise the extent of cut batters and undertake sensitive design of these to blend them into their landscape setting (for example considering potential for revegetation, rock pitching). Locations to consider include: ▸ Railway Street (near Viewpoint 12) (approximately Ch 59.8 km to Ch 60.5 km), Laidley East: Sensitive landscape design input to the embankment and cuts in this area including extensive tree planting to the greatest extent possible along the realigned Railway Street and in wider corridor to assist in integrating the new landforms into the landscape and minimise the impact on resident's views from the streets surrounding this area including Douglas McInnes Drive. ▸ **Tunnels:** Consider cuts on the approach to tunnels as described above and consider the detailed design of tunnel portals. Consider the following opportunity: ▸ Landscape and Urban Design input to Little Liverpool Range tunnel approach (within LCT H: Forested Uplands and visible in Viewpoints 13 and 14): opportunity for review of treatment of cut batters and surrounding landscape to minimise impacts on landscape (approximately Ch 61.2 km to Ch 62.8 km) ▸ **Concept noise barriers:** Minimise the use of noise barriers to the greatest extent possible. Where these are or may be required in the future, particularly in towns and urban areas to ensure they are designed sympathetically to their surroundings and consider crime prevention through environmental design and graffiti issues, where appropriate considering the inclusion of community artwork and urban design. This strategy will be applied to any concept noise barriers required within Gatton (approximately Ch 43.5 km to Ch 44.8 km), Forest Hill (approximately Ch 52.5 km to Ch 51.7 km) or Valley Vista Estate at Laidley (approximately Ch 57.0 km to Ch 58.2 km).

Delivery Phase	Aspect	Proposed mitigation measures
Detailed design (continued)	Landscape design treatments	Develop a Project landscape design with landscaping treatments determined referencing the key landscape characteristics and elements identified in the EIS with emphasis on sensitive design that is appropriate to the setting as described below. The Project landscape design will also define appropriate treatments for areas subject to the Reinstatement and Rehabilitation Plan (or equivalent), and comply with the ARTC Engineering *(Track & Civil) Code of Practice Section 17 Right of Way Requirements* (ARTC, 2013b): ▸ **Rural and natural landscapes:** The landscape design shall respect and enhance the rural landscapes. Considerations include: ▸ Design of the landscape earthworks and planting to screen and integrate the railway and associated structures and features, wherever practicable and appropriate to the character and maintenance of desired views. This includes further opportunity for design of targeted planting of buffer/shelterbelts adjacent to major earthworks within the rail corridor to the extent consistent with safety. For example, planting strips could be introduced adjacent to significant embankments to reduce visual impact and assist in integrating the landform into the existing landscape setting that, which already includes similar shelterbelts beside roads and riparian vegetation along watercourses, as described above, and in the following locations: – Near Paroz Road in Laidley to screen potential views from adjacent properties and in recognition that Paroz Road is used to access Cunningham's Crest Lookout – Adjacent Laidley Plainlands Road in Laidley, to screen the alignment and bridge abutments ▸ The landscape design will seek to enhance the features and qualities that give the landscape its characteristics, ensuring the design responds to the natural patterns of the rural or natural landscape ▸ Where appropriate consult with local stakeholders and landowners during design (and construction) to understand the landscape context and the qualities of existing landscapes ▸ **Ecologically sensitive areas:** Design to provide opportunities for ecological gain to benefit biodiversity. This includes: ▸ Development of diverse planting and seed mixes to maximise and connect habitat types for ecological gain ▸ Enhancement of landscape corridors and ecological links across the landscape by, where possible, joining or re-joining fragmented areas of habitat ▸ Landscape design and planting to incorporate ecological requirements to benefit the characteristic and visual amenity of local landscapes including revegetation with locally indigenous species ▸ **Townships:** Seek to create landscape settings that enhance or complement the local context for the social, environmental and economic benefit of local communities. This includes: ▸ All components in an urban context to consider the appearance and careful integration of new structures, fencing and noise barriers ▸ Undertake local community collaboration in the land management and restoration of footpath and cycle route connections; maintaining and, where possible, improving connectivity to provide access to open spaces including recreational areas

Delivery Phase	Aspect	Proposed mitigation measures
Detailed design (continued)	Landscape design treatments (continued)	▸ Provide enhanced planting and habitat creation to benefit the local community and support health and wellbeing, for example streetscape strategies within the vicinity of the Project alignment and street tree planting within Gatton, Forest Hill and Calvert and measures to enhance the setting of the Laidley Cultural Centre: – Gatton Railway Station (near Viewpoint 5) (approximately Ch 43.3 km to Ch 43.5 km): Landscape and urban design input to the setting of the Gatton Railway Station, including the replacement of two ex-ground palms (thought to be *Phoenix canariensis*) if they are removed by the realignment works; urban design input into the new pedestrian overpass that will replace the existing 'heritage' wooden structure, landscape connectivity legibility enhancements through station from CBD to Littleton Park on Hickey Street and general streetscape enhancements and rehabilitation adjacent to the rail corridor – Eastern Drive/Western Drive (near Viewpoint 6), Gatton (approximately Ch 43.9 km to Ch 44.6 km): Consider undertaking rehabilitation associated with the Eastern Drive Road Bridges to create a positive gateway legacy on the approach to Gatton from the A2/eastern approach e.g. through street tree planting, reinstatement of existing pocket park, rehabilitation and artwork – Shared-user path (near Viewpoint 6), Gatton (approximately Ch 43.7 km to Ch 51.1km): Opportunity to provide shade tree planting along the proposed new path to improve the amenity – Laidley Cultural Centre: Undertake careful design of screen planting and oval landscaping adjacent to the alignment where it deviates adjacent to Old Laidley Forest Hill Road and Laidley Plainlands Road (between approximately Ch 56.8 km to Ch 57.3 km) – Gordon Street and Glenore Grove Road (near Viewpoint 7), Forest Hill (approximately Ch 52.3 km to Ch 52.7 km): Careful streetscape design to enhance the legacy of Inland Rail associated with the level crossing realignment including provision of new street trees and enhancing the approach to the Cobb and Co Staging Post – Grandchester/Mount Mort Road (near Viewpoint 16), Grandchester (approximately Ch 65.8 km to Ch 66.1 km): Leverage rehabilitation to create a positive gateway legacy on the approach to Grandchester e.g. through street tree planting and vegetation rehabilitation – Hiddenvale Road, Calvert (approximately Ch 71.2 km to Ch 71.3 km): Leverage rehabilitation associated with the laydown area and level crossing to create a positive gateway legacy on the approach to Calvert e.g. through enhancement of existing pocket park adjacent to LCTB9: Western Creek Vegetated Watercourse in this area ▸ **Heritage landscapes**: Through detailed design: ▸ Seek to further limit direct impacts or impacts to the setting of identified items of Aboriginal, historic or natural heritage significance including non-Indigenous heritage places (comprising local heritage places and other areas of interest as identified in the EIS) and Indigenous heritage places (to be identified through the CHMP) ▸ Consider the development of interpretation strategy and wayfinding to assist in the interpretation of visual elements of heritage significance, such as old rail lines, bridges, buildings or other items of visual value.
	Visual impacts of lighting	During detailed design, review assessment of the potential for operational light impacts to residents and identify if/where attenuation measures are required.
Pre-construction	Landscape and visual values	**Visual impacts of lighting** Implement the relevant aspects of the Reinstatement and Rehabilitation Plan and progressively deliver to minimise disturbance to landscape and visual amenity values during and post the pre-construction period. Where feasible and practicable, construction areas including compounds, stockpiles, fuel storage, laydown areas and staff parking to be located outside the tree protection zone as defined in AS4970-2009 Protection of trees on development sites (Standards Australia, 2009b).

Delivery Phase	Aspect	Proposed mitigation measures
Construction and commissioning	Landscape and visual values	Establish vegetation protection zones and Project clearing extents prior to commencement of works to avoid impacts on adjoining vegetation and habitats as far as reasonably practicable.
	Visual impacts of construction activities	Avoid or minimise locating construction compounds within proximity to existing sensitive receptors to provide as much separation as possible. Minimise height of all stockpiles to the greatest extent possible to reduce their visual impact; as well as maintain soil viability and avoid heat sterilisation of seed bank. Cover stockpiles with temporary vegetative cover (such as mulch, grass seeding/hydro-mulch, soil binder). Temporary treatments (such as hoardings and shade-cloth screens) to site compound fencing will be considered to assist in reducing visual impacts of temporary infrastructure and sun glare within proximity of sensitive receptors. This may include art-based treatments to assist with screening the works from the public and using information boards (or similar) to inform the public about the construction works.
	Lighting impacts of construction activities	Implement attenuation measures in discussion with potentially affected landholders.
	Reinstatement/ rehabilitation	Implement the landscape design, and the Reinstatement and Rehabilitation Plan, and the relevant requirements of the Landscape and Rehabilitation Management Plan, until performance criteria are satisfactorily achieved.

23.13.3.4 Monitoring

Monitoring compliance of the development and implementation of the landscape and visual amenity related management processes and performance criteria identified in this draft Outline EMP Sub-plan will be captured in the processes identified in Section 23.8.

23.13.4 Flora and fauna

23.13.4.1 Environmental outcomes

Project works are designed and managed to minimise impacts to existing ecological values of adjoining habitats.

Environmental offsets are provided where Project works have a significant residual impact on flora and fauna that are matters of national and/or state environmental significance.

23.13.4.2 Performance criteria

- Environmental offsets (for ecological receptors) are provided for quantified significant residual impacts, on matters of national environmental significance and matters of state environmental significance, in accordance with the Environmental Offsets Delivery Strategy
- Clearing for the Project does not occur outside of the Project disturbance footprint
- Appropriate fauna habitat connectivity measures including fencing and fauna movement structures are provided during construction in accordance with detailed design to ensure permeability for wildlife
- Environmental weeds and pests including prohibited and restricted matters prescribed under the *Biosecurity Act 2014* (Qld) and Biosecurity Regulation 2016 within the Project area are appropriately managed.

23.13.4.3 Proposed mitigation measures

Relevant environmental aspects and proposed mitigation and management measures for the detailed design, pre-construction and construction and commissioning phases of the Project are included in Table 23.7.

TABLE 23.7: MITIGATION MEASURES—FLORA AND FAUNA

Delivery phase	Aspect	Mitigation and management measures
Detailed design	Flora and fauna	While the assessment assumes the entire Project disturbance footprint will be cleared, the disturbance footprint will be refined through detailed design as far as practical, to that required to safely and efficiently construct and operate the Project and avoid unnecessary clearing. This will involve inputs from the design team, construction contractor and where applicable, the Constructing Authority. Flora and fauna surveys will be undertaken where they are required to verify prior surveys and assessments, confirm habitat. Refine potential offsets, inform micro-siting of infrastructure, support secondary approvals and establish baseline conditions against which relevant outcomes of the Reinstatement and Rehabilitation Plan and monitoring activities can be compared. Methods and sequencing of surveys, including seasonal timing, will be in accordance with the relevant published State Government and Australian Government survey guidelines and conservation advices for each target species, such as the *Flora survey guidelines—protected plants* (DEHP, 2016g), *Flora survey guidelines—Protected Plants* (DES, 2019c) and *Survey guidelines for Australia's threatened birds* (Department of the Environment, Water, Heritage and the Arts, 2010). Flora species to be targeted through these surveys include, but are not limited to the following: **Matters of National Environmental Significance (MNES)** Hairy-joint Grass (*Arthraxon hispidus*)Four-tailed Grevillea (*Grevillea quadricauda*) Blunt-leaved Leionema (*Leionema obtusifolium*) Lloyd's Olive (*Notelaea lloydii*) a grass (*Paspalidium grandispiculatum*) Brush Sophora (*Sophora fraseri*) Austral Toadflax (*Thesium australe*). **Matters of State Environmental Significance (MSES)** Bailey's Cypress Pine (*Callitris baileyi*) Helidon Ironbark (*Eucalyptus taurina*) Swamp Tea-tree (*Melaleuca irbyana*). Fauna surveys, including terrestrial, aquatic habitats and breeding habitats (including burrows and hollow bearing trees/logs, wetlands, existing culverts and structures) will target, but not be limited to, include the following: **MNES (threatened species)** Regent Honeyeater (*Anthocharea phrygia*) Australasian Bittern (*Botaurus poiciloptilus*) Curlew Sandpiper (*Calidris ferruginea*) Spotted-tail Quoll (*Dasyurus maculatus maculatus*) Collared Delma (*Delma torquata*) Red Goshawk (*Erythrotriorchis radiatus*) Grey Falcon (*Falco hypoleucos*)Painted Honeyeater (*Grantiella picta*) Swift Parrot (*Lathamus discolor*) Australian Lungfish (*Neoceratodus forsteri*) Greater Glider (*Petauroides volans*) Brush-tailed Rock-wallaby (*Petrogale penicillata*) Koala (*Phascolarctos cinereus*) Long-nosed Potoroo (*Potorous tridactylus tridactylus*) New Holland Mouse (*Pseudomys novaehollandiae*) Grey-headed Flying-fox (*Pteropus poliocephalus*) Australian Painted Snipe (*Rostratula australis*) Black-breasted Button-quail (*Turnix melanogaster*). **MSES and MNES (non-threatened)** **(* indicates migratory species)** Common Sandpiper (*Actitis hypoleucos*)* Sharp-tailed Sandpiper (*Calidris acuminata*)* Pectoral Sandpiper (*Calidris melanotos*)* Red-necked Stint (*Calidris ruficollis*)* Glossy Black-cockatoo (*Calyptorhynchus lathami lathami*) Oriental Dotterel (*Charadrius veredus*)* Oriental Cuckoo (*Cuculus optatus*)* Latham's Snipe (*Gallinago hardwickii*)* Gull-billed Tern (*Gelochelidon nilotica*)* Caspian Tern (*Hydroprogne caspia*)* Black-tailed Godwit (*Limosa limosa*)* Black-faced Monarch (*Monarcha melanopsis*)* Yellow Wagtail (*Motacilla flava*)* Satin Flycatcher (*Myiagra cyanoleuca*)* Powerful Owl (*Ninox strenua*)* Platypus (*Ornithorhynchus anatinus*) Eastern Osprey (*Pandion haliaetus*)* Red-necked Phalarope (*Phalaropus lobatus*)* Glossy Ibis (*Plegadis falcinellus*)* Pacific Golden Plover (*Pluvialis fulva*)* Rufous Fantail (*Rhipidura rufifrons*)* Spectacled Monarch (*Symposiachrus trivirgatus*)* Short-beaked Echidna (*Tachyglossus aculeatus*) Common Greenshank (*Tringa nebularia*)* Marsh Sandpiper (*Tringa stagnatilis).**

Delivery phase	Aspect	Mitigation and management measures
Detailed design (continued)	Flora and fauna (continued)	Where a species is detected, it will be reported to the relevant agencies along with information on the species habit, habitat in which the species was identified and, where possible, population size and local threatened processes—with the information used to refine the predictive habitat mapping, significant residual impact assessment, disturbance limits, mitigation measures and offsets. Surveys of representative MNES habitat, remnant and regrowth vegetation communities that will be impacted by the Project will be undertaken during the detailed design phase in accordance with the *Guide to determining terrestrial habitat quality: Methods for assessing habitat quality under the Queensland Environmental Offsets Policy, Version 1.3* (DES, 2020b) and the *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy* (Department of Sustainability, Environment, Water, Populations and Community, 2012) as relevant to enable a condition assessment of vegetation communities that require offset for the Project. Based on the outcome of flora, fauna, vegetation communities and MNES habitat surveys: ▸ Work with the design team and construction team to implement measure to avoid and/or further minimise the extent of impacts (i.e. designate no-go zones, reduce the construction or operational footprint within or adjacent to communities or habitat for MNES, clearing limits) ▸ This information will inform a staged and sequential clearing (i.e. clearing of non-habitat trees in area, then wait period and then the clearing of the remaining habitat) ▸ Identify suitable locations for the release of fauna that may be encountered during pre-clearing or clearing for the salvaging of microhabitats For any threatened flora species identified through surveys within the disturbance footprint, consult with relevant specialist to determine the feasibility of translocating or propagating specimens in accordance with relevant guidelines (e.g. *Guidelines for the Translocation of Threatened Plants in Australia* (Commander et al., 2018)), including the collection of seed. Feasibility will be assessed noting that not all species can be translocated or propagated and that for the majority of the species identified as potentially occurring with the Project disturbance footprint there is limited evidence of these species being successfully translocated, though some are used in the horticultural industry.
	MNES: Hairy-joint Grass (*Arthraxon hispidus*), Four-tailed Grevillea (*Grevillea quadricauda*), Blunt-leaved Leionema (*Leionema obtusifolium*), Lloyd's Olive (*Notelaea lloydii*), *Paspalidium grandispiculatum* (a grass), Brush Sophora (*Sophora fraseri*) and Austral Toadflax (*Thesium australe*)	The following species-specific measures will also be implemented: ▸ Avoid works in areas that may support an important population of the species ▸ Undertake protected flora surveys as per *Flora survey guidelines—Protected Plants* (DES, 2019c) with a particular focus within the area suspected of supporting the species (refer species habitat mapping in Appendix F of Appendix J: Matters of National Environmental Significance Technical Report).

Delivery phase	Aspect	Mitigation and management measures
Detailed design (continued)	MNES: Australian Lungfish (*Neoceratodus forsteri*)	The following species-specific measures for Australian Lungfish (*Neoceratodus forsteri*) will also be implemented: ▸ Avoid clearing within and along major watercourses, through the use of bridge structures and the placement of pylons away from bed and banks ▸ Pre-construction surveys of waterways identified as potential habitat of species (e.g. Bremer River) to identify whether Australian Lungfish occurs. Surveys will follow the *Survey guidelines for Australia's threatened fish* (Department of Sustainability, Environment, Water, Populations and Community, 2011b) ▸ Where a temporary impoundment or diversion is required for construction purposes and the species is found to be present, the Flora and Fauna Sub-plan will include requirements for an appropriately qualified person to be consulted to make an assessment on the method of recovery, transport and release of fish. The Flora and Fauna Sub-plan will include requirements for the application of relevant State (DAF) fish salvage guidelines during construction activities ▸ The Biosecurity Management Sub-plan will include measures to manage the risk of translocating non-endemic flora and fauna through dewatering and fish salvage activities ▸ The Surface Water Sub-plan will be developed to include measures to maintain low flows during drought conditions and avoid fluctuations to water levels downstream during spawning period ▸ The Reinstatement and Rehabilitation Plan will establish requirements for instream and riparian habitats impacted by Project works. This will include restoration of natural riparian vegetation and, where possible, reinstatement of instream habitat to pre-construction state (e.g. replacement of large woody debris and ensure no or limited change to instream flows and allow fish passage).

	MNES: Spotted-tail quoll (*Dasyurus maculatus maculatus*) Long-nosed potoroo (*Potorous tridactylus tridactylus*), New Holland mouse (*Pseudomys novaehollandiae*) and Brush-tailed Rock-wallaby (*Petrogale penicillata*)	The following species-specific measures will be implemented:
		▸ Avoid works above the tunnel as this area is a key corridor to maintain movement during construction and operation of the Project
		▸ Targeted surveys for identified mammal species will follow the *Survey guidelines for Australia's threatened mammals* (Department of Sustainability, Environment, Water, Populations and Community, 2011c) and include the identification of species-specific habitat (refer species habitat mapping in Appendix F) and habitat features considered suitable for species presence (e.g. cliff faces/boulder piles for Brush-tailed Rock-wallaby and Spotted-tail Quoll)
		▸ As part of the MNES monitoring plan, establish camera traps above the tunnel areas to monitor fauna movement across this area during construction
		▸ The Flora and Fauna Management Sub-plan will include restricted works measures for implementation if species are observed within or adjacent to disturbance footprint to allow safe movement away from works area. These measures may include, but are not limited to the following:
		  ▸ Measures to remove carrion from the Project disturbance footprint (and the rail corridor), along with waste management measures
		  ▸ Pest control measures in known or potential habitat for these species consider risks to the species (e.g. use of baiting to control wild dogs)
		  ▸ Salvage hollow logs and rocky outcrops removed from the Project disturbance footprint into adjoining habitat
		  ▸ Establish buffer zones around known key habitat and den sites
		  ▸ Where possible, avoid clearing within the known habitat during the breeding season for these species
		▸ Measures to manage the clearing of hollow logs and hollow bearing trees (e.g. tapping of tree prior to clearing, removal of hollows prior to clearing and grubbing activities).

	MNES: Swift Parrot (*Lathamus discolor*)	The following species-specific measures for the Swift Parrot (*Lathamus discolor*) will also be implemented: ▸ Where possible through design, reduce the disturbance footprint in winter foraging habitat, including avoiding clearing for ancillary works ▸ Incorporate winter foraging species into the landscape design and Reinstatement and Rehabilitation Plan.

Delivery phase	Aspect	Mitigation and management measures
Detailed design (continued)	MNES: Australian Painted Snipe (*Rostratula australis*), Curlew Sandpiper (*Calidris ferruginea*) and Australasian Bittern (*Botaurus poiciloptilus*)	The following species-specific measures will also be implemented: ▸ Targeted surveys to be undertaken of potential habitat following the *Survey guidelines for Australia's threatened birds* (former Department of the Environment, Water, Heritage and the Arts, 2010) ▸ Should these species or other target wetland species be found to occur, the CEMP Flora and Fauna sub-plan will include: ▸▸ clearing/construction works in potential habitat areas will be timed where possible to avoid wet conditions where habitat is likely to be most suitable ▸▸ restricted works/avoidance measures in place should nesting be detected. The CEMP will include measures to minimise noise as much as feasible and the Air Quality Sub-plan will include measures to minimise dust impacts including dust monitoring and suppression methods. The Biosecurity Management Sub-plan will include site hygiene and waste management measures to ensure pest predator fauna are not attracted to works areas or using Project disturbance footprint.
	MNES: Collared Delma (*Delma torquata*)	The following species-specific measures for Collared Delma (*Delma torquata*) will also be implemented: ▸ Targeted surveys to be undertaken as per *Survey guidelines for Australia's threatened reptiles* (Department of Sustainability, Environment, Water, Populations and Community, 2011d) where suitable habitat is identified (refer species habitat mapping in Appendix F of Appendix J: Matters of National Environmental Significance Technical Report) ▸ The Flora and Fauna Sub-plan will include restricted works measures for implementation if the Collared Delma is observed within or adjacent to the disturbance footprint to allow safe movement away from the works area. Other measures may include, but are not limited to, the following: ▸▸ Measures to ensure retrieval of potential habitat elements (e.g. loose surface rock, large fallen timber) during vegetation clearing and placement in adjacent unimpacted habitat ▸▸ Erosion and sediment control measures in steep slopes (and known important habitat for this species) to avoid/minimises slippage ▸▸ Measures to allow safe handling of fauna (where required) and repatriation in a suitable habitat away from site.
	MNES: Red Goshawk (*Erythrotriorchis radiatus*), Regent Honeyeater (*Anthochaera phrygia*), Painted honeyeater (*Grantiella picta*), Black-breasted Button-quail (*Turnix melanogaster*) and Grey Falcon (*Falco hypoleucos*)	The following species-specific measures will also be implemented: ▸ Pre-clearing surveys of woodlands identified as potential habitat for these species (refer species habitat mapping in Appendix F of Appendix J: Matters of National Environmental Significance Technical Report) will be undertaken to identify whether individuals occur and potentially nest within the disturbance footprint. Surveys for nest sites within or near the disturbance footprint will be as per MNES guidelines where suitable nesting habitat (i.e. large emergent trees near water) is identified ▸ Where nesting is identified in pre-clearing surveys, the Flora and Fauna Sub-plan will include restricted works measures for construction to allow nesting to continue undisturbed (e.g. micro-siting of works to avoid nests or maximise separation distance, 100 m buffer and signage around nests, no disturbance to nests until after breeding season (being until fledglings / offspring no longer use the nest / roost for habitat). Some limited works may occur in the buffer zone during this period (e.g. cultural heritage surveys).

Delivery phase	Aspect	Mitigation and management measures

Detailed design (continued)	MNES: Koala (*Phascolarctos cinereus*)	The following species-specific measures for Koala (*Phascolarctos cinereus*) will also be implemented:
		▸ Avoid works above the tunnel as this area is a key corridor to maintain movement during construction and operation of the Project
		▸ Pre-clearing surveys to be undertaken of woodlands (and other relevant habitats) identified as potential habitat of species (refer species habitat mapping in Appendix F of Appendix J: Matters of National Environmental Significance Technical Report) to identify whether individuals occur within disturbance footprint
		▸ Project design to incorporate fauna crossing structures to allow fauna movement across alignment. The location and frequency of the passages will be based on an understanding of local Koala movements and in consultation with relevant stakeholders (e.g. DTMR and local councils)
		▸ Fauna and fencing in accordance with ARTC guidelines and DTMR's *Fauna Sensitive Road Design Manual* (DTMR, 2000; DTMR, 2010). Fencing extent will be determined by the availability of suitable habitat adjacent to alignment
		▸ The Flora and Fauna Sub-plan will include restricted works measures for implementation within or adjacent to Koala habitat to allow safe movement away from works area. These measures may include, but are not limited to the following:
		  ▸ Staged and sequential clearing within Koala habitat
		  ▸ In areas where Koala have been identified as being present, undertake pre-clearing Koala searches on the morning prior to clearing commencing
		  ▸ Measures to allow safe handling of Koalas (where required) and repatriation in suitable habitat away from site
		  ▸ Requirements for Koalas subject to handling to be examined and if suspected of Chlamydia infection they will be taken to a predesignated veterinarian/wildlife care facility for treatment prior to release
		  ▸ A procedure to guide Koala interactions, including any translocations
		  ▸ Appropriate construction traffic speed limits will be established and managed to minimise vehicle strike risk
		  ▸ Incorporation of Koala trees in landscape design and rehabilitation works, especially along existing corridors that are to be retained (e.g. riparian corridors).

	MNES: Greater Glider (*Petauroides volans*)	The following species-specific measures for Greater glider (*Petauroides volans volans*) will also be implemented:
		▸ Avoid works above the tunnel as this area is a key corridor to maintain movement during construction and operation of the Project
		▸ Pre-clearing surveys to be undertaken of woodlands (and other relevant habitats) identified as potential habitat for the species (refer species habitat mapping in Appendix F of Appendix J: Matters of National Environmental Significance Technical Report) to identify whether individuals occur within disturbance footprint, including potential movement pathways, nest sites (.e. hollow bearing trees) and feeder trees
		▸ Project design to incorporate fauna crossing structures to allow fauna movement across alignment. The location and frequency of the passages will be based on an understanding of local Greater Glider movements and in consultation with relevant stakeholders (e.g. DTMR and local councils)
		▸ Fauna and fencing in accordance with ARTC guidelines and DTMR's *Fauna Sensitive Road Design Manual* (DTMR, 2000; DTMR, 2010). Fencing extent will be determined by the availability of suitable habitat adjacent to alignment. Also, where possible, avoid the use of barbed wire, particularly on the top strand, to prevent threatened species (particularly Greater Gliders, flying-foxes and microbats) from becoming entangled. Fauna-friendly fencing must be used, while being in accordance with landowner and/or structural requirements
		▸ The Flora and Fauna sub-plan will include:
		  ▸ Requirements for pre-clearing surveys to identify and map out hollow-bearing trees, feed trees and potential movement pathways
		  ▸ Consultation with the Project team and construction team to determine whether key microhabitats can be avoided
		▸ Where key microhabitats cannot be avoided, develop protocols/procedures to manage these features, including relocating hollow-bearing trees into adjacent habitat and the use of nest boxes, tapping of hollows nearing trees or where possible by lowering slowly with a claw extension.

Delivery phase	Aspect	Mitigation and management measures
Detailed design (continued)	MNES: Grey-headed Flying fox (*Pteropus poliocephalus*)	The following species-specific measures for Grey-headed Flying-fox (*Pteropus poliocephalus*) will also be implemented: ▸ Pre-clearing surveys to be undertaken of riparian habitat identified as potential roost sites of species to identify whether camps occur within or near the disturbance footprint. It is noted no roost sites have been previously identified within 5 km of the Project ▸ Where possible, reduce the disturbance footprint in winter foraging species, including avoiding clearing for ancillary works ▸ Incorporate winter foraging species into the landscape design and Reinstatement and Rehabilitation Plan ▸ Work with the design team and property team to incorporate fencing which minimises the risk of entanglement (e.g. avoid the use of barbed wire fencing with a high tensile wire strand as the top wire) ▸ The Flora and Fauna Sub-plan will include measures to be implemented should a roost site be found to occur. These will incorporate the mitigation standards detailed in the *Commonwealth's Referral guideline for management actions in grey-headed and spectacled flying-fox camps* (former Department of the Environment, 2015c).
	MNES, MSES	For other species not listed above, review the outcome of the flora and fauna surveys, and adopt species-specific measures as appropriate for pre-clearing surveys, landscape design, the Reinstatement and Rehabilitation Plan and the Flora and Fauna sub-plan.
	MNES	Develop a post-construction MNES monitoring plan, with reference to the survey results. The MNES monitoring plan will be developed in consultation with relevant stakeholders and imposed conditions. The MNES monitoring plan will define the TEC or other MNES habitat location, reference condition, assessment framework, infrastructure elements (e.g. erosion and sediment control devices, fauna crossing structures), corrective actions, completion criteria and monitoring timeframes.
	Fauna	Project design to incorporate minimum lighting requirements feasible for Project safety.
	Flora and fauna	The potential for Project works to impact MNES and other ecological receptors through erosion, soil loss, land degradation, sedimentation or decreased surface water or groundwater quality or availability will be managed through the following: ▸ Soil surveys to further characterise soil conditions across the disturbance footprint at a suitable scale to inform detailed design, including appropriate design responses where reactive or problem soils are present or suspected ▸ Contaminated land surveys to inform detailed design and subsequent contaminated land strategy ▸ A Soil Management Plan will be developed to provide the framework for the stripping, storage, treatment and reuse of topsoil.

Delivery phase	Aspect	Mitigation and management measures
Detailed design (continued)	Flora and fauna (continued)	▸ An ESCP will be developed by a CPESC as part of the CEMP, in accordance with the *International Erosion Control Association's Best Practice Erosion and Sediment Control* (IECA, 2008). It will include: ▸ soil/land conservation objectives for the Project ▸ management of problem soils ▸ temporary/permanent drainage, erosion and sediment control measures ▸ stockpiling and management/segregation of topsoil where it contains native plants seedbank or weed material ▸ vehicle, machinery and imported fill hygiene protocols and documentation ▸ requirements for training, inspections, corrective actions, notification and classification of environmental incidents, record keeping, monitoring and performance objectives for handover on completion of construction. ▸ where practical and/or in accordance with specific flora and fauna management plans, vegetation clearing and ground disturbing works will be staged sequentially across the Project to minimise areas exposed to erosion and sediment risk of receiving waterways and drainage lines in accordance with the general environmental duty of the Environmental Protection Act 1994 (Qld) ▸ measures for minimising the exposure time of unprotected materials to prevent sedimentation of receiving waterways and subsequent impacts to ecological receptors ▸ a process for site-and activity-specific preparation when forecast large or high-intensity wet weather events are predicted. This may include, but not be limited to, removing equipment out of riparian zones, stabilising/covering live work areas, additional application of soil binders/veneers and pre event treatment and dewatering of sediment basins. ▸ process for the continuous reviews of effectiveness of erosion and sediment controls ▸ water quality monitoring requirements as defined in the Surface Water Sub-plan to assess the effectiveness of erosion and sediment controls and reinstatement and rehabilitation programs ▸ the ESCP will align with the Reinstatement and Rehabilitation Plan and will include progressive stabilisation of earth materials and soil consolidation to prevent erosion and sedimentation in areas within the disturbance footprint that do not form part of the permanent works (e.g. temporary construction compounds, temporary waterway barrier works and laydown areas). ▸ The ESCP will be reviewed prior to the commencement of pre-construction activities, once construction methodology is finalised and to document location-specific controls ▸ A surface water monitoring framework, which will inform the development of the Surface Water Sub-plan and construction water quality monitoring program. It will identify monitoring locations including upstream, downstream and at the intersection of the Project disturbance footprint and watercourse. It will include the relevant water quality objectives, parameters, criteria and specific monitoring locations, frequency and duration identified in consultation with relevant regulators to reduce impacts to surface water quality. ▸ The Surface Water Sub-plan will establish the construction water quality monitoring program which will include (as a minimum): ▸ analysis of the representative background monitoring dataset ▸ identification of Project works and activities during construction and operation, including runoff, emergencies and spill events, that have the potential to impact on surface water quality of potentially affected waterways and riparian land (via discharge points) ▸ a risk management framework for evaluation of the risks to surface water quality and ecosystems in the receiving environment, including definition of impacts that trigger contingency and ameliorative measures. ▸ Potential aquatic and terrestrial Groundwater Dependent Ecosystems will be field-truthed to confirm presence ▸ Further geotechnical investigations will be undertaken at deep cut sections to inform design and location-specific construction management of groundwater. Risks associated with dewatering (i.e. water table lowering) and environmental management requirements during construction will be identified through appropriate baseline groundwater monitoring, modelling and analysis and incorporated into the CEMP.

Delivery phase	Aspect	Mitigation and management measures
Detailed design (continued)	Riparian vegetation and aquatic habitats	Project design minimises impacts to waterways, riparian vegetation and in-stream flora and habitats by: ▸ Adopting a waterway crossing structure hierarchy: bridges preferred to culverts, to maintain infrastructure permeability for fauna at identified habitat connectivity points, however local conditions and constructability impacts must be considered when determining the preferred environmental solution ▸ Avoiding, then minimising the extent of permanent waterway diversions. Where unavoidable, waterway diversion design to include simulation of natural features e.g. meanders, pools, riffles, shaded and open sections, deep and shallow sections and different types of sub-strata, depending on the pre-disturbance environmental values, as per requirements of relevant and applicable conditions of approval, legislation, regulations and industry guidelines. Maintenance activity locations, construction compounds and storage areas will be defined as part of Project detailed design and positioned away from waterways ▸ Continuing to refine Project design in response to hydraulic modelling outcomes. This includes addressing flood impact objectives which include consideration of peak water levels, flow distribution, velocities, and duration of inundation, and implications for fish passage. This will confirm bridge lengths, culvert sizing and numbers, localised scour and erosion protection measure for both rail, road and other permanent Project infrastructure ▸ Stormwater controls, such as scour protection, are to be further developed and incorporated where necessary to achieve compliance with established water quality objectives—temporary and permanent measures must be appropriate to the site conditions, responding to the erosion risk assessment, sensitive environmental receptors, climatic zone and seasonal factors ▸ Ensuring the disturbance footprint extents allow enough space for provision of the required temporary and permanent erosion and sediment control measures/pollution control measures defined during detailed design Undertaking rehabilitation of temporary waterway crossings in accordance with the Reinstatement and Rehabilitation Plan.
	Fauna passage[1, 2]	Refine fauna passage locations and associated rehabilitation areas in the design, in accordance with the fauna crossing strategy, to maintain infrastructure permeability, particularly at the three key locations identified as part of the EIS assessment process to maintain and/or re-establish habitat connectivity for the targeted local species: ▸ Spotted-tailed Quoll (*Dasyurus maculatus maculatus*) ▸ Greater Glider (*Petauroides volans*) ▸ Brush-tailed Rock-wallaby (*Petrogale penicillata*) ▸ Koala (*Phascolarctos cinereus*) ▸ New Holland mouse (*Pseudomys novaehollandiae*). Design of fauna passage structures and associated rehabilitation areas will respond to local topographical and hydrological context, with consideration of safety requirements for the rail corridor and adjoining properties. Design bridges and culverts to accommodate terrestrial fauna passage where assessed as appropriate, in addition to fish passage design requirements. Design and location of fauna passage structures will be discussed with the relevant stakeholders including DTMR, DES and local councils. This will focus on, but not be limited to, areas of future development or complementary to any ecological corridor strategies within the ecology study area. Including those associated with the Queensland Governments South East Koala Conservation Strategy (2020–2025) (DES, 2020c). Fauna passage design will be consistent with the intent of DTMR's Fauna-Sensitive Road Design Manual (DTMR, 2000; , DTMR 2010) and where applicable, species-specific requirements.
	Fauna fencing[1, 2]	Fauna fencing opportunities will be further assessed and, where appropriate, developed during detailed design to limit fauna strike and fauna mortality risk and/or maintain habitat connectivity. This will include: ▸ Assessment of the compatibility of each approach for the targeted local species with the general fencing principles at each proposed fencing location. ▸ Consideration of safety and operational requirements for the rail corridor and adjoining properties. ▸ Consultation with adjoining landholders. ▸ Requirements for maintaining an appropriate clearance buffer between adjacent vegetation and fauna fences. ▸ Consideration for maintenance constraints and responsibilities that a fauna connectivity or fencing opportunity may introduce to operations. Fauna fencing will be designed in reference to guidelines documented in DTMR's *Fauna Sensitive Road Design Manual* (DTMR, 2000; , DTMR 2010). Additional expert guidance in relation to specific design features will be sought during the detailed design process. The design will aim to maximise infrastructure permeability by connecting fauna fencing with safe crossing opportunities.

Delivery phase	Aspect	Mitigation and management measures
Detailed design (continued)	Aquatic fauna	Design watercourse crossing structures (including culverts and bridges) to maintain fish passage where applicable in accordance with *Accepted development requirements for operational work that is constructing or raising waterway barrier works* (Department of Agriculture and Fisheries (DAF), 2018a) or conditions of development approval for operational work that is constructing or raising waterway barrier works. Detailed design to minimise the need for ongoing maintenance and inspection to maintain fish passage. The design will aim to minimise the need for ongoing maintenance and inspection to maintain fish passage. Dewatering strategies will be required to comply with the *Biosecurity Act 2014* (Qld) to take reasonable measures to avoid the spread of pest species and in accordance with any required aquatic fauna species management plans and water quality objectives defined in the outline CEMP.
	Flora	Where feasible and practicable, locate construction areas including compounds, stockpiles, fuel storage, laydown areas and staff parking outside the tree protection zone as defined in *AS4970-2009 Protection of trees on development sites* (Standards Australia, 2009b). Where practical, existing tracks will be used and the design for new access tracks (permanent and temporary) will be undertaken with the aim of minimising disturbance of substrate and vegetation.
	Landscape, rehabilitation and stabilisation	Landscape design establishes the requirements for rehabilitation of disturbed areas for habitat re-creation, landscaping and stabilisation, including for riparian zones and informs the development of the Reinstatement and Rehabilitation Plan and the Landscape and Rehabilitation Management Plan. This should also include criteria for retrieval of potential habitat elements (loose surface rock, large fallen timber) during vegetation clearing for habitat recreation where appropriate. Develop a Reinstatement and Rehabilitation Plan for areas within the disturbance footprint that do not form part of the permanent works (e.g. construction compounds, laydown areas, temporary access tracks). The Plan will include and clearly identify: ▸ Location of areas subject to rehabilitation and/or reinstatement/stabilisation, in accordance with the landscape and rehabilitation design developed during detailed design, including operational rail safety considerations ▸ Objectives and timeframes for rehabilitation and/or reinstatement/stabilisation works (including biodiversity, vegetation establishment and erosion and sediment control outcomes to be achieved) ▸ Where appropriate, the plan describes how the objectives align with relevant recovery plans, threat abatement plans, conservation advices or policy guidance for target species in areas identified for rehabilitation ▸ Details of the actions and responsibilities to progressively rehabilitate, regenerate, and/or revegetate areas, consistent with the objectives ▸ Native flora species endemic to the Lockyer Valley and Ipswich regions or other suitable species appropriate to the landscape context and nursery/seed stock sources—where possible (i.e. propagated material is available) include MNES species (i.e. Lloyd's olive) in rehabilitation activities. ▸ Incorporate koala trees in landscape design and rehabilitation works, especially along existing corridors which are to be retained (e.g. riparian corridors). ▸ Procedures, timeframes, measurable performance objectives and responsibilities for monitoring the success of rehabilitation and/or reinstatement/stabilisation areas ▸ Corrective actions if the outcomes of rehabilitation and/or reinstatement/stabilisation are not achieved. Develop a Landscape and Rehabilitation Management Plan to define post-construction maintenance requirements, monitoring requirements and completion criteria for areas defined in the landscape design and/or identified in the Reinstatement and Rehabilitation Plan.

Delivery phase	Aspect	Mitigation and management measures
Detailed design (continued)	Offsets[1, 2]	Restriction of the Project disturbance footprint through detailed design as far as practical, to that required to safely and efficiently construct and operate the Project. Significant adverse residual impact to habitat for MNES and MSES will be re-calculated to confirm the Project's offset obligations under Australian Government and State requirements based on the outcomes of the flora, fauna and MNES habitat surveys. Re-calculated impacts will be used to confirm the Project's offset obligations under Australian Government and State Government requirements. A Project offset delivery plan and Offsets management plans will be developed to provide for the staged delivery of offsets, where appropriate, ahead of relevant clearing works being undertaken and finalised in consultation with relevant Australian Government and State regulatory agencies Appendix K: Matters of National Environmental Significance Technical Report for the Environmental Offset Delivery Strategy – Qld).

Pre-construction	Flora and fauna	Develop the CEMP Flora and Fauna Sub-plan to include appropriate criteria, directives and procedures in relation to:
		▸ Requirements for pre-clearing surveys, including terrestrial, aquatic and wetland habitats, protected plants, breeding habitats (including burrows and hollow bearing trees/logs, existing culverts and structures, riparian habitat identified as potential roost sites) for both threatened and non-threatened species by suitably qualified persons. This includes:
		  ▸ Staged and sequential clearing protocols
		  ▸ Signage requirements for the delineation of no-go areas and clearing extents
		▸ Animal handling protocols, including relocation and emergency care. For example: Consideration of chytrid fungus for frogs, Koalas (*Phascolarctos cinereus*) subject to handling will be examined and if suspected of Chlamydia infection will be taken to a predesignated veterinarian/wildlife care facility for treatment prior to release
		▸ Restricted works/avoidance works/avoidance measures if nesting Australian Painted Snipe (*Rostratula australis*) or Australasian Bittern (*Botaurus poiciloptilus*) are detected
		▸ Works protocols if an active Red Goshawk (*Erythrotriorchis radiatus*) nest site is identified, to allow nesting to continue undisturbed
		▸ Works protocols should a Grey-headed Flying-fox (*Pteropus poliocephalus*) roost site be found, in accordance with the *Referral guideline for management actions in Grey-headed and Spectacled Flying-fox camps* (former Department of the Environment, 2015c)
		▸ Works protocols to allow safe movement away from works area, should other fauna be observed within or adjacent to the works area
		▸ Relocation of plants and micro-habitats (such as hollow bearing logs) where applicable
		▸ Requirements for inspections and corrective actions during construction and rehabilitation activities
		▸ Biodiversity/fauna and flora management actions, including those required under secondary approvals to be undertaken by suitably qualified persons
		Requirements for training, inspections, corrective actions, notification and classification of environmental incidents, record keeping, monitoring and performance objectives for handover on completion of construction.

Delivery phase	Aspect	Mitigation and management measures
Pre-construction (continued)	Weeds and pests	Develop the CEMP Biosecurity Management Plan to include: ▸ Pre-clearing surveys to determine the risk of environmental weeds and pests including prohibited and restricted matters prescribed under the *Biosecurity Act 2014* (Qld) and Biosecurity Regulation 2016 being present ▸ Consideration of relevant guidelines to control potential deleterious pathogens including *Phytophthora cinnamomi* and *Austropuccinia psidii* (Myrtle rust) (e.g. Department of the Environment, 2015b) associated with Project activities both of which may impact Melaleuca species ▸ Revegetation species to be obtained from source certified free of *Phytophthora cinnamomi* ▸ Mapping the existing extent and severity of any weed infestation and weed management requirements in the disturbance footprint or on adjacent land ▸ Pest animal management, including Red Imported Fire Ants management within the Fire Ants Biosecurity Zones 1 and 2 as per current DAF advice ▸ Weed surveillance and treatment during construction and rehabilitation activities ▸ Vehicle and plant washdown protocols when traversing properties via temporary access tracks or if any high-risk areas are identified during the Project construction ▸ Requirements in relation to pesticide and herbicide use and documentation, recognising ACDC Act requirements including any limitations on use, such as, restrictions on use in sensitive environmental areas, drainage lines that flow to waterways and aquatic habitats, and ensuring that broad-scale use does not result in an increased erosion and sediment risk ▸ Vehicle and plant equipment and imported fill hygiene protocols and documentation ▸ Erosion and sediment control risks associated with broad-scale weed removal or treatment ▸ Stockpiling and management/segregation of topsoil where it contains native plants seedbank or weed material ▸ Dewatering and fish salvage requirements to manage the risk of translocating non-endemic flora and fauna ▸ Consideration of relevant local government Biosecurity Plans Develop the Community Engagement Sub-plan in the CEMP, to enable members of the public to assist with weed surveillance in the vicinity of Project works.
	Flora and fauna	Implement the CEMP Flora and Fauna Sub-plan. Undertake pre-clearing surveys in any areas to be cleared to enable pre-construction activities and confirm the species-specific works protocols to be implemented. Document the area and type of vegetation cleared in a post clearance summary, including MNES and MSES for offsetting and compliance purposes.
	Landscape, rehabilitation and stabilisation	The Reinstatement and Rehabilitation Plan will guide the approach to rehabilitation and be implemented progressively during pre-construction and construction phase activities.
	Weeds and pests	Implement the Biosecurity Management Plan during pre-construction to reduce the potential for the spread of weeds and pests into the surrounding environments and land uses.
	Erosion and sediment control	The ESCP developed during detailed design will be reviewed and updated by a CPESC, incorporating further construction methodology details as required. Implement appropriate site stabilisation treatments, including seeding and planting requirements, in accordance with the ESCPs and Reinstatement and Rehabilitation Plan.

Delivery phase	Aspect	Mitigation and management measures
Construction and commissioning	Flora and fauna	Avoid disturbance to protected areas such as Bowman Park Koala Nature Refuge. Project clearing extents are limited to that which is required to safely construct, operate and maintain the Project, in accordance with the approved disturbance footprint. Locate temporary construction facilities compounds, stockpiles, fuel storage, laydown areas, temporary access roads and staff parking to minimise the extent of disturbance on existing habitat and significant vegetation i.e. undertake micro-siting of these temporary activities and facilities. Appropriate construction traffic speed limits will be established and managed to minimise vehicle strike risk. Clearly define clearing boundaries associated with the construction disturbance footprint with flagging or marking tape, signage or other suitable means to delineate no go areas. Undertake this delineation and marking process in a manner that is consistent with the Project flagging/marking tape process and specifications, to ensure that it is consistent with the wider Project control processes and does not conflict or contradict any other demarcation practices. Staged and sequence clearing where feasible to minimise the extent of exposed areas. Where possible, minimise loss of canopy vegetation and works that will lead to the proliferation of weed species.
		A qualified Fauna Spotter Catcher will undertake pre-clearance surveys of habitats and vegetation, including where applicable, fauna reduction activities. The Fauna Spotter Catcher will supervise the subsequent clearing. The area and type of vegetation cleared will be documented where required for compliance with secondary approvals and offset purposes. Implement the post-construction MNES Monitoring Plan. Continue monitoring each nominated MNES against initial assessment values, until completion criteria are achieved. Corrective actions to be implemented where Project-associated impacts are identified Implement the Air Quality Sub-plan to minimise dust impacts including dust monitoring and suppression methods.
	Riparian vegetation and aquatic habitats	Locate construction areas including compounds, stockpiles, fuel storage, laydown areas, temporary and permanent access roads within the Project disturbance footprint. Undertake a flood/drainage assessment to inform the siting and scale of temporary construction areas (including stockpiles, construction compounds, fuel storage and laydown areas). Locate these areas on land that is not subject to flooding to the extent possible. Siting of plant and equipment and refuelling facilities to be undertaken in accordance with AS1940:2017 *The storage and handling of flammable and combustible liquids* (Standards Australia, 2017). Implement the site-specific ESCPs. Works within or adjacent to watercourses will be conducted in accordance with relevant secondary approvals including: ▸ *Riverine protection permit exemption* requirements (WSS/2013/726) Version 2.01 (DNRME, 2019b) or conditions of a riverine protection permit issued for the Project ▸ *Accepted development requirements for operational work that is constructing or raising waterway barrier works* (DAF, 2018a) or conditions of development approval for operational work that is constructing or raising waterway barrier works.

Delivery phase	Aspect	Mitigation and management measures
Construction and commissioning (continued)	Riparian vegetation and aquatic habitats (continued)	Dewatering/extraction of water from artificial impoundments will be undertaken after consultation with relevant stakeholders. Dewatering strategies will be required to comply with the *Biosecurity Act 2014* (Qld) to take reasonable measures to avoid the spread of pest species (with capacity to affect water quality) and in accordance with any required aquatic fauna species management plans. The salvage and relocation of fish within isolated aquatic environments will be managed in accordance with the DAF *Guidelines for Fish Salvage* (DAF, 2018b). An appropriately qualified person will be consulted to make an assessment on the method of recovery, transport and release of fish and other aquatic fauna, as required. As a minimum, the following will be implemented: ▸ Relocation will be undertaken by a suitably qualified person ▸ Dewatering pumps will have an intake screen ▸ Records of all fish recovered, and the location of their release will be maintained. In the event of a spill incident during construction, any impacted aquatic environments will be assessed for the presence of fauna. If necessary, salvage and recovery efforts will be undertaken.
	Fauna passage	Prioritise bridge structures/culverts construction where practical and feasible, particularly in the six key locations identified as part of the EIS assessment process to maintain and/or re-establish habitat connectivity as soon as possible and minimise the disruption to waterways. Stage the implementation of the Reinstatement and Rehabilitation Plan in locations associated with fauna passage structures.
	Fauna fencing	Install fauna exclusion fencing in accordance with detailed design and fencing hierarchy especially in conjunction with the three identified fauna passages/creek crossing locations for the Project to maintain permeability in the alignment.
	Flora	Minimise clearance of remnant vegetation to that necessary for construction and safe operation, and in accordance with the Project disturbance footprint and secondary approvals. [1, 2, 3] Where practicable and feasible, locate construction areas including compounds, stockpiles, fuel storage, laydown areas, staff parking outside the tree protection zone as defined in *AS4970-2009 Protection of trees on development sites* (Standards Australia, 2009). Where possible, minimise loss of canopy vegetation and works that will lead to the proliferation of weed species. Implement the Soil Management Plan as part of the CEMP, guiding the stripping, stockpiling and management of topsoil where it has the potential to contain seedbank or weed material. Topsoil stockpiles will be managed to maintain the viability of soil seed banks for threatened flora species. [1] Plan and implement revegetation and rehabilitation works so that they do not create safety, maintenance or performance issues e.g. vegetation does not grow and obscure signals or impact longevity of rail infrastructure.
	Aquatic fauna	Construct temporary and permanent watercourse crossing structures in accordance with the detailed design and *Accepted development requirements for operational work that is constructing or raising waterway barrier works* (DAF, 2018a) or conditions of development approval for operational work that is constructing or raising waterway barrier work. This is required to minimise impacts to aquatic fauna (i.e. fish passage) and hydrology (all phases).
	Weeds and pests	Implement the Biosecurity Management Plan during construction to reduce the potential for the spread of weeds and pests into the surrounding environments and land uses. The effectiveness of weed hygiene measures will be monitored as a component of the environmental monitoring procedure for the Project. Any vegetated material containing, or with the potential to contain, weed seed material will not be used for onsite mulching or erosion protection.[1,2] Implement the Community Engagement Sub-plan in the CEMP to enable members of the public to assist with weed surveillance in the vicinity of Project works.

Delivery phase	Aspect	Mitigation and management measures
Construction and commissioning (continued)	Landscape, rehabilitation and stabilisation	Construct landscaping treatments in accordance with the landscape design. Implement the Soil Management Plan. Undertake progressive rehabilitation and reinstatement of disturbed areas in accordance with the Reinstatement and Rehabilitation Management Plan and the Landscape and Rehabilitation Management Plan.
	Erosion and sediment control	Vegetation clearing and ground disturbing activities will be supplemented by the progressive installation of erosion and sediment controls including stabilisation works to minimise areas exposed to erosion and sediment risk. Implement site stabilisation treatments in accordance with: ▸ ESCP ▸ Air Quality Sub-plan ▸ Reinstatement and Rehabilitation Plan. Assess the suitability of cleared vegetation for mulching/erosion protection on a case-by-case basis. Any vegetated material containing or with the potential to contain weed seed material will not be used for onsite mulching or erosion protection without prior treatment. For any unsuitable material i.e. noxious weeds, the cleared and grubbed material will be removed from the site and disposed of in accordance with relevant statutory requirements and the Biosecurity Management Plan. Re-use suitable mulch generated by construction of the Project within appropriate timeframes and manner as specified in the ESCP and the Reinstatement and Rehabilitation Plan.

Table notes:

1. Mitigation measure successfully implemented as part of the Toowoomba Second Range Crossing Project.
2. Mitigation measure approved by Australian Government as part of the rail component for the Carmichael Coal Mine and Rail Project.
3. Mitigation measure commonly applied across other projects as approved by the Australian Government in central and southern Queensland.

23.13.4.4 Monitoring

Requirements for monitoring will be documented in the following plans that will support the CEMP:

- Flora and Fauna Sub-plan
- Biosecurity Management Plan
- Construction Noise and Vibration Management Plan
- Reinstatement and Rehabilitation Plan
- Post-construction MNES monitoring plan.

Monitoring and reporting on compliance with the mitigation measures identified in this draft Outline EMP Sub-plan will be captured in the processes identified in Section 23.8.

The proposed mitigation measures identified in Table 23.7 have been selected based on the best available information including government guidelines (e.g. DTMR's *Fauna Sensitive Road Design Manual* (DTMR, 2000; DTMR, 2010)) and mitigation measures used on similar projects that have been subject to legislative approval. It is acknowledged the effectiveness of these measures may not have been subject to rigorous peer-reviewed analysis to date.

Ongoing monitoring of the effectiveness of the measures with contingency (under an adaptive management framework) will allow change/improvement of management strategies where deleterious impacts to the identified environmental values are observed, or are not minimised, as per the objectives of the proposed mitigation measures.

23.13.5 Air quality

23.13.5.1 Environmental outcomes

Design and construction of the Project is undertaken in a manner that minimises air quality impacts, specifically impacts to the following environmental values which are relevant for the Project qualities of the air environment that are conducive to:

- Human health and wellbeing
- Protecting the aesthetics of the environment, including the appearance of buildings, structures and other property.

23.13.5.2 Performance criteria

The air quality objectives adopted for the assessment are presented in Table 23.8.

TABLE 23.8: CONSTRUCTION AIR QUALITY GOALS

Pollutant	Air quality objective	Averaging period	Environmental value
TSP	90 µg/m^3	Annual	Health and well being
PM_{10}	50 µg/m^3	24 hours	Health and well being
	25 µg/m^3	Annual	Health and well being
Dust deposition[1]	120 mg/m^2/day	Monthly	Protecting aesthetic environment

Table notes:

µg/m^3	microgram per cubic metre
mg/m^2/day	milligram per square metre per day
1	dust deposition is assessed as the insoluble solids component of deposited dust

23.13.5.3 Proposed mitigation measures

Relevant environmental aspects and proposed mitigation and management measures for the detailed design, pre-construction and construction and commissioning phases of the Project are presented in Table 23.9.

For several of the mitigation measures proposed, the expected control efficiency (emission reduction percentage) has been nominated. The control efficiencies reported have been obtained from the NPI *Emissions Estimation Manual for Mining* (NPI, 2012).For several emission sources there are multiple available mitigation measures. The exact method of mitigation implemented will be determined during construction phase planning and following confirmation of the availability and suitability of water supply sources.

During the commissioning phase of the Project, air emissions are expected to be limited to combustion engine emissions associated with transport vehicles and train locomotives, and limited dust emissions from vehicle travel on unsealed roads. Mitigation measures for transport vehicles (dust and combustion engine emissions) are the same during the construction and commissioning phases, and therefore the mitigation measures in Table 23.9 are combined for these phases. Air emissions from train locomotives during the commissioning phase are not expected to be significant and therefore no mitigation measures are required for train locomotives in this phase.

TABLE 23.9: MITIGATION MEASURES—AIR QUALITY

Delivery phase	Aspect	Proposed mitigation measures
Detailed design	Availability of water for dust suppression and stabilisation during construction	Prior to construction, quantities of water required for dust suppression, construction, landscaping and stabilisation activities will be confirmed. The availability and suitability of water supply sources will be determined and where water supply is deemed insufficient or in high demand for other uses, other dust suppression and stabilisation methods will be implemented.
	Emissions from refuelling activities during construction	Design of fuel storage areas will ensure that fuel tanks will be located at least 50 m from the nearest sensitive receptor, with separation distances maximised as far as practical within site restrictions.
	Fugitive dust emissions (windborne erosion)	Clearing extents limited to the disturbance footprint and minimised to that required to safely construct, operate and maintain the Project. Laydown areas and other construction-phase facilities will be designed and arranged to minimise emissions and reduce the potential for air quality impacts to sensitive receptors. Design considerations will include the locations of stockpiles, activity areas, travel routes, rumble grids and truck washdown areas. Earthworks and landscape design of railway batters and other exposed surfaces will be designed to incorporate treatments and enable stabilisation to reduce wind erosion.
	Emissions reporting requirements	Emissions reporting requirements for the construction phase will be confirmed during detail design and be consistent with the Sustainability Management Plan.
Pre-construction and construction	Dust generation from survey and geotechnical investigations, or other pre-construction activities	Vehicle travel on unsealed roads will be minimised as far as practical. Sealed roads will be used where possible, in accordance with the Project Construction Traffic Management Plan. Disturbed areas will be rehabilitated and stabilise as soon as practical on completion of works.
Construction and commissioning	Dust generation from earthworks, clearing and grubbing, mobile plant activity and wind erosion of exposed areas within the temporary construction disturbance footprint	Limit clearing to: ▸ The disturbance footprint as identified during the detailed design constructability assessment and planning ▸ That required to safely construct and operate the Project. Where practical, stage clearing and grubbing and construction activities to limit the size of exposed areas. Adequate precautions to effectively minimise the generation of dust, which may affect the safety and general comfort of the travelling public, the construction contractor's employees and/or occupants of adjacent buildings, during the construction of the work will be undertaken. These precautions will involve regular applications of water or other measures along the sections of the work traversed by the travelling public, as required, to minimise dust. Implement water sprays or other measures to reduce dust emissions from: ▸ Excavation or disturbance of soils or vegetation, or handling ballast ▸ Trucks unloading material (up to 70 per cent reduction achievable) ▸ Mobile plant loading to or from material stockpiles (up to 50 per cent reduction achievable). To reduce wind erosion, the following mitigation methods will be used subject to water availability and stockpile activity: ▸ Water sprays (up to 50 per cent reduction achievable) ▸ Wind breaks or earthworks profiling (up to 30 per cent reduction achievable) ▸ Application of rock armour/covering (up to 30 per cent reduction achievable) ▸ Covering of the stockpile (i.e. tarpaulin) or binding agent (up to 100 per cent reduction achievable). If water sprays or other measures are implemented for stockpiles, the application rate of water will be increased for stockpiles, which will receive new material regularly, such as tunnel excavation stockpiles.

Delivery phase	Aspect	Proposed mitigation measures
Construction and commissioning (continued)	Dust generation from earthworks, clearing and grubbing, mobile plant activity and wind erosion of exposed areas within the temporary construction disturbance footprint (continued)	Disturbed areas and exposed surfaces will be stabilised as a soon as practical. The following mitigation methods will be used subject to final purpose of the exposed area: ▸ Initial establishment of vegetation (up to 30 per cent reduction achievable) ▸ Maintained revegetation (up to 90 per cent reduction achievable)Establishment of self-sustaining rehabilitation vegetation (up to 100 per cent reduction achievable) ▸ Sealing of exposed surface (i.e. concrete, asphalt) (up to 100 per cent reduction achievable). Long-term stockpiles will be avoided where possible. However, where necessary (e.g. topsoil), long-term stockpiles will be established in locations with suitable separation from sensitive receptors. During periods of inactivity, stockpiles will be stabilised appropriately. Establish and communicate the protocol for notifying relevant stakeholders when potentially dust generating activities are planned to be carried out, with contact details for queries or complaints.
	Emissions from combustion engines (construction vehicles and generators)	Construction plant, vehicles and machinery will be maintained and operate in accordance with manufacturers' recommendations.
	Use of non-potable water for dust suppression	Water used in dust suppression will be of suitable quality and not result in environmental or human health risks, or impact rehabilitation outcomes. Water additives used to improve dust suppression effectiveness (e.g. the addition of soil binders to water for dust suppression on roads or hard stand areas) will be risk assessed prior to adoption.
	Dust generated by traffic on access tracks	To reduce emissions from construction vehicle movements on unsealed roads, road watering (anticipated emission reduction of 50 to 75 per cent) or other appropriate measures will be implemented for haul roads. Water additives used to improve dust suppression effectiveness will be considered.
	Fugitive dust emissions from vehicles transporting materials to and from site	Vehicles transporting potentially dust and/or spillage generating material to and from the construction site will have their loads covered immediately after loading, prior to traversing public roads. Rumble grids and the operation of truck washdown areas will be maintained to reduce trackout of material onto public roads where it will become resuspended. Site-based construction traffic is limited to identified haul routes as per the Project Construction Traffic Management Plan.
	Cumulative effects of dust emissions from construction and external land uses or activities	If construction or track work is undertaken on adjacent Inland Rail projects or on existing rail networks proximal to the Project, interfacing environmental risks will be considered and enhanced mitigation will be implemented if required to mitigate impacts to receptors.
	Dust generation and deposition as a result of adverse weather conditions	Avoid ground-disturbing activities including excavation and vegetation clearing during windy conditions where practical. When avoidance of ground-disturbing activities is not practical, implement enhanced management measures, such as water application and/or implementation of temporary stabilisation treatments.

23.13.5.4 Monitoring and reporting requirements

Monitoring and reporting on compliance with the mitigation measures identified in this draft Outline EMP Sub-plan will be captured in the processes identified in Section 23.8.

Emissions reporting during construction (e.g. NGERs and reporting against Sustainability Management Plan targets) will be undertaken where applicable.

In addition, this section describes how the Project will monitor, report and audit compliance with the Project's air quality objectives.

Construction phase—weather conditions monitoring

To help avoid dust generation during adverse weather conditions, weather forecasts and observations for adverse weather (e.g. winds > 36 km/hr or 20 knots) will be observed during the construction phase of the Project using existing Bureau of Meteorology (BoM) weather stations.

To assist with auditing and the analysis of air quality monitoring and complaints (if received), periods of adverse weather periods will be recorded in monthly environmental reports.

Construction phase—air quality monitoring

Visual monitoring of dust generation (visible plumes) will be undertaken throughout construction.

Daily onsite inspections of dust generation will be undertaken by construction staff to monitor dust being generated onsite to inform mitigation measures.

In addition, routine offsite inspection will be undertaken at sensitive receptors located near high intensity construction areas such as:

- Heavily trafficked haul roads
- Excavation areas
- Laydown areas.

If air quality complaints regarding Project construction works dust are received, quantitative monitoring of air quality may be required. Subject to receiver-specific requirements, monitoring could be undertaken to investigate either dust deposition or airborne particulate concentrations (TSP or PM_{10}). Monitoring site selection, duration and descriptors will be tailored to conditions present to allow appropriate corrective measures to be implemented

All relevant results (inspections, monitoring, corrective measures and follow-up) will be included in environmental monitoring reports prepared by the construction contractor.

23.13.6 Surface water and hydrology

23.13.6.1 Environmental outcomes

Project works are designed to minimise the use of water resources and maximise the opportunities for re-use of suitable water from the construction site.

Discharge of surface water from construction sites does not adversely affect the environmental values of receiving water and habitats.

Project works are designed consistent with the Project hydraulic design criteria to achieve established flood impact objectives (at flood sensitive receptors).

23.13.6.2 Performance criteria

- Steps are taken to investigate and maximise the use of water collected onsite, including use of water captured within sediment basins
- Use of potable water is minimised where possible
- Project works are undertaken in accordance with the ESCPs (refer Section 23.13.2.3)
- Project works are planned and staged to minimise the potential for adverse impacts on existing water flows and/or flooding profiles
- Water quality monitoring demonstrates that the construction works do not have an adverse impact on water quality upstream or downstream of works
- Stormwater discharges released from the construction worksites to receiving surface waters will comply with goals established in the CEMP at the nominated discharge points
- Project works must not cause flooding impacts that exceed the Project flood impact objectives (for the 1% Annual Exceedance Probability (AEP)) established at flood-sensitive receptors including:
  - 10 mm or more at existing habitable and/or publicly used commercial structures, buildings/premises
  - 50 mm or more at existing habitable residential or publicly used commercial properties/lots where flooding does not impact dwellings/buildings
  - 100 mm or more at existing non-habitable structures or industrial building/premises
  - 100 mm or more at existing roadways (currently in use)
  - 200 mm or more at existing agricultural and grazing land.

23.13.6.3 Proposed mitigation measures

Relevant environmental aspects and proposed mitigation and management measures for the detailed design, pre-construction and construction and commissioning phases of the Project are included in Table 23.10.

TABLE 23.10: MITIGATION MEASURES—SURFACE WATER AND HYDROLOGY

Delivery phase	Aspect	Proposed mitigation measures
Detailed design	Water quality of waterways	Seek to further refine the disturbance footprint identified and assessed in the EIS, to avoid, and where avoidance is not possible, further minimise impacts to all waterways including defined watercourses, currently unmapped waterways and drainage features (defined by *Water Act 2000* (Qld) and water quality of Sandy Creek (Grantham), Lockyer Creek, Sandy Creek (Forest Hill), Laidley Creek, Western Creek their tributaries and downstream impoundments or users by: ▸ Avoiding, then minimising the extent and duration of temporary waterway diversions ▸ Avoiding, then minimising the extent of permanent waterway diversions or realignments. Where unavoidable, permanent waterway realignment/diversion design to include simulation of natural features e.g. meanders, pools, riffles, shaded and open sections, deep and shallow sections and different types of sub-strata, depending on the pre-disturbance environmental values ▸ Planning and defining maintenance activity locations, construction compounds and storage areas, and management procedures ▸ Undertaking pre-construction water quality monitoring and detailed design hydraulic modelling to inform temporary and permanent drainage design. Requirements for treatment controls, scour protection, to be incorporated where necessary to achieve compliance with established objectives. Temporary and permanent measures will be appropriate to the site conditions, responding to the erosion risk assessment, environmental receptors, climatic zone and seasonal factors ▸ Developing ESCPs, in accordance with International Erosion Control Association's *Best Practice Erosion and Sediment Control* (IECA, 2008), for implementation during pre-construction, construction and commissioning, which will establish and specify the monitoring and performance objectives for handover on completion of construction ▸ Ensuring the disturbance footprint defined during detailed design allows enough space for provision of the required temporary and permanent erosion and sediment control measures/pollution control measures ▸ Designing batters, cuts and other exposed surfaces to reduce erosion risk ▸ Designing watercourse crossing structures (including culverts and bridges) to minimise the need for ongoing maintenance and inspection to maintain aquatic fauna (e.g. fish) passage and minimise the risk of debris deposition during large flow events in accordance with relevant regulatory requirements.
	Monitoring	Develop the surface water monitoring framework to inform the development of the CEMP and the construction water quality monitoring program. It will identify monitoring locations including upstream, downstream and at the intersection of the Project disturbance footprint and watercourses where works are being undertaken. It will include the relevant water quality objectives, parameters, and criteria, and specific monitoring locations, frequency and duration identified in consultation with relevant regulators to reduce surface water quality impacts. The water quality monitoring program will include (as a minimum): ▸ Analysis of the representative background monitoring dataset ▸ Identification of Project works and activities, including runoff, emergencies and spill events, that have the potential to impact on surface water quality of potentially affected waterways and riparian land (via discharge points) ▸ A risk management framework for evaluation of the risks to surface water quality and ecosystems in the receiving environment, including definition of impacts that trigger contingency and ameliorative measures ▸ The identification of location-specific and construction activity erosion and sediment control and stormwater management requirements relating to surface waters during all phases.

Delivery phase	Aspect	Proposed mitigation measures
Detailed design (continued)	Monitoring (continued)	The presentation of Water Quality Objective (WQO) trigger values, standards and parameters against which changes to water quality will be assessed, having regard to the ANZECC/ARMCANZ 2000/2018 Guidelines, or other suitable guidelines. As a minimum, this should include values for: ▸ Total Suspended Solids—Equivalent to corresponding background (milligrams per litre (mg/L)) ▸ Turbidity—Equivalent to corresponding background (Nephelometric Turbidity Units (NTU)) ▸ pH 6.5–8 ▸ Oils and grease (no visible films)—if oils and grease are visually evident, a sample will be forwarded to the laboratory for analysis. Establishment of construction surface water monitoring locations including waterways, waterbodies and wetlands (e.g. upstream of, downstream of, and at the intersection of the Project disturbance footprint and watercourse and tunnel dewatering into the Western Creek sub-catchment) and discharge points, which are representative of the potential extent of impacts from the Project, including relevant analytes and frequency of monitoring. Identification of seasonal factors with the potential to influence water quality at the monitoring sites. A minimum monitoring period following the completion of construction completion criteria. Surface-water quality during baseflow conditions that meet representative pre-construction up and downstream background monitoring, and/or WQOs will confirm adequate rehabilitation The post-construction monitoring will assess the efficacy of constructed water control measures, as defined as part of drainage during detailed design of the Project, such as vegetated buffer strips basins and vegetated swales. Contingency and ameliorative measures if adverse impacts to water quality are identified, with reference to the impact triggers defined as part of the water quality monitoring program. Surface water quality samples are to be collected and analysed in accordance with industry-accepted standards and quality assured procedures, with laboratory analysis undertaken by NATA-accredited facilities. Commence water quality monitoring in accordance with the surface water quality monitoring framework for an adequate period of time to acquire representative data prior to construction at waterway crossing locations (e.g. Lockyer Creek—upstream of, downstream of, and at the intersection of the Project disturbance footprint and watercourse) to establish baseline water conditions provide a sufficient seasonal variation.
	Drainage design, erosion sediment control and salinity hazard	Water-quality matters will inform permanent drainage design for the rail and road realignments (i.e. requirements for treatment controls where necessary to comply with established water quality objectives through scour protection) and to inform erosion and sediment control plans. Design defines temporary and permanent stormwater, erosion and sediment/pollution control measures in ESCPs and Reinstatement and Rehabilitation Plan, that each comply with IECA *Best Practice Erosion and Sediment Control* (IECA, 2008). The plans will establish and specify the monitoring and performance objectives for handover on completion of construction.
	Construction water	Develop a dewatering strategy where dewatering of artificial impoundments is required (artificial impoundments within the disturbance footprint)to comply with the *Biosecurity Act 2014* (Qld) to take reasonable measure to avoid the spread of pest species (with capacity to affect water quality) and in accordance with any required aquatic fauna species management plans. Requirements for construction water (volumes, quality, demand curves, approvals requirements and lead times) will be defined during detailed design and construction planning. This will include identification of opportunities to utilise dewatered artificial impoundments (where impacted along the disturbance footprint) for construction purposes. Construction water sources and demand will use a hierarchical approach to confirm the suitability of water sources, with a focus on utilising existing sustainable allocated water entitlements. Licences, approvals and agreements to access water from sources identified in the finalised construction water strategy will be obtained. These may include water licences under the *Water Act 2000* (Qld) or access agreements with bulk water suppliers or private landowners. Specify performance criteria in the CEMP for construction water requirements to minimise the risk of adverse water quality, environmental or health impacts and avoid the use of potable water where non-potable sources can be applied.

Delivery phase	Aspect	Proposed mitigation measures
Detailed design (continued)	Tunnel dewatering	Groundwater quality and modelling works will be undertaken to inform the design for the Little Liverpool Range tunnel dewatering treatment facility. Develop a treatment and discharge plan, consistent with the tunnel dewatering treatment framework for implementation at the tunnel dewatering plant. The collected water will be required to meet the water quality objectives (to be established during baseline water quality monitoring) for release, and schedule release periods to minimise changes in hydrological regime, physical and chemical characteristics and ecological processes. The treatment and discharge plan will also establish criteria and protocols if releases during no-flow conditions is required.
	Hydrology and flooding	Incorporate outcomes from consultation with stakeholders including directly impacted landowners, Local Government authorities, State Government departments and recognised subject matter experts to inform and refine the Project design. Continue to refine Project design in response to hydraulic modelling outcomes—this includes addressing flood impact objectives and consideration of peak water levels, flow distribution, velocities and duration of inundation. Refinement of Project design will confirm bridge lengths, culvert sizing and numbers, localised scour and erosion protection measures for both rail, road and other permanent Project infrastructure. Undertake a Project flood risk assessment to inform the siting and scale of temporary construction areas, including stockpiles, construction compounds, access, laydown areas. Construction planning reviews of the design to locate plant and equipment maintenance activities and chemical/hazardous goods storage facilities in accordance with the risk assessment and incorporate appropriate location-specific controls and procedures to minimise the risk and avoid impacts to waterways, aquatic habitats, and groundwater. Impacts must be determined at all drainage structures and waterways affected by Project works. The change in flood levels and impacts on infrastructure and properties outside the rail corridor must be justified for a range of events up to and including the 1% AEP event. Incorporate outcomes from consultation with stakeholders including directly impacted landholders, local government authorities, State Government departments and recognised subject matter experts to inform and refine the Project design.

Pre-construction	Erosion and sediment control (water quality related)	ESCPs will be developed for the Project as part of the CEMP, in accordance with the International Erosion Control Association's *Best Practice Erosion and Sediment Control* (IECA, 2008). The ESCPs will include the following procedures and protocols relevant to potential impacts on water quality values:
		▸ Soil/land conservation objectives for the Project
		▸ Management of problem soils, such as:
		  ▸ Acid sulfate soils, which may occur in proximity to water storages
		  ▸ Erosive or dispersive soils, such as sodosols that are expected to be encountered at approximately Ch 62.0 km to Ch 70.0 km (associated with Grandchester)
		  ▸ Cracking clays (vertosols) that are expected to be encountered in the disturbance footprint associated with the alignment in proximity of Forest Hill and Laidley (principally associated with waterways)
		  ▸ Saline soils, particularly in high salinity hazard areas.
		Specification of the type and location of erosion and sediment controls. The erosion and sediment control measures will be reviewed by a CPESC and be in accordance with the International Erosion Control Association's *Best Practice Erosion and Sediment Control* (IECA, 2008).
		A Project Soil Management Plan that will include location-specific temporary/permanent erosion and sediment control measures, such as:
		▸ Sediment retention basins (six included in the design)
		▸ Scour protection (included in the design)
		▸ Sediment fencing
		▸ Berms and other surface flow redirection through disturbance areas.

Delivery phase	Aspect	Proposed mitigation measures
Pre-construction (continued)	Erosion and sediment control (water quality related)(continued)	Nomination of location-specific erosion controls will include consideration of site conditions, proximity to environmental receptors, adjoining land uses, and climatic and seasonal factors, and will be based on an erosion risk assessment. Minimise the area of disturbance during each stage to that required to enable the safe construction, operation and maintenance of the rail corridor. Scheduling and management of works in areas proximal to waterways (as risk water quality receptors) with consideration to periods of higher rainfall (summer months), where practical. Establish and specify the monitoring and performance objectives for handover on completion of construction. Stockpiling and management/segregation of topsoil where it contains native plants seedbank or weed material. Vehicle, machinery and imported fill hygiene protocols and documentation, in accordance with the requirements of the *Biosecurity Act 2014* (Qld). Requirements for training, inspections, corrective actions, notification and classification of environmental incidents, record keeping, monitoring and performance objectives for handover on completion of construction. The ESCPs are to include a process for site-and activity-specific preparation when forecasted large- or high-intensity wet weather events are predicted. This will include removing plant and equipment out of riparian zones, stabilising/covering live work areas, additional application of soil binders/veneers and pre-event treatment and dewatering of sediment basins.
	Water quality	Review and adjust (as required) the surface water monitoring framework and develop the water quality monitoring program as part of the Surface Water Sub-plan of the CEMP, with reference to the baseline (representative background) monitoring dataset. Dewatering/extraction of water from artificial impoundments will be undertaken after consultation with relevant stakeholders. To the extent possible and where required, stage Project works to use dewatered artificial impoundments to reduce external water requirements. Dewatering strategies will be required to comply with the *Biosecurity Act 2014* (Qld) to take reasonable measure to avoid the spread of pest species (with capacity to affect water quality). Undertake site inspections before the construction of cuts, including visual examination of surface outcrops for sulfide minerals or evidence of sulfide mineralisation. Use the information from these inspections to inform the management of potential Acid Rock Drainage (ARD) from cuttings prior to Project works. If ARD-contaminated discharge water is found to be generated from the deep cuts, this water will be impounded in ponds and neutralised via treatment (hydrated lime or dilution or similar) prior to release into the surrounding catchment or other discharge mechanism. Identification and/or reuse of contaminated, hazardous or potentially contaminated material on site (i.e. soil, ballast) will be subject to a risk assessment and managed accordingly.
	Hydrology and flooding	Impacts will be determined at all drainage structures and waterways affected by Project works. Afflux must be calculated. The change in flood levels and impacts on infrastructure and properties outside the Project disturbance footprint will be justified for a range of events up to and including the 1% AEP event. Construction works must not cause adverse flooding impacts to private land or public infrastructure.

Delivery phase	Aspect	Proposed mitigation measures
Construction and commissioning	Erosion and sediment control	Clearing extents are limited to the disturbance footprint, and clearing is scheduled to minimise the exposure time of unprotected materials to prevent sedimentation of receiving waterways. Appropriate erosion and sediment control measures will be implemented for each stage or element of the Project works, in accordance with the progressive revisions of the ESCPs that are reviewed by a CPESC in accordance with the International Erosion Control Association's *Best Practice Erosion and Sediment Control* (IECA, 2008). Stages/elements are expected to include (but not be limited to): ▸ Vegetation clearing and grubbing ▸ Temporary access tracks and/or temporary waterway crossings ▸ Early installation of stormwater drainage and clean water catch drains to divert clean water flows through/around the construction site ▸ Bulk earthworks and interim topography changes ▸ Waterway diversions (as required for the western portal of the Little Liverpool Range tunnel and realignment of an unmapped tributary of Western Creek) ▸ Bridge and culvert works ▸ Ballast placement ▸ Reinstatement activities ▸ Rehabilitation and landscape activities. Temporary waterway crossings are rehabilitated in accordance with the Reinstatement and Rehabilitation Plan. Where practical and/or in accordance with specific flora and fauna management plans, vegetation clearing, and ground disturbing works will be staged sequentially across the Project to minimise areas exposed to erosion and sediment risk of receiving waterways and drainage lines in accordance with the general environmental duty of the *Environmental Protection Act 1994* (Qld).
	Water quality	Implementation of the Surface Water Sub-plan. The surface water monitoring framework will include the relevant water quality objectives, parameters, and criteria, and specific monitoring locations, frequency and duration identified in consultation with relevant regulators to reduce impacts to surface water quality. To the extent possible, schedule works to utilise dewatered artificial impoundments along the disturbance footprint to reduce external water requirements. Dewatering strategies will be required to comply with the *Biosecurity Act 2014* (Qld) to take reasonable measure to avoid the spread of pest species, with capacity to affect water quality. If water quality objectives cannot be achieved for waters to be released, alternate treatment/disposal options will be implemented prior to release or re-use. Water will need to meet the established water quality objectives for receiving waterways before being released/discharged into local waterways. Water that does not comply with relevant water quality objectives will either be: ▸ Treated onsite to enable discharge ▸ Used for construction water purposes that is not quality dependent, if safe to do so and adequate environmental controls are in place ▸ Removed from site for disposal at an appropriately licensed facility. Bulk storage areas for dangerous goods and hazardous materials will be located away from areas of social and environmental receptors such that offsite impacts or risks from any foreseeable hazard scenario will not exceed the dangerous dose for the defined land use zone, i.e. either sensitive, commercial/community, or industrial, in accordance with the intent of the State Planning Policy.

Delivery phase	Aspect	Proposed mitigation measures
Construction and commissioning (continued)	Water quality (continued)	Appropriate register and records of chemicals, hydrocarbons and hazardous substances and materials onsite will be maintained up-to-date as required by the CEMP. Where appropriate, this should include a relevant risk assessment prior to the substance coming to, and being used onsite, plus a dangerous goods manifest and SDS Register. Licensed transporters operating in compliance with Australian Code for the Transport of Dangerous Goods by Road & Rail will be utilised for the transportation of dangerous goods. Chemicals stored and handled as part of construction activities will be managed in accordance with: ▸ *Work Health and Safety Act 2011* (Qld) and Regulation ▸ AS 2187:1998 *Explosives—storage, transport and use* (Standards Australia, 1998) ▸ AS 1940:2017 *Storage and Handling of Flammable and Combustible Liquids* (Standards Australia, 2017) ▸ AS 3780:2008 *The Storage and Handling of Corrosive Substances* (Standards Australia, 2008) ▸ Requirements of chemical SDSs ▸ Any relevant ERA conditions. Procedures will be established for safe and effective fuel, oil and chemical storage and handling. This includes storing these materials within roofed, bunded areas. The bunding will have floors and walls that are lined with an impermeable material to prevent leaching and spills. Construction tasks will be scheduled to avoid, where possible, bulk earthwork activities within the 1% AEP during periods of elevated flood risk. Where works cannot be scheduled outside of this time period, activity-specific flood readiness and response planning will be required. This planning will be developed in consultation with the relevant local council and QFES. Laydown areas and other construction facilities that are located within the 1% AEP will be temporary. Their planning and function in supporting construction will reflect the local flood risk. For example, hazardous goods will not be bulk stored in these locations. Mobile plant will not be stored in the 1% AEP when not scheduled to be in use for construction purposes. Plant maintenance and refuelling will be carried out with appropriate interception measures in place to avoid impacts to waterways, aquatic habitats and groundwater. Appropriate spill control materials including booms and absorbent materials will always be onsite at refuelling facilities. Appropriate waste bins will be in laydown areas to facilitate segregation and suitable containment of waste materials.
	Construction water	The extraction of water will occur in accordance with licenses, approvals and/or agreements. Volume monitoring during extraction will be required for each source point, with extraction logs maintained. Extraction reporting will occur, as required, in accordance with requirements of relevant licenses, approvals and/or agreements obtained to cover this activity.
	Waterways	Maintenance activities and refuelling will be carried out at an appropriate distance from riparian vegetation and waterways, with appropriate measures in place to avoid impacts to surface water quality. Where this is not achievable due to type of activities (e.g. piling activities within a riparian zone), additional mitigation measures will be implemented to prevent impacts on water quality. Appropriate selection and use of aquatic-friendly pesticides.
	Hydrology and flooding	Inspection of cross drainage structures to verify placement, structural integrity and confirm expected performance.

23.13.6.4 Monitoring

A surface water monitoring framework will be developed as part of the CEMP. It will identify monitoring locations at discharge points, and selected locations in watercourses where works are being undertaken. Monitoring will be undertaken as close as possible to the proposed discharge points of the Project to the receiving waters. The sampling locations will be representative of where the site discharge mixes with the receiving waters. Upstream and downstream samples will be taken. The surface water monitoring framework will include the relevant water quality objectives, parameters and criteria. Specific monitoring locations, frequency and duration will be established as per the water quality monitoring program.

Rainfall and weather monitoring and recording will also be undertaken across the Project disturbance footprint for input into mitigation measures and reporting throughout the Project.

Monitoring and reporting on compliance with the mitigation measures identified in this draft Outline EMP Sub-plan will be captured in the processes identified above in Section 23.8.

23.13.7 Groundwater

23.13.7.1 Environmental outcomes

Groundwater inflow to Project works, including the Little Liverpool Range tunnel, cuttings and excavations, is minimised.

Project works do not adversely impact groundwater quality.

Project works are designed to minimise the use of, and impacts on, groundwater resources and existing users.

23.13.7.2 Performance criteria

- Contamination of groundwater by construction materials is avoided.
- Risks associated with dewatering (i.e. water table lowering) and environmental management requirements during construction are identified through appropriate baseline groundwater monitoring and analysis prior to commencement of Project works.

23.13.7.3 Proposed mitigation measures

Relevant environmental aspects and proposed mitigation and management measures for the detailed design, pre-construction and construction and commissioning phases of the Project are included in Table 23.11.

TABLE 23.11: MITIGATION MEASURES—GROUNDWATER

Delivery phase	Aspect	Proposed mitigation measures
Detail design	Water resources	Undertake additional investigations and assessment of potential drainage/dewatering impacts associated with the Little Liverpool Range tunnel, portals, and deep cut sections to refine current understanding and inform detailed design, verify potential impacts and ensure proposed mitigation measures are appropriate. Refine seepage analysis for deep cuts to inform detail design (for example drainage blanket specifications, shotcrete and weep hole specifications). Review the proposed groundwater monitoring network to ensure locations are accessible during pre-construction, construction, and commissioning and operation of the Project. Continue collection of baseline groundwater monitoring data (levels and quality) to confirm seasonal variation and inform detail design and the development of the final Groundwater Management and Monitoring Program (GMMP). Include monitoring at any additional bores identified during the development of the GMMP prior to construction and operation. Engage with relevant landowners to confirm the location of existing bores, identification/confirmation of new monitoring bore locations and/or unregistered bores and procure access agreements to existing registered groundwater bores included in the GMMP. Confirm (i.e. physical survey or ground truth) the location of registered and unregistered bores that may be lost due to construction or operation of the Project. Where a groundwater bore is expected to be decommissioned or have access to it impaired as result of the Project, reasonable options and potential and make-good arrangements will be agreed, where feasible, in consultation with the potentially affected landowner. These measures could include: ▸ provision of an alternate water supply/new bore ▸ changing the bore pump so that it is better suited to the decreased water level in the bore ▸ deepening the bore to allow it to tap a deeper part of the aquifer ▸ reconditioning of the water bore to improve its hydraulic efficiency ▸ Monitoring of the bore water levels and efficiency to provide a level of confidence to the landowner that the impacts are being effectively managed. Undertake ground 'truthing' of identified potential aquatic and terrestrial groundwater dependent ecosystems (GDEs) within the groundwater study area that can potentially be impacted by the Project and confirm their status. Confirm sources for construction water requirements via consultation with relevant stakeholders (including landowners/occupants) prior to construction. Appropriate approvals and agreements will be sought for the extraction of water. Where private water sources are used for construction, monitoring will be undertaken during extraction to ensure volumes and conditions stipulated by licence requirements and/or private landowner agreements are met.
	Water quality	Undertake detailed geotechnical investigations at deep-cut sections to inform design and location-specific construction management of groundwater. Risks associated with dewatering (i.e. water table lowering) and environmental management requirements during construction will be identified through appropriate baseline groundwater monitoring, modelling, and analysis.
Pre-construction	Water resources	Continue collection of baseline groundwater monitoring data (levels and quality) to confirm seasonal variation and inform detail design and the development of the GMMP. Include monitoring at any additional bores identified during the development of the GMMP to establish a comprehensive monitoring regime prior to construction and operation.
	Water quality	Undertake site inspections before the construction of cuts, including visual examination of surface outcrops for sulfide minerals or evidence of sulfide mineralisation. Utilise the information from these inspections to inform the management of potential ARD from cuttings prior to Project works.

Delivery phase	Aspect	Proposed mitigation measures
Construction and commissioning	Water resources	Implement the CEMP and the construction phase GMMP with appropriate groundwater level-and quality-monitoring criteria based on the baseline groundwater monitoring, modelling, analysis, and regulatory requirements; with make-good arrangements with the owners of groundwater bores as necessary. Opportunities to re-use or recycle groundwater resultant from tunnel and cuttings, where encountered, will be identified and implemented where feasible during construction.
	Water quality	Vehicle and plant maintenance will be undertaken in suitable bunded hardstand areas, to minimise the risk of contaminants from incidental spills or leaks from entering aquifers via infiltration or surface runoff. Mobile plant, drill rigs and equipment will be maintained in accordance with manufacturers' requirements and inspected frequently to minimise breakdowns and decrease the risk of contamination. Personnel involved in ground-disturbing works will be made familiar with hazardous spill management procedures. Spill kits will be available at all work fronts and laydown areas in the event of a spill or leak. All vehicles and machinery will have dedicated spill kits. These refuelling locations will be equipped with onsite chemical and hydrocarbon absorbent socks/booms and spill kits. Chemical and dangerous goods storage areas will be in appropriately designed facilities, such as bunded areas, sealed or lined surfaces, hardstand areas, or storage within containers. Storage of chemicals, oils, fluids and other hazardous substances will be in accordance with the appropriate safety data sheets and relevant Australian Standards. These measures will minimise the risk of contaminants from incidental spills or leaks from entering aquifers via infiltration or surface runoff. Where possible, laydown areas and storage areas will be located away from creeks, rivers and sensitive receptors such as existing groundwater bores or known GDEs. Imported fill material will be clean, certified contaminant free and be required to comply with regulatory guidelines for the intended use. Material won from site will be tested and assessed for suitability prior to use within proximity to potential groundwater infiltration sites. Any excavated material which is suspected to contain sulfides will be stockpiled, lined and covered and managed to minimise rainfall infiltration and leaching. Where possible, treatment and onsite reuse would be preferred to offsite disposal. A case-by-case assessment of the suitability of material for treatment and reuse will be undertaken. Routine sampling of discharge waters from the deep cuts intersecting groundwater will be undertaken to assess the potential for ARD processes taking place. Screening of the seepage water onsite for pH (trending down) and EC (trending up) and comparison to the baseline groundwater monitoring program results/trends will allow for indication of ARD processes. Further laboratory analyses for the key analytes pH, Total Dissolved Solids (TDS), Electrical Conductivity (EC), Total Suspended Solids (TSS), alkalinity, and dissolved metals will validate the presence or absence of ARD potential. If ARD-contaminated discharge water is found to be generated from the deep cuts, this water will need to be impounded in ponds and neutralised via treatment with hydrated lime or dilution prior to release into the surrounding catchment or other discharge mechanism. Implement the construction GMMP. Any groundwater supply or monitoring bores that are decommissioned will be in accordance with the *Minimum Construction Requirements for Water Bores in Australia—Edition 3* (National Uniform Drillers Licensing Committee, 2012).

23.13.7.4 Monitoring

Continue collection of groundwater baseline data (levels and quality) to further inform the dataset to be incorporated into the GMMP.

Implementation and adherence to the CEMP GMMP with appropriate groundwater level and quality monitoring criterion based on the baseline groundwater monitoring, modelling, analysis and regulatory requirements. Reasonable options and potential make-good arrangements will be agreed, where feasible, in consultation with the owners of the potentially affected groundwater bores as necessary.

Routine sampling of discharge waters from the deep cuts intersecting groundwater will be undertaken during construction to assess the potential for ARD processes taking place. Screening of the seepage water onsite for pH (trending down) and EC (trending up) and comparison to the baseline groundwater monitoring program results/trends will allow for indication of ARD processes. Further laboratory analyses for the key analytes pH, TDS, EC, TSS, alkalinity, and dissolved metals will validate the presence or absence of ARD potential.

Requirements for monitoring during the operational phase will be established during detailed design. Monitoring and reporting on compliance with the mitigation measures identified in this draft Outline EMP Sub-plan will be captured in the processes identified above in Section 23.8.

23.13.8 Noise and vibration

23.13.8.1 Environmental outcomes

Project works are designed, planned and implemented to maintain:

- Human health and wellbeing with respect to noise and vibration, to the extent reasonable and practicable
- Daily patterns of activity, and to minimise sleep disturbance at night.

Project works are managed to avoid vibration-related structural damage on all properties.

23.13.8.2 Performance criteria

Project works:

- Aim to not exceed noise levels to achieve the goals presented in Table 23.12 at a sensitive receptor, measured in accordance with Section 5 of DTMR *Code of Practice (CoP) Volume (Vol) 2* (DTMR, 2015a), to the extent reasonable and practicable.
  - Although the below-standard hours are not consistent with the *CoP Vol 2* (DTMR, 2015a), ARTC is seeking to strike a balance between maintaining a reasonable amenity, and cost and program implications
  - In some cases, extended construction hours that limit the overall duration of construction will be a mitigation measure
- Aim to not exceed the following airblast limits:
  - Airblast overpressure:
    - 115 dB (Lin) Peak for 9 out of any 10 consecutive blasts
    - 120 dB (Lin) Peak for any blast
- Are designed, planned and implemented to achieve the:
  - Blasting ground vibration criteria in Table 23.14 to the extent reasonable and practicable.
  - Vibration goals in Table 23.15, Table 23.16, Table 23.17 and Table 23.18, at an existing sensitive receptor, to the extent reasonable and practicable.

TABLE 23.12: CONSTRUCTION NOISE GOALS (EXTERNAL)

	External noise level $L_{Aeq,adj,15min}$ [4,5] dBA			
Work period	**Lower limit**	**Upper limit**[6]		
Proposed standard hours **Monday to Friday** 6.30 am to 6.00 pm **Saturday** 6.30 am to 1.00 pm No work on Sundays or public holidays	RBL + 10[1,2,3] Minimum 50 dBA Maximum 75 dBA	75 where RBL > 55 dBA	70 where 40 dBA < RBL ⩽ 55 dBA	65 where RBL ⩽ 40 dBA
Non-standard hours	RBL + 5 Minimum 45 dBA	RBL + 5		

Source: CoP Vol 2 (DTMR, 2015a)

Table notes:

1. RBL + 5 dBA should be considered where a facility, equipment and long-term earthworks are required in an area for greater than six months.
2. Where the lower limit value exceeds the upper limit value, the lower limit value is taken to equal the upper limit value.
3. Minimum lower limit is 50 dBA for standard hours and 45 dBA for non-standard hours. A maximum lower limit of 75 dBA applies to non-standard hours.
4. Noise contribution from construction activity determined as the component level.
5. The noise level from construction includes adjustment factors in Table 23.13 (for example, low frequency noise, impulsivity, tonality, intermittency and modulation).
6. For a single short event in a 24-hour period, the upper limit may be increased by:
   a. for standard hours: (i) 2 dBA for event of 6 minutes to 15 minutes; (ii) 10 dBA for event of 1.5 minutes to 6 minutes; and, (iii) 15 dBA for event of less than 1.5 minutes.
   b. for non-standard hours: (i) 5 dBA for event of less than 1.5 minutes.

TABLE 23.13: ADJUSTMENT FACTORS

Table Factor	Assessment/ measurement	When to apply	Correction	Comments
Tonal noise	1/3 octave or narrow band analysis	Level of 1/3 octave band exceeds the level of the adjacent bands on both sides by: ▸ 5 dB or more if the centre frequency of the band containing the tone is above 400 Hz. ▸ 8 dB or more if the centre frequency of the band containing the tone is 160 to 400 Hz inclusive. ▸ 15 dB or more if the centre frequency of the band containing the tone is below 160 Hz.	5 dB	Narrow-band frequency analysis may be required to precisely detect presence of tonality
Low-frequency noise	Measurement of C-weighted and A-weighted level	Measure/assess C-weighted and A-weighted frequency levels over the same time period Correction to be applied if the difference between the two levels is 15 dB or more	5 dB	C-weighting is designed to be more responsive to low-frequency noise. All noise energy down to 10 Hz is to be considered
Impulsive noise	A-weighted fast response and impulse (I) response or C-weighted for low frequency noise	If difference in A-weighted maximum noise levels between fast response and impulse response is greater than 2 dB If difference in C-weighted maximum noise levels between fast response and impulse response is greater than 2 dB for low frequency noise	Apply difference in measured levels as the correction, up to a maximum of 5 dB	Impulse response is defined by a short rise time of 35 milliseconds (ms) and decay time of 1.5 s

Table Factor	Assessment/ measurement	When to apply	Correction	Comments
Intermittent/ modulating noise	Measurement of difference between L_{A10} and L_{A90}, average difference between short term samples, or subjectively assessed	Difference between L_{A10} and L_{A90} exceeds 5 dB repeatedly for a characteristic averaging period (for example, 10 seconds) for intermittent sources Average difference between measured L_{Aeq} levels exceeds 5 dB for a characteristic sampling frequency (for example, 10 Hz) for rapidly varying source Subjectively annoying for a combination not easily characterised	5 dB	Adjustment to be applied for night-time only.
Maximum adjustment	Refer to individual modifying factors	Where two or more adjustment factors are indicated	Maximum correction of 10 dBA	-

Source: CoP Vol 2 (DTMR, 2015a)

TABLE 23.14: BLASTING GROUND VIBRATION GOALS

Category	Human comfort	Structural damage
Sensitive structures (e.g. residential, theatres, schools)	5 mm/s for 95 per cent blasts per year and 10 mm/s maximum unless agreement is reached with the occupier that a higher limit may apply.	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above
Occupied non-sensitive structures of reinforced concrete or steel construction (e.g. factories and commercial premises)	25 mm/s maximum unless agreement is reached with the occupier that a higher limit may apply. For sites containing equipment sensitive to vibration, the vibration will be kept below manufacture's specifications or levels that can be shown to adversely affect the equipment operation.	50 mm/s maximum unless agreement is reached with the occupier that a higher limit may apply
Occupied non-sensitive structures that include masonry, plaster and plasterboard in their construction (e.g. factories and commercial premises)	25 mm/s maximum unless agreement is reached with the occupier that a higher limit may apply. For sites containing equipment sensitive to vibration, the vibration will be kept below manufacturers' specifications or levels that can be shown to adversely affect the equipment operation.	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above
Unoccupied non-sensitive structures of reinforced concrete or steel construction (e.g. factories and commercial premises)	N/A	50 mm/s maximum unless agreement is reached with the occupier that a higher limit may apply
Unoccupied non-sensitive structures that include masonry, plaster and plasterboard in their construction	N/A	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above
Buildings of special value or significance (may include historical buildings, monuments)	2 mm/s	N/A

Source: AS 2187.2 (Standards Australia, 2006)

TABLE 23.15: STRUCTURAL DAMAGE LONG-TERM CONSTRUCTION VIBRATION GOALS

Group	Type of structure	Peak Particle Velocity (PPV) in mm/s of vibration in horizontal plane of highest floor, at all frequencies
1	Buildings used for commercial purposes, industrial buildings and buildings of similar design	10
2	Dwellings and buildings of similar design and/or use (i.e. residential)	5
3	Structures that, because of their sensitivity to vibration, cannot be classified under Group 1 or Group 2 and are of great intrinsic value (e.g. listed buildings under preservation order)	2.5

Source: DIN 4150.3 (Deutsches Institut für Normung, 1999)

TABLE 23.16: STRUCTURAL DAMAGE SHORT-TERM CONSTRUCTION VIBRATION GOALS

		PPV in mm/s		
		Frequency at building foundation		
Group	Type of structure	1 to 10 Hz	10 to 50 Hz	50 to 100 Hz[1]
1	Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50
2	Dwellings and buildings of similar design and/or use (i.e. residential)	5	5 to 15	15 to 20
3	Structures that because of their sensitivity to vibration, do not correspond to those listed in Group 1 or Group 2 and have intrinsic value (e.g. heritage-listed)	3	3 to 8	8 to 10

Source: DIN 4150.3 (Deutsches Institut für Normung, 1999)

Table notes:
Frequency (f) is the repetition rate of the cycle measured in Hertz (Hz). The frequency corresponds to the pitch of the sound. A high frequency corresponds to a high-pitched sound and a low frequency to a low-pitched sound.

For frequencies above 100 Hz, the higher values in the 50 to 100 Hz column should be used.

TABLE 23.17: HUMAN COMFORT CONSTRUCTION VIBRATION GOALS

		Resultant PPV (mm/s), at all frequencies	
Building	Work period[1]	Lower limit	Upper limit
Dwellings (including hotels and motels)	Standard hours	1.0	2.0
	Non-standard hours	0.3	1.0
Medical/health buildings (wards, surgeries, operating theatres, consulting rooms)	All	0.3	1.0
Educational facilities (rooms designated for teaching purposes)	While in use		
Court of law (court rooms)			
Court of law (court reporting and transcript areas, judges' chambers)			
Community buildings (libraries, places of worship)	While in use	1.0	2.0
Commercial (offices) and retail areas			

Source: DIN 4150.3 (Deutsches Institut für Normung, 1999)

Table note:

1. Work periods are defined as per Table 23.12

TABLE 23.18: SHORT-TERM CONSTRUCTION VIBRATION GOALS ON BURIED PIPEWORK

Line	Pipe material	Guideline values for velocity (mm/s), measured on the pipe [1]
1	Steel (including welded pipes)	100
2	Clay, concrete, reinforced concrete, pre-stressed concrete, metal (with or without flange)	80
3	Masonry, plastic	50

Source: DIN 4150.3 (Deutsches Institut für Normung, 1999)

Table note:

1. When assessing long-term vibration impacts the values presented are to be divided by two

23.13.8.3 Proposed mitigation measures

Relevant environmental aspects and proposed mitigation and management measures for the detailed design, pre-construction and construction and commissioning phases of the Project are included in Table 23.19.

TABLE 23.19: MITIGATION MEASURES—NOISE AND VIBRATION

Delivery phase	Aspect	Mitigation and management measures
Detailed design	Noise and vibration impacts on sensitive receptors	Avoid/minimise impacts on nearby sensitive receptors during detailed design. Update the construction noise and vibration assessment to reflect/inform the final location of construction sites, construction activities and construction scheduling to inform the development of the Construction Noise and Vibration Management Plan to achieve the performance criteria and inform the Construction Noise and Vibration Management Plan.
	Operational railway noise and vibration impacts on sensitive receptors	Review and, if necessary, update the operational railway noise and vibration assessment to reflect/inform the detailed design, including incorporation of potential noise or vibration treatments. The following treatments will be considered as part of detailed design: ▸ Source controls—mitigation measures applied to the railway infrastructure to control the emission of noise and vibration at its source. Measures can include rail dampers, track lubrication (for control of curving noise), identification of rollingstock causing discrete high noise events or lower noise emission alarm bells ▸ Pathway controls—measures to impede and limit the propagation of railway noise to the sensitive receptors and typically constructed within the rail corridor. Measures can include railway noise barriers,-low height noise barriers or earth mounding ▸ Receptor controls—measures to mitigate noise and vibration levels or manage potential noise and vibration impacts at the sensitive receptor properties and land-uses. Measures can include; architectural acoustic treatment of property, property construction/relocation, upgrades to existing property fencing or negotiated agreement with landowners. The vibration assessment will identify building condition survey requirements at vibration-sensitive receptors that are expected to exceed the structural damage vibration limits given by DIN 4150.3 (Deutsches Institut für Normung, 1999) and recommended by the CoP Vol 2 (DTMR, 2015a) (or other suitable standard/guideline). The vibration assessment will include consideration of: ▸ Buildings/structures that will remain near the Project works ▸ Other vibration-sensitive receptors (including buildings/structures of heritage value).
	Operational road traffic noise impacts on sensitive receptors	Review/update the operational road traffic noise to reflect/inform the detailed design, including incorporation of potential noise treatments. The following mitigation measures will be considered as part of detailed design where operational road traffic noise impacts are predicted to exceed adopted road traffic noise goals: ▸ Pavement surface treatment ▸ Provision of acoustic façade treatments to affected sensitive receptors ▸ Noise transmission control in the form of a landscaped earth mound and/or a noise transmission treatment to affected sensitive receptors. A combination of mitigation measures may be appropriate.
	Operational fixed infrastructure noise impacts on sensitive receptors	Noise from fixed infrastructure is predicted to exceed established acoustic quality objectives (Environmental Protection (Noise) Policy, 2019) at the closest existing sensitive receptors. Mitigation is expected to be required. Indicative mitigation proposed consists of sound absorption linings (Noise Reduction Coefficient of 0.85, covering a minimum area of 150 m^2) in plenums and attenuators. Mitigation has been identified to achieve compliance and this information has been included in the reference design. This mitigation will also need to be reviewed and audited (where appropriate) during future stages of the Project to confirm compliance is achieved.

Delivery phase	Aspect	Mitigation and management measures
Pre-construction	Noise and vibration impacts on sensitive receptors	Develop and implement a Construction Noise and Vibration Management Plan, under the CEMP. The Construction Noise and Vibration Management Plan will include: ▸ Location of sensitive receptors in proximity to the disturbance footprint ▸ Requirements for pre-construction dilapidation surveys and/ or vibration monitoring at vibration sensitive receptors during construction ▸ Specific management measures for activities that could exceed the construction noise and vibration criteria at a sensitive receptor ▸ Notification process within the community engagement plan (including who to contact in the event of a complaint) to advise of significant works with potential for noise nuisance or vibration at sensitive receptors. Noise management measures including controlling noise and vibration at the source, controlling noise and vibration on the source to receptor transmission path and controlling noise and vibration at the sensitive receptor. Practicable and reasonable measures to minimise the noise and vibration impacts of construction activities on sensitive receptors Any other measures necessary to comply with conditions of approval or regulatory requirements. Where it is found that existing mitigation measures are insufficient to reduce noise and vibration impacts to acceptable levels, additional mitigation measures will be investigated and implemented, including consultation with affected sensitive receptors.
Construction and commissioning	Noise and vibration impacts on sensitive receptors	Sensitive receptors identified in the Construction Noise and Vibration Management Plan, as well as residents within at least 2 km of the Project disturbance footprint and other relevant stakeholders will be provided with enough information to enable them to understand the likely nature, extent and duration of noise and vibration impacts during construction. Sensitive receptors with the potential to be affected by noise will be notified prior to the commencement of relevant works. Construction progress and upcoming activities will be regularly communicated to residents/stakeholders, particularly when noisy or vibration-generating activities are planned, such as vibratory compaction and piling.
	Damage to buildings and structures	Building condition/dilapidation surveys will be undertaken for vibration-sensitive receptors identified as potentially exposed to vibration impacts from the Project works during the detailed design phase modelling and assessment. Surveys are to take place prior to commencement and on completion of vibration-generating works (such as pile-driving). Following such surveys, more accurate data may be used to assess the impacts to vibration-sensitive receptors. If, during detailed design and construction methodology refinement, vibration impacts are predicted to exceed recommended goals at a heritage sensitive receptor, the following mitigation will be undertaken: ▸ Consultation with the owner of the structure to determine the sensitivity of the structure to construction vibration. A more appropriate goal to be applied at the location may be agreed upon as a result ▸ Baseline vibration monitoring will be undertaken prior to the activity commencing and monitored and audited (where appropriate) throughout the activity to assess compliance with vibration limits set as part of the Construction Noise and Vibration Management Plan for the relevant receptor. Vibration monitoring results are to be assessed and used to refine vibration predictions and management measures as applicable, such as developing and enforcing exclusion zones around the sensitive structure or implementing appropriate remediation measures. Where reasonable and practicable, modify the construction methodology to reduce the predicted vibration impacts. This could include: ▸ Using smaller equipment, such as a handheld jackhammer instead of a rock-breaker ▸ Changing the construction methodology. Vibration monitoring will be undertaken at locations where the potential for building/structural damage risk has been identified during the detailed design and is warranted. This includes vibration sensitive receptors at which vibration impacts are expected to exceed the structural damage goals. Vibration monitoring will be undertaken by a suitably qualified professional.

Delivery phase	Aspect	Mitigation and management measures
Construction and commissioning (continued)	Noise impacts on sensitive receptors	Where practicable and feasible, noise monitoring will be undertaken at noise sensitive receptors where the potential for noise impacts to exceed relevant goals has been identified. Noise and/or vibration monitoring will also be undertaken in response to noise or vibration complaints, where required or deemed necessary.
	Noise impacts on sensitive receptors —hours of work	Project works will be undertaken in accordance with the nominated hours of work within the Construction Noise and Vibration Management Plan and as per advice to stakeholders and sensitive receptors regarding permitted out-of-hours activities.
	Noise impacts on sensitive receptors —staff	Staff training is to be undertaken so that unnecessary noise emissions are avoided. Training must enforce that: ▸ Unnecessary shouting or loud stereos/radios onsite are not tolerated ▸ Materials are not to be dropped from height ▸ Metal items are not thrown ▸ Doors/gates are not slammed ▸ Vehicle radios and engines will be turned off or volume lowered wherever possible.
	Noise and vibration impacts on sensitive receptors—selection of construction equipment near sensitive receptors	Quieter and non-vibratory construction equipment will be selected for use near sensitive receptors, where feasible and reasonable. This is particularly important for any non-standard/out of hours construction activities where sensitive receptors are nearby. This is also particularly important for loud and/or vibration-intensive plant such as mulchers and piling rigs. Appropriately sized equipment is to be selected for the task, such as vibratory compactors and rock excavation equipment. For example, a 22-tonne excavator is expected to operate 8 dBA quieter than a 40-tonne excavator, based on equipment noise emissions given by BS5228.1 (British Standards, 2009a).
	Noise and vibration impacts on sensitive receptors—selection of construction methods near sensitive receptors	Where reasonable and practicable, alternative construction methods will be adopted to reduce the noise and vibration impacts in the vicinity of sensitive receptors, such as: ▸ Using damped tips on rock-breakers where appropriate ▸ Using rock saws instead of blasting ▸ During clearing, using excavators with grabs and rake attachments instead of chainsaws; and mulching cleared material at locations away from sensitive receptors ▸ Avoiding onsite fabrication work, where possible ▸ Using alternatives to impact pile-driving where possible, such as continuous flight auger injected piles, pressed-in preformed piles, auger bored piles, impact bored piles or vibratory piles ▸ When piling, avoiding dynamic compaction using large tamping weights near sensitive and critical receptors where possible ▸ Reducing energy per blow when piling (consider first whether this may result in prolonged exposure with no realised reduction in community disturbance).
	Noise and vibration impacts on sensitive receptors—blasting	Where blasting impacts are expected to exceed the adopted vibration limits, the following measures are to be implemented where reasonable and practicable: ▸ Reducing the charge size by use of delays and reduced charge masses ▸ Ensuring adequate blast confinement to minimise the amount of overpressure ▸ Avoiding secondary blasting where possible; the use of rock-breakers or drop hammers may be an acceptable alternative ▸ Minimising blasting during heavy cloud cover or during strong winds blowing towards sensitive receptors ▸ Establishing a blasting timetable through community consultation for example, blasts times negotiated with surrounding sensitive receptors.

Delivery phase	Aspect	Mitigation and management measures
Construction and commissioning (continued)	Noise and vibration impacts on sensitive receptors—during hours of construction	Where reasonable and practicable, the duration of simultaneous operation of noise or vibration-intensive plant will be minimised. Plant and equipment used intermittently or no longer in use will be throttled down or shut off. Vibration-intensive stationary plant located near sensitive receptors will be isolated with resilient mounts. Noise-emitting plant and equipment, construction compounds laydown areas will be orientated away from sensitive receptors where reasonable and practicable. Equipment will be operated in the correct manner and correctly maintained including replacement of engine covers, repair of defective silencing equipment, tightening of rattling components and repair of leakages in compressed air lines. Construction plant, vehicles and machinery will be maintained and operated in accordance with manufacturer's instructions to minimise noise and vibration emissions. When piling, the pile and rig will be carefully aligned, and cable slap and chain clink minimised.
	Noise and vibration impacts on sensitive receptors—mechanical plant management	All mechanical plant near sensitive receptors will be silenced by best practical means, such as: ▸ Internal combustion engines will be fitted with a suitable muffler in good repair, operating as per the manufacturer's specifications, as a minimum ▸ Pneumatic tools will be fitted with an effective silencer on their air exhaust port, where reasonable and practicable ▸ Aggregate bins and chutes will be lined with a rubber material, to dampen the vibration of the structure ▸ When piling, acoustic damping will be provided to sheet steel piles to reduce vibration and resonance ▸ When piling, resilient pads will be used between pile and hammerhead. Care will be taken when selecting a resilient pad as energy is transferred to the pad in the form of heat.
	Noise impacts on sensitive receptors —stationary noise sources	Stationary noise sources near noise sensitive receptors will be shielded or enclosed where reasonable and practicable. Acoustic shielding will also be considered where works are expected to occur close to sensitive receptors for lengthy periods.
	Noise and vibration impacts on sensitive receptors—shielding of noise emitting plant	Where reasonable and practicable, structures and noise-emitting plant will be located such that the structures provide some shielding to any nearby receptors. Structures include: ▸ Temporary site buildings such as sheds ▸ Materials stockpiles ▸ Fencing ▸ Storage/shipping containers. Where vibration impacts at sensitive receptors are expected to exceed the structural damage limits, and where reasonable and safe to do so, cut-off trenches to interrupt the direct transmission path of vibrations between source and receptors will be provided.
	Noise impacts on sensitive receptors	Non-tonal reversing beepers (or an equivalent mechanism) will be fitted and used on all construction vehicles and mobile plant regularly used onsite and for any out-of-hours work.
	Noise impacts on sensitive receptors —delivery of materials	Site access points and roads will be sited as far as is practicable from sensitive receptors. Acoustic shielding will be considered if loading/unloading areas are close to sensitive receptors. Delivery vehicles will be fitted with straps rather than chains where feasible. Off-site truck parking areas, if required, will be located away from residences and will be nominated where practicable. The drop height of materials will be minimised, for example, while loading and unloading vehicles or in storage areas. Reversing movements of vehicles will be minimised to reduce the use of reversing alarms. Where practicable, sites will be designed such that delivery vehicles are able to drive through the site and not be required to reverse.

Delivery phase	Aspect	Mitigation and management measures
Construction and commissioning (continued)	Noise impacts on sensitive receptors —construction traffic	Where reasonable and practicable: ▸ Unsealed areas will be regularly graded ▸ Potholes filled in sealed access roads ▸ Hardstand areas to reduce noise from construction vehicles ▸ Night-time construction traffic will be redirected away from noise sensitive receptors, in accordance with the Construction Traffic Management Plan. Appropriate construction traffic speed limits will be established and managed near noise sensitive receptors.

23.13.8.4 Monitoring

Vibration monitoring will be undertaken at locations where the potential for building/structural damage risk has been identified and deemed warranted. This includes vibration-sensitive receptors at which vibration impacts are expected to exceed the structural damage criteria recommended by DIN 4150.3 (Deutsches Institut für Normung, 1999) and recommended by the *CoP Vol 2* (DTMR, 2015a). Vibration monitoring will be undertaken by a suitably qualified professional.

Noise monitoring will be undertaken to verify compliance at locations nominated in the Construction Noise and Vibration Management Plan, and at noise-sensitive receptors with the potential for noise impacts to exceed relevant criteria.

Noise and/or vibration monitoring may also be undertaken in response to substantiated noise or vibration complaints.

Monitoring and reporting on compliance with the mitigation measures identified in this draft Outline EMP Sub-plan will be captured in the processes identified in Section 23.8.

23.13.9 Cultural heritage

23.13.9.1 Environmental outcomes

Project works that involve excavation, construction or other activities that may cause harm to Aboriginal cultural heritage will not take place unless permitted under a CHMP in accordance with the *Aboriginal Cultural Heritage Act 2003* (Qld) (CLH017009) (ACH Act).

Project works will be designed, located and undertaken to avoid or minimise impacts or disturbance of Aboriginal, historic and natural heritage items.

23.13.9.2 Performance criteria

- Comply with the approved CHMP under the ACH Act
- Provide opportunities for ARTC staff and contractors to learn about the Aboriginal cultural heritage and non-Indigenous heritage associated with delivery of Inland Rail
- Clearing extents avoid impacts to previously undisturbed areas as far as practicable
- Project works avoids direct and indirect impacts (e.g. vibration) to identified items/sites/areas of Aboriginal heritage significance, historic and natural heritage significance where practicable.

23.13.9.3 Proposed mitigation measures

Relevant aspects and proposed mitigation and management measures for the detailed design, pre-construction and construction and commissioning phases of the Project are included in Table 23.20.

TABLE 23.20: MITIGATION MEASURES—CULTURAL HERITAGE

Delivery phase	Aspect	Proposed additional mitigation measures
Detailed design	All heritage	Detailed design to: ▸ Avoid direct or indirect impacts to identified places/sites/items of Indigenous and non-Indigenous heritage significance where practicable ▸ Respond to the outcomes of any further cultural heritage surveys.
	Non-Indigenous heritage, vibration	Tailor construction methodology to limit vibration impacts. Vibration at heritage places to be kept below a target of 2.5 mm/sec (peak particle velocity) where-ever possible (with reference to DIN 4150 (Deutsches Institut für Normung, 1999).
Pre-construction	All heritage	Construction planning avoids directly impacting on identified places/sites/items of Indigenous and non-Indigenous heritage significance where practicable. If places/ sites/items cannot be avoided, photographic/archival recording of culverts/underbridges with timber components, former rail station sites and other contextual locations/structures of heritage significance will occur in accordance with outcomes of any further Project cultural heritage surveys. Artefacts will be collected prior to construction in accordance with the Heritage Management Sub-plan. The Heritage Management Sub-plan will be developed and will detail mitigation and management measures to be implemented during construction in relation to cultural heritage. It is expected to include: ▸ Requirements for site induction, training, heritage monitors, inspections, audits, corrective actions, notification and classification of environmental incidents, record keeping, monitoring and performance objectives for handover on completion of construction ▸ Heritage management actions to be undertaken by a suitably qualified person ▸ Specific requirements for cultural heritage sites/items that cannot be avoided during construction ▸ Unexpected finds procedure, including assessment by a suitably qualified person and notification obligations under the applicable legislation ▸ Procedure for encountering potential burial sites or potential human skeletal material including notification obligations under applicable legislation ▸ Any other requirements necessary to comply with conditions of approval, subsequent approvals, regulatory requirements or ARTC cultural heritage management plans/agreements.
	Vibration	Building condition/dilapidation surveys will be undertaken at all heritage structures identified during detailed design as being subject to potential vibration impacts. Surveys will occur before and after undertaking vibration generating works (e.g. pile-driving), with the potential for monitoring during the construction activities as per the Construction Noise and Vibration Management Plan. The following will be considered: ▸ Tailor construction methodology to limit vibration impacts to heritage structures ▸ Vibration at heritage places to be kept below 2.5 mm/sec (peak particle velocity) wherever possible (in accordance with DIN4150 (Deutsches Institut für Normung, 1999)) ▸ Pre-construction and post-construction condition dilapidation surveys to be undertaken at all heritage places at risk of vibration impact ▸ Vibration to be monitored at places where thresholds exceedances are possible ▸ Where vibration exceedances occur, change design/construction methodology where possible to reduce impact.
	Indigenous heritage	Cultural heritage will be managed through the approved CHMP, in accordance with the ACH Act, which includes the following management measures: ▸ A cultural heritage induction for Inland Rail project staff ▸ Developing a cultural heritage awareness program ▸ Provisions for managing unexpected finds of cultural material/sites (including burials).

Delivery phase	Aspect	Proposed additional mitigation measures
Pre-construction (continued)	Non-Indigenous built heritage	If impacts cannot be avoided, refer to following measures for built heritage impacts: ▸ Archival recording ▸▸ Undertake archival photographic recording in accordance with the Department of Environment and Heritage Protection's Guideline: *Archival Recording of Heritage Places* (DEHP, 2013b) ▸▸ Copies of archival records to be lodged with the John Oxley Library (or local libraries and/or historical societies as appropriate). ▸ Relocation ▸▸ Relocation of heritage items is generally undesirable, as setting forms an intrinsic part of heritage value (International Council on Monuments and Sites Australia, 2013). Where impacts cannot be managed in any other way, it may be appropriate to relocate buildings or items of moveable heritage to another location, such as a local historical society. The approach for any such requirements will be defined in the Heritage Management Sub-plan.
	Non-Indigenous archaeological heritage	If impacts to non-Indigenous cultural heritage places cannot be avoided, the following pre-construction measures may be implemented by suitably qualified historical archaeologists: ▸ Archaeological survey ▸▸ Undertake archaeological survey to map elements of complex sites and identify areas of possible subsurface deposit ▸ Archaeological excavation ▸▸ If warranted by results of archaeological survey, undertake a two-stage archaeological excavation: – Stage 1: test excavation to confirm subsurface deposit – Stage 2: salvage excavation of subsurface deposits (if required and if possible) ▸ Archaeological surface collection ▸▸ Collect archaeological artefacts on the ground surface ▸▸ Depending on nature of site may be undertaken in conjunction with, or in place of, excavation.
Pre-construction and construction	Indigenous heritage	Cultural heritage to be managed in accordance with the CHMP. This might include: ▸ Undertaking comprehensive cultural heritage surveys for both early works and Project activities with the Traditional Owners ▸ Undertaking archaeological survey (including excavations where necessary) ▸ Generating survey reports to provide detailed assessment and management recommendations ▸ Assessing significance of any cultural heritage ▸ Recording (where Project activities may have a direct impact on cultural heritage values). Archaeological investigations will only be undertaken by archaeologists qualified and experienced in Aboriginal heritage, in consultation with the Aboriginal Parties, in accordance with the CHMP. Monitoring (during Project activities) to ensure impacts to known cultural heritage are appropriately mitigated.

Delivery phase	Aspect	Proposed additional mitigation measures
Construction and commissioning	All heritage	Where impacts can be avoided to known Indigenous or non-Indigenous heritage, appropriate precautionary measures, such as informing relevant staff and contractors of the nature and location of the items and need to avoid impacts, detailing location onsite maps, along with temporary protective fencing and signage will be implemented for those sites within close proximity of the area of works. Works will not be performed on potential heritage items without required approvals and appropriate management plans. If a suspected Aboriginal or historical heritage item, site or Area of Interest is identified, any works that may impact the item or site will stop, and the unexpected finds procedure in the Heritage Management Sub-plan will be followed. Any responses to chance finds will only be undertaken by archaeologists qualified and experienced in the relevant discipline. In the event of the discovery of potential human remains, all work in the area will cease and the relevant statutory process for the notification and management of human remains will be instigated, in accordance with the Heritage Management Sub-plan and other relevant plans.
	Non-Indigenous built heritage	Vibration monitoring will be undertaken at vibration-sensitive receptors where the potential for building/structural damage risk is identified during the detailed design phase or as part of pre-construction building surveys. Vibration monitoring will be undertaken by a suitably qualified person, in accordance with relevant standards and guidelines. Where monitoring is required occur at a heritage structure, placement of equipment will be carried out on advice from a suitably qualified person (heritage practitioner). Any damage that occurs at heritage places as a result of vibration or other Project activity will be repaired in accordance with Burra Charter principles (Article 1.4).
	Non-Indigenous archaeological heritage	Depending on the outcome of archaeological assessments undertaken during pre-construction, ground-breaking activities may be subject to archaeological monitoring by a suitably qualified person. In the case of unexpected archaeological finds anywhere in the Project, the protocol included in the Heritage Management Sub-plan will be followed.
	Indigenous heritage	Cultural heritage values to be managed in accordance with the CHMP. This will include: ▸ Constraining of all surface disturbance to areas which have been previously surveyed for cultural heritage ▸ Establishing buffer zones around areas of heritage value that are to be retained ▸ Monitoring of ground-breaking where warranted by the presence of known or potential archaeological values. In the case of unexpected archaeological finds anywhere in the Project, the protocol included in the Heritage Management Sub-plan is to be followed. Archaeological investigations will only be undertaken by archaeologists qualified and experienced in Aboriginal heritage, in consultation with the Aboriginal Parties, in accordance with the CHMP.

23.13.9.4 Monitoring

Vibration monitoring will be required at locations where the potential for building/structural damage risk is identified, further surveys during the detailed design phase or as part of pre-construction dilapidation surveys. Vibration monitoring will be undertaken by a suitably qualified person, in accordance with relevant standards and guidelines. Where monitoring is required to occur at a heritage structure, placement of equipment will be carried out on advice from a suitably qualified person (heritage practitioner).

Monitoring and reporting on compliance with the mitigation measures identified in this draft Outline EMP Sub-plan will be captured in the processes identified in Section 23.8.

23.13.10 Traffic, transport and access

23.13.10.1 Environmental outcomes

Project construction traffic is managed to avoid or minimise and mitigate adverse impacts on road safety and traffic flow, public transport, school bus routes, property access and existing road pavements.

Workforce parking is provided within the disturbance footprint and managed to avoid, minimise and mitigate adverse impacts to the local community.

Traffic access for emergency services to construction worksites and adjoining properties and wider road network identified within the traffic impact assessment is maintained throughout the construction phase.

Reasonable access is maintained to properties throughout Project works.

23.13.10.2 Performance criteria

- Construction vehicles travel on designated routes defined in the Construction Traffic Management Plan
- Construction vehicles, including spoil haulage vehicles, are managed to avoid school zones during school pick up and drop off, and minimise the use of local roads
- Construction vehicles that are 'heavy vehicles' are managed appropriately to avoid speeding, queuing, traffic incidents and to manage and avoid over-loading, spills and safety incidents
- Information about the timing and scale of changes to traffic and transport conditions on traffic networks in the vicinity of Project works is provided in advance to the local community, road users and on request to other people interested in the Project works
- Access to private properties is maintained during construction, unless an acceptable solution is agreed with the landowner
- A Construction Traffic Management Plan will be developed and implemented by the construction contractor and communicated to all site personnel during site induction, including requirements for traffic routes and parking
- The construction workforce is provided with adequate onsite parking and use of parking is reinforced during induction and training.

23.13.10.3 Proposed mitigation measures

Relevant environmental aspects and proposed mitigation and management measures for the detailed design, pre-construction and construction and commissioning phases of the Project are included in Table 23.21.

TABLE 23.21: MITIGATION MEASURES—TRAFFIC, TRANSPORT AND ACCESS

Delivery phase	Aspect	Proposed mitigation measures
Detailed design/pre-construction	Pavement/road safety	Develop procedures for managing and responding to road impacts for the duration of the construction period in consultation with DTMR and relevant Local Government authorities. Developed procedures will be communicated to the Project consultation team for inclusion within community consultation plans. Road safety audits will be undertaken for all road designs in accordance with the Austroads guidelines (desk-top and to meet asset owner requirements). Level crossing treatments and suitability will be determined through the Inland Rail level crossing risk tool, which incorporates ALCAM (2016), to confirm the: ▸ Level of protection continues to be appropriate ▸ Infrastructure is appropriate for the traffic conditions ▸ Levels crossings are designed to provide suitable stacking and sight.
	Road network	A Construction Traffic Management Plan is to be prepared prior to construction. This plan will identify the impacts that construction traffic (including workforce commuting) is likely to have on the local transport infrastructure and road users and detail ameliorative measures required to avoid, reduce or mitigate all identified impacts of the Project. It will also establish performance criteria and monitoring requirements during construction. The Construction Traffic Management Plan will be developed in consultation with DTMR, relevant local councils and emergency services. A Road Use Management Plan (RUMP) is to be prepared and implemented for the Project, in accordance with DTMR's *Guide to Traffic Impact Assessment* (GTIA) (DTMR, 2017b). Where road realignments or closures are envisaged, traffic management requirements associated with these works will have to be included in the RUMP. This will need to include the requirements for obtaining necessary approvals and permits from relevant authorities as well as notifying the community on any changes to traffic conditions due to the Project works.
	Intersections	Construction Traffic Management Plans, traffic control plans and temporary road works including diversion and signage should be prepared prior to construction in accordance with the latest edition of the *Traffic Control at Work Sites: Technical Manual*, (Transport for NSW, 2018a) and *Australian Standard 1742.3 Manual of uniform traffic control devices—Traffic control for works on roads* (Standards Australia, 2014b). Traffic management plans will consider construction activity delivery timeframes which avoid peak hour travel conditions.
	Access	Ongoing consultation with local council/DTMR and asset owners will be undertaken to ensure proposed access arrangements are suitable.
Pre-construction	Management plans	The RMAR Strategy, Construction Traffic Management Plans and traffic control plans developed during the detailed design phase will be reviewed and updated to ensure they remains effective and appropriate to the construction works, activities and staging.
Construction and commissioning	Road safety	Temporary traffic management will be implemented, as per the Construction Traffic Management Plan. Fatigue management measures will be introduced and enforced for all workers during construction Road safety measures will be implemented taking into consideration speed restrictions, driver fatigue, in-vehicle communications, signage, demarcations, maintenance, safety checks, and interaction with public transport, transport of hazardous and dangerous goods and emergency response and disaster management. Relevant emergency services will be notified in advance prior to the movement of all hazardous/dangerous or oversize construction material and equipment. Appropriate construction traffic controls will be implemented where construction traffic is required to travel on school bus routes during pick-up and set-down times on school days. This may include limiting construction traffic at these times or installing appropriate school bus infrastructure. All over-size and/or over-mass and restricted access vehicles will comply with the *Guideline for Excess Dimension Vehicles in Queensland* Version 8 (DTMR, 2013) in terms of transport safety.

Delivery phase	Aspect	Proposed mitigation measures
Construction and commissioning (continued)	Road network and intersections	Construction Traffic Management Plans will be implemented and reviewed periodically for effectiveness by relevant stakeholders including local councils, DTMR, QPS and emergency services. Ongoing consultation with relevant local councils, DTMR, QPS, emergency services and affected landowners/occupiers to inform of project status and likely traffic disruptions and temporary road closures. Directional signage and line marking around construction sites and the surrounding network will be implemented as per Construction Traffic Management Plans, including using variable message signs (VMS) if appropriate. Relevant emergency services will be notified in advance prior to the movement of all hazardous/dangerous or oversize construction material and equipment. Secondary alternative construction routes will be determined as part of the traffic management plans, in the event of the primary route is blocked off by an emergency/accident. Construction Traffic Management Plans, traffic control plans and temporary road works will be implemented and reviewed periodically with relevant stakeholders to ensure effectiveness.
	Road–rail interface	Road safety audits will be undertaken post-construction in accordance with the *Austroads Guide to Traffic Management: Part 3 Traffic Studies and Analysis* (Austroads, 2017). Public level crossings will be assessed through ALCAM (2016) to verify the : ▸ Level of control continues to be appropriate (for example: sighting distances) ▸ Infrastructure is appropriate for the traffic conditions (for example: stacking).
	Pavement—dirt tracking/ debris management	Install rumble grids and inspection points at exits onto the sealed road from unpaved roads to reduce potential for rocks and debris transporting offsite. For Local Government roads, undertake a condition assessment prior to, and at, ongoing intervals during construction and at the conclusion of construction works in consultation with councils. Implement procedures for managing and responding to road impacts for the duration of the construction period in consultation with DTMR and relevant Local Government authorities. This may entail works such as crack sealing, pothole patching, edge repairs, resealing and grading (of gravel roads).

23.13.10.4 Monitoring

Requirements for monitoring will be documented in the Traffic, Transport and Access Sub-plan.

If traffic transport and access management conditions vary from those documented in detailed design, a review of compliance with conditions of the CEMP will be undertaken by the service provider and revised as required.

Monitoring and reporting on compliance with the mitigation measures identified in this draft Outline EMP Sub-plan will be captured in the processes identified in Section 23.8.

23.13.11 Hazard and risk

23.13.11.1 Environmental outcomes

Appropriate measures are implemented to avoid or minimise the risk of a health, safety or environmental incident during Project works.

Emergency management procedures will be in effect to manage potential natural hazards including flooding, fire, cyclone or heatwave events during Project works.

23.13.11.2 Performance criteria

- A safe working environment is maintained for the construction workforce, nearby landholders and other relevant stakeholders
- A Project Hazard and Risk Register will be maintained to record and implement appropriate systems and procedures to manage and respond to both natural and manmade hazards and risks during construction
- Comply with relevant Australian Standards for the handling and storage of hazardous goods.

23.13.11.3 Proposed mitigation measures

Relevant environmental aspects and proposed mitigation and management measures for the detailed design, pre-construction and construction and commissioning phases of the Project are included in Table 23.22.

TABLE 23.22: MITIGATION MEASURES—HAZARD AND RISK

Delivery phase	Hazard type	Aspect	Proposed mitigation measures
Detailed design	Natural	Bushfire	Design to maintain appropriate access during construction and operation, ensuring local roads allow emergency access, first response firefighting, access to water supply for firefighting purposes, and safe evacuation routes. A landscaping design to include (where possible) cleared land on either side of the tracks to act as a fire break.
	Natural	Flooding and flash flooding	Work with stakeholders including directly impacted landowners, relevant community stakeholders and local councils to inform and refine assessments and design. Continue to refine project design in response to hydraulic modelling. This includes consideration of peak water levels, flow distribution, velocities and duration of inundation. This will inform bridge lengths, culvert sizing and numbers, scour and erosion protection measures for both rail, road and other permanent project infrastructure. Review flood risk assessment to inform the siting and scale of temporary construction areas (including stockpiles, construction compounds, access roads, laydown areas). Locate plant and equipment maintenance activities and fuel storage facilities in accordance with *AS1940:2017 The storage and handling of flammable and combustible liquids* (Standards Australia, 2017).
	Natural	Landslide, sudden subsidence, movement of soil or rocks	Incorporate batter slopes and scour protection into design.
	Natural	Climatic conditions	The design will implement safety measures for the potential damage of tracks and assets as a result of extreme hot weather events, such as considering the use of elastic fasteners or heavier sleepers to reduce track buckling, selection of materials and colour to reduce heat load on trackside equipment. The Project design will be developed to achieve a design life of 100 years (for structures). All formation, track and structures will be developed in accordance with the ARTC Codes of Practice. The management of temperature fluctuation would be assured by sourcing components that have the assurance from manufacturers that the components maintain integrity at the required or envisaged temperatures. Factor for the potential increase in flood risk arising from any increase in extreme rainfall because of climate conditions. Adaption strategies such as installing an early flood warning system to alert ARTC to impending flood risks and requirements for suspension of local operations, locating critical electrical systems (signalling, communications huts) above potential flood zones and considering the use of solar and battery devices to ensure uninterrupted operation of signalling and network communication in the event of power failure to be considered for incorporation into the detailed design. Design for future climate, including consideration of existing ARTC protocols for operating in extreme temperatures. Sustainability initiatives, particularly in relation to energy consumption and savings throughout the project lifecycle will be incorporated in detailed design.
	Project	Rail incidents	Track design will incorporate trackside monitoring systems, which will detect faults in the wheel set and monitor rail wheel condition and defects at various locations deemed necessary by the design team.
	Project	Underground and overhead services	The Project will also comply with the clearance distance as specified in the ARTC Engineering Standard for *Requirements—Electric Aerials Crossing ARTC Infrastructure* (ARTC, 2005a) to ensure enough clearance and prevent contact with live electricity. Design to confirm that the construction methods will not infringe on the defence air space restrictions.

Delivery phase	Hazard type	Aspect	Proposed mitigation measures
Detailed design (continued)	Project	Gas and pipelines	The Project design will comply with the clearances or agreed risk mitigation design treatments developed through consultation with: ▸ APA ▸ Santos.
	Project	Road–rail interfaces	Any physical controls such as boom gates and warning lights that have been determined necessary, will be detailed in the Project design. Detailed design of 1.8 m chain fencing is required near roads or where trespass risk is identified.
	Project	Emergency access	Emergency access, especially in the Little Liverpool Range tunnel, will be addressed by developing an access strategy. Consideration will be given to the use of the maintenance access road by emergency vehicles when evaluating the position of corridor access points. To facilitate emergency egress, multiple access points into and out of the rail corridor will be provided. This will include the consideration for the access of three pumpers, one rescue/incident control appliance, one urban rescue tender and one urban hazmat medium in the event of a major train tunnel incident (QFES, 2018). Safe corridor access and vehicle turnaround points will be provided for maintenance work to ensure enough setback while working adjacent to live railway. Maintenance and emergency access roads will be designed such that it will allow separation to prevent interaction between trains and vehicles without impeding escape or rescue activities.
	Project	Tunnel	The fire-and life-safety controls for the tunnel will include detailed design fire resistance level (load-bearing elements) to achieve 120-minute structural adequacy when exposed to the RWS (Rijkswaterstaat) temperature time curve, while non-load bearing elements are to achieve Fire Resistance Level of -/120/120, safety equipment and devices, such as emergency phones, emergency exits, emergency lighting, fire doors, hydrants and extinguishers. Tunnel design has incorporated fire and life safety mitigation measures, to ensure appropriate facilities are available. These mitigation measures include limiting the amount of combustible materials used in construction, providing fire detection systems, preventing derailed trains from entering the tunnel, and preventing trains that are on fire from stopping in the tunnel.
	Project	Abandoned mines and underground collieries	Engage with Abandoned Mines Program in the Department of Resources (former DNRME) to identify potential risk of disturbance footprint interacting with abandoned or disused mines or underground collieries.
Pre-construction	Project	Underground and overhead services	The Project will identify known services that require relocation prior to construction, with the exception of enabling works as discussed in Section 23.3.4. Site investigations and visual inspections of the hazard and risk study area will be undertaken to identify underground and overhead service hazards. Inspections will focus on identifying soil conditions, trenches, pits, bores, standing water and any potentially dangerous obstructions which may impact on the safe execution of construction work. Inspections will be undertaken in accordance with ARTC *Underground/Overhead Services Work Method Statement* (ARTC, 2016a). The Project will lodge a 'Dial Before You Dig' enquiry before extraction or drilling work, which provides information about underground services on the worksite. Procedural control for the Project will ensure that excavation work will comply with Safe Work Australia *Code of Practice—Excavation Work* (Safe Work Australia, 2018d). Overhead transmission lines and buried telecommunication cables will be managed to satisfy the requirements of the *Electrical Safety Act 2002* (Qld) and subordinate legislation and Safe Work Australia Model *Code of Practice—Managing Electrical Risk in the Workplace* (Safe Work Australia, 2018c). The ARTC Engineering Standard for *Requirements—Electric Aerials Crossing ARTC Infrastructure* (ARTC, 2005a) requires that all structures supporting a span of electric aerials over ARTC railway track or sidings be located that in the event of failure, no part of them will fall within 1.8 m of the outside rail of any railway track.

Delivery phase	Hazard type	Aspect	Proposed mitigation measures
Pre-construction (continued)	Project	Contaminated land	Registered contaminated sites, hazardous facilities, landfills, areas of dryland salinity and acid sulfate soil risk have been assessed for the hazard and risk study area. The risks will be reviewed before execution of any excavation work. Undertake contaminated land assessments and investigations for land identified as having known or suspected contaminated areas and prepare a Contaminated Site Management Plan to document management controls for works on the relevant contaminated areas and outline the process to identify, document and manage each of the contaminated sites.
	Project	Asbestos	Older infrastructure and previously disturbed land within the disturbance footprint may contain asbestos. The Project will adhere to Safe Work Australia's model *Code of Practice—How to Manage and Control Asbestos in the Workplace* (Safe Work Australia, 2018b) and Safe Work Australia's model *Code of Practice—How to Safely Remove Asbestos* (Safe Work Australia, 2018a). Survey of infrastructure that will be removed or disturbed by the Project will be conducted to potentially identify asbestos containing materials. Construction activities likely to disturb asbestos will review the presence and requirement for specific controls. The Project will engage with competent contractors who are appropriately licensed for asbestos disturbance work.
	Project	Bridges	Ground surveys will be carried out with boreholes at all pier locations and abutments during construction early works to mitigate against bridge collapse.
	Project	Abandoned mines and underground collieries	Develop measures for encountering unrecorded historic collieries (or voids or similar) under the 'Unexpected Finds Protocol/Procedure' as part of the CEMP. In the event an interface with abandoned mines or underground collieries is determined, develop a construction management strategy to minimise risk in consultation with the Department of Resources (former DNRME).
	Project	Road–rail interfaces	Crossing consolidation, relocation, diversion or realignment—existing road rail interfaces may be closed, consolidated into fewer crossing points, relocated or diverted. Roads will only be closed where the impact of diversions or consolidations is considered acceptable, or the existing location is not considered safe and cannot reasonably be made safe. Approval for closures, where required, will be progressed in accordance with the requirements of the relevant legislation and road closure permits.
Construction and commissioning	Natural	Bushfire	High fire risk activities such as hot works including flash-butt welding will be carried out in accordance with ARTC's *Fire Prevention Management Procedure* (ARTC, 2007), *Total Fire Bans Procedure* (ARTC, 2018d) and Section 17 (Right of Way) of the *Engineering Code of Practice* (ARTC, 2013b). These procedures establish processes to manage hot work/high fire risk activities, including observation of relevant QFES directives, check extent of work site vegetation prior to hot work, and ensure appropriate firefighting equipment and trained personnel are available. Depending on site-specific requirements, ARTC will remove unsafe vegetation as necessary, which can include the use of weed control, spot spraying, slashing of high grass and pruning overhanging trees or large shrubs.
	Natural	Flooding and flash flooding	Construction staging to include construction of drainage structures before embankment sections to mitigate flooding potential during construction. Locate laydown areas away from creeks (such as the Western Creek, Lockyer Creek, Bremer River, Laidley Creek, Sandy Creek, Tent Hill Creek, and various other unnamed creeks).

Delivery phase	Hazard type	Aspect	Proposed mitigation measures
Construction and commissioning (continued)	Natural	Landslide, sudden subsidence, movement of soil or rocks	Implement a Soil Management Plan to manage the topsoil onsite such that it can be reused in rehabilitation and landscaping activities, soil stockpiles will be managed in accordance with ESCPs. Regular earthworks inspections will be implemented to identify defects and conditions that may affect or indicate problems with the stability of earthworks. Clearing of land and ground disturbance works to accommodate the construction of track work will be staged sequentially to minimise areas exposed to erosion and sediment risk, with specific consideration given to physical and topographical impacts including rocky and uneven terrain. The period that soil is exposed will be minimised through progressive ground cover revegetation to minimise erosion. Temporary construction facilities will be sited to avoid flood areas, overland flow paths and minimise clearance of established vegetation where possible.
	Natural	Climatic conditions	Consider opportunities for the reduction of greenhouse gas generation during construction. Laydown areas have been nominated along the length of the Project and at strategic locations, such as near the tunnel ports or structures. These will act as a centralised point for material storage, with some storing hazardous materials such as fuel. The locations of laydown areas have been chosen to avoid areas that are within the 1% AEP floodplains where possible. However, by virtue of the requirement of laydown areas for constructing bridges, some laydown areas must be within floodplains and near water sources. ARTC will work towards minimising future risk in emergencies and engage with the local councils and the Local Disaster Management Groups. Weather station environmental monitoring for all areas especially those subject to high winds. Construction water will be obtained from appropriate sources, with the necessary water entitlement, water allocation, water licence or water permit.
	Natural	Wildlife	Construction works will be undertaken in accordance with a Flora and Fauna Sub-plan.
	Natural	Biosecurity	Develop and implement a Biosecurity Management Plan as part of the CEMP to include: ▸ Requirements for pre-clearing surveys to determine the risk of weeds or pest animals being present ▸ Maps of the existing extent and severity of weed infestation and weed management requirements ▸ Pest animal management (including fire ants in fire ant biosecurity zones) ▸ Site hygiene and waste management procedures to deter pest animals ▸ Weed surveillance and treatment during construction and rehabilitation activities ▸ Requirements in relation to pesticide and herbicide use and documentation, including any limitations on use, such as, restrictions on use in sensitive environmental areas, drainage lines that flow to waterways and aquatic habitats, and ensuring that broad scale use does not result in an increased erosion and sediment risk ▸ Vehicle, machinery and imported fill hygiene protocols and documentation ▸ Erosion and sediment control risks associated with broad scale weed removal or treatment.
	Project	Fatigue and heat stress management	Ensure Construction management plans, systems, workplace conditions and facilities align with requirements of *the Work Health and Safety Act 2011* (Qld). Follow *Guide to managing the risks of working in heat* (Safe Work Australia, 2020).

Delivery phase	Hazard type	Aspect	Proposed mitigation measures
Construction and commissioning (continued)	Project	Asbestos	Depending on the type and amount of asbestos containing materials, if they are disturbed by the Project, the Project will engage with a Class A or Class B licensed asbestos removalist for the handling and disposal of asbestos. In the event there is uncertainty as to whether exposure standards will be exceeded, or work will generate airborne fibres by any method, air monitoring will be carried out by appropriately qualified personnel.
	Project	Dust, respirable silica and other airborne contaminants	Direct construction worker exposure to respirable silica and other airborne contaminants will be controlled using appropriate personal protective equipment. Where sensitive receptors, agricultural land uses or protected vegetation are located within close proximity (350 m from the boundary of construction works, or 50 m from a construction haul route), or where visible dust is generated from vehicles using unsealed access roads, watering or other appropriate controls are to be implemented. Cover vehicles transporting potentially dust and/or spillage generating material to and from the construction site immediately after loading (prior to traversing public roads). Where necessary, use additional controls such as wheel wash and/or rumble grids at site entrances. Limit clearing to the Project disturbance footprint. Where practical, stage clearing and grubbing and construction activities to minimise exposure to erosive processes. Implement controls to prevent and/or minimise dust generation during activities involving excavation or disturbance of soils or vegetation, or handling ballast (i.e. use water sprays or water carts for dust suppression as required). Avoid ground-disturbing activities during windy conditions (i.e. winds >10 m/s) or when prevailing winds are likely to result in dust impacts to sensitive receptors. Implement additional dust suppression controls prior to the onset of adverse weather including covering or stabilisation of temporary stockpiles and additional treatment of access roads. Longer-term material stockpiles will be suitably treated to prevent risk of windborne erosion and dust.
	Project	Noise and vibration	The Project will develop and implement a Construction Noise and Vibration Management Plan as part of the CEMP. Noise and vibration sources from construction involving heavy machinery will incorporate appropriate noise mitigation equipment and devices including mufflers and acoustic barriers. The Project will reduce and manage noise as much as is possible through a range of noise management measures. Noise disruption from night works are kept to a minimum and work will be as quickly and efficiently as possible.
	Project	Road incidents	A Traffic, Transport and Access Management Sub-plan will be developed and implemented to identify the impacts that construction traffic is likely to have on transport infrastructure and detail ameliorative measures required to mitigate all identified impacts of the development. Specific hazard control measures that will be applied include clearly defined access for vehicles and pedestrians along the rail corridor and the provision of fencing and gating for all corridor access points to prevent unauthorised entry. ARTC will manage critical pedestrian, road and rail safety risks during operation in accordance with the ARTC's *Fatal and Severe Risk Program* (ARTC, 2017d). Storage areas and equipment laydowns will be maintained in good condition to maintain visibility for vehicles.
	Project	Tunnel	Tunnel construction will likely require blasting work. The use of explosive substances will be managed meeting the requirements of the *Explosives Act 1999* (Qld).

Delivery phase	Hazard type	Aspect	Proposed mitigation measures
Construction and commissioning (continued)	Project	Underground and overhead services	Procedural control for the Project will ensure that excavation work will comply with Safe Work Australia Model *Code of Practice — Excavation Work* (Safe Work Australia, 2018d) ARTC's *Engineering Standard for Requirements—Electric Aerials Crossing ARTC Infrastructure* (ARTC, 2005a) requires that all structures supporting a span of electric aerials over ARTC railway track or sidings be located so that in the event of failure, no part will fall within 1.8 m outside rail of any railway track.
	Project	Gas and pipelines	Procedural control for the Project will ensure that excavation work will comply with Safe Work Australia's *Model Code of Practice— Excavation Work* (Safe Work Australia, 2018c) and other construction safety and clearance measures as agreed with Santos and APA.
	Project	Contaminated land (including unexploded ordnance)	Construction personnel involved in ground-disturbing works will be trained in the identification of potential contaminated soil/material and the relevant controls that will be put in place in the event of its discovery. Waste generation from construction activities can potentially contaminate the surrounding land and will be managed in accordance with the Waste Management Sub-plan. A Contaminated and Hazardous Materials Management Plan will be developed and implemented as part of the Waste Management Sub-plan. Identification of unexploded ordnance will be subject to a risk assessment. Where there is a risk of encountering known or possible unexploded ordnance, a suitably qualified person will assess and identify management options. Implementation of the Contaminated Site Management Plan if contaminated land is suspected.
	Project	Emergency access	The maintenance of emergency access will be managed through the development and implementation of a Project access strategy. Access for emergency vehicles during construction of the Project will be discussed with contractors during development of the strategy. In instances where construction phase emergency access is affected, use of the RMAR by emergency vehicles may be appropriate. Multiple access points into and out of the rail corridor will be provided. A Construction Traffic Management Plan will be in place during construction to manage construction traffic and minimise impacts to surrounding land users.
	Project	Abandoned mines and underground collieries	If an unrecorded historic colliery is encountered during construction, the measures outlined under the 'unexpected finds protocol/procedure' in the CEMP will be followed. Noting this risk will be controlled during construction such that construction above collieries or abandoned mines will be avoided, leading to a removal of the risk in the operational phase.
	Dangerous goods and hazardous chemicals	Chemicals spillage and loss of containment	Where it has been identified that hazardous materials may be used or stored, construction facilities will be located outside of floodplains and away from areas of social and environmental receptors in accordance with the Queensland State Planning Policy 2017. Additionally, the locations of construction facilities where vehicle maintenance and refuelling activities are expected to occur, will be selected to achieve appropriate separation to riparian vegetation and waterways. During the construction phase of the Project, dangerous goods will be required at construction sites and facilities. Licensed transporters operating in compliance with *Australian Code for the Transport of Dangerous Goods by Road & Rail* (National Transport Commission, 2018) will be used for dangerous goods deliveries. Additionally, the locations of construction facilities where vehicle maintenance and refuelling activities are expected to occur, will be selected to achieve appropriate separation to riparian vegetation and waterways. Standard procedures for the storage, containment, disposal and spills response for chemicals will be managed in accordance with their applicable Australian Standards, such as AS1940-2017 *Storage and Handling of Flammable and Combustible Liqui*d (Standards Australia, 2017) and *AS 3780-2008 Storage and Handling of Corrosive Substance* (Standards Australia, 2008). Construction chemicals stored and handled will be managed in accordance with the *Work Health and Safety Act 2011* (Qld) and Regulation, the relevant Australian Standards and the requirements of chemical safety data sheets. Safety data sheet information will be obtained from the supplier of these chemicals and stored in an easily accessible location.

Delivery phase	Hazard type	Aspect	Proposed mitigation measures
Construction and commissioning (continued)	Dangerous goods and hazardous chemicals	Explosives	Where explosives are used for construction, the works will be undertaken by licensed shotfirers in accordance with the *Explosives Act 1999* (Qld) and *AS 2187—Explosive—Storage, Transport and Use* (Standards Australia,1998). Where explosives are used during construction, a Blast Management Plan will be developed as part of the Construction Noise and Vibration Management Plan within the CEMP. At all times, the handling and use of explosives will incorporate procedures to: ▸ Prevent misfire ▸ Reduce the risk associated with material projected by a blast ▸ Minimise adverse effects of ground vibration and shock waves caused by a blast ▸ Ensure explosives are not used after either the manufacturer's recommended shelf life or the approved, extended shelf-life ▸ Maintain public safety, vehicular access and security ▸ Identify other activities within proximity of explosive use ▸ Characterise the environment of explosive use, including flood, bushfire, landslide zones. WH&S Management Plans to include appropriate measures to manage risk associated with blasting such as consultation with service providers, comply with separation requirements and access controls, exclusion zones, trails, and buffers. WH&S Management Plans will seek to minimise interruption to dangerous goods and hazardous materials (including explosives) transport routes, by communicating with relevant stakeholders regarding the schedule and activities of the Project.

23.13.11.4 Monitoring

Regular earthworks inspections will be implemented to determine defects and conditions that may affect or indicate problems with the stability of earthworks such as fissures, rocks or debris on or near tracks, loss of track geometry, track subsidence, water seepage and damage to embankments.

Monitor actual hours of construction work and take action to reduce risk of fatigue where required.

Monitoring and reporting on compliance with the mitigation measures identified in this draft Outline EMP Sub-plan will be captured in the processes identified in Section 23.8.

23.13.12 Waste and resource management

23.13.12.1 Environmental outcomes

All wastes generated during construction are effectively stored, handled, treated, reused, recycled and/or disposed of lawfully and in a manner that protects environmental values.

Measures are implemented to reduce the amount of waste generated by the Project works.

23.13.12.2 Performance criteria

- Adopt the waste hierarchy (avoid/reduce, reuse, recycle, recover, treat, dispose) across the Project
- Assess, classify, manage, and dispose of waste in accordance with the relevant State regulatory requirements and guidelines and in a manner that protects environmental values
- Establish and meet construction waste targets
- Implementation of opportunities identified for beneficial reuse of spoil and other materials during detailed design in accordance with appropriate management procedures and relevant applicable legislation and regulations
- Minimise the import and disposal of fill material.

23.13.12.3 Proposed mitigation measures

Relevant environmental aspects and proposed mitigation and management measures for the detailed design, pre-construction and construction and commissioning phases of the Project are included in Table 23.23.

TABLE 23.23: MITIGATION MEASURES—WASTE AND RESOURCE MANAGEMENT

Delivery Phase	Aspect	Proposed design objectives and mitigation measures
Detailed design	Waste	Cut-and-fill balance and minimisation of transport requirements for import/disposal of spoil to be considered further during detailed design by implementing the spoil management hierarchy presented in Appendix T: Spoil Management Strategy. Establish waste reduction targets for design and construction. A waste reduction review will be undertaken to identify opportunities to meaningfully achieve the waste reduction targets through detailed design and construction of the Project. Consideration of alternative approaches to materials used, construction and operational techniques and maintenance of a process to achieve a less resource intensive and more efficient process, in accordance with relevant design standards. For example, material specifications will consider aspects such as use of prefabricated materials, percentage of recycled content and percentage of material rejection to reduce waste generation from the Project. Establish waste reporting requirements for the pre-construction, construction and commissioning phases of the Project and incorporate into the Waste Management Sub-plan.
Pre-construction	Waste	Develop a Waste Management Sub-plan as part of the CEMP, which complies with the Project conditions of approval and relevant regulatory requirements, including: ▸ Waste targets (or waste reduction targets) to be achieved for the Project ▸ Waste reporting requirements ▸ General protocols and performance objectives for keeping the work site clean and tidy ▸ Describe potential waste impacts, waste streams and estimated volumes ▸ Identify temporary waste storage areas and disposal locations onsite and offsite (including stockpiles and landfilling) ▸ Ensure waste disposal is undertaken in line with NEPM criteria for disposal sites ▸ Requirements for waste segregation e.g. green waste, spoil, construction and demolition waste, general waste, regulated waste and recyclables ▸ Requirements for secure temporary storage, collection frequency and disposal/recycling requirements ▸ Effluent management for construction staff amenities ▸ Procedures and reporting/documentation requirements for ensuring waste transporters and receivers are appropriately licensed according to the type of waste ▸ Requirements for training, inspections, audits, corrective action, notification and classification of environmental incidents, record keeping, monitoring and performance objectives for handover on completion of construction.
	Hazardous waste	Waste from the Project works must be tested, treated and managed in accordance with the *Environmental Protection Act 1994* (Qld). A hazardous material and waste survey will be undertaken prior to demolition of structures (e.g. sheds, houses/buildings. If asbestos or other hazardous materials are identified in these structures, a Hazardous Materials and Waste Management Plan will be developed and implemented as part of the Waste Management Sub-plan.

Delivery Phase	Aspect	Proposed design objectives and mitigation measures
Construction and commissioning	Waste	Where practicable, spoil will be re-used within the disturbance footprint through treatment, amelioration or drying, and any material that cannot be treated for appropriate re-use may then be disposed offsite. Identify opportunities to achieve waste reduction targets appropriate to the scope of the construction works. Reduce the amount of spoil generated through construction methodology. For example, the use of roadheader in tunnelling construction allows for accurate cut whilst maintaining efficient spoil management. Implement the Construction Spoil Management Plan described in the Land Resources Sub-plan (refer Section 23.13.1.4). All cut material of appropriate suitability for re-use will be stockpiled separately and re-used onsite where possible. Careful specification of construction material requirements to avoid overestimation. Source good quality construction materials, in accordance with relevant design standards. Purchase construction materials in bulk to minimise packaging waste. Develop and implement administrative controls on the transportation of waste materials from the Project, within the disturbance area and offsite. Ensure plant and equipment utilised in the Project is appropriately maintained. Construction maintenance activities, refuelling, concrete washout will be carried out in defined locations with appropriate measures in place to reduce the potential for impacts to waterways, aquatic habitats, and groundwater. Portable toilets and amenities to be serviced and maintained to ensure efficient operation and minimise environmental risks associated with their operation and decommissioning. Contractors to adhere to the practices of the *Waste Reduction and Recycling Act 2011* (Qld) waste and resource management hierarchy, which sets out an order of preference for options for managing waste from avoiding, to re-using, recovering, treating and disposing of waste. Appropriate waste bins, facilitating segregation of waste, to be located at key site compounds to facilitate segregation and prevent cross contamination. Comply with the waste reporting requirements established in the Waste Management Sub-plan.
	Hazardous waste	Hazardous and/or contaminated waste will be classified and disposed in accordance with the Waste Management Sub-plan. Hazardous or dangerous waste (e.g. asbestos, chemicals, oils) will be correctly stored, managed and disposed of by a licensed contractor or facility and in accordance with the relevant occupational health and safety legislative and regulatory obligations, including wastes generated as a result of demolition.

23.13.12.4 Monitoring

Monitoring compliance of the development and implementation of the waste and resource management related management processes and performance criteria identified in this draft Outline EMP Sub-plan will be captured in the processes identified in Section 23.8.