INLAND RAIL

Table of Contents

Executive Summary

Border to Gowrie

Environmental Impact Statement

ARTC

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

IR_1381

COVER IMAGE
Photo of existing Queensland Rail railway line and farmland near Kurumbul, Queensland.

INLAND RAIL

ACKNOWLEDGEMENT OF COUNTRY

Inland Rail acknowledges the Traditional Custodians of the land on which we work and pay our respect to their Elders past, present and emerging.

IR_1534

TABLE OF CONTENTS

Contents

Executive Summary

Chapter 1

Chapter 2

Chapter 3

Chapter 4

Chapter 5

Chapter 6

Chapter 7

Chapter 8

Chapter 9

Chapter 10

Chapter 11

Chapter 12

Chapter 13

Chapter 14

Chapter 15

Chapter 16

Chapter 17

Chapter 18

Chapter 19

Chapter 20

Chapter 21

Chapter 22

Chapter 23

Chapter 24

Chapter 25

Appendices

Appendix A	Terms of Reference
Appendix B	Terms of Reference Compliance Table
Appendix C	Stakeholder Engagement Report
Appendix D	Study Team
Appendix E	Corporate Policies
Appendix F	Impacted Properties
Appendix G	Geotechnical Investigation Results
Appendix H	EMR Search Certificates and Soil Laboratory Certificates
Appendix I	Landscape and Visual Impact Assessment Technical Report
Appendix J	Terrestrial Ecology Technical Report
Appendix K	Aquatic Ecology Technical Report
Appendix L	Matters of National Environmental Significance Technical Report
Appendix M	Preliminary Fauna Movement Provision and Fencing Strategy
Appendix N	Draft Offset Strategy
Appendix O	Air Quality Technical Report
Appendix P	Surface Water Quality Technical Report
Appendix Q1	Hydrology and Flooding Technical Report—Volume I
Appendix Q2	Hydrology and Flooding Technical Report—Volume II
Appendix R	Groundwater Technical Report
Appendix S	Construction Noise and Vibration and Operational Road Traffic Noise Technical Report
Appendix T	Operational Railway Noise and Vibration Technical Report
Appendix U	Social Impact Assessment
Appendix V	Economic Impact Assessment
Appendix W	Non-Indigenous Cultural Heritage Survey Report
Appendix X	Traffic Impact Assessment
Appendix Y	Spoil Management Strategy
Appendix Z	Proponent Commitments

Figures

Executive Summary

Chapter 1 Introduction

Chapter 2 Project Rationale

Chapter 3 Legislation and Project Approvals Process

Chapter 4 Assessment Methodology

Chapter 5 Project Description

Chapter 7 Land Use and Tenure

Chapter 8 Land Resources

Chapter 9 Landscape and Visual Impact Assessment

Chapter 10 Flora and Fauna

Chapter 11 Air Quality

Chapter 12 Surface Water and Hydrology

Chapter 13 Groundwater

Chapter 14 Noise and Vibration

Chapter 15 Social

Chapter 16 Economics

Chapter 17 Cultural Heritage

Chapter 18 Traffic, Transport and Access

Chapter 19 Hazard and Risk

Chapter 20 Waste Management

Chapter 21 Cumulative Impacts

Chapter 22 Outline Environmental Management Plan

Photographs

Chapter 8 Land Resources

Chapter 10 Flora and Fauna

Tables

Executive Summary

Chapter 1 Introduction

Chapter 2 Project Rationale

Chapter 3 Legislation and Project Approvals Methodology

Chapter 4 Assessment Methodology

Chapter 5 Project Description

Chapter 6 Sustainability

Chapter 7 Land Use and Tenure

Chapter 8 Land Resources

Chapter 9 Landscape and Visual Impact Assessment

Chapter 10 Flora and Fauna

Chapter 11 Air Quality

Chapter 12 Surface Water and Hydrology

Chapter 13 Groundwater

Chapter 14 Noise and Vibration

Chapter 15 Social

Chapter 16 Economics

Chapter 17 Cultural Heritage

Chapter 18 Traffic, Transport and Access

Chapter 19 Hazard and Risk

Chapter 20 Waste Management

Chapter 21 Cumulative Impacts

Chapter 22 Outline Environmental Management Plan

Chapter 23 Conclusions

EXECUTIVE SUMMARY

INLAND RAIL—BORDER TO GOWRIE ENVIRONMENTAL IMPACT STATEMENT

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

Executive Summary

Due to the State election in Queensland in October 2020, machinery of government changes means that there has been a change to some department names. The up-to-date departmental names will be revised prior to the Final EIS.

1. The Project

The Border to Gowrie Project (the Project) is a 216.2 km project within the broader Inland Rail Program, which will connect metropolitan Melbourne to Brisbane. The Project is one of the 'missing links' within the Inland Rail Program, which has been divided into 13 projects—providing a long-term rail solution for competitive freight rail movement.

The Inland Rail route, which is approximately 1,700 kilometres (km) long, is shown in Figure 1 and will involve:

- Using the existing interstate rail corridor through Victoria (VIC) and southern New South Wales (NSW)
- Upgrading approximately 400 km of existing corridor, mainly in western NSW
- Providing approximately 600 km of new corridor in northern NSW and southeast Queensland.

The location of the Project is shown in Figure 2.

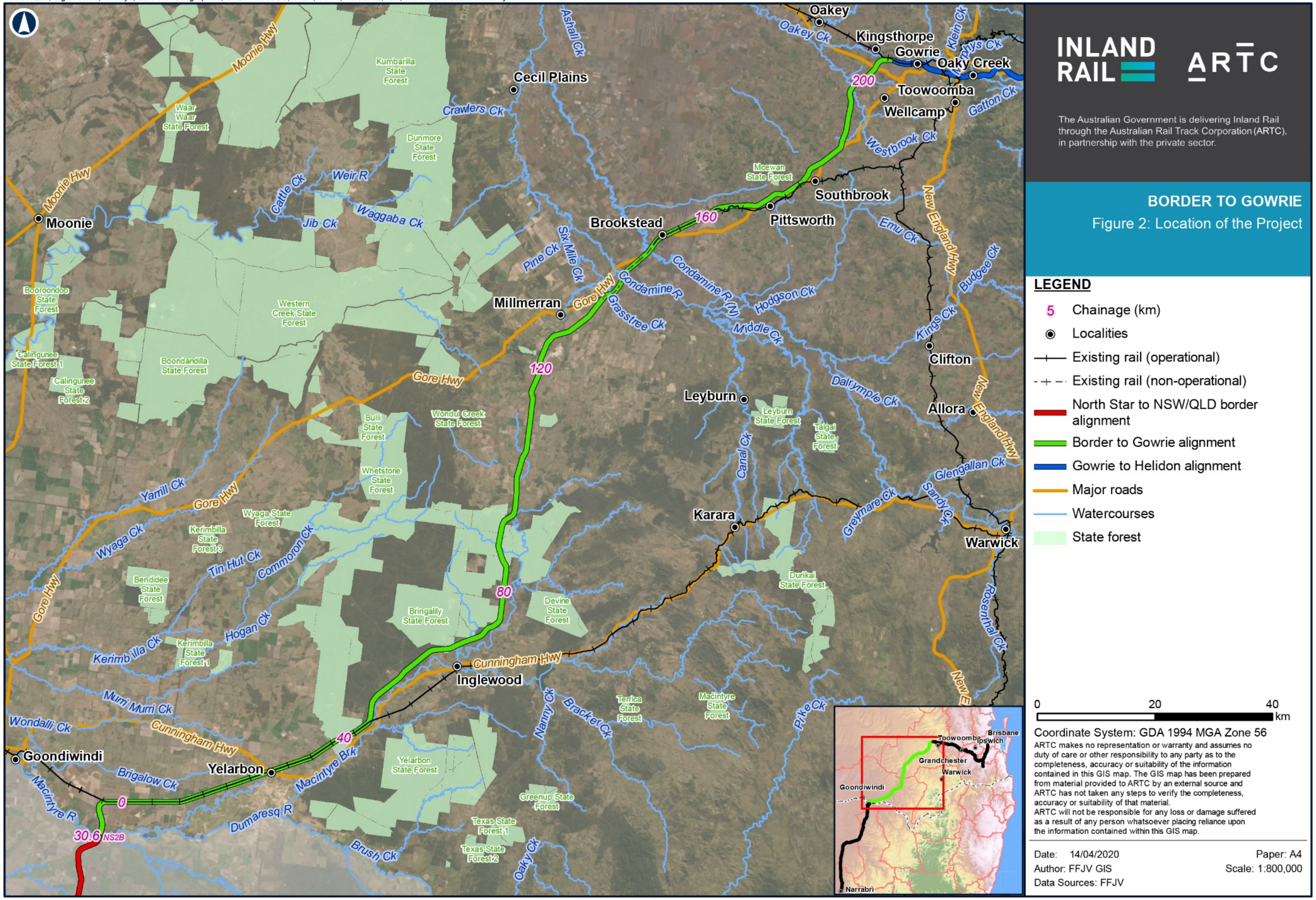
Further information on Inland Rail can be found at **inlandrail.com.au**.

The Australian Rail Track Corporation (ARTC) proposes to construct and operate the Project. As the operator and manager of Australia's national rail freight network, ARTC has successfully delivered more than $5 billion worth of capital upgrades. Having emerged from this period of significant investment and network upgrades, ARTC has now been tasked with delivering Inland Rail under the guidance of the Australian Government Department of Infrastructure, Transport, Regional Development and Communications.

Further information on ARTC can be found at **artc.com.au**.

FIGURE 1 THE MELBOURNE TO BRISBANE INLAND RAIL ROUTE

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



Map by: LCT/IW Z:\GIS\GIS_310_B2G\Tasks\310-EAP-201812111441_EIS_Chapter_1_Figures\310-EAP-201812111441_ARTC_Chapter0_Fig2_location_of_project_v2.mxd Date: 14/04/2020 12:42

2. Environmental assessment process

On 16 March 2018, the Coordinator-General declared the Project to be a 'coordinated project for which an EIS is required' under the *State Development and Public Works Organisation Act 1971* (Qld) (SDPWO Act).

The Environmental Impact Statement (EIS) has been prepared to address the Terms of Reference (ToR) issued by the Coordinator-General dated 16 November 2018. The ToR provide the matters that ARTC must address when preparing the EIS.

This draft EIS documents the environmental impact assessments undertaken by ARTC to support the delivery of the Project. The objective of the draft EIS is to ensure that all relevant environmental, social and economic impacts of the Project are identified and assessed and to demonstrate that the Project is based on sound environmental principles and practices. The draft EIS includes an Outline Environmental Management Plan (Outline EMP), which proposes a framework to implement mitigation measures to avoid or minimise adverse impacts and to enhance potential benefits.

As the Project has the potential to impact on both Australian and State Government environmental matters, the Project requires approval by the Queensland Coordinator-General under the SDPWO Act and the Commonwealth Minister administering the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act).

The Project will be assessed via the accredited assessment process under the Bilateral Agreement between the Australian Government and the State of Queensland (section 45 of the EPBC Act) using the information presented in the EIS.

The Australian Government Minister for the Environment will receive a copy of the Coordinator-General's Evaluation Report to use when deciding whether to approve the Project (with or without conditions) under the EPBC Act.

3. Community and stakeholder engagement

Since its inception, community engagement has formed an integral part of the Border to Gowrie Project; connecting the Project team with stakeholders, community members and landowners who have helped to inform key decisions. This community engagement approach has been driven by a strong commitment to create community awareness and understanding of the Project and to effectively engage affected landowners.

Throughout these activities, landowners and members of the community identified a number of concerns related to potential impacts on the community as a result of the Project. Key concerns identified include the potential for impacts on:

- Cultural landscapes and local character
- The use and amenity of properties as a result of property acquisition and property severance
- Farm productivity and management
- Homes, farms and agricultural land as a result of changes to flood patterns
- Rural amenity as a result of Project construction and operation
- Connectivity within and between properties, on the road network, and with respect to level crossings
- Property values
- Community stress due to a desire for more/better information about the Project
- Mental health, due to Project-related stress and the need for support for affected residents
- Community wellbeing as a result of noise, vibration, and air quality changes
- Groundwater access for farms and businesses as a result of construction
- Community safety as a result of Project traffic using school bus routes.

In some instances, these concerns relate directly to technical issues addressed in the draft EIS, such as access, business operations, flooding, air quality and noise, while many of the concerns stem from uncertainty about Project impacts and future compensation. These are common in the early stages of infrastructure projects while the design continues to be developed and where there is a potential for impacts on community members' financial position and concern about ensuring a mechanism for a fair and equitable process.

ARTC is committed to ongoing engagement with the local community and key stakeholders, and values the relationship built to date. Active community engagement is an ongoing process and one that will continue throughout the life of the Project.

4. Making a submission

Any person, group or organisation can make a submission about the Project's EIS to the Office of the Coordinator-General. Any properly made submissions must be accepted by the Coordinator-General and considered in evaluating the EIS. In the instance that submissions are received that are not properly made, the Coordinator-General may accept or decline at their discretion.

Under the SDPWO Act a properly made submission must:

- Be made in writing
- Be received on or before the last day of the submission period
- Be signed by each person who makes the submission
- State the name and address of each person who makes the submission
- State the grounds of the submission and the facts and circumstances relied on in support of those grounds.
- A person wishing to make a submission about the EIS should also:
- Clearly state the matter(s) of concern or interest and list points to help with clarity
- Reference the relevant section(s) of the EIS
- Ensure the submission is legible.

Submissions regarding this EIS should be addressed to:

The Coordinator-General
C/- EIS Project Manager—Inland Rail, Border to Gowrie
Coordinated Project Delivery
Office of the Coordinator-General Box 15517
CITY EAST QLD 4002

Submissions can be made electronically at the following email address:

inlandrailb2g@coordinatorgeneral.qld.gov.au

Electronic submissions are still required to meet the properly made requirements of the SDPWO Act.

For further enquiries, please contact:
Telephone: 13 QGOV (13 74 68).

5. Need for the Project

The Project is a key missing link for Inland Rail as it will provide inland connectivity between the existing NSW and Queensland freight rail networks, enabling the key technical characteristics of the Inland Rail service offering to be achieved. This section provides discussion on the justification for Inland Rail, which in turn provides justification for the Project as a component of the larger Inland Rail Program.

5.1 The Inland Rail Program

Australia is heavily reliant on efficient and reliable supply chains to provide competitive domestic freight links and gateways for international trade.

At present, there is no continuous inland rail link between Melbourne and Brisbane. Interstate rail freight currently travels between Melbourne and Sydney via Albury, and then between Sydney and Brisbane, generally along the coast. Long transit times are endured since the existing network cannot accommodate highly efficient, long, double-stacked trains.

The *Australian Infrastructure Plan* (Infrastructure Australia, 2016a) notes that the existing north–south rail corridor between Melbourne and Brisbane does not provide a service offering that is competitive with road transport. This is largely the result of 19th century alignments leading to low travel speeds, poor reliability and major bottlenecks, most notably in the Sydney metropolitan area. Much of the existing regional rail infrastructure is old and has maintenance and renewal issues.

Infrastructure Australia (2016a) notes that the demand for key urban road and rail corridors is set to increase and, as a result, the demand for urban transport infrastructure is projected to significantly exceed the current capacity by 2031. Without action, the cost to the wider community of congestion on urban roads could rise to more than $50 billion each year by 2031.

Inland Rail provides a significant opportunity to change the fundamentals of the freight logistics supply chain in Australia and deliver economic and social benefits long into the future.

The Inland Rail service offering is central to the delivery and competitiveness of Inland Rail and reflects the priorities of freight customers. It was developed in consultation with market participants and stakeholders and represents the key elements to be addressed by Inland Rail to enable a competitive and complementary service offering compared to other modes of transport, including road.

The key characteristics of the Inland Rail service offering are:

- **Reliability**—98 per cent, defined as the percentage of goods delivered on time by road freight, or available to be picked up at the rail terminal or port when promised
- **Price**—cheaper, relative to road transportation, as a combined cost of access to the rail network, rail haulage and pick-up and delivery
- **Transit time**—24 hours or less from Melbourne to Brisbane
- **Availability—**services available with departure and arrival times that are convenient for customers.

While the Inland Rail service offering is specific to the rail network, terminals are a critical element in enabling connection opportunities and, therefore, ARTC will work with terminal operators and proponents as the Inland Rail Program progresses.

5.2 Project benefits

As a component of the larger Inland Rail Program, the potential benefits of the Project cannot be separated from those that are attributed to the full Melbourne to Brisbane alignment. The full suite of potential benefits associated with the Inland Rail Program can only be realised once this Project and the 12 other Inland Rail projects are complete and operational.

5.2.1 Providing competitive freight transport

Potential direct supply chain benefits of the Project include:

- **Improved access to and from regional markets.** Inland Rail is expected to attract 2 million tonnes of agricultural freight from road to rail, with a total of 8.9 million tonnes of agricultural freight expected to be carried in 2050. Consequently, agricultural areas and regions, such as the Darling Downs, are expected to have improved access to key local and international markets and ability to move greater volumes of grain via rail (the preferred mode).
- **Reduced freight transport costs for the market**. Inland Rail is likely to reduce lifecycle costs for infrastructure owners/operators on traditional road freight routes due to lower freight volumes on these assets. This would reduce maintenance costs and enable investments in capacity to be avoided or deferred.
- **Improved reliability and certainty of transit time**. Inland Rail would provide linkages between existing rail networks, such as the existing Queensland Rail (QR) South Western Line, Millmerran Branch Line and West Moreton Line. Additionally, railway infrastructure within existing corridors used by Inland Rail would be subject to replacement and upgrade. As a result, the Project would deliver increased productivity and economic efficiency by way of operating-cost savings, shorter transit times, improved availability and avoided road incidents on the coastal route.
- **Increased capacity of the transport network**. Inland Rail would enable a greater volume of inter-capital freight to be moved via rail, with a reduced reliance on long-haul commodity transport via existing State-controlled and local road networks including the Gore, Cunningham and Warrego Highways.
- **Reduced distances travelled.** Inland Rail will provide a shorter option for the transportation of freight, resulting in a reduced time between the point of source and the market for goods and produce. The dedicated freight transport corridor, as proposed via the Darling Downs, will provide a direct freight route, offering a competitive alternative to road or the current coastal route that is outdated and impacted by priority for passenger rail.
- **Improved road safety.** Road safety would be improved by removing an estimated 200,000 long-haul truck movements from roads each year from 2049–50. It is expected that road transport will still be required for distribution from intermodal terminals.

- **Improved sustainability and amenity for the community.** Inland Rail will replace some of the long-haul road freight tasks, resulting in reduced road congestion and fewer vehicular carbon emissions. It is estimated that transportation of freight on Inland Rail is expected to use one third of the fuel when compared to transportation of the same volume of freight via the existing road route (ARTC, 2015b).

5.2.2 Supporting regional and local business

At a regional level, the Project has the potential to be a catalyst for growth and development through:

- Opportunities to encourage, develop and grow Indigenous, local, and regional businesses. This will be as a result of the supply of resources and materials for the construction and operation of the Project (e.g. borrow and ballast materials, fencing, electrical installation (excluding rail systems) and instrumentation, rehabilitation and landscaping, cleaning and maintenance of construction and non-resident workforce accommodation).
- Opportunities in secondary service and supply industries (such as retail, hospitality and other support services) for businesses in proximity to the construction footprint (including opportunities to supply the three proposed non-resident workforce accommodation sites near to Turallin (Millmerran), Inglewood and Yelarbon. The expansion in construction activity is also likely to support additional temporary flow-on demand and additional spending by the construction workforce in the local community.
- The potential to stimulate business and industry development at the Toowoomba Enterprise Hub at Wellcamp. By providing efficient transport access to intrastate and interstate markets, the Project may act as a catalyst for further private sector investment in this area, particularly for freight and logistics operations. The further development of the Toowoomba Enterprise Hub has the potential to unlock greater economic activity in the region, such as through promoting greater international export opportunities via Wellcamp Airport.
- The creation of a more direct rail freight corridor for freight operators. As a critical link of the broader Inland Rail Program, the Project offers opportunities to support the local agricultural industry, by driving savings in freight costs, improving market access, and reducing the volume of freight vehicles on the region's road network.

5.3 Inland Rail versus other freight transport

Alternative solutions with the potential to address Australia's current and future freight challenges were assessed in the Inland Rail Implementation Group Report to the Australian Government (Inland Rail Implementation Group, 2015) and the *Inland Rail Programme Business Case* (ARTC, 2015b).

The following alternatives were reviewed by the Inland Rail Implementation Group:

- Maritime shipping
- Air freight
- Road freight
- Rail solution.

5.3.1 Maritime shipping

Examination of maritime shipping as a potential alternative concluded that:

- Shipping is unlikely to be a strong alternative to Inland Rail because it does not provide the level of service (transit time and service availability) required by much of the Melbourne to Brisbane interstate market
- Shipping still has a role to play, especially due to its strengths in transporting high-volume and long-distance cargo around the coast. Shipping can be used in conjunction with other modes, such as an inland railway, to meet Australia's future transport needs.
- A maritime freight solution would not provide the same potential economic benefits and opportunities to inland communities that can be provided by Inland Rail.

5.3.2 Air freight

Air freight is highly specialised due to the inherent constraints on aircraft size and the nature of the goods that can be carried.

Examination of maritime shipping as a potential alternative concluded that:

- Air freight has a limited role to play in the transport of bulky or heavy goods on the Melbourne to Brisbane corridor, but will continue to play a crucial role for small, high-value and time-dependent goods
- Air freight is not a viable alternative for addressing Australia's freight requirements on the Melbourne to Brisbane corridor into the future.

5.3.3 Road freight

The *Melbourne–Brisbane Inland Rail Report* (Inland Rail Implementation Group, 2015) concluded that:

- While road transport will continue to contribute to Australia's freight task, unless substantial additional investment is made in road infrastructure, it will be unlikely to meet the longer-term needs for Australia's freight task by itself, due to significant local and regional capacity constraints
- Should the Australian Government decide not to proceed with a rail solution, further investigation of road transport is required to determine its capacity to manage the future north–south freight task.

5.3.4 Rail is the solution

The report concluded that:

- For Melbourne to Brisbane freight, the existing east coast railway would not be competitive with road in terms of cost or time, even with significant further investment and is therefore not a viable alternative to Inland Rail
- Inland Rail would meet Australia's future freight challenge and bring significant and positive national benefits by boosting national productivity and economic growth, while promoting better safety and environmental outcomes.

5.4 The Border to Gowrie solution to the freight challenge

The continuing growth in freight demand, particularly within and between major capital cities (Melbourne and Brisbane), presents an urgent challenge.

Alternative alignments to other Queensland destinations have been raised through stakeholder engagement but, while they may fulfil other freight supply chain objectives, they will not service the immediate and long-term need for commodity transport from the Melbourne to southeast Queensland markets.

The Border to Gowrie dedicated rail freight transport corridor, as proposed, has been aligned to provide as direct a freight route as possible and provide the most competitive alternative to road or the current coastal rail route.

The Project has long been identified in national strategic freight planning as the link needed to support Australia's economic objective of providing an efficient freight supply chain in the global market. Further, the Project has been demonstrated to meet and support Queensland freight and transport planning.

The Project will support local and regional business in the Darling Downs by providing a freight transport solution that connects the network of existing and future intermodal terminals.

6. Project description

6.1 Cost and timing

The estimated capital expenditure for the Project is approximately $1.1 billion[1] (ARTC, 2015a)

Project early works activities are scheduled for commencement in 2021, during the pre-construction phase, with construction scheduled for completion by the beginning of 2026. Inland Rail, and the Project, are scheduled to be operational in 2026.

The anticipated timing of phases for the Project are shown in Table 1.

TABLE 1 ANTICIPATED TIMING OF PROJECT PHASES

Project phase	2020	2021	2022	2023	2024	2025	2026
Detail design							
Pre-construction and early works							
Construction							
Commissioning							
Operation							

6.2 Reference design

6.2.1 Basis of Design

The key characteristics of the Inland Rail Program service offering are reliability, price, transit time and availability. To help achieve this service offering, ARTC has developed a Basis of Design—a set of standardised performance specifications to provide consistent design requirements and parameters across the Inland Rail Program. The standardised performance specifications provide guidance for consistent designs, ensuring assets are only delivered if they meet business and operational requirements.

Standardised performance specifications for Inland Rail and the Project are summarised in Table 2.

TABLE 2 PERFORMANCE SPECIFICATIONS FOR INLAND RAIL AND THE PROJECT

Attribute	Specification
Reference train	
Intermodal	21 tonne axle load (TAL), 115 kilometres per hour (km/h) maximum speed, 1,800 m length (initial) 2.7 horsepower per tonne (hp/tonne) power:weight ratio
Bulk freight	25 TAL (initial), 80 km/h maximum speed, length determined by customer requirements within maximum train length
Operational specification	
Freight train transit time (terminal to terminal)	Target driven by a range of customer preferences and less than 24 hours Melbourne–Brisbane for the intermodal reference train Flexibility to provide for faster (higher power:weight ratio) and slower (lower power:weight ratio) services to meet market requirements

1. The EIS includes an estimated capital cost profile of approximately $1.1 billion, consistent with the Inland Rail Programme Business Case (ARTC, 2015a) and is an estimate of direct construction costs—including, but not limited to: delivering environmental and heritage commitments; fencing and earthworks; tunnels and tunnel services; formation and roadworks; structures; track works (loops and crossings); delivery works (incidentals and utilities); and supply of track, sleepers and turnouts.
The Project is expected to represent an investment of up to $1.4 billion—this figure includes both direct construction costs and indirect costs. Indirect costs include items such as: design services, Contractor overhead and margins, contingency, and escalation.
The total investment figure also includes ARTC Program costs such as project management, train control systems, property requirements and insurances.
The total investment figure makes provision for expected Project contingency and risk.
Further detail on the economic impact assessment is located in Chapter 16: Economics and Appendix V: Economic Impact Assessment Technical Report.

Attribute	Specification
Gauge	Standard (1,435 mm) with dual standard/narrow (1,067 mm) gauge in appropriate Queensland sections
Maximum freight operating speed	115 km/h at 21 TAL
Maximum axle loads (initial)	21 tonnes at 115 km/h, 23 tonnes at 90 km/h, 25 tonnes at 80 km/h
Maximum train length	1,800 m (initial), with potential for operation of 3,600 m trains
Minimum design standards	
Design speed	115 km/h target, 80 km/h minimum
Maximum grade	1:100 target, 1:80 maximum (compensated) 1:200 maximum at arrival or departure points at loops
Curve radius	115 km/h sections: 1,200 m target, 800 m minimum 80 km/h sections: 800 m target, 400 m minimum
Rail corridor width	40 m minimum
Rail	Minimum 53 kg/m on existing track; 60 kg/m on new or upgraded track
Concrete sleepers	Rated to 30 TAL
Sleeper spacing	667 mm spacing (1,500/km)—existing track 600 mm (1,666/km)—new corridors/track or re-sleepering existing track
Turnouts	Rated at track speed on the straight and 80 km/h entry/exit on the diverging track
Crossing loops (initial)	1,800 m (clearance point to clearance point) plus signalling overlap No level crossing across loops or within road vehicle sighting distance from loops
Future proofing	
Train length	To provide for future extension of maximum train length to 3,600 m
New structures	Capable of 30 TAL at 80 km/h minimum
Formation	Formation on new track suitable for 30 TAL at 80 km/h
Crossing loops	Loops designed and located to allow future extension for 3,600 m trains
Reliability and availability	Competitive with road

6.2.2 Design elements

Specific design elements are described in the following sections. Some design elements are explained using chainage. Chainage is the distance measured along the railway line from its beginning point.

Rail

The Project includes the establishment of 216.2 km of new single-track railway, consisting of 7 km of standard-gauge rail (1,435 mm) and 209.2 km of dual-gauge rail (standard (1,435 mm) and narrow (1,067 mm) gauge). Figure 3 shows a typical section for a standard-gauge ballasted track. Figure 4 shows a typical section for a dual-gauge ballasted track.

The 7 km of standard-gauge rail is a continuation of track from the North Star to NSW/Queensland Border Project and extends from the NSW/QLD border to the tie-in point with the South Western Line at Kurumbul. The remainder of railway for the Project will be dual standard/narrow gauge to enable interoperability with the existing QR network.

The Project requires establishment of approximately 145 km of new rail corridor (greenfield) and approximately 71.2 km of upgrades, enhancements or construction of new track within existing rail corridors (brownfield) coincident with the South Western Line and the Millmerran Branch Line, which are components of QR's South Western System.

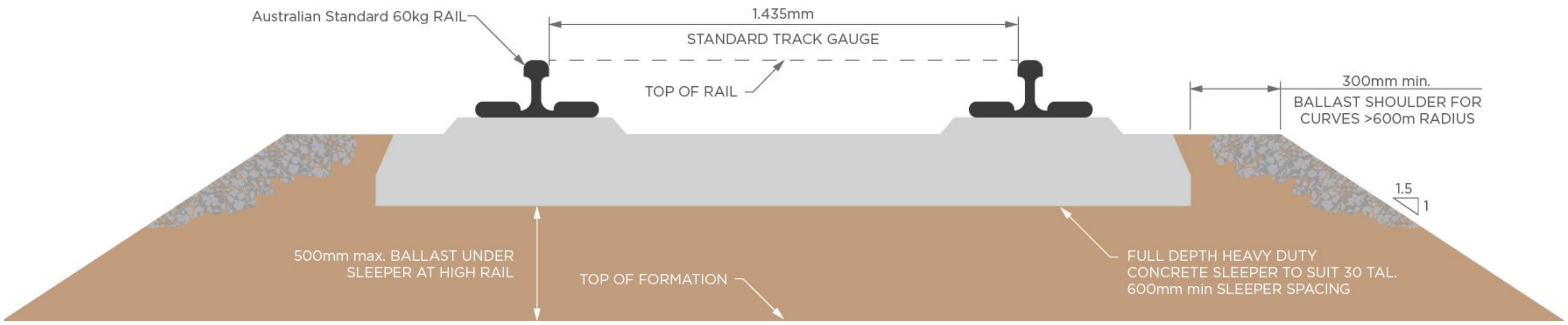


FIGURE 3 TYPICAL STANDARD-GAUGE BALLASTED TRACK CROSS SECTION

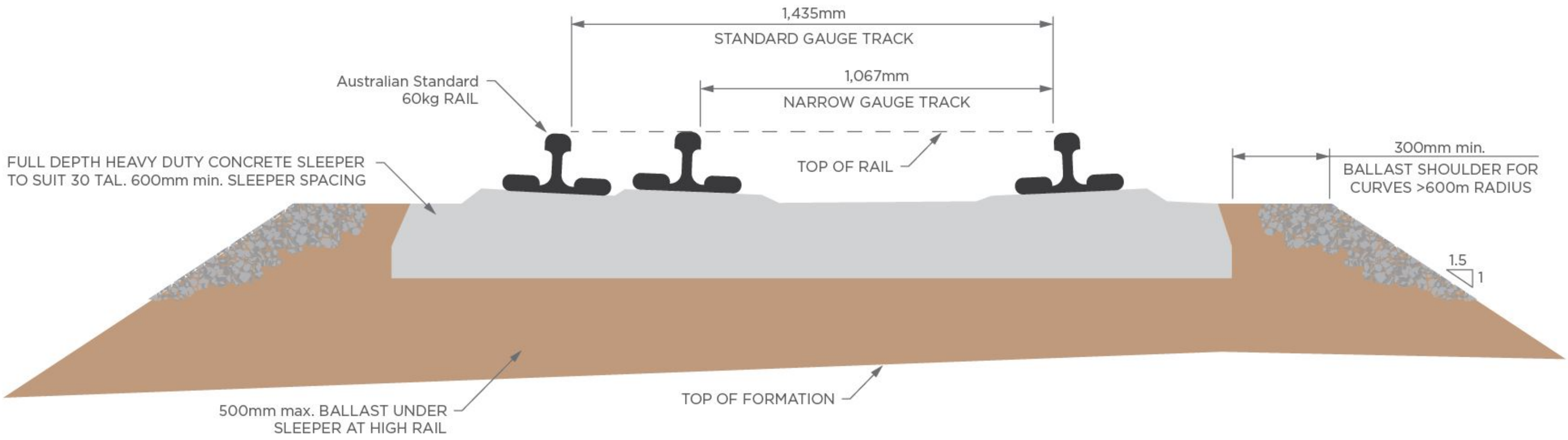


FIGURE 4 TYPICAL DUAL-GAUGE BALLASTED TRACK CROSS SECTION

The track structure will be a ballasted track system (including bridges) consisting of continuously welded rail, resilient fasteners, rail pads and concrete full-depth sleepers at 600 mm centres.

The ballast depth below the low rail will be a minimum 250 mm and will not exceed 500 mm, with minimum 300 mm shoulder width for lateral restraint.

Crossing loops

Crossing loops are places on a single-line track where trains in opposing directions can pass each other. The Project includes five new crossing loops. The selection of crossing loop locations was informed by operational modelling for the Inland Rail Program and has taken into consideration proximity to sensitive receptors, interferences with existing infrastructure and flexibility for future extension.

The loops would be constructed as new sections of track roughly parallel to the existing track. They would each be 2,200 m long to initially accommodate 1,800 m trains. Crossing loops have been positioned to enable future extension to accommodate 3,600 m trains (future proofed). The proposed locations for the crossing loops are:

- Yelarbon—Chainage (Ch) 16.3 km to Ch 18.5 km (future-proofed to Ch 20.3 km)
- Inglewood—Ch 50.2 km to Ch 52.4 km (future-proofed to Ch 54.2 km)
- Kooroongarra—Ch 89.2 km to Ch 91.4 km (future-proofed to Ch 93.2 km)
- Yandilla—Ch 129.8 km to Ch 132.0 km (future-proofed to Ch 129.3 km)
- Broxburn—Ch 174.9 km to Ch 177.1 km (future-proofed to Ch 178.9 km to accommodate 3,600 m trains).

Each of these locations is shown on Figure 5.

FIGURE 5 LOCATIONS OF CROSSING LOOPS ALONG THE PROJECT ALIGNMENT

A typical layout of a crossing loop is shown in Figure 6.

FIGURE 6 TYPICAL LAYOUT OF A CROSSING LOOP

Bridges

Bridge structures are required so that water, vehicles and, in some cases, stock and pedestrians may cross the proposed rail corridor. Bridge structures may either be rail-over-watercourse or road, or road-over-rail, depending on local topology and rail or road alignment requirements.

The Project involves the construction of 34 new bridge structures, as follows:

- Rail-over-road bridges: 11
- Rail-over-waterway bridges: 20 (Includes one bridge that also goes over a road)
- Road-over-rail bridges: 3

These structures are summarised in Table 3. The Project does not involve the reinstatement or reconstruction of any existing bridge structures.

TABLE 3 SUMMARY OF BRIDGE STRUCTURES FOR THE PROJECT

Bridge name	Chainage start (km)	Chainage end (km)	Crossing type	Bridge length (m)
Macintyre River Viaduct	30.5 (NS2B)	30.7 (NS2B)	Rail-over-waterway	165
	30.7 (NS2B)	31.1 (NS2B)	Rail-over-waterway	435
Macintyre Floodplain #1 Rail Bridge	31.4 (NS2B)	31.6 (NS2B)	Rail-over-waterway	140
Macintyre Floodplain #2 Rail Bridge	32.2 (NS2B)	32.8 (NS2B)	Watercourse and road	546
Cunningham Highway Bridge	25.6		Road-over-rail	104
Macintyre Brook Rail Bridge 1	52.4	52.7	Rail-over-waterway	207
Macintyre Brook Rail Bridge 2	55.4	55.6	Rail-over-waterway	207
Pariagara Creek Rail Bridge	67.2	67.5	Rail-over-waterway	345
Cattle Creek Rail Bridge	88.2	88.3	Rail-over-waterway	138
Native Dog Creek Rail Bridge	93.8	94.0	Rail-over-waterway	184
Bringalily Creek 1 Rail Bridge	97.4	97.7	Rail-over-waterway	299
Bringalily Creek 3 Rail Bridge	100.1	100.7	Rail-over-waterway	621
Nicol Creek Rail Bridge	104.3	104.4	Rail-over-waterway	92
Millmerran–Inglewood Road Rail Bridge #2	115.5	115.6	Rail-over-road	75
Millmerran–Inglewood Road Rail Bridge #3	126.9	127.1	Rail-over-road	167
Back Creek Rail Bridge	127.9	128.1	Rail-over-waterway	230
Grasstree Creek #1 Rail Bridge	138.0	138.3	Rail-over-waterway	336

Bridge name	Chainage start (km)	Chainage end (km)	Crossing type	Bridge length (m)
Grasstree Creek #2 Rail Bridge	138.8	139.3	Rail-over-waterway	952
Condamine River #1 Rail Bridge	141.3	142.0	Rail-over-waterway	658
Condamine River #2 Rail Bridge	142.6	144.5	Rail-over-waterway	1,918
Condamine River #3 Rail Bridge	144.5	145.1	Rail-over-waterway	602
Condamine River North Branch Rail Bridge	147.8	149.3	Rail-over-waterway	1,568
Gore Highway Bridge	153.1		Road-over-rail	108
Yarranlea Road Rail Bridge	161.2	161.2	Rail-over-road	69
Roche Road Rail Bridge	163.2	163.3	Rail-over-road	121
Oakey Pittsworth Road Rail Bridge	170.9	171.0	Rail-over-road	69
Lochaber Road Rail Bridge	172.4	172.5	Rail-over-road	75
Linthorpe Road Bridge	175.9		Road-over-rail	66
Biddeston-Southbrook Road Rail Bridge	183.5	183.7	Rail-over-road	144
Toowoomba-Cecil Plains Road Rail Bridge	196.1	196.1	Rail-over-road	92
Westbrook Creek Rail Bridge	197.1	197.4	Rail-over-waterway	230
Dry Creek Rail Bridge	197.9	198.0	Rail-over-waterway	184
Brimblecombe Road Rail Bridge	198.7	198.8	Rail-over-road	75
Warrego Highway Rail Bridge	203.0	203.1	Rail-over-road	132
Chamberlain Road Rail Bridge	204.4	204.5	Rail-over-road	299

The type of bridge proposed for a location depends on a range of factors, including the local topography, road usership, rail and road alignments at the crossing point and access requirements. Bridges have been provided at all major watercourse crossings along the Project alignment to minimise impacts to flow regimes and to avoid having to divert watercourses.

A typical section of a road-over-rail bridge structure is illustrated in Figure 9. Typical sections of rail bridges are illustrated in Figure 7 and Figure 8.

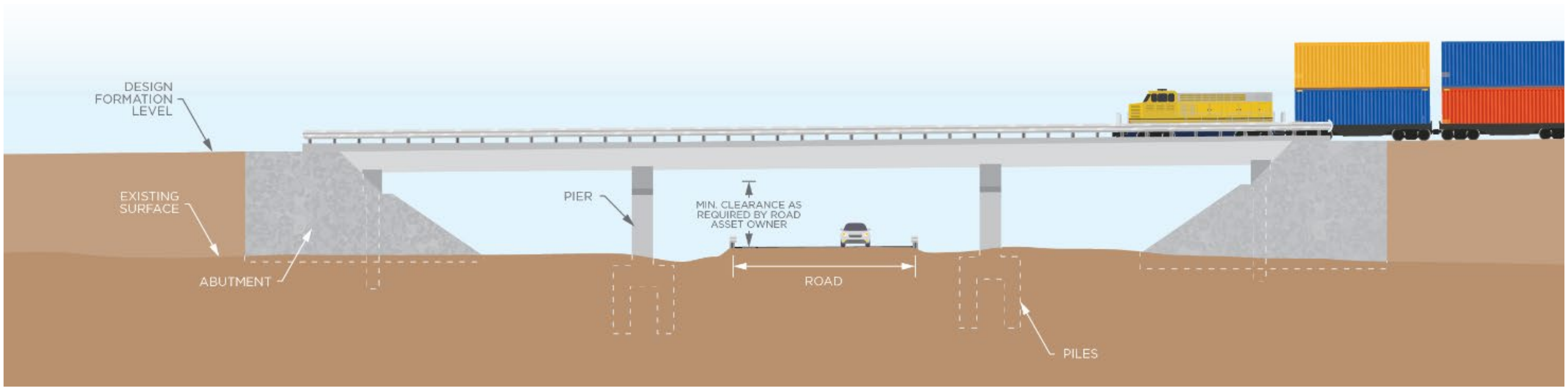


FIGURE 7 TYPICAL SECTION OF RAIL-OVER-ROAD BRIDGE STRUCTURE

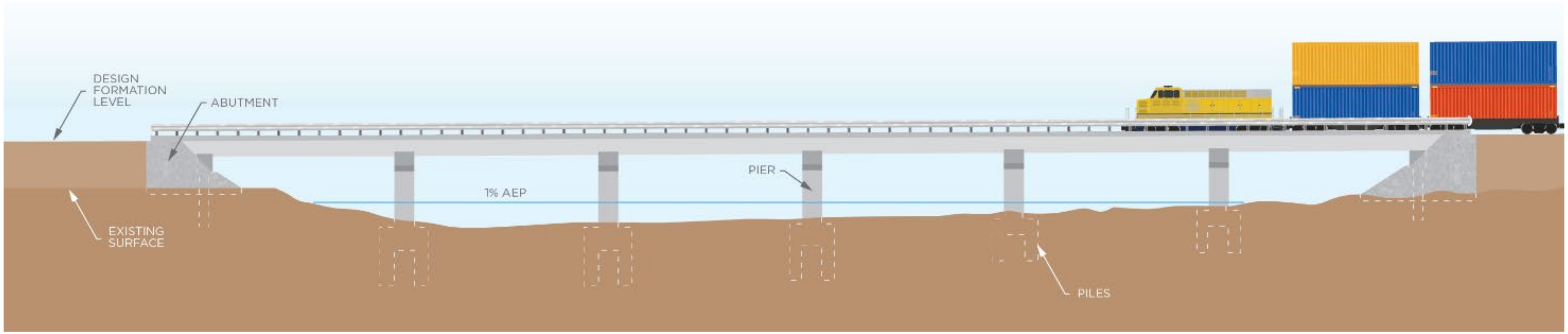


FIGURE 8 TYPICAL SECTION OF RAIL-OVER-WATERCOURSE BRIDGE STRUCTURE

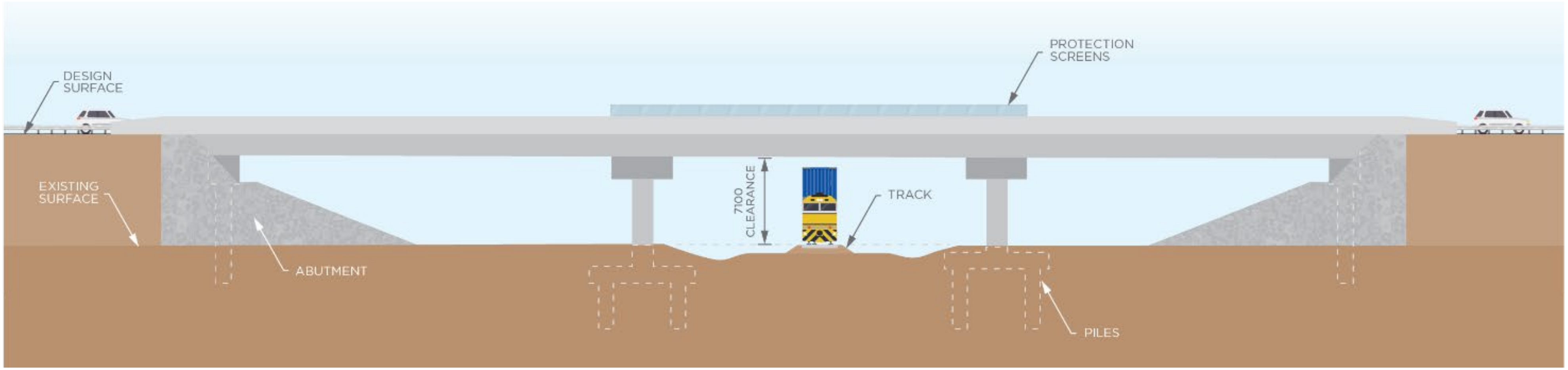


FIGURE 9 TYPICAL SECTION OF ROAD-OVER-RAIL BRIDGE STRUCTURE

Interfaces with existing rail network

The Project will require upgrade and tie-ins with QR's South Western Line and Millmerran Branch Line. Upgrade works will include the removal of existing narrow-gauge track (rail and sleepers) and the construction of new formation and dual-gauge track within the existing rail corridor.

The lengths of Project interface with these existing railways are summarised in Table 4.

TABLE 4 SUMMARY OF INTERFACES WITH EXISTING QUEENSLAND RAIL INFRASTRUCTURE

Proposed interface with Queensland Rail corridor	Approximate length (km)
Upgrade of South Western Line to a dual-gauge track	46.8
Upgrade of Millmerran Branch Line to a dual-gauge track	24.4

The staging of the existing rail upgrade works during construction and its associated impacts will be subject to interface and track possession agreements with QR.

Turnouts are switches that allow a train to be guided from one section of track to another. Where the Project replaces the existing QR line, connections are provided to existing sidings and an existing crossing loop. These connections will be achieved with dual-gauge turnouts with a narrow-gauge turn-off leg. Turnouts to existing sidings and loops are listed in Table 5 and shown on Figure 10.

TABLE 5 TURNOUTS TO EXISTING QUEENSLAND RAIL NETWORK, SIDINGS AND LOOPS

Location	Description	Turnout type
Ch 37.6 km (NS2B)	South Western Line connection at Kildonan	Standard gauge from NSW to Kildonan (Ch 37.6 km). Dual gauge eastwards from Ch 37.6 km towards Yelarbon. Single gauge westwards from Ch 37.6 km towards Goondiwindi.
Ch 6.1 km	Kurumbul Loop	Dual-gauge Inland Rail to narrow-gauge loop
Ch 6.6 km	Kurumbul Siding	Dual-gauge Inland Rail to narrow-gauge siding
Ch 6.9 km	Kurumbul Loop	Dual-gauge Inland Rail to narrow-gauge loop
Ch 26.1 km	Yelarbon Loop	Dual-gauge Inland Rail to narrow-gauge loop
Ch 26.5 km	Yelarbon Siding	Dual-gauge Inland Rail to narrow-gauge siding
Ch 27.0 km	Yelarbon Loop	Dual-gauge Inland Rail to narrow-gauge loop
Ch 44.6 km	South Western Line connection at Whetstone	Dual-gauge Inland Rail to narrow-gauge South Western Line
Ch 138.0 km	Millmerran Branch Line connection at Yandilla	Dual-gauge Inland Rail to narrow-gauge Millmerran Branch Line
Ch 152.9 km	Brookstead Siding East	Not provided, as this siding is not currently used for rail operations, and may cause conflict with the proposed GrainCorp access road A future turnout is possible but would need to consider interaction with the GrainCorp access road.
Ch 153.1 km	Brookstead Siding West	Dual-gauge Inland Rail to narrow-gauge siding
Ch 159.0 km	Millmerran Branch Line connection at Yarranlea	Dual-gauge Inland Rail to narrow-gauge Millmerran Branch Line

FIGURE 10 LOCATIONS OF TURNOUTS ALONG THE PROJECT ALIGNMENT

Road–rail interfaces

Road–rail interfaces are points at which the Project alignment intersects a public road. The Project requires the crossing of State-controlled roads and local government (Goondiwindi Regional Council (GRC) and Toowoomba Regional Council (TRC)) roads. A summary of the number of interfaces with each public road type is presented in Table 6.

TABLE 6 ROAD INTERFACE TREATMENTS INCLUDED IN THE REFERENCE DESIGN FOR THE PROJECT

Road interface treatments	Number
State-controlled roads:	**7 roads in 9 locations**
▸ Active level crossing	2
▸ Grade separation: rail-over-road	5
▸ Grade separation: road-over-rail	2
Local government roads:	
▸ Goondiwindi Regional Council (GRC)	
▸ Passive level crossing	8
▸ Active level crossing	8
▸ Grade separation: rail-over-road	2
▸ Grade separation: road-over-rail	0

Road interface treatments	Number
Toowoomba Regional Council (TRC)	
- Passive level crossing	12
- Active level crossing	7
- Grade separation: rail-over-road	6
- Grade separation: road-over-rail	1

Treatments for public road–rail interfaces can be categorised as:

- **Grade separated crossings**—road and rail cross each other at different heights so that traffic flow is not affected. Grade separations are either road-over-rail, or rail-over-road.
- **Level crossings**—road and rail cross each other at the same level. Level crossings have either passive or active controls to guide road users:
  - Passive—have static warning signs (e.g. stop and give way signs) that are visible on approach. This signage is unchanging, with no mechanical aspects or light devices.
  - Active—flashing lights with or without boom barriers for motorists, and automated gates for pedestrians. These devices are activated prior to and during the passage of a train through the level crossing.
- **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 where 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.

For public crossings, ARTC is engaging and will continue to engage with the Department of Transport and Main Roads (DTMR), GRC and TRC on preferred road–rail interface treatments for each location.

Rail maintenance access roads

Rail maintenance access roads are required to facilitate maintenance for critical infrastructure (e.g. turnouts), and to provide access for emergency recovery. Formation level access has been proposed for all turnout locations and, where reasonably practical, for the full extent of crossing loops.

For the considerable number of bridge abutments requiring access for inspection and maintenance, a surface-level access road has been proposed unless there are location-specific reasons for providing a formation-level access road.

Utilities

A total of 656 utilities that interface with the reference design for the Project have been identified. A preliminary review of the likely requirements for major diversions of utilities has been completed. The potential major utility diversions that may have an impact on construction are listed in Table 7.

TABLE 7 SUMMARY OF UTILITY INTERFACE TREATMENTS BY SERVICE TYPE

Utility/service	Protection	Relocation	Remain in place—no treatment required	Total
Communication	44	457	3	504
Electricity		95	39	134
Gas	2			2
Oil	1			1
Potable water	1	3		4
Raw water		2	1	3
Recycled water	5	1		6
Sewer gravity main		1		1
Sewer rising main		1		1
Total	**53**	**561**	**42**	**656**

Utility owners have been consulted by ARTC during reference design development to establish potential interface impacts and to identify initial design solutions.

Fencing

Several fencing types will be provided for the Project. Fencing specifications will vary according to function and purpose.

Access and security

The primary reason for the majority of fencing along the length of the rail corridor is to limit access to the railway. Fencing will act to protect adjoining lands from trespass and to prevent stock on such adjoining land from gaining access to the railway. Fencing is to extend between the corridor and lands of owners or occupiers adjoining the railway, with any specific requirements to be designed in consultation with the adjoining landowner.

As the Project comprises substantial greenfield works in rural agricultural and grazing areas, standard rural fencing will typically be provided. Where superior fencing is required (for example where tracks are in proximity to roads and/or communities, or where trespass is anticipated to occur) a 1.8 m chain link boundary fence may be provided.

Fencing will not be provided across flood-prone areas due to the risk of debris being caught in the fencing during flood events. Instead, guideposts will be used to demarcate the extent of the rail corridor across the floodplain.

Gates will be provided at suitable corridor entry/exit locations to allow convenient access to infrastructure for maintenance purposes, and at private level crossings and stock crossings.

Fauna movement

Maintaining effective fauna movement across the rail corridor has been an important design consideration for the Project. A preliminary fauna movement provision and fencing strategy has been prepared for the Project. The intent of this strategy is to identify fauna movement and fencing opportunities that are to be investigated further during the detail design phase of the Project, to confirm the appropriateness of each solution at the nominated location. Fauna movement opportunities that have been identified for the Project are classified as follows:

- At grade crossing, via track crossing
- Overpass, via canopy bridge
- Underpass at rail bridge location.

The opportunity to provide fauna exclusion fencing in association with the above-mentioned fauna crossings has been identified. This fencing would guide animals towards the preferred fauna crossing structure or passage, while reducing their potential to be struck by vehicles or trains. A 3 m buffer, clear of vegetation on the habitat side of the fauna exclusion fence, would be required to ensure that species cannot use vegetation to climb onto the exclusion fencing.

Pest exclusion fencing

The Project alignment runs parallel to the existing wild dog check fence from Ch 26.8 km to 43.5 km and it then intersects the wild dog check fence at four locations, Ch 50.1 km, Ch 51.2 km, Ch 54.9 km and Ch 56.0 km. The wild dog check fence will need to be reinstated on the northwest side of the rail corridor boundary in six locations, as rectification for severance of this fence.

The Project intersects the Darling Downs–Moreton Rabbit Board (DDMRB) fence when traversing through the locality of Clontarf, at approximately Ch 120.2 km. The rabbit fence will need to be reinstated and a rabbit trap will be set up in this location.

ARTC has commenced consultation with the GRC and DDMRB to determine fencing requirements at these locations. ARTC's nominated fencing solution for reinstatement of the fences will be submitted to the relevant asset manager for acceptance prior to works commencing.

Signalling and communications

A direct traffic control signalling system is currently used on the existing South Western Line and Millmerran Branch Line. Train movements on these lines are controlled and communicated via QR's control centre in Brisbane.

The Project will be operated using Advanced Train Management System (ATMS), a communications-based safeworking signalling system currently being developed by ARTC. The ATMS will consist of signalling and communications equipment to ensure the safe movement of trains on the Inland Rail network. This system will consist of signals, indicators, signs, detection, monitoring and control equipment on track, beside the track and in enclosures in the rail corridor. The safeworking system will be monitored and controlled by one or more of ARTC's network control centres currently located in Adelaide, Junee and Newcastle.

The ATMS will replace the Direct Traffic Control signalling system operation on sections of replaced QR track. This will interrupt the current continuous Direct Traffic Control operation along QR's network. The interoperability of the ATMS with QR's network will be confirmed through consultation with QR and incorporated into the detail design for the Project.

6.3 Construction

6.3.1 Construction schedule

Construction of the Project will commence once the detail design is complete and all the necessary approvals have been obtained. The estimated construction milestones are:

- Contract award end of 2020
- Pre-construction activities and early works commence in 2021
- Target completion of construction by the beginning of 2026
- Six months testing and commissioning phase.

The anticipated construction schedule may be subject to change as a result of:

- Weather conditions
- Changes to construction methods and materials
- Unexpected finds, such as threatened biodiversity species or cultural heritage values
- Community interest in the Project or issues that need to be addressed.

If the duration and timing of construction were to change, work will be rescheduled, considering site-specific environmental and engineering constraints. The schedule of environmental controls, including traffic management and noise controls, would also be adjusted.

6.3.2 Construction hours

The construction program will generally be based on the following worksite hours:

- General construction activities:
  - Monday to Friday—6.30 am to 6.00 pm
  - Saturday—6.30 am to 1.00 pm
  - No work planned on Sundays or public holidays.
- Track possessions may occur on a 7-day/24-hour calendar basis, subject to agreement with QR.

Track possession of QR's assets will generally be allocated over weekend periods, with extended track possession occurring over holiday periods.

There may be circumstances where work outside the above standard hours, including night works, will be required, for example, for the delivery of materials. Work outside standard hours will only be undertaken where consultation with the local community has been undertaken.

6.3.3 Construction workforce

A preliminary estimate of the workforce required to undertake the construction tasks for the Project to the anticipated construction schedule is shown in Figure 11. Workforce onsite for the Project is estimated to peak at 950 full-time equivalents (FTE) between weeks 50 and 70. The average number of FTE workforce onsite across the full construction period is over 400 people.

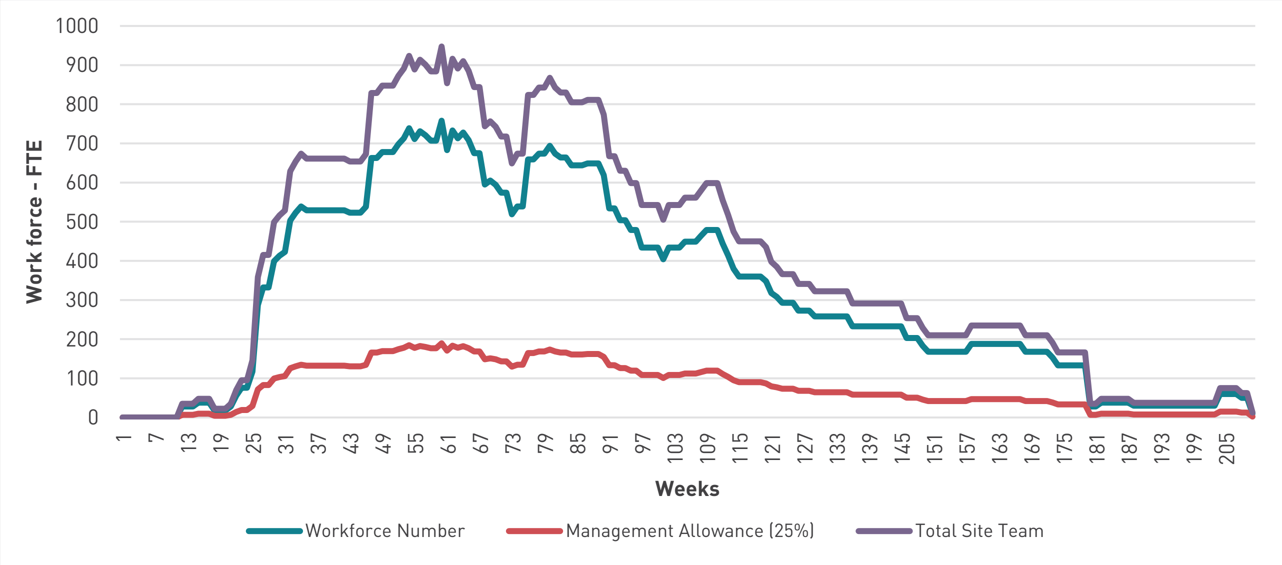


FIGURE 11 EXPECTED SITE WORKFORCE

6.3.4 Laydown, stockpile and storage areas

Several laydown areas have been identified along the length of the Project. These laydown areas are situated next to the rail corridor to facilitate direct access to/from the laydown to the rail corridor. The laydown areas will act as designated locations for all material storage. Some laydowns will also consist of fuel storage areas and site office compounds. Establishing temporary laydown areas will generally involve clearing, grubbing, topsoil stripping, installing environmental controls, laying hardstand material, and constructing parking areas and temporary vehicle access.

Each bridge location along the Project alignment will have a dedicated laydown/work area. The area may also include crane pads for the lifting of bridge members. These areas are primarily to support bridge works; however, larger areas have been provided for locations requiring the storage of other materials that are not associated with the construction of bridges.

Each laydown has been positioned to avoid or minimise potential impacts to environmental and social receptors. The locations of the laydown areas have been chosen to avoid areas that are within the 1% annual exceedance probability (AEP) floodplains, where possible. AEP refers to the probability of a flood event occurring in any year. By virtue of the requirement of laydown areas for constructing bridges; however, some laydown areas must be within floodplains and near watercourses or drainage features. In such instances, the following precautions will be taken:

- The potential site will be surveyed prior to site establishment to understand the exact extent of potential flooding impact to facilities and storage areas
- The earthworks and temporary drainage will be designed to minimise flooding impacts
- Critical equipment would be placed on earthworks and plinths that raise it above the predicted 1% AEP water level.

Excess material resulting mainly from the excavation of track formation and longitudinal drainage will be stockpiled along the rail corridor. The stockpiles will be located as close as possible to the source of the excavated material and will be formed into permanent spoil mounds, spread out to minimise height.

6.3.5 Concrete batching

Two locations have been identified as potential pre-cast concrete facilities and concrete batch plants for the Project (refer Table 8). While two locations have been nominated, only one plant is expected to be necessary to supplement the supply of concrete from established plants. The proposed locations are immediately north and south of the Condamine River floodplain outside the 1% AEP flood line.

TABLE 8 PRECAST CONCRETE FACILITY AND CONCRETE BATCH PLANT LOCATIONS

Location	Chainage	Description
Gore Highway and Dieckmann Road	Ch 150.5 km	Precast concrete facility and concrete batch plant—north
Gore Highway	Ch 137.0 km	Precast concrete facility and concrete batch plant—south

6.3.6 Non-resident workforce accommodation

The accommodation requirements for workforce in the northern extent of the Project are expected to be sufficiently met by existing accommodation available in Toowoomba, and surrounding towns such as Southbrook and Pittsworth. Existing accommodation is less readily available south of Pittsworth. To compensate for this shortage in accommodation, the Project includes allowance for three non-resident workforce accommodation sites to accommodate the construction workforce. Each accommodation will be required to hold 300 staff during the peak, between weeks 50 and 70. The average occupancy of the accommodation outside of the peak period will be approximately 150 people per site.

Table 9 identifies the three properties that have been identified as suitable for the establishment of non-resident workforce accommodation.

TABLE 9 INDICATIVE LOCATIONS FOR NON-RESIDENT WORKFORCE ACCOMMODATION

Lot and plan	Address
Lot 30 MH721	Cunningham Highway, Yelarbon
Lot 5 MH75	Millmerran–Inglewood Road, Inglewood
Lot 135 DY1033	553 Turallin Road, Turallin

At a minimum, non-resident workforce accommodation will be self-contained and will include accommodation units with kitchen, dining, ablution and laundry facilities. Supporting and additional infrastructure associated with each site will include:

- Potable water storage—approximately 0.51 megalitre (ML) of water per five-day week of operation during peak occupancy, based on average usage of 340 litres (L) per person, per day
- Water and wastewater treatment and collection facilities, including temporary package sewage treatment (estimated capacity of 300 equivalent population)
- Power generation (if not connected to the local electricity grid) by diesel-powered generators, in combination with solar panels, where appropriate
- Solid waste-collection facilities
- Recreational facilities
- Paramedic and first aid facilities
- Offices
- Car parking and gatehouse/security.

The layout of each non-resident workforce accommodation site will vary depending on site constraints and accessibility to existing services. Where water and sewerage treatment plants are used, they will be package systems capable of the complete purification of domestic sewage to a degree allowing discharge to local water courses, irrigation and reuse.

Statutory approvals will be obtained post-EIS for non-resident workforce accommodation prior to the commencement of operation.

6.3.7 Construction water

Significant volumes of water will be required for various activities associated with construction of the Project, including for earthworks, concrete production, track works and the operation of non-resident accommodation. A summary of the estimated water requirement by construction activity is presented in Table 10.

TABLE 10 SUMMARY OF ESTIMATED WATER REQUIREMENT BY CONSTRUCTION ACTIVITY

Construction activity	Estimated water requirement (ML)
Rail	
Material conditioning	1,225
Dust suppression and revegetation[1]	613
Haul road and laydown area maintenance	490
Rail total:	**2,328**
Roads	
Material conditioning	110
Dust suppression and revegetation[1]	55
Haul road and laydown area maintenance	44
Roads total:	**209**
Track works	
Dust suppression during ballast dropping	1.30
Dust suppression during tamping and regulating	0.86
Track works total:	**2.16**
Concrete[2, 3]	
Precast concrete	4.8
Wet (bulk) concrete	10.2
Concrete total:	**15.0**

Table notes:

1. This allowance covers the water required to re-establish vegetation on disturbed surfaces following the completion of works
2. Excludes concrete (in situ and precast) for culverts, which will all be supplied by existing commercial suppliers
3. For in-situ concrete required between Ch 138 km and Ch 165 km. In-situ concrete required outside of this chainage range will be supplied by existing commercial concrete batching plants.

For three non-resident workforce accommodation operating at full capacity (300 beds) over a 58-month period, a total conservative water usage of 540 ML is estimated. A breakdown of this total volume is presented in Table 11.

TABLE 11 ESTIMATED WATER USAGE FOR NON-RESIDENT WORKFORCE ACCOMMODATION

Rate of water usage (L/p/d)	Occupants per site	Daily water usage (kL/day/site)	Days of operation[1]	Total water usage per facility (ML)	Number of accommodation sites	Total water usage (ML)
340	300	102	1,765	180.03	3	540.09

Table note:

1. Based on 58 months of accommodation operation

ARTC recognises water sourcing and availability is critical to supporting construction for the Project. Preparation and implementation of a water plan outlining construction water management strategies will be finalised as the construction approach is refined during the detail design and tender phases of the Project (post-EIS) and will be dependent on:

- Climatic conditions in the lead up to construction
- Confirmation of private water sources made available to the Project by landowners under private agreement
- Confirmation of access agreements with local governments for sourcing of mains water.

The hierarchy of preference for accessing of construction water is generally anticipated to be as follows:

- Commercial water supplies where capacity exists—existing infrastructure, well-understood water systems, available water volumes known, licensing in place
- Public surface water storages, i.e. dams and weirs
- Permanently (perennial) flowing watercourses
- Privately held water storages, i.e., dams or ring tanks, under private agreement
- Existing registered and licensed bores
- Treated water, e.g., from wastewater treatment plants, coal seam gas (CSG) plants, or desalination plants
- Drilling of new bores (least-preferred option).

An assessment of the suitability of each source will need to be made for each construction activity requiring water, based on the following considerations:

- Legal access
- Volumetric requirement for the activity
- Water-quality requirement for the activity, e.g. non-resident workforce accommodation will need potable water
- Source location relative to the location of need.

The construction water requirements (volumes, quality, demand curves, approvals requirements and lead times) will be confirmed through the construction approach refinement process. The refinement process will apply a hierarchical approach when confirming the suitability of water sources, with a focus on using existing sustainable allocated water entitlements from private water holders. The ultimate water-sourcing strategy for the Project will be documented in a Construction Water Plan.

Licenses, approvals and agreements to access water from sources identified in the finalised Construction Water Plan will be obtained. These may include water licenses under the *Water Act 2000* (Qld) (the Water Act) or access agreements with bulk water suppliers or private landowners.

6.3.8 Mass haul

The bulk earthworks for rail and road components of the Project are summarised in Table 12.

TABLE 12 SUMMARY OF BULK EARTHWORKS FOR RAIL AND ROAD COMPONENTS

Earthworks	Volume
Cut	
Unusable cut (without treatment)	148,905 m^3
Useable cut (without treatment)	12,376,132 m^3
Total cut	12,525,037 m^3
Fill	
General (rail)	9,595,807m^3
Structural (rail)	2,070,678 m^3
Capping (rail)	584,214 m^3
Fill requirement (rail)	12,250,699 m^3
Fill requirement (road)	1,096,670 m^3
Total fill requirement	13,347,369 m^3
Balance	**822,332 m^3 material deficit**

The total fill requirement (i.e. rail, road and supporting infrastructure) based on the reference design for the Project is 13,347,369 m^3. If all unusable cut material is able to be treated for re-use, then the total material deficit for the Project will be 822,332 m^3; however, this deficit may be up to 971,237 m^3 depending on the feasibility and success of material treatment options. The fill deficit for the Project will be met through the importation of appropriate material type from operational licensed quarries or from borrow pits established for the Project. Where possible, the re-use of fill from other Inland Rail projects may be considered, subject to the material complying with the required specifications, biosecurity legislation and distance from source location.

Different options have been identified for the reuse of localised excess cut material within the Project. Detailed mass haul assessment will be carried out in the detail design stage to assess the possibility of the following options:

- Use excess rock material for scour protection at bridge and culverts, if suitable
- Use excess material for temporary works construction, such as access roads, laydown areas etc.
- Construct rail maintenance access road at rail formation
- Extend rail formation for future passing loops
- Use excess material for other developments near the Project
- Rehabilitate borrow pit sites.

6.3.9 Borrow pits and quarries

Nineteen material source locations have been identified by ARTC as potentially suitable for use during construction activities. These sites consist of 7 external operational licensed quarries and 12 potential borrow pit sites. The feasibility and suitability of each materials source will be confirmed and statutory approvals, if required, will be obtained during detail design.

It is anticipated that sufficient useable material will be generated through cut (12,376,132 m3) to meet the necessary general fill (9,595,807 m3) and structural fill (2,070,678 m3) requirements for the Project; however, there may be localised instances where the haulage of material from the point of source to the location of need is prohibitive. In such instances, the Principal Contractor may elect to obtain general fill from borrow pits to supplement the general fill requirement for the Project.

In some instances, suitable ballast and capping material may be obtained through cut activities along the rail corridor; however, established quarries are expected to be the primary source for ballast and capping for the Project. The ballast and capping requirements for the Project are summarised in Table 13. These are the maximum tonnages of material that may be required from the external quarries.

TABLE 13 ESTIMATE OF QUARRY MATERIAL REQUIREMENT

Material type	Tonnes per metre of railway	Tonnes required
Bottom ballast	2	432.4
Top ballast	1	216.2
Capping	2	432.4

6.4 Landscaping and rehabilitation

Site restoration will be undertaken in accordance with the following:

- Inland Rail Environment and Sustainability Policy (refer Appendix E: Corporate Environment and Safety Policies)
- Inland Rail Landscape and Rehabilitation Strategy (available from: **inlandrail.artc.com.au/16369/widgets/111021/documents/173593/download**)
- Border to Gowrie Rehabilitation and Landscaping Sub-plan.

The Inland Rail Landscape and Rehabilitation Strategy documents ARTC's approach to meeting these obligations and establishes governing landscape objectives and principles. The strategy also outlines landscape and rehabilitation treatment solutions for the various phases of the Inland Rail Program. This includes the rail corridor and ancillary infrastructure, as well as temporary works areas such as construction access, site compounds, non-resident workforce accommodation, borrow pits and other enabling works.

Opportunities for beneficial re-use of construction facilities, such as laydown areas and non-resident workforce accommodation, will be investigated through consultation with local governments and relevant stakeholders.

Where a beneficial re-use cannot be identified, the construction facilities will be progressively decommissioned so that reinstatement and revegetation activities can commence as soon as possible. A Project-specific Rehabilitation and Landscaping Management Sub-plan will be developed prior to the completion of construction for the management of land that is not required for the operation phase. The Rehabilitation and Landscaping Management Sub-plan will be developed based on the Inland Rail Landscape and Rehabilitation Strategy and property-specific reinstatement commitments.

6.5 Commissioning

All construction works will be subject to approved testing and commissioning plans and appropriate inspection and test plan, as required.

Testing and commissioning (checking) of the rail line and communication/signalling systems will be undertaken to ensure that all systems and infrastructure are designed, installed, and operating according to ARTC's and QR's operational requirements. Testing and commissioning of the Project is scheduled to occur over a six-month period, commencing at the beginning of 2026.

For the connections to the existing QR and ARTC networks, the testing and commissioning plan will address the existing QR and ARTC signalling system and will need to be approved by both parties.

Commissioning of the track works will require completed inspection and test plans, clearance reports, weld certification, rail stressing records, as-built documentation and track geometry reports.

6.6 Operation

Operation will include the use of the railway for freight purposes, operation and maintenance of safety systems, signalling, and general track and infrastructure maintenance. The hours of operation are anticipated to be on a 24-hour/7-day calendar.

It is anticipated that the ongoing operation and maintenance of the Project will require a workforce of approximately 10–15 FTE. It is anticipated that the majority of the operational workforce will be based at provisioning centres outside the immediate vicinity of the Project.

Train control will be managed via ARTC's existing control centres. Train services will be provided by a variety of operators. Trains will be a mix of grain, bulk freight and other general transport. Inland Rail as a whole will be operational once all 13 sections are complete, which is estimated to be in 2026.

The Project will involve operation of a single-rail track with crossing loops, initially, to accommodate double-stacked freight trains, 1,800 m long and 6.5 m high. Train speeds will vary according to axle loads and track geometry, and range from 80 to 115 km/hr.

It is estimated that, once operational, the Project will involve an annual average of about 14 train services per day in 2026. This is likely to increase to an average of 20 trains per day in 2040, and up to 25 per day during peak operational periods. Annual freight tonnages will increase in parallel, from approximately 14.2 million tonnes per year in 2026 to 21.8 million tonnes per year in 2040.

Electricity supply will be needed for points, signalling and other infrastructure. It is anticipated that the supply of these services will be delivered by relevant providers under the terms of their respective approvals and/or assessment exemptions.

Standard ARTC maintenance activities will be undertaken during operations. Typically, these activities include:

- Minor maintenance works, such as:
  - Bridge inspections
  - Culvert cleanout
  - Sleeper replacement
  - Rail welding
  - Rail grinding
  - Ballast profile management
  - Track tamping
  - Clearing/slashing vegetation within the rail corridor.
- Major periodic maintenance, such as:
  - Ballast cleaning
  - Formation work
  - Reconditioning of track
  - Adjustment
  - Turnout replacement
  - Correction of track level and line
  - Maintenance of structures including waterproofing, jointing etc.

These activities will occur on a scheduled basis unless they are in response to unplanned requirements, e.g., maintenance following adverse weather events.

6.7 Decommissioning

The Project is expected to be operational for in excess of 100 years. The design life of structures is 100 years to support this operational objective. The decommissioning of the Project cannot be foreseen at this point in time and is therefore not considered further as a Project phase in this draft EIS.

If the Project, or elements of it, were subject to plans for decommissioning it is envisaged that the works would be undertaken in accordance with a Decommissioning Environmental Management Plan, or similar, which would be developed in consultation with relevant stakeholders and regulatory authorities.

7. Key findings of the Environmental Impact Statement

7.1 Land use and tenure

7.1.1 Existing environment and potential impacts

Approximately one third of the Project length will involve upgrade, enhancement or construction of new track coincident with existing rail corridor. The balance of the Project has been co-located with existing road infrastructure or will be established on land that, by and large, has been subject to previous disturbance for agricultural purposes.

Land surrounding the Project is predominantly used for livestock grazing, combined with other agricultural uses, including irrigated cropping. Other land uses include production forestry, other minimal use (consisting of areas of land that are largely unused, for example, residual native cover or land reserved for stock routes) and transport and communication.

The Project traverses through, or near to, the townships of Yelarbon, Inglewood, Millmerran, Pampas, Brookstead, Pittsworth, Southbrook, Athol, Gowrie Mountain and Kingsthorpe. Notable land uses traversed by, or located within proximity to, the Project include the Kildonan Key Resource Area (KRA 120), Whetstone State Forest, Bringalily State Forest, Commodore Mine, several intensive animal production operations, including cattle feedlots, poultry farms and piggeries and, at the north-eastern end, the Toowoomba Wellcamp Airport and Toowoomba Enterprise Hub.

The tenure of land within the permanent footprint is predominantly freehold, where new (greenfield) rail corridor is required for the Project, and leasehold, where using the existing South Western Line and Millmerran Branch Line rail corridors. Tenure within the impact assessment area is summarised in Table 14.

TABLE 14 TENURE WITHIN THE IMPACT ASSESSMENT AREA

	Permanent footprint			Temporary footprint		
Type of tenure	**No. of land parcels**	**Area (ha)**	**% of permanent footprint**	**No. of land parcels**	**Area (ha)**	**% of temporary footprint**
Freehold	368	1,878.02	70.8	453	399.36	72.6
Leasehold (other than State forest)	61	201.40	7.6	66	10.14	1.8
Leasehold (State forest)	2	112.18	4.2	2	13.18	2.4
Reserve	7	20.89	0.8	9	4.69	0.9
State land	2	4.71	0.2	12	0.16	0.0
Road type parcel	-	433.30	16.3	-	121.71	22.1
Watercourse	-	3.06	0.1	-	0.94	0.2
Total	**440**	**2,653.56**	**100.0**	**542**	**550.19**	**100.0**

The Project alignment has been intentionally located to use the existing South Western Line and Millmerran Branch Line rail corridors, where possible, minimising the extent of new properties to be acquired. Of the 440 properties within the permanent footprint, 58 are within the existing South Western Line and Millmerran Branch Line rail corridors.

Land acquisition for the Project will be in accordance with the requirements of the *Acquisition of Land Act 1967* (AL Act) (Qld). Where land is required within State forests, land required for the rail corridor will be revoked in accordance with the *Forestry Act 1959* (Qld), the *Operational Policy: Revocation of QPWS managed areas* (Department of Environment and Science (DES), 2016c) and, in consultation with DES, the Department of Agriculture and Fisheries (DAF) and the Department of Natural Resources, Mines and Energy (DNRME).

Land required for construction will also be acquired in accordance with the requirements of the AL Act, or leased from landowners, subject to individual agreements. This may include the temporary acquisition of land for the establishment of non-resident workforce accommodation to accommodate the construction workforce that will be unable to reside within local towns along the length of the Project alignment.

The Project interfaces with the State stock route network in 12 locations. Locations of stock routes that intersect with the Project are identified in Table 15.

TABLE 15 STOCK ROUTES THAT INTERFACE WITH THE PROJECT

Location and Project interface point (approximate chainage)	Stock route ID, type, status and class	Description
Kildonan Road Ch 33.1 km (NS2B)	**ID:** 005GWND **Type:** Road **Status:** Open **Class:** Primary	This stock route follows Kildonan Road. The Project alignment crosses this stock route at Kurumbul.
Rainbow Reserve and Eukabilla Road Ch 33.4 km (NS2B)	**ID:** RAINBOW RESERVE **Type:** Reserve **Status:** Open **Class:** Primary	This stock reserve encompasses the Rainbow Reserve camping area and Eukabilla Road. The Project alignment enters into this stock reserve at Ch 33.15 km (NS2B) and crosses Eukabilla Road at 33.4 km (NS2B). The Project alignment continues to run parallel to the western edge of the existing Eukabilla Road, within the stock reserve, to Ch 34.9 km (NS2B). At this point, it exits the stock reserve.
Wondalli–Kurumbul Road and Yelarbon–Kurumbul Road Ch 7.2 km	**ID:** 081GWND **Type:** Road **Status:** Open **Class:** Secondary	This stock route is aligned along Wondalli–Kurumbul Road and parallel to Yelarbon–Kurumbul Road, which runs adjacent to the existing South Western Line rail corridor. The Project alignment crosses this stock route at the intersection of Wondalli–Kurumbul Road and Yelarbon–Kurumbul Road.
Yelarbon Ch 25.4 km	**ID:** 811GWND **Type:** Road **Status:** Open **Class:** Minor and unused	This stock route is aligned with Merton Road, the Cunningham Highway and Yelarbon–Keetah Road. The stock route crosses the existing QR South Western Line at an active level crossing on the Cunningham Highway. The Project will require the closure of the existing active level crossing, to be replaced by a road-over-rail crossing approximately 400 m to the west of the existing crossing point. This road reconfiguration will result in the severance of the current stock route.

Location and Project interface point (approximate chainage)	Stock route ID, type, status and class	Description
East of Sawmill Road Ch 27.0 km	**ID:** RESERVE **Type:** Reserve **Status:** Open **Class:** Minor and unused	This is an isolated stock reserve, with no mapped stock route linkages. The stock reserve is bound by the Cunningham Highway to the west and east of Sawmill Road to the north. The Project involves curve easing of east of Sawmill Road, which will encroach by up to 15 m into the north–west corner of the stock reserve. The existing Yelarbon levee extends diagonally across this stock reserve. Modifications to the existing Yelarbon levee, if they are to occur, will temporarily require works within the stock reserve.
Lovells Crossing Road Ch 65.8 km	**ID:** 813GWD **Type:** Road **Status:** Open **Class:** Minor and unused	This stock route follows Lovells Crossing Road. The Project alignment crosses this stock route approximately 3 km north of Inglewood.
Millmerran–Inglewood Road (Inglewood) Ch 73.1 km to Ch 76.5 km	**ID:** 820GWD **Type:** Road **Status:** Open **Class:** Minor and unused	This stock route follows Millmerran–Inglewood Road. The Project alignment crosses this stock route twice in 10 km, once at Ch 75.0 km and again at Ch 85.0 km.
Millmerran–Inglewood Road (Inglewood) Ch 84.2 km	**ID:** 820GWD **Type:** Road **Status:** Open **Class:** Minor and unused	This stock route follows or runs parallel to the east of Millmerran–Inglewood Road. The Project alignment crosses this stock route at the point of the stock route re-joining Millmerran–Inglewood Road.
Kooroongarra–Anderson Road Ch 96.1 km	**ID:** 856TOOW **Type:** Road **Status:** Open **Class:** Minor and unused	This stock route branches off 820TOOW and provides an east–west connection to Stonehenge Road. The Project alignment crosses this stock route at the intersection of Kooroongarra–Anderson Road and Millmerran–Inglewood Road.
Millmerran–Inglewood Road (near Heckendorfs Road) Ch 115.5 km	**ID:** 820TOOW **Type:** Road **Status:** Open **Class:** Minor and unused	This stock route follows Millmerran–Inglewood Road. The Project alignment crosses this stock route approximately 900 m south of the intersection of Heckendorfs Road and Millmerran–Inglewood Road.
Kooroongarra Road (Commodore Mine) Ch 127.2 km	**ID:** 820TOOW **Type:** Road **Status:** Open **Class:** Minor and unused	The stock route follows Millmerran–Kooroongarra Road and Millmerran–Inglewood Road. This Project alignment crosses this stock route approximately 550 m north of the intersection between Millmerran–Inglewood Road, Millmerran–Kooroongarra Road and Schwartens Road.
Warrego Highway Ch 203.01 km	**ID:** No ID—Unused **Type:** Road **Status:** Open **Class:** Minor and unused	This stock route follows the Warrego Highway. The Project alignment crosses this stock route approximately 700 m west of the intersection between the Warrego Highway, Chamberlain Road and Jannuschs Road.

Potential impacts to land use and tenure as a result of the Project include:

- Change in tenure and loss of property. Specifically, acquisition of all or part of the following number of properties is expected to be required to accommodate the permanent footprint of the Project:
  - Freehold: 368
  - Leasehold: 3
  - Lands lease (State forest): 2
  - Reserve: 7
  - State land: 2
- Disruption to land over which native title claims have been made. The Project footprint traverses 10 properties where native title may continue to exist. This includes eight under reserve and two under State land tenure. Native title may also continue to exist in boundary watercourses.
- Temporary and permanent change in land use, including:
  - Loss of agricultural land. Approximately 1,860.83 ha of land within the permanent footprint (outside of existing rail and road corridors) is classified as Class A or Class B agricultural land and will be acquired for the Project
  - Land fragmentation and disruption to access and infrastructure
  - Alterations to stock routes, including realignments of:
    - Eukabilla Road Reserve
    - 811GWND at Yelarbon
    - 820GWD on Millmerran–Inglewood Road (two locations)
  - Alterations to the wild dog check fence and DDMRB fence
  - Other indirect impacts on agricultural land, without the implementation of appropriate environmental management controls may occur as a result of:
    - Land contamination
    - Biosecurity risks
    - Changes in surface water hydrology
    - Erosion and sedimentation.
- Impacts to accessibility, including impacts to the existing road network and to private property access. The reference design for the Project includes 53 crossing points of the public road network where the Project alignment and the road network interface. The reference design for the Project also includes 23 locations where a crossing is not provided at the location where the Project alignment and the road network interface.
- Disruption, relocation and modification to services and utilities
- Beneficial impacts, including supporting the agricultural industry, improving access to and from regional markets and acting as a catalyst for development in the area.

7.1.2 Development of reference design

The reference design for the Project has been developed to respond, where possible, to potential impacts to land use and tenure. Measures that have been incorporated into, or commenced in parallel with, the reference design development are as follows:

- The Project has been aligned to:
  - Be co-located with existing rail and road infrastructure, where possible, minimising the need to develop land that has not previously been subject to disturbance for transport infrastructure purposes. Of the 416 properties within the permanent footprint, 58 are within the existing South Western Line and Millmerran Branch Line rail corridors.
  - Avoid the current and future operational footprint of the Commodore Mine
  - Avoid KRA 120 to ensure adverse impacts on the operations of the KRA are minimised
  - Ensure that a double-stacked train on the Project alignment will not extend vertically into the obstacle limitation surface for the Toowoomba Wellcamp Airport.
- Refinement of the horizontal alignment considered placement of the rail corridor such that it traverses along, or as close as possible to, property boundaries to reduce potential fragmentation and sterilisation of Class A land, Class B land and land within important agricultural areas

- The Project footprint has been established to provide the minimum-sized area required to enable safe and efficient construction, operation and maintenance of the Project
- Intensive livestock operations, including feedlots and poultry farms, have been avoided where possible
- Consultation has commenced with GRC and with DDMRB regarding the severance and realignment of the wild dog check fence and the rabbit fence, respectively
- Where stock routes have been intersected by the Project, an allowance for the continuity of movement of stock along the same route has been made in the reference design. In some instances, such as Eukabilla Road Reserve, Yelarbon (811GWND) and the southern end of Millmerran–Inglewood Road (820GWD), this has involved allowance for a localised realignment of the current stock route.
- Consultation has commenced with Queensland Parks and Wildlife Service (QPWS) (part of DES), DAF, and DNRME regarding the process for revocation of State forest for the Project. The State forest revocation application will be supported by finalised land acquisition plans for the Project.

Proposed mitigation measures

Where impacts cannot be avoided, the extent of impacts will be managed, mitigated and/or compensated. Management, mitigation and compensation measures for impacts to land use and tenure include, but are not limited to:

- Where the Project requires the permanent acquisition of properties, this will be undertaken in accordance with the requirements of the AL Act. Where land is acquired by the compulsory acquisition process in accordance with the AL Act, compensation will be able to be claimed by the landowner after the 'Taking of Land Notice' is published in the Queensland State Government Gazette. Compensation will be assessed on an individual basis based on the market value of the land as at the date of resumption. Additional compensation amounts for disturbance caused by the resumption of a property is also payable.
- Mitigation measures for individual property treatments will be developed in consultation with landowners/occupants, with respect to the management of construction on, or immediately adjacent to, private properties
- During construction, land will be required temporarily. Purchasing or leasing arrangements for these properties will be investigated in consultation with relevant landowners
- Where native title has not been extinguished within the permanent footprint, prior to construction, ARTC will seek the extinguishment of the native title rights and interests in question to enable the grant of the interests required to construct the Project
- ARTC will work with individual landowners to ensure the continuation of current property management activities is allowed for, where possible, in the detail design and construction methodology. Feedback from landowner consultation, including agreed property mitigation measures, will be incorporated into property agreements (or similar), as appropriate.
- Where legal access to a property is permanently affected and a property has no other legal means of access, alternative access to and from a public road will be provided to an equivalent standard, where feasible and practicable
- Where an alternative access is not feasible or practicable, and a property is left with no access to a public road, negotiations will be undertaken with the relevant property owner for acquisition of the property in accordance with the provisions of the AL Act
- Development approvals for activities in support of the Project that have not been assessed through the EIS will be obtained in accordance with the requirements of the Planning Act and the *Environmental Protection Act 1994* (Qld)
- Consultation with DNRME, GRC and TRC will continue through the detail design process to ensure that the detail design for the Project achieves continued access of existing stock routes
- Consultation with resource interest holders will be undertaken during detail design. Where the Project may impact on likely significant deposits within the area, appropriate mitigation will be developed in consultation with tenement holders.
- New fencing will be installed prior to the removal of existing fencing and prior to any works being carried out on the subject land, unless otherwise agreed with the landowner
- Where severance of a biosecurity fence is required, it is anticipated that fence realignment and reconstruction will be undertaken as an early works package prior to the commencement of construction of rail infrastructure
- Land required temporarily during construction that is subject to ground disturbance will be rehabilitated in accordance with a Rehabilitation and Landscaping Management Sub-plan, as a component of the Construction Environmental Management Plan, following construction.

The Project is generally consistent with and supports the intent of the relevant State and regional land-use planning and policy instruments for the impact assessment area. This includes the Darling Downs Regional Plan, which identifies a long-term aspiration of a modal shift towards freight rail infrastructure, and is acknowledged within the *South East Queensland Regional Plan* (ShapingSEQ) (Department of Infrastructure, Local Government and Planning (DILGP, 2017a) document, which identifies the Inland Rail Program as key region-shaping infrastructure that supports the vision for South East Queensland.

7.2 Land resources

Existing environment and potential impacts

The assessment of land resources has included consideration of:

- Topography
- Geology
- Soils
- Acid sulfate soil (ASS)/acid rock
- Naturally occurring asbestos
- Saline, dispersive and reactive soils
- Erosion risk
- Contaminated land
- Agricultural land
- Soil conservation plans
- Unexploded ordnance (UXO).

The existing environment for the Project was prepared in reference to published datasets and literature, in addition to site-specific geotechnical and soils data collected during investigations undertaken to inform the development of the reference design and draft EIS for the Project.

The assessment established the existing conditions within the impact assessment to be as follows:

- The most common rock types found within the impact assessment area include sandstone, siltstone, mudstone, shale, coal and conglomerate. The landscape in the low-lying areas is mostly composed of undulating siltstone lowlands, while sandstone dominates the hills with alluvial sediment and highly weathered bedrock found along floodplains of the Condamine River. Alluvial and colluvial deposits are also evident within the landscape, which lead to the deposition of sand, silt or silty clay at the base of hillslopes and along floodplains.
- The *Australian Soil Resource Information System* (ASRIS) Atlas of Australian Soils mapping (Commonwealth Scientific and Industrial Research Organisation (CSIRO), 2014a) indicates that soil type varies considerably along the Project Alignment and consists of the following broad Australian Soil Classification (ASC) groups:
  - Vertosol—shrink/swell properties and are prone to developing strong vertical cracks when dry. Common sub-soil structure features including slickensides and/or lenticular aggregates (Harris et al., 1999). These soils are important agricultural soils in the region, being very fertile and extensively cultivated (Vandersee, 1975).
  - Sodosol—clear of abrupt textural B horizons in which the major part of the upper 0.2 m of the B2 horizon is sodic and is not strongly sub-plastic (Isbell & National Committee on Soil and Terrain, 2016; Harris et al., 1999)
  - Dermosol—structured B2 horizon and lack a strong texture contrast between the A and B horizons (Harris et al., 1999).
  - Chromosol—clear of abrupt textural B horizon where the pH is 5.5 (water) or greater in the upper 0.3 m of the B2 horizon (Harris et al., 1999).
  - Kandosol—lack strong texture contrast and have massive or only weakly developed structured B horizons. The B2 horizons is well developed and has a maximum clay content in some parts of the B2 which exceeds 15 per cent. They are also not calcareous throughout (Harris et al., 1999).
  - Lithosol—these soils generally have weak pedological organisation throughout the profile apart from the A horizons (Harris et al., 1999).
- Within the impact assessment area, sodosols and chromosols are considered to be the soil types with the greatest inherent soil erodibility; however, soils that are not dispersive, such as vertosols, can still be susceptible to erosion.
- Based on the underlying geology of the impact assessment area, the surface water quality data as well as existing acid sulphate soils (ASS) mapping, there is considered to be a low risk of inland ASS or potential inland ASS present within the majority of the impact assessment area. Further sediment assessment will be necessary to establish the location-specific risk of ASS occurrence where construction activities are required within permanent waterways along the Project alignment.

- The overall salinity hazard categorisation of sub-catchments within the impact assessment area has been assessed in reference to soil analysis results from Project investigations, the inherent soil salt store and the hazard categorisation for each of four Potential Expression Area (PEA) types, as follows:
  - Basalt contact PEAs
  - Catena PEAs
  - Artificial restriction PEAs
  - Confluence of streams PEAs.

  The mean salinity hazard mapping shows that each sub-catchment is considered to have either a moderate or a high hazard rating, when risks from each of the five individual PEAs was combined. The sub-catchments where a high mean salinity hazard rating has been determined generally correlate with the risk areas identified by the *Salinity Risk Assessment for the Queensland Murray–Darling Region* (Biggs et al., 2010b) and the *Strategic Salinity Risk Assessment for the Condamine Catchment* (Searle et al., 2007).
- Multiple soil conservation plans exist for properties within the impact assessment area. Approved property and Project area plans can be modified to accommodate circumstances that differ from those applying at the time of approval. Plans may be amended or their approval may be revoked. This involves similar procedures to those used in the initial approval process.
- The assessment of potential sources of contamination identified 16 properties within the impact assessment area that are outside of the existing rail corridors and subject to current ERAs or hold a mining lease. Of the 16 properties, only three of these properties are listed on the EMR, with the closest property, Commodore Mine, located 0.13 km from the Project alignment.

The assessment of land resource aspects identified the following potential impacts that may occur during construction or operation of the Project:

- Changes to landform and topography will be an unavoidable result of the Project, due to the need to achieve a 1:100 (target) maximum operation gradient for the railway; however, these impacts will be limited within established rail corridor, where the existing landform is more conducive to achieving the operating grade for the Project. Achieving this operating grade will require a combination of cut (maximum depth of 29.7 m) and fill (maximum height of 24.5 m) across the undulating landscape. Alterations to landform may cause secondary impacts to surface water, in floodplain areas, and groundwater, where deep cuts intersect the groundwater table.
- The loss of soils, as a resource, from construction and operation of the Project may broadly arise due to:
  - Direct, permanent loss of productive soils due to change in land use from agriculture to rail corridor or road reserve
  - Reduced production value of soils that are subject to disturbance by construction activities
  - Indirect loss of soils due to erosion that is either caused or exacerbated by Project activities.
- If present, ASS would only be encountered during works that involve sub-surface disturbance within, or immediately adjacent to, permanent flowing waterways, such as the Macintyre River, Macintyre Brook, Condamine River and Oxley Creek. Additional geotechnical investigation undertaken during the detail design phase will target these locations in order to provide further details on the likelihood of occurrence of inland ASS in proximity to these waterways. Project activities may expose potential ASS to oxygen through soil disturbance which, in turn, may result in the creation of sulfuric acid. In addition, acidic conditions have the potential to corrode infrastructure built from concrete, steel and other materials (Environment Protection and Heritage Council and the Natural Resource Management Ministerial Council (EPHC & NRMMC), 2011).
- Project activities have the potential to cause secondary salinisation, through processes such as the removal of vegetation, alteration of waterways, application of water (e.g. for material compaction) and general land use changes (Department of Environment and Resource Management (DERM), 2011). Leakage from longitudinal drainage channels, if ponding were to occur, may also contribute to rising water tables and the vertical movement of salts in the soil profile.
- Potential impacts to each soil conservation plan traversed by the Project alignment have been established through consultation with DNRME. Some of the plans traversed by the Project alignment are more than 10 years old, and the soil conservation measures may not have been maintained during this period, or the agricultural land use may have changed. Consequently, the currency of all soil conservation plans within the Project footprint will need to be verified through detail design to confirm the likelihood of impacts.
- Project activities have the potential to disturb existing contaminated land resources, particularly during construction. The disturbance of contaminated soil or groundwater during Project activities has the potential to spread or exacerbate existing contamination, contaminate previously unaffected soil or groundwater and affect human health through ingestion as well as dermal contact with contaminants.

Development of reference design

The reference design for the Project has been developed to respond, where possible, to potential impacts to land resources. Measures that have been incorporated into, or commenced in parallel with, the reference design development are as follows:

- The Project has been aligned to be co-located with existing rail and road infrastructure, where possible, minimising the need to develop land and modify landform that has not previously been subject to disturbance for transport infrastructure purposes.
- The quantity of spoil to be generated by the Project has been reduced through development of the reference design to achieve as close to a net balance in earthworks as is practicable.
- A draft Spoil Management Strategy has been developed to guide the decision-making process for the management of spoil material generated by the Project. The purpose of the draft Spoil Management Strategy is to provide overarching principles to guide the storage, treatment, reuse or disposal of material (including contaminated material) generated during construction of the Project.
- Geotechnical investigations have been completed within the Project footprint to determine geotechnical conditions and inform development of the reference design. Investigations have been targeted to specific locations, such as bridge abutments, locations of significant cuts and locations of significant fill.
- Geotechnical and soils data has been used to derive design criteria for structures, rail formation and scour protection. This has enabled the Project to be designed to cater for field-verified geotechnical and soil conditions.
- Design and ratings of earthworks in support of culverts, viaducts, and bridges are in accordance with *AS 5100 Bridge Design* (Standards Australia, 2017b) and *AS 7636 Railway Structures* (Standards Australia, 2013b) and other applicable Australian Standards.
- Scour protection measures have been included around culvert entrances and exits, on disturbed stream banks and on land bound by a watercourse to avoid erosion. Scour protection or energy dissipation measures have been specifically designed and sized for each culvert location in accordance with Guide to Road Design Part 5B: Drainage—Open Channels, Culverts and Floodways (Austroads, 2013b) with consideration for flow velocity, soil type and vegetation cover.
- Scour protection measures for culvert outlets have been designed to ensure that the maximum allowable flow velocities in a 1% AEP, as specified in Table 3.1 of the Guide to Road Design Part 5B: Drainage—Open Channels, Culverts and Floodways (Austroads, 2013b), are not exceeded.
- Cross-drainage structures have been incorporated into the reference design where the Project intercepts existing drainage lines and watercourses. The type of cross-drainage structure in the design depends on various location-specific factors, such as the natural topography, rail formation levels, design flow and soil type.
- Bridges are proposed at all major waterway crossings to avoid disturbance to the existing flow regime. In some instances, bridges are provided in locations that may have multiple drainage features passing under the rail corridor, such as across the Condamine River floodplain.
- The reference design includes 17 sediment basins within the Project footprint. The number of sediment basins required for the final earthworks design will be confirmed during detail design. All sediment basins are passive, which allows surface runoff from a catchment to flow into the sediment basin without the need for pumping.

Proposed mitigation measures

Where impacts cannot be avoided, the extent of impacts will be managed, mitigated and/or compensated. Management, mitigation and compensation measures for impacts to land resources include, but are not limited to:

- Additional geotechnical investigations will be undertaken to inform the design of earthworks and foundations for structures, suitability of borrow and quarry material, and construction planning for the Project. Additional geotechnical investigations will specifically target locations where:
  - The design includes:
    - Cuts
    - Embankments
    - Bridge piers and abutments
  - Potential/actual acid sulphate soils (ASS), specifically material within Macintyre River, Macintyre Brook, Condamine River and Oxley Creek, may be disturbed by construction.

- Detailed soil investigations will be undertaken at a suitable sampling intensity to inform the development of detail design. Subject to land access, the soil sampling will be of an intensity to enable mapping at a 1:10,000 scale. Detailed soil investigations will enable identification of potential/actual problematic soils including: acid sulfate, reactive, erosive, dispersive, saline, acidic, alkaline and liberation of contaminants. Examples of soils that will require specific design consideration include:
  - The high naturally occurring sodicity of soils in the Yelarbon area (Sodosols)
  - Cracking clays of the Condamine River floodplain (Vertosols)
- The methodology for the detailed soil investigation will be developed in consultation with DNRME and will be in accordance with the *Guidelines for surveying soil and land resources* (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). Soil investigations will be conducted under the supervision of a suitably qualified soil practitioner
- Additional soil data will be incorporated into the Final EIS and used to ensure that 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
- Opportunities for slope batter optimisation will be assessed through the detail design.
- Based on the finalised cut-and-fill balance, determine the number of borrow pits and volumes from each that is required to supply the confirmed material demand for the Project.
- Undertake an initial desktop assessment of the viability and feasibility of accessing material from the preferred borrow pit locations to meet location-specific material demands. Undertake further site assessment, including geotechnical testing, at potentially viable borrow pit locations, to determine material usability, volumes and potential post-EIS approval triggers.
  - Explore through detail design the 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 the import of rock amour.
- Confirm the currency and accuracy of soil conservation plans that may be impacted by the Project. Confirmation will involve discussion with DNRME in addition to the holders of each soil conservation plan. If a soil conservation plan is found to be current and materially affected by the Project, ARTC will consider options for amending or modifying that plan in accordance with the *Soil Conservation Act 1986* (Qld). If required, this would be progressed in consultation with DNRME and the holder of the soil conservation plan.
- Develop a Soil Management Sub-plan in accordance with the Outline Environmental Management Plan of this EIS as a component of the Construction Environmental Management Plan that manages:
  - Ground disturbance activities during pre-construction, construction and operational activities to minimise environmental impacts and maximise the potential for successful land rehabilitation following construction
  - The storage, transport and handling of hazardous materials during site construction and operational activities to protect the environment
  - The health and environmental risks from contaminated land.
- The Soil Management Sub-plan will include erosion and sediment controls as a component of the Construction Environmental Management Plan. The erosion and sediment control measures will be developed by a certified practitioner in erosion and sediment control, in accordance with the *Best Practice Erosion and Sediment Control* (International Erosion Control Association, 2008) and will be implemented during construction of the Project.
- Temporary earthworks and permanent landform for the Project will be designed to avoid unwanted ponding of water. This will be achieved through surface levelling and use of cross-drainage and longitudinal drains within the rail corridor.
- A contamination assessment of Environment Management Register (EMR) listed sites and other areas of potential contamination will be undertaken by a suitably qualified person once detail design, the Project footprint and the cut-and-fill balance are finalised, in accordance with the requirements of the *National Environment Protection (Assessment of Site Contamination) Measure 1999* (National Environment Protection Council, 2013).

- Suspected contaminated soils or materials, if encountered, will be managed in accordance with the unexpected finds protocol/procedure documented in the Contaminated Land Management Sub-plan. Opportunities to treat and re-use contaminated materials within the rail corridor will be assessed and subjected to a risk assessment.
- If unexpected ASS are identified through further geotechnical investigations, and the ASS will be disturbed directly or indirectly during Project activities, an ASS Management Plan will be required. The ASS Management Plan would be in accordance with the requirements of *the Queensland Acid Sulfate Soil Technical Manual: Soil Management Guidelines* (Department of Science, Information technology, Innovation and the Arts (DSITIA), 2014a) and the *State Planning Policy* (Department of Infrastructure, Local Government and Planning (DILGP), 2017c).
- A Rehabilitation and Landscaping Management Sub-plan will be developed for the Project, as a component of the Construction Environmental Management Plan. This Sub-plan will be based on the Inland Rail Landscape and Rehabilitation Strategy, in addition to location and property-specific reinstatement commitments. Disturbed areas will be sequentially reinstated, stabilised and rehabilitated following completion of works in each area, in accordance with the Rehabilitation and Landscaping Management Sub-plan.

This assessment concluded that the majority of potential impacts to land resources through Project activities are expected to have a low residual risk rating. Permanent alteration to landform and topography, loss of soil resources, erosion and disturbance of existing contaminated land during the construction phase of the Project all remain a medium residual risk. All potential impacts to land resources will be managed through adherence to the Outline EMP and supporting sub-plans.

7.3 Landscape and visual amenity

Existing environment and potential impacts

The landscape between Kurumbul (near the NSW/QLD border) and Gowrie Junction is typically a sparsely settled rural landscape characterised by generally flat irrigated and non-irrigated croplands and undulating pastures, interspersed by a network of vegetated watercourses associated with the Dumaresq, Macintyre and Condamine Rivers and set against a backdrop of forested low hills and isolated volcanic peaks. It is, for the most part, a highly modified landscape as a result of historical clearing practices for agriculture and grazing, the establishment of linear infrastructure (railways, highways and powerlines) and other development activity (e.g. Commodore Mine, Toowoomba Wellcamp Airport and surrounds). The northern extent of the Project is located within the Western Gateway Regional Economic Cluster (REC), as identified in ShapingSEQ as supporting significant agricultural and resource activities and priority sectors of manufacturing, transport and logistics, and health and knowledge. The REC is located to include the Toowoomba Wellcamp Airport, Toowoomba Bypass, Warrego, Gore and New England highways, InterLinkSQ and the city of Toowoomba. Historically, freight rail has existed within the impact assessment area, and there is a legacy of modern and heritage rail infrastructure throughout the area.

The key landscape and visual impacts of the Project relate to the introduction of rail infrastructure into relatively intact rural and natural settings, the removal of vegetation, along with the provision of new infrastructure elements, including embankments, deep cuts, viaducts and new road and rail bridges.

Twelve landscape character types and their associated landscape character areas have been identified within the impact assessment area. These LCTs are presented in Table 16.

TABLE 16 LANDSCAPE CHARACTER TYPES AND AREAS

Landscape character type (LCT)	Associated landscape character areas
LCT A: Vegetated watercourses—Rivers	This LCT is located in both the western and central parts of the impact assessment area, associated with the Macintyre and Condamine rivers. There are four LCAs of this type in the impact assessment area.
LCT B: Vegetated watercourses—Creeks and Channels	This LCT is located throughout the impact assessment area, associated with the many small tributaries of the Condamine River (near Pampas) and Macintyre River (along the NSW/QLD border). There are 38 LCAs of this type in the impact assessment area.
LCT C: Irrigated Croplands	This LCT is located within the alluvial valleys and fertile floodplains of the Macintyre and Weir Rivers, Macintyre Brook and Condamine River catchments. There are 64 LCAs of this type in the impact assessment area.
LCT D: Dry Croplands and Pastures	This LCT extends across a considerable part of the impact assessment area and is largely defined by extensively cleared, often undulating, open rural properties used for agriculture and livestock production. In the western extent of the impact assessment area, the landscape is typically flatter and prone to flooding. There are 44 LCAs of this type in the impact assessment area.
LCT E: Vegetated Grazing	This LCT occurs in isolated patches, particularly near Toowoomba, and comprises grazing areas set within vegetated landscapes. While this LCT falls within the impact assessment area, it is not affected by the Project and has therefore not been assessed.
LCT F: Rural Settlement	Seventeen rural settlements are located within the impact assessment area. They include the city of Toowoomba, the towns of Kingsthorpe, Meringandan, Gowrie Junction, Highfields, Westbrook, Southbrook, Pittsworth, Brookstead, Millmerran, Inglewood, Yelarbon, the Indigenous settlement Toomelah, and the small rural settlement of Pampas. There are 17 LCAs of this type in the impact assessment area.
LCT G: Rural Living	This LCT is typically located in elevated parts of the impact assessment area, near major transport infrastructure with access to towns and services and is characterised by large-lot rural residential development, which is typically somewhat vegetated. There are 17 LCAs of this type in the impact assessment area.
LCT H: Forested Uplands	This LCT is typically associated with elevated, undulating areas within the impact assessment area, including parts of the Great Dividing Range, West Ridge and South Ridge. There are 20 LCAs of this type in the impact assessment area.
LCT I: Settled Hills	This LCT is associated with the elevated, undulating areas and basaltic uplands of the Darling Downs, surrounding Pittsworth. There is one landscape character area of this type—the Pittsworth Hills.
LCT J: Forested Hills and Plains	This LCT is typically associated with the densely vegetated, lower-lying and gently undulating areas of the impact assessment area, typically west of Millmerran. This landscape type includes Wondul Range National Park, while other areas are predominately designated as State forests, which typically have very limited recreational opportunity. There are 14 LCAs of this type.
LCT K: Salinity Scald	This LCT is associated with the dryland salinity scald surrounding Yelarbon, in the western extent of the impact assessment area. There is one landscape character area of this type—the Yelarbon Salinity Scald.
LCT L: Transitional Landscapes	This LCT comprises disturbed and developing landscapes, such as around Commodore Mine near Millmerran, that are not valued for their existing landscape character or quality. While this LCT falls within the impact assessment area, it is not affected by the Project and has therefore not been assessed.

Impacts up to a 'high' level of effect have been identified for two character areas prior to the application of mitigation:

- Landscape Type I: Settled Hills—which comprises landscapes of high local scenic value as identified in the Toowoomba Regional Council Scenic Amenity study
- LCT F: Rural Settlement—which includes the landscapes around the settlements of Yelarbon, Brookstead and Pittsworth.

No significant impacts have been identified on landscapes of high scenic amenity identified using the regional scenic amenity methodology or in the TRC Scenic Amenity Study 2009 (TRC, 2009).

The number of visual receptors varies greatly across the impact assessment area. Key areas with high numbers of receptors include the various population centres close to the alignment, such as Kingsthorpe, Gowrie Mountain, Southbrook, Pittsworth, Brookstead, Pampas and Yelarbon, as well as numerous rural living areas where residents are present. Additionally, views can be obtained by travellers on roads throughout the area, including the Cunningham Highway, Gore Highway, Warrego Highway and tourist drives (including parts of the Warrego Way and Adventure Way, Open Plains Country Drive and Border Rivers Tourist Drive routes).

Visual impacts are often contained by the presence of vegetation and landform; however, there are localised elevated areas affording views over a wider area, including three scenic lookouts at varying distances to the alignment, which are located at Mount Basalt Reserve, Commodore Peak picnic area and Mount Kingsthorpe summit.

Twenty-two representative viewpoints were selected to provide an assessment of the potential landscape and visual impacts of the Project on a range of visual audiences and landscape settings at a range of distances from the alignment within the impact assessment area, including, but not limited to, the views experienced by the following:

- Local residents and workers in towns and rural settlements (including Yelarbon, Inglewood, Millmerran, Pampas, Brookstead, Pittsworth, Southbrook, Athol, Gowrie Mountain and Kingsthorpe)
- Local residents and workers on rural and acreage properties within the impact assessment area
- Travellers on main and local roads
- Tourists on roads including users of 'scenic drives' and visitors staying in tourist accommodation within the impact assessment area
- Tourists on the 'Westlander' train
- Recreational users of the landscape, particularly using walking trails within national parks (Wondul Range National Park), State forests (such as Whetstone State Forest) and other nature reserves.

The viewpoint assessment concluded that, without mitigation, the Project is considered likely to result in 'moderate' impacts during construction on eight representative viewpoints, specifically:

- Viewpoint 2: Yelarbon rest area
- Viewpoint 9: Commodore Peak picnic area looking towards Millmerran Power Station
- Viewpoint 13: Gore Highway near service station (Pampas)
- Viewpoint 15: Near Brookstead State School
- Viewpoint 17: Pittsworth–Felton Road near Pittsworth Motor Inn
- Viewpoint 18: Gore Highway near Southbrook
- Viewpoint 19: View from Athol
- Viewpoint 22: Mount Kingsthorpe summit scenic lookout.

The viewpoint assessment concluded that without mitigation the Project is considered likely to result in 'high' impacts during operation on six representative viewpoints, relating to:

- The impact of the Cunningham Highway road bridge on Viewpoint 2: Yelarbon rest area
- The combined impact of the new Gore Highway road-over-rail bridge, new rail infrastructure, realignment of Saal Road and Ware street and vegetation removal on Viewpoint 15: near Brookstead State School
- The impact due to the provision of a new railway on a large embankment and the provision of a rail-over-road bridge over Oakey–Pittsworth Road, Viewpoint 17: Pittsworth–Felton Road
- The impact of the large cuts and embankments close to rural residential properties at Viewpoint 18: Gore Highway near Southbrook
- The impact of embankments and a proposed passive level crossing in proximity to existing rural residential properties south of Viewpoint 19: View from Athol
- The impact on views obtained from the summit of Mount Kingsthorpe at Viewpoint 22: Mount Kingsthorpe summit scenic lookout.

Lighting impacts of up to a 'moderate' level of effect were identified for the construction and operation phase. Concern has been raised through stakeholder engagement regarding the potential for lighting from the construction and operation of the Project to impact on the operations of the University of Southern Queensland's Mt Kent Observatory. The observatory is located approximately 21 km southeast from the Project (closest Project point is Southbrook), beyond the extent of the impact assessment area. The Project will not result in lighting impacts at the Mt Kent Observatory for the following reasons:

- The substantial distance between the Project and the observatory
- The limited lighting associated with the construction (flashing beacons and temporary spotlights in support of short-duration night works, if required) and operation (head lamp on rollingstock and safety lighting at road-rail interfaces) of the Project
- The presence of several more substantial light sources that are located closer, or equally distant, to the observatory.

Lighting provision for realignment of existing roads will generally be in accordance with current arrangements unless additional lighting requirements are identified in consultation with asset owners.

Development of reference design

The reference design for the Project has been developed to respond, where possible, to potential impacts to landscape and visual amenity. Measures that have been incorporated into, or commenced in parallel with, the reference design development are as follows:

- The Project has, where possible, avoided impacts on nationally or regionally protected landscape areas such as the Wondul Range National Park and has minimised impacts on State forests such as Whetstone State Forest by following the edge of the protected area to the greatest extent possible.
- The Project has been intentionally aligned along the eastern boundary of the Rainbow Reserve so as to minimise the extent of encroachment into this reserve, while also avoiding severance impacts to agricultural properties to the east of Rainbow Reserve.
- The Project has avoided, where possible, direct impacts on areas noted as being of regional landscape significance defined using the regional scenic amenity methodology (ShapingSEQ).
- The Project has been aligned to be co-located with existing rail and road infrastructure where possible, minimising the extent of new transport corridor established for the Project.
- The Project alignment has been positioned to reduce the number of crossings and extent of impact on waterways.
- The Project footprint has aimed to minimise vegetation clearing extents to that required to safely and efficiently construct and operate the works.
- The alignment has avoided significant settlements to the greatest extent possible to assist in minimising visual impacts (e.g. Inglewood, Millmerran, Pittsworth) except where the alignment is within or adjacent to existing rail corridor (i.e. through Yelarbon, Pampas, and Brookstead).

Proposed mitigation measures

The appropriateness of specific mitigation to manage landscape and visual impacts is limited and constrained by practical, safety and operational factors. Specific mitigation opportunities have been identified, which, while having limited potential to alter the extent of residual impact, would result in an enhanced outcome for affected local visual receptors. These opportunities have potential to enhance the legacy of the Project and would reduce the residual impact of the Project on some landscapes and views, particularly landscapes and views around rural settlements, including Yelarbon, Brookstead and Pittsworth.

These opportunities include but are not limited to the following considerations:

- Clearing extents of visually significant vegetation are further limited, where feasible, to that required to safely construct, operate and maintain the Project. Locations include:
  - East of Rainbow Reserve (Viewpoint 1) (approximately Ch 32 km to Ch 34.6 km)
  - Yelarbon–Kurumbul Road (approximately Ch 0.00 km to Ch 8.00 km)
  - Whetstone State Forest and adjoining forested areas (approximately Ch 37.8 km to Ch 50.0 km)
  - Bringalily State Forest and adjoining forested areas (approximately Ch 55.2.7 km to Ch 94.4 km)
  - Through Brookstead, particularly regarding the alignment of the proposed rail corridor adjacent to Ware Street and the impact on the removal of existing vegetation that provides a key visual buffer for nearby residents (approximately Ch 151.6 km to Ch 153.0 km)
  - Associated with river and creek crossings.

- Ensure that bridge designs are considerate of the local setting, connectivity requirements, crime prevention through environmental design and graffiti issues.
- At locations where embankments are near roads and/or adjoin bridge structures, minimise the extent to which embankments restrict views or affect views from nearby residences, including through selection of sensitive stabilisation techniques, revegetation or, where appropriate, screen planting. Particularly consider treatment opportunities for the new embankment along the northern edge of Pittsworth, between Ch. 170.0 km and 173.0 km.
- Assess opportunities to blend cut batters into their landscape setting (e.g. considering potential for revegetation, rock pitching, etc.). Particularly with consideration to the cut near Athol (approximately Ch 189.0 km to Ch 190.0 km).
- Refine the Project footprint and develop the construction methodology to avoid impacts, where possible, to items of Aboriginal, historic or natural heritage significance, such as the old Brookstead railway station, Yelarbon Silos and the Yelarbon and District Soldiers Memorial Hall.
- Where noise barriers are confirmed as necessary for effective noise attenuation through detail design, ensure they are designed with regard to landscape character and consider materials, finishes, colour selection and crime prevention through environmental design and graffiti issues. Where appropriate, consider the inclusion of community artwork into the design.
- Detail design to incorporate lighting to the minimal level required to meet operational road and rail safety requirements for the Project.
- Enhancement of landscape corridors and biodiversity links across the landscape, where possible, by connecting fragmented areas of habitat through implementation of a Rehabilitation and Landscaping Management Sub-plan as a component of the Construction Environmental Management Plan that is consistent with ARTC's Landscape and Rehabilitation Strategy.

The consideration of these opportunities and implementation of mitigation measures have the potential to enhance the legacy of the Project and would reduce the residual impact of the Project on some landscapes and views, particularly those landscapes and views around several rural settlements.

7.4 Flora and fauna

Existing environment and potential impacts

The Project is situated within the Brigalow Belt South bioregion, which has experienced a long history of human disturbance as a result of agricultural practices and resource development. At a regional level, most remaining areas of vegetation are now fragmented, occurring on the rockier hilly areas of ranges, as roadside vegetation, or as relatively small isolated remnants.

The impact assessment area provides suitable habitat for matters of national environmental significance (MNES) including threatened ecological communities and threatened species (controlling provisions under the EPBC Act), non-threatened MNES species (migratory birds), State listed threatened species and 'special least concern' species (listed under the Nature Conservation Act 1992 (Qld)). In addition, a number of 'endangered', 'of concern' and 'least concern' regional ecosystems (REs) are also present within the impact assessment area that are protected under the Vegetation Management Act 1999 (Qld). The impact assessment area contains a suite of other terrestrial ecological values, including protected areas (e.g. Whetstone State Forest and Bringalily State Forest), High Value Regrowth (HVR) vegetation, conservation-significant flora and fauna species, regionally significant species, as well as bioregional corridors (local, regional and State significant).

Eighty-nine sensitive environmental receptors were identified within the impact assessment area for the purposes of this assessment. These varied from broad-scale sensitive environmental receptors, such as protected areas and bioregional corridors, down to finer species-scale sensitive environmental receptors, including conservation-significant and migratory species. These sensitive environmental receptors were grouped into high, moderate and low sensitivity categories based on factors including, conservation status, exposure to threatening processes, resilience and representation in the broader landscape.

It has been established through assessment that the construction and operation of the Project has the potential to impact on ecological receptors through:

- Habitat loss and degradation from vegetation clearing/removal
- Fauna species injury or mortality
- Reduction in biological viability of soil to support growth due to soil compaction
- Displacement of flora and fauna species from invasion of weed and pest species
- Reduction in the connectivity of biodiversity corridors
- Edge effects
- Habitat fragmentation
- Barrier effects
- Noise, dust, and light
- Increase in litter (waste)
- Aquatic habitat degradation
- Erosion and sedimentation
- Contamination
- Flooding.

In accordance with the outcomes of the MNES significant impact guideline, the potential for significant impacts are predicted for the following threatened EPBC Act threatened species/communities (i.e. Project controlling provisions under the EPBC Act):

- Brigalow (*Acacia harpophylla* dominant and co-dominant) Threatened Ecological Community (TEC): 62.89 ha (potential extent)
- Weeping Myall Woodlands TEC: 39.72 ha (potential extent)
- Poplar Box Grassy Woodland on Alluvial Plains TEC: 39.72 ha (potential extent)
- *Dichanthium queenslandicum* (King blue-grass): 5.29 ha
- *Lepidium monoplocoides* (Winged peppercress): 40.91 ha
- *Homopholis belsonii* (Belson's panic): 3.19 ha
- *Picris evae* (Hawkweed): 18.68 ha
- *Rhaponticum australe* (Austral cornflower): 2.29 ha
- Spotted-tail quoll (mainland) (*Dasyurus maculatus maculatus*): 15.49 ha
- Condamine earless dragon (*Tympanocryptis condaminensis*): 17.93 ha
- Five-clawed worm-skink (*Anomalopus mackayi*): 16.68 ha
- Collared delma (*Delma torquata*): 295.76 ha
- Dunmall's snake (*Furina dunmalli*): 298.85 ha
- Swift parrot (*Lathamus discolor*): 243.54 ha
- Koala (*Phascolarctos cinereus*): 481.05 ha.

Significant residual impact assessment of prescribed environmental matters (MSES) was undertaken in accordance with the MSES significant impact criteria. This analysis indicated that the Project is likely to result in significant residual impacts to following MSES:

- 'Endangered' or 'of concern' REs: 214.24 ha
- Regulated vegetation (Category B (other than grassland) within a defined distance from the defining banks of a relevant watercourse or relevant drainage feature): 43.88 ha
- Essential Habitat: 117.31 ha

- Connectivity areas:
  - Regional terrestrial corridors: 235.37 ha
  - State riparian corridors: 37.42 ha
  - State terrestrial corridors :161.39 ha.
- Protected wildlife habitat for the following species:
  - Flora:
    - *Cyperus clarus* (A sedge): 106.0 ha
    - *Digitaria porrecta* (Finger panic): 455.61 ha
    - *Picris barbarorum* (Tall hawkweed): 567.49 ha.
  - Fauna:
    - Common death adder (*Acanthophis antarcticus*): 540.87 ha
    - Glossy black-cockatoo (*Calyptorhynchus lathami lathami*): 480.86 ha
    - *Nature Conservation (Koala) Conservation Plan 2017* (Queensland Government, 2017b) mapping (Koala Habitat Areas): 81.73 ha.

Development of reference design

The reference design for the Project has been developed to respond, where possible, to potential impacts to flora, fauna and habitat values. Measures that have been incorporated into, or commenced in parallel with, the reference design development are as follows:

- The Project has been positioned to maximise the use of existing rail corridors and to be co-located with existing road infrastructure, where possible. Co-location with existing linear infrastructure minimises the need to develop natural and rural landscapes that have not previously been subject to disturbance for a similar purpose.
- Greenfield components of the Project have been aligned to minimise the extent of impact to remnant vegetation, and the number of watercourses traversed by the Project. Clearing of remnant vegetation will be restricted to the minimum required to enable the safe construction, operation and maintenance of the rail corridor, including minimising the disturbance of sensitive areas such as:
  - Habitat for 'critically endangered', 'endangered' and 'vulnerable' flora and fauna species
  - 'Endangered' and 'of concern' REs and HVR
  - Riparian vegetation
  - Steep slopes
  - Along riverbanks.
- The Project footprint has been restricted to what is anticipated to be required to construct, operate and maintain the works in a safe and efficient manner. Restricting the temporary construction disturbance footprint and the permanent operational disturbance footprint, minimises the extent of disturbance to vegetation and habitats during construction and operation.
- Watercourse crossing structures (including culverts and bridges) have been designed to maintain aquatic fauna passage and minimise the risk of blockages in reference to the *Accepted development requirements for operational work that is constructing or raising waterway barrier works* (DAF, 2018e).
- The Project has been developed to minimise impacts to watercourses, riparian vegetation and in-stream flora and habitats, by adopting a crossing structure hierarchy where bridges are preferred to culverts to maintain connectivity for species such as fish and platypus, and riparian fauna conduits that are important to fauna species.
- Bridges and culvert structures have been designed to:
  - Minimise impacts to the bed, banks and environmental flows of watercourses in accordance with requirements of the *Fisheries Act 1994* (Qld) (the Fisheries Act)
  - Avoid increases in peak water levels, velocities and duration of inundation
  - To maintain existing flow paths and flood flow distributions, such as across the Condamine River floodplain, where six bridges have been incorporated into the design with a combined length of 6 km.
- Scour and erosion protection measures have been incorporated into the design in areas determined to be at risk, such as around culvert headwalls, drainage discharge pathways and bridge abutments
- A preliminary fauna movement provision and fencing strategy has been developed to:
  - Maintain habitat connectivity across the rail corridor. Identified connectivity opportunities attempt to align with waterway crossing structures and the State-significant fauna movement corridor to the north of Inglewood, as well as other locations assessed as providing movement opportunities for the greatest number of species.
  - Provide fencing strategies to guide species such as koala to safe movement opportunities.

Proposed mitigation measures

Where impacts cannot be avoided, the extent of impacts will be managed, mitigated and/or offset. These proposed mitigation measures have been identified to address Project-specific issues and opportunities. Information related to government threat abatement plans and recovery plans has been incorporated into the identified mitigation measures, wherever applicable. Management, mitigation and compensation measures for impacts to flora, fauna and habitats include, but are not limited to:

- Fauna fencing opportunities will be further assessed and, where appropriate, developed during detail design. Fauna fencing will be designed in reference to guidelines documented in the *Fauna Sensitive Road Design Manual* (DTMR, 2000). Additional expert guidance in relation to specific design features will be sought during the detail design process.
- Priority will be given to fauna fencing in areas identified as State, regional or local fauna movement corridors to channel fauna toward safe movement options (i.e. culverts) to limit vehicle strikes and associated incidents.
- The design will continue to be developed to minimise the extent of impacts to waterways, riparian vegetation and in-stream flora and habitats, in accordance with the intent of:
    - *Riverine protection permit exemption requirements* (DNRME, 2018a). Where the Project is unable to comply with the exemption requirements, a riverine protection permit will be required for works within a watercourse.
    - *Accepted development requirements for operational work that is constructing or raising waterway barrier works* (DAF, 2018e). Where the Project is unable to comply with the accepted development requirements for operational work that is constructing or raising waterway barrier works, a development approval for these works will be required.
- Detailed ecological surveys of the Project footprint will be undertaken in parallel to the development of the detail design. These surveys will be in accordance with the relevant survey guidelines for nationally threatened species, published in accordance with the EPBC Act. Where TECs are found to occur, condition assessment will be undertaken (using BioCondition assessment)[2]. Data obtained from these detailed surveys will be used to refine the quantification of ecological impacts and revise the calculation of offset requirements for the Project.
- Annual monitoring of remnant and regrowth vegetation communities and habitats retained within the Project footprint against the initial BioCondition assessment. Corrective actions to be implemented where Project-associated impacts are identified.
- A Biodiversity Management Sub-plan will be developed as a component of the Construction Environmental Management Plan. This sub-plan will include appropriate criteria, directives and procedures in relation to:
    - Methods and sequencing of protected plant surveys, including seasonal timing, in accordance with the requirements of the Flora Survey Guidelines—Protected Plants (DES, 2019e)
    - Methods and sequencing of pre-clearance fauna surveys, including terrestrial, aquatic habitats and breeding habitats (including burrows and hollow bearing trees/logs, existing culverts and structures)
    - Staging works so that they avoid animal breeding periods as much as possible, e.g. Murray cod (September and October) within areas of habitat (large watercourses)
    - Staged and sequential clearing protocols
    - Animal handling protocols, including engagement of an approved fauna handler with a valid damage mitigation permit
    - Relocation of plants and habitats, particularly habitat components for the Brigalow Belt reptiles (five-clawed worm skink, collared delma, yakka skink and Dunmall's snake) and the Condamine earless dragon
    - Requirements for inspections and corrective actions during construction and rehabilitation activities
    - Biodiversity/fauna and flora management actions 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
    - Corrective actions should the outcomes not achieve the objectives adopted.

2. BioCondition is a condition assessment framework for Queensland that provides a measure of how well a terrestrial ecosystem is functioning for biodiversity values. It is a site-based, quantitative and therefore repeatable assessment procedure that can be used in any vegetative state, and provides a numeric score that can be summarised as a condition rating of 1, 2, 3 or 4, or functional through to dysfunctional condition for biodiversity. (Eyre et al.,2015)

- A Biosecurity Management Sub-plan will be developed as a component of the Construction Environmental Management Plan. This sub-plan will include:
  - Requirements for pre-clearing and operational surveys to determine the risk of weeds or pest animals being present within the Project footprint
  - Maps of the existing extent, confirmed through surveys, and severity of weed infestation (e.g. restricted matters including mother-of-millions (*Bryophyllum delagoense*), prickly pear (*Opuntioid cactus*), African boxthorn (*Lycium ferocissimum*), lippia (*Phyla canescens*) and lantana (*Lantana camara*)) and weed-management requirements
  - Pest animal management controls, including protocols for severing, realigning and reinstating the wild dog check fence and the DDMRB rabbit fence
  - Site hygiene and waste management procedures to deter pest animals
  - Locations of vehicle washdown (light vehicle and oversize vehicles) and rumble grids
  - Weed surveillance and treatment during construction and rehabilitation activities such as:
    - Vehicle and plant washdown requirements for fleet moving from low-risk to high-risk areas
    - Weed certification requirements for vehicles, plant and materials arriving onto the construction site.
  - Requirements for pesticide and herbicide use, including limitations on use. Restrictions may apply in proximity to watercourses, known areas of MNES or MSES habitat or land uses sensitive to spray drift from the application of pesticides and herbicides (e.g. organic farming practices).
  - Erosion and sediment control risks associated with broad-scale weed removal or treatment
  - Corrective actions should the outcomes not achieve the adopted objectives.
- Disturbed areas will be reinstated, stabilised and rehabilitated sequentially, at the completion of works, in accordance with the Rehabilitation and Landscaping Management Sub-plan (refer Section 7.2, above)
- Property-specific weed hygiene requirements will be developed in consultation with the relevant landowners/operators prior to pre-construction/construction activities occurring on that property, outside of the permanent footprint. Protocols, where agreed, will be documented in individual property management agreements.

ARTC is committed to implementing ongoing monitoring of the effectiveness of the measures with contingency (under an adaptive management framework) to change/improve 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.

The Project will result in significant residual adverse impacts, even after the implementation of all mitigation measures, including rehabilitation. As such, the provisions of offsets for the MNES and prescribed matters presented above will be required under the EPBC Act Offsets Policy and delivered consistent with the *Queensland Environmental Offsets Policy 2017*.

ARTC's *Environmental Offset Delivery Strategy—Qld* (Strategy) (refer Appendix N: Draft Offset Strategy) will inform the development of offset delivery components including an Environmental Offset Delivery Plan and Offset Area Management Plans. A Detailed Environmental Offset Delivery Plan and Offset Area Management Plans will be developed and implemented by ARTC prior to construction commencement.

7.5 Air quality

Existing environment and potential impacts

The assessment of air quality impacts included establishment of background air quality and existing emission sources in the regional airshed of relevance to the Project, a qualitative assessment of construction phase impacts, a quantitative dispersion modelling assessment of operational phase impacts, determination of proposed mitigation measures and an assessment of the residual impacts on the Project (assuming the inclusion of these mitigation measures).

Background air quality was established using PM_{10} and $PM_{2.5}$ monitoring data collected for the Project at an air-quality monitoring station established for Inland Rail at the InterLinkSQ site, immediately adjacent to the northern end of the Project. Background concentrations for other pollutants of interest not monitored by the Inland Rail air-quality monitoring station were estimated using data available from other air-quality monitoring stations operated by DES.

A three-month deposited dust monitoring program was conducted for the Project in 2016, as part of *the Yelarbon to Gowrie (Y2G) Preliminary Environmental Assessment Report* (AECOM, 2017c). The monitoring was conducted at four sites in accordance with AS/NZS 3580.10.1:2003 *Methods for sampling and analysis of ambient air Method 10.1: Determination of particulate matter—Deposited matter—Gravimetric method* (Standards Australia, 2003). The highest measured rate of 50 mg/m^2/day (measured in May/June 2016) was adopted as the background concentration for the air quality impact assessment.

Table 17 summarises the existing environment background concentrations adopted for the air quality assessment. Where appropriate, the 70th percentile concentration was selected as the adopted background concentration.

TABLE 17 SUMMARY OF ADOPTED EXISTING POLLUTANT CONCENTRATIONS COMPARED TO AIR QUALITY OBJECTIVES

Pollutant	Averaging time and statistic	Air quality goal (µg/m^3)	Adopted background (µg/m^3)	Monitoring location
Deposited dust	30 days, maximum	-	50 mg/m^2/day	Four locations along the Project alignment (Y2G Preliminary Environmental Assessment)
NO_2	1 hour, maximum	250	57.5	Mutdapilly
	Annual average	62	7.8	
TSP	Annual average	90	42.8[1]	Inland Rail air quality monitoring station (AQMS)
PM_{10}	24 hours, 70th percentile	50	17.4	
	Annual average	25	17.1	
$PM_{2.5}$	24 hours, 70th percentile	25	7.6	
	Annual average	8	6.5	
Benzene	Annual average	5.4	5.2	Springwood
Toluene	1 hour, 70th percentile	1100	23	
	24 hours, 70th percentile	4100	21.7	
	Annual average	400	18.5	
Xylenes	24 hours, 70th percentile	1200	31.5	
	Annual average	950	26	

Table notes:

1. Calculated from PM_{10} concentrations measured at Inland Rail AQMS using a ratio of 2.5, which is based on a PM_{10}:TSP ratio of 0.4 as reported by the Australian Coal Association Research Program (ACARP) (Roddis et al., 2015).

A search of the National Pollutant Inventory (NPI) conducted for the air quality impact assessment area identified that eight facilities in proximity to the Project are required to report emissions annually. A description of each existing emission source is identified and its approximate distance from the impact assessment area is described in Table 18. Relevant NPI emissions for pollutants of interest from these regulated sources were included in the model.

TABLE 18 NATIONAL POLLUTANT INVENTORY LISTED FACILITIES IN THE IMPACT ASSESSMENT AREA

Facility name	Industry	Distance from alignment (km)	Direction from alignment
Commodore Mine	Coal mining	<1.0	East
Millmerran Power Station	Power generation	4.5	Southeast
Sapphire Feedlot	Sheep, beef cattle and grain farming	<1.0	South
Yarranbrook Feedlot	Sheep, beef cattle and grain farming	<1.0	Northwest
Doug Hall Enterprises	Poultry farming	1.0	West
Pittsworth	Poultry farming	1.6	South
Inghams TF3 Breeder Farm Toowoomba	Poultry farming	4.0	East
Boral Asphalt Charlton	Hot mix asphalt manufacturing	3.6	Southeast

In addition to these operational NPI regulated sources, the following sources have been included in the dispersion modelling due to their potential to contribute to cumulative air-quality impacts in the air quality impact assessment area (AQIA):

- North Star to NSW/Queensland Border Project (Inland Rail)
- Gowrie to Helidon Project (Inland Rail)
- West Moreton System (existing rail west of the junction between this Project and the Gowrie to Helidon section of Inland Rail).

The main pollutant of concern during the construction phase is particulates, predominantly airborne PM_{10} and deposited dust. These emissions were the focus of the construction phase air quality impact assessment. The assessment methodology used for the construction phase was that specified in the United Kingdom Institute of Air Quality Management (IAQM) *Guidance on the assessment of dust from demolition and construction* (UK IAQM, 2014). Construction emissions for large linear infrastructure projects are complex due to the number of construction activities, the distribution of sites across a large geographical area, and the transitory nature of many individual construction activities at particular locations. As such, the potential construction air-quality impacts associated with the Project were assessed by describing the nature of proposed works, plant and equipment, potential emissions sources and levels.

The IAQM method requires the dust emission magnitude of Project activities to be determined and for the sensitivity of surrounding sensitive receptors to be established for dust soiling and human health impacts. The assessment concluded that earthworks, track-out and other construction activities have the greatest dust emission potential. The assessment also concluded that surrounding sensitive receptors are expected to have a medium sensitivity to dust soiling and a low sensitivity to human health impacts. The results of the qualitative air-quality risk assessment conclude that the unmitigated air emissions from the construction of the Project poses a 'low' risk of human health impacts but a 'medium' risk of dust soiling.

The results of the qualitative dust risk impact assessment for construction activities, established in accordance with the IAQM, are presented in Table 19.

TABLE 19 DUST RISK IMPACTS FOR PROJECT CONSTRUCTION ACTIVITIES, WITHOUT MITIGATION

Construction activity	Surrounding area sensitivity	Demolition	Earthworks	Construction	Track-out
		Small[1]	Large[1]	Large[1]	Large[1]
Dust soiling	Medium	Low	Medium	Medium	Medium
Human health	Low	Negligible	Low	Low	Low

Table notes:
1. Activity dust emission potential in accordance with Table 4 of the IAQM.

Dispersion modelling of operational line-source emissions (i.e. emissions from freight trains travelling along the railway) was undertaken to assess the Project's compliance with the adopted air-quality goals at sensitive receptor locations. The air dispersion modelling was undertaken using the CALPUFF modelling suite (an advanced modelling system for the simulation of atmospheric pollution dispersion in a non-steady state) and considered operational details such as the proposed track alignment, number, frequency and speed of trains and emissions factors for diesel engines.

The dispersion modelling concluded that compliance would be achieved for all pollutants at all averaging periods for peak operation train volumes, with the exception of 24-hour average PM10. Exceedance of the 24-hour average PM10 air-quality goal is predicted at one sensitive receptor, located approximately 1.1 km to the north of the existing Commodore Mine and to the north of the Project alignment. The predicted PM10 24-hour cumulative concentration at this sensitive receptor is 50.1 µg/m3, which represents a 0.1 µg/m3 exceedance of the air quality goal of 50 µg/m3.

There is uncertainty regarding emissions from the Commodore Mine due to the uncertainty in the NPI emission estimation methods and the absence of ambient monitoring data for the area local to the mine and Millmerran Power Station. As a result, there is also uncertainty regarding the accuracy of the predicted cumulative concentrations at receptors near the mine, including at the sensitive receptor where the 24-hour average PM10 criteria is exceeded. To improve the understanding of background air quality in the area local to the mine, an air-quality monitoring station has been installed at a residential dwelling on Millmerran–Inglewood Road, Millmerran. Monitoring data from this location will improve understanding of ambient air quality and emissions from the mine and will be used to guide the detail design and finalisation of the construction approach for the Project.

Based on the results of the CALPUFF modelling, the operational emissions from the Project are not expected to significantly adversely impact environmental values of the air environment. The assessment has considered background air quality in the prediction of cumulative concentration and deposition levels at sensitive receptors and has therefore considered the assimilative capacity of the air environment in determining the impact of the Project. The assessment of all operation-phase impacts has considered peak train numbers. As typical train numbers will be lower than peak volumes, predicted concentrations and dust deposition levels and the impact to sensitive receptors would be reduced accordingly.

Investigation into the deposition of dust emissions at sensitive receptor water tank locations showed that predicted pollutant water concentrations would be significantly lower than those prescribed in the *Australian Drinking Water Guidelines* (NHMRC & NRMMC, 2011). Compliance with the drinking water guideline values is predicted by a significant margin and therefore the residual impact to drinking water as a result of the Project is expected to be insignificant.

Development of reference design

The reference design for the Project has been developed to respond, where possible, to potential impacts to air quality. Measures that have been incorporated into, or commenced in parallel with, the reference design development are as follows:

- The horizontal and vertical alignment has been established to optimise the earthworks required and achieve as close to a net balance as possible. By minimising the material deficit for construction of the Project, the volume of material required to be imported has been reduced. Less imported material equates to fewer construction truck movements and less vehicular emissions.
- Construction traffic routes that provide the shortest journey time between origin and destination have been identified. These routes restrict fuel consumption and vehicular emissions and have been assessed as part of the traffic impact assessment.
- The planning, siting and assessment of potential temporary fuel storage locations has taken into consideration the location of sensitive receptors to avoid potentially impacting sensitive receptors as far as practical.
- The Project footprint has been established to provide the minimum clearing extents required to safely and efficiently construct, operate and maintain the Project, thus minimising the total extent of exposed area, where possible.
- Laydown areas and other construction-phase facilities have been located to avoid impacts to environmental and social receptors.
- Embankment batters and other exposed surfaces have been designed to enable stabilisation to reduce fugitive dust emissions.

- The Project has been co-located within existing transport corridors as much as possible, including being positioned within the existing South Western Line and Millmerran Branch Line rail corridors, to avoid introducing a new linear infrastructure corridor in proximity to receptors that are potentially sensitive to air emissions.
- Where possible, the Project has been aligned to avoid steep terrain and topographical constraints to provide for more efficient operational track geometry and grade; resulting in faster train transit time and less locomotive emissions.
- Where possible, crossing loops at Yelarbon, Inglewood, Kooroongarra, Yandilla and Broxburn have been positioned to avoid the exposure of sensitive receptors to diesel emissions from idling trains.

Proposed mitigation measures

Where impacts cannot be avoided, the extent of impacts will be managed and/or mitigated. Management and mitigation measures for impacts to air quality include, but are not limited to:

- The extent of sensitive-receptor impacts will be re-assessed through the detail design process once the Project footprint and construction methodology has been confirmed. The location and classification of sensitive receptors in proximity to the finalised Project footprint will be confirmed as part of this re-assessment process.
- Baseline particulate data (PM10 and PM2.5) will continue to be collected from the AQMS on Millmerran–Inglewood Road, Millmerran. Data collected from this station will be used to guide the detail design and finalisation of the construction approach for the Project to ensure that air-quality impacts to sensitive receptors are avoided or minimised as much as possible.
- Baseline dust deposition data will be established prior to construction in proximity to the Commodore Mine (e.g., from Ch 120.0 km to Ch 128.0 km). This baseline data will enable comparison with dust deposition data during construction of the Project. Dust deposition monitoring will be completed at a small number of locations (< 5) adjacent to the Commodore Mine and nearby sensitive receptor locations. Monitoring will occur for a period of three months and will aim to collect data representative of dust-generating activities that occur at the mine, such as blasting, to provide baseline data on the existing air environment. This data will provide an indication of the impact on the local air quality from the nearby Commodore Mine and Millmerran Power Station. Dust deposition monitoring will be conducted in accordance with AS/NZ 3580.10.1:2003—Determination of Particulate Matter—Deposited matter—Gravimetric method (Standards Australia, 2003).
- Dust deposition monitoring will be undertaken during the active period of construction, in proximity to the Commodore Mine (e.g. from Ch 120.0 km to Ch 128.0 km), at locations where baseline data was collected (refer above), to determine if construction results in significant dust impacts.
- Development of a Dust Management Sub-plan, as a component of the Construction Environmental Management Plan, prior to construction. The sub-plan will include measures to minimise the potential for dust emissions during construction in accordance with the Outline Environmental Management Plan of this EIS.
- If onsite wastewater treatment systems are required for non-resident workforce accommodation, these systems will be planned and positioned in accordance with separation distances consistent with the Environmental Protection Authority Victoria (EPA Victoria) guideline *Recommended separation distances for industrial residual air emissions* (EPA Victoria, 2013) and operated and maintained in accordance with conditions of approval (sought separately to approval sought through the EIS).

There is presently no foreseeable market-driven demand for coal to be transported on the Inland Rail network, between the NSW/QLD border and Gowrie; however, the transportation of coal on this section of the network cannot be precluded in future operation years. If coal is to be transported in future operation years, the potential for coal-dust generation will require management via a Coal Dust Management Plan. The measures included in the Coal Dust Management Plan will aim to minimise surface lift-off of materials in transit and establish protocols to minimise spillage onto external areas of wagons. The plan will be prepared in consultation with the relevant regulatory agency at the time.

7.6 Surface water quality

Existing environment and potential impacts

The Project is located across two surface water catchment areas, the Condamine River basin and the Border Rivers basin. The Project alignment extends through the Borders Rivers basin from the NSW/QLD border to approximately 15 km southwest of Millmerran (Ch 117.0 km). From this point, the Project alignment is located in the Condamine River basin until its northern end point at Ch 206.9 km.

The reference design includes full-width crossings of 15 major waterways (stream order ≥ 3) and 66 minor waterways (stream order < 3).

The existing condition of surface waters within the impact assessment area was established through assessment of publicly available datasets, in combination with water-quality data collected across five sampling events, with seasonal variation. For each sampling event, in-situ data and water samples were collected from 20 water-quality monitoring locations.

Water-quality data from collected samples was compared to historical water-quality data from DNRME's Macintyre Brook, Condamine River and Gowrie Creek gauging stations, as a general proxy for the impact assessment area. This comparison identified that water-quality values recorded during sampling for the Project are typically consistent with similar data obtained from the corresponding gauging stations.

Historic water quality was typically outside of water-quality objectives (WQOs) developed under the provisions of the *Environmental Protection Policy (Water and Wetland Biodiversity) 2019* under the EP Act. Total suspended solids exceeded WQOs, both historically and within the current assessment. Total nitrogen and phosphorus, as a typical anthropogenic contaminant, was also consistent with historical data, with WQO exceedances recorded across all sampling events. Water quality across the impact assessment area was typically considered average to poor, with typical patterns of alkaline pH, high electrical conductivity, elevated concentrations of suspended sediment, nutrients and instances of diminished dissolved oxygen concentrations.

Water-quality conditions observed within the impact assessment area were considered to be consistent with, and typical of, those expected during a period of extended dry conditions. Water-quality impacts due to the diminished flow conditions were observed throughout the assessment. The existing water quality within the impact assessment area is considered average, with expectation of a period of poorer water quality coinciding with an initial return to base flow due to catchment run-off after an extended drier period.

Based on the existing surface water conditions, the main potential impacts to surface water as a result of construction of the Project are expected to be as follows:

- Increased debris load in waterways, thereby reducing the aesthetic quality of downstream waterway systems. Debris may also impact on the health of aquatic and terrestrial fauna, particularly if ingested.
- Altered water quality, principally from increased water turbidity and sedimentation. Suspended sediments can clog fish and invertebrate gills, decrease light availability for aquatic plants and reduce visibility for fish. Furthermore, localised high sediment contamination can become a barrier to migration of some species that then decline in abundance due to restriction in range or loss of seasonal habitat above the contaminated reach (Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand (ANZECC & ARMCANZ), 2018).
- Altered water chemistry, including an increase in salinity. Alterations to water chemistry may impact on the aquatic ecosystem condition of the downstream waterway system, as well as affect the useability of downstream waters for purposes such as irrigation, farm supply, stock use, recreation etc.

The main potential impacts to surface water as a result of operation of the Project are expected to be as follows:

- Increased debris due to rubbish and debris from operations blown off or washed away from the rail corridor into proximal watercourses
- Introduction of contaminants from a variety of sources during operation and maintenance due to:
  - Oil and grease spills—there is the potential for oil and grease from rolling stock to enter the waterways after heavy rainfall events
  - Residual heavy metals from maintenance rail grinding and welding
  - Leaching of compounds that are adhered to ballast materials
  - Leaching of materials from within the rail formation, if localised material encapsulation or embankment zoning were to fail
  - Accidental spills from freight carriages during routine operations
  - Chemicals, including fuels and oils used for maintenance machinery.

- Structural failure—with the introduction of bridge or culverts within waterways, should these structures fail, there is the potential for impacts to water quality either from potential contaminants (debris) or from detained water flushing from collapsed structures. Furthermore, structural failure has the capacity to alter flow regimes and increase potential secondary salinity issues, with flow-on issues resulting in surface water quality degradation.
- Maintenance—maintenance of the rail line or machinery near waterways (such as the crossing loops associated with Macintyre Brook at approximate Ch 50.20 km to Ch 52.40 km) has the potential to mobilise sediments from disturbed areas and increase the potential for litter or rubbish to enter waterways. Furthermore, oils and greases and other contaminants, such as metals, have the potential to enter waterways from spills, and for impact from the use of environmental toxicants (such as biocides) to maintain operating infrastructure areas. Without appropriate mitigation, these activities have the potential to impact nearby waterways, through discharge points.
- Increase in rates of erosion and resultant sedimentation of waterways, where soils are exposed as a result of unsuccessful site rehabilitation.

Development of reference design

The reference design for the Project has been developed to respond, where possible, to potential impacts to surface water quality. Measures that have been incorporated into, or commenced in parallel with, the reference design development are as follows:

- The Project uses the existing South Western Line and Millmerran Branch Line rail corridors to avoid introducing a new linear infrastructure corridor across waterways and floodplains, where possible.
- The reference design has been developed to minimise impacts to watercourses, riparian vegetation and in-stream flora and habitats by adopting a crossing structure hierarchy where bridges are preferred to culverts. Bridges and waterway crossings are designed to minimise impacts to bed, banks and environmental flows, in accordance with relevant regulatory requirements (as per requirements of DAF and the Fisheries Act).
- Watercourse crossing structures (including culverts and bridges) are designed to minimise the need for ongoing maintenance and inspection to maintain aquatic fauna passage (e.g., fish and turtles) and minimise the risk of blockages in reference to the *Accepted development requirements for operational work that is constructing or raising waterway barrier works* (DAF, 2018e).
- The reference design has been developed to avoid the need to permanently divert watercourses, as defined and mapped under the Water Act. Three unmapped watercourses are expected to require diversion.
- To avoid erosion, scour protection measures have been included around culvert entrances and exits, on disturbed stream banks and on land bound by a watercourse. All required scour lengths are predicted to fit within the rail corridor.
- The reference design includes 17 sediment basins. The number of sediment basins required for the final earthworks design will be confirmed during detail design. All sediment basins are passive, which allows surface runoff from a catchment to flow into the sediment basin without the need for pumping.
- Longitudinal drains have been designed to include 3.5 m buffer strips within 100 m swales before the point of discharge into the local waterway system.

Proposed mitigation measures

Where impacts cannot be avoided, the extent of impacts will be managed or mitigated. Management and mitigation measures for impacts to surface water quality include, but are not limited to:

- A Surface Water Management Sub-plan will be developed as a component of the Construction Environmental Management Plan, with the objective of documenting surface water quality management measures that are specified to the finalised construction methodology. The sub-plan will include a surface water monitoring framework for the Project that establishes additional monitoring and sampling required to establish baseline water-quality conditions, as a continuation of data collected during the EIS phase.
- Baseline water-quality conditions will be undertaken preferentially at water-quality monitoring sites previously monitored for development of the EIS. These will be monitored at quarterly intervals (minimum), for a period of 12 months prior to commencement of construction, as per the *Queensland Water Quality Guidelines* (Department of Environment, Heritage and Protection (DEHP), 2009). Additional monitoring and sampling may also be undertaken in response to large rain events.

- Surface water quality data will be collected at accessible sites in accordance with the DES *Monitoring and Sampling Manual* (DES, 2018a). At each sampling location, the following in-situ parameters will be recorded:
  - Dissolved oxygen (mg/L) and saturation (per cent)
  - pH
  - Electrical conductivity (μs/cm)
  - Temperature (°C)
  - Turbidity (NTU)
  - Total dissolved solids (ppm)
  - Oxidation reduction potential (mV).
- Samples will also be collected from each site for analysis at a National Association of Testing Authorities (NATA) accredited laboratory for the following analytes:
  - Conductivity and salinity
  - Total suspended solids
  - Total hardness as $CaCO_3$ (Alkalinity)
  - Nutrient suite (ammonia, nitrite, nitrate, total nitrogen, total Kjeldahl nitrogen, nitrogen oxides, reactive phosphorus and total phosphorous)
  - Organic nitrogen
  - Dissolved metals (eight metals suite: arsenic, cadmium, chromium, copper, nickel, lead, zinc and mercury)
  - Polycyclic aromatic hydrocarbons (PAHs)
  - Chlorophyll *a*.
- Minimising the Project's temporary construction footprint while still allowing sufficient room for erosion and sediment control measures.
- The detail design will be developed to ensure that, where possible, private water storages are avoided and that affected landowners retain access to existing natural resources. If impacts to access to existing natural resources cannot be avoided through design, appropriate compensation arrangements will be discussed and agreed with the relevant impacted landowner.
- Where the Project will result in disturbance to private surface water storages (e.g. dams), ARTC will consult with the owners of relevant, legal storage structures, prior to works commencing, to agree an approach to decommissioning or relocation of the structure. This may also include the usage or relocation of stored water and compensation (if applicable).

7.7 Hydrology and flooding

Independent International Panel of Experts for Flood Studies in Queensland

The Australian and Queensland governments established an Independent International Panel of Experts (The Panel) for flood studies to provide advice to the Australian and the Queensland Governments on the flood models and structural designs developed by ARTC for Inland Rail in Queensland. As an advisory body to Government, The Panel is independent of the ARTC in respect of the development, public consultation and approvals for the Inland Rail EIS process. Relevant submissions received from public exhibition of the draft EIS will be provided to The Panel for consideration as part of its review.

Information on The Panel may be viewed here**: tmr.qld.gov.au/projects/inland-rail/independent-panel-of-experts-for-flood-studies-in-queensland**.

Existing environment and potential impacts

The Project alignment crosses several major waterways, with the key waterways being the Macintyre River, Macintyre Brook, Condamine River and Gowrie Creek. Other major creek crossings include Pariagara Creek, Cattle Creek, Native Dog Creek, Bringalily Creek, Nicol Creek, Back Creek, Westbrook Creek and Dry Creek. Detailed hydrologic and hydraulic assessments have been undertaken due to the catchment sizes and substantial floodplain flows associated with each of these watercourses.

The hydrology and flooding assessment of the Project used a quantitative approach to impact assessment and has involved the following activities:

- Collation and review of available background information, including existing hydrologic and hydraulic models, survey, rainfall and streamflow data, calibration information and anecdotal flood-related data. This review established which datasets were suitable to use for the draft EIS.
- Determination of critical flooding mechanisms for waterways and drainage paths in the impact assessment area (i.e., regional flooding versus local catchment flooding)
- Determination of high-risk watercourses that the alignment crosses, qualitatively, considering:
  - The catchment size, resulting flood flows and velocities
  - The land use in the vicinity of the rail alignment
  - The extent and depth of flood inundation
  - The duration of flood events and catchment response time
  - The proximity to and nature of flood sensitive receptors (e.g. houses, sheds, roads, etc).
- Development of tailored hydrologic and hydraulic models for key waterways as base modelling (Existing Case) for the assessment
- Validation of the hydrologic models and hydraulic models against available recorded data for historical flood events
- Community and stakeholder engagement to validate model performance in an effort to gain acceptance of modelling and calibration outcomes
- Update of hydrologic and hydraulic models to include Australian Rainfall and Runoff (ARR) 2016 design event methodology (Ball et al., 2016)
- Simulation of ARR 2016 design events for the Existing Case and comparison to previous studies to confirm drainage paths, waterways, and associated floodplain areas, and establish the existing flood regime in the vicinity of the Project. The range of flood event magnitudes assessed included the 20%, 10%, 5%, 2%, 1% events, extreme events including the 1 in 2,000 and 1 in 10,000 AEP events and the probable maximum flood (PMF).
- Inclusion of Project elements (proposed rail alignment, road reconfigurations and associated drainage structures) (Developed Case) into the hydraulic models and simulation of ARR 2016 design events. The Developed Case also includes the North Star to NSW/Queensland Border and the Gowrie to Helidon Inland Rail projects, which are being concurrently developed. The North Star to NSW/Queensland Border and the Gowrie to Helidon Inland Rail projects have been included in the Developed Case for this Project to enable cumulative impacts to be considered and addressed.
- Assessment of impacts of the Project using the suite of design floods, including consideration of change in flood levels, flow distributions, velocities and duration of inundation.
- Determination of appropriate mitigation measures to manage potential impacts, including refinement of location and dimensions of drainage structures under the Project alignment and for road reconfigurations. Iterations undertaken in the hydraulic models to achieve a design that meets the flood impact objectives.

Flood-impact objectives were established for the Inland Rail Program and used to guide the Project design, including mitigation of impacts through refinement of the hydraulic design, through adjustment of the numbers, dimensions and location of major drainage structures. Table 20 summarises the adopted flood impact objectives and how the Project design performs against each of the objectives.

TABLE 20 FLOOD IMPACT OBJECTIVES AND OUTCOMES

<table>
<tr><th>Parameter</th><th colspan="6">Objectives and outcomes</th></tr>
<tr><td rowspan="3">Change in peak water levels</td><td>Existing habitable and/or commercial and industrial buildings/ premises (e.g. dwellings, schools, hospitals, shops)</td><td>Residential or commercial/industrial properties/lots where flooding does not impact dwellings/ buildings (e.g. yards, gardens)</td><td>Existing non-habitable structures (e.g. agricultural sheds, pump-houses)</td><td>Roadways
Rail lines</td><td>Agricultural (cropping) land</td><td>Agricultural (grazing) land/forest areas and other non-agricultural land</td></tr>
<tr><td>≤ 10 mm</td><td>≤ 50 mm</td><td>≤ 100 mm</td><td>≤ 100 mm</td><td>≤ 100 mm with localised areas up to 400 mm</td><td>≤ 200 mm with localised areas up to 400 mm</td></tr>
<tr><td colspan="6">Objective: Changes in peak water levels are to be assessed against the above proposed limits.
Outcome: Generally, the Project design meets the above limits with the exception of a few localised areas along the Project alignment where these limits are exceeded. These areas are generally on agricultural land. Flood-sensitive receptors that are impacted by changes in peak water levels under the 1% AEP event that exceed the flood-impact objectives include:
▸ Nine dwellings (five between Pampas and Yandilla, and four at Yelarbon)
▸ One shed at Pampas
▸ Three commercial buildings (grain silos) at Yandilla
▸ One State-controlled road (Cunningham Highway at Yelarbon)
▸ One local public road (Leesons Road between Kingsthorpe and Gowrie Junction).</td></tr>
<tr><td>Change in duration of inundation</td><td colspan="6">Objective: Identify changes to duration of inundation through determination of ToS. For roads, determine AAToS (if applicable) and consider impacts on accessibility during flood events.
Outcome: There are localised increases in ToS at the same locations where peak water levels are increased. These changes in inundation duration do not affect flood-sensitive receptors except for one local public road—Draper Road—and one State-controlled road—the Cunningham Highway. The Cunningham Highway has a +0.8 hours per year increase in AAToS, which is a negligible change, with Draper Road experiencing an even lower impact.</td></tr>
<tr><td>Flood flow distribution</td><td colspan="6">Objective: Aim to minimise changes in natural flow patterns and minimise changes to flood flow distribution across floodplain areas. Identify any changes and justify acceptability of changes through assessment of risk, with a focus on land use and flood-sensitive receptors.
Outcome: The Project has minimal impacts on flood flows and floodplain conveyance/storage, with significant floodplain structures included to maintain the existing flood regime.</td></tr>
<tr><td>Velocities</td><td colspan="6">Objective: Maintain existing velocities where practical. Identify changes to velocities and impacts on external properties. Determine appropriate scour mitigation measures, taking into account existing soil conditions.
Outcome: In general, changes in velocities are minor, with most changes in velocities experienced immediately adjacent to the Project alignment and no flood-sensitive receptors impacted. Scour protection has been specified where the outlet velocities for the 1% AEP event exceed the allowable soil velocities for the particular soil type for each location, which was identified from published soil mapping.</td></tr>
<tr><td>Extreme event risk management</td><td colspan="6">Objective: Consider the risks posed to neighbouring properties for events larger than the 1% AEP event, to ensure no unexpected or unacceptable impacts.
Outcome: A review of impacts under the 1 in 2,000 AEP, 1 in 10,000 AEP and PMF events has been undertaken with the existing flood depths and increase in peak water levels at flood-sensitive receptors identified on each floodplain. Considering the flood depths that occur, particularly under the PMF event, indicates that the changes in peak water levels would be unlikely to exacerbate flood conditions during extreme events.</td></tr>
</table>

Parameter	Objectives and outcomes
Sensitivity testing	**Objective:** Consider risks posed by climate change and blockage in accordance with ARR 2016. Undertake assessment of impacts associated with Project alignment for both scenarios. **Outcomes:** Climate change—climate change has been assessed in accordance with ARR 2016 requirements, with the RCP8.5 (2090 horizon) scenario adopted. The impacts resulting from changes in peak water levels under the 1% AEP event with climate change are generally similar to those seen under the 1% AEP event, with some additional impacts on flood-sensitive receptors. Blockage—blockage of drainage structures has been assessed in accordance with ARR 2016 requirements. The blockage assessment resulted in no blockage factor being applied to bridges and a blockage factor of 25 per cent being applied to culverts. Two blockage sensitivity scenarios were tested, with both 0 per cent and 50 per cent blockage of all culverts assessed. The resulting changes in peak water levels associated with the Project alignment are localised but impact on some flood-sensitive receptors. During detail design, the blockage factors will be reviewed in line with the final design and local catchment conditions. This may result in a varied and/or lower blockage factors being applied along the Project alignment.

Development of reference design

The reference design for the Project has been developed to respond, where possible, to potential impacts to hydrology and flooding. Measures that have been incorporated into, or commenced in parallel with, the reference design development are as follows:

- The Project has been designed to achieve the hydraulic design criteria that has been adopted for Inland Rail, which includes:
  - 50-year design life for formation and embankment performance
  - Track drainage ensures that the performance of the formation and track is not affected by water
  - Earthworks designed to ensure that the rail formation is not over-topped during a 1% AEP flood event
  - Embankment cross section can sustain flood levels up to the 1% AEP
  - Bridges are designed to withstand flood events up to and including 0.05% AEP (2000-year event).
- Flood models were developed in consultation with stakeholders and, where possible, models were calibrated and validated using stakeholder-supplied information.
- The Project uses the existing South Western Line and Millmerran Branch Line rail corridors as much as possible, to avoid introducing a new linear infrastructure corridor across floodplains. This means that 71.2 km of the total 216.2 km Project length is located within existing rail corridor.
- The Project incorporates bridge and culvert structures to maintain existing flow paths and flood flow distributions, such as across the Condamine River floodplain, where six bridges have been incorporated into the design, with a combined opening width of > 6 km
- Bridge and culvert structures have been located and sized to avoid increases in peak water levels, flow distribution, velocities and duration of inundation in accordance with the flood-impact objectives
- Progressive refinement of bridge location/extents and culvert banks (location, number of barrels and dimensions) has been undertaken as the Project design has evolved. This refinement process has considered engineering requirements as well as input and feedback from stakeholders to achieve acceptable outcomes that address the flood impact objectives.
- Stakeholder concerns regarding the dispersive nature of soils in floodplains were addressed in the reference design by incorporating scour and erosion protection measures into the design in areas determined to be at risk, such as around culvert headwalls, drainage discharge pathways and bridge abutments
- The reference design includes the option to modify the existing Yelarbon flood levee to increase the flood immunity for the township of Yelarbon due to the addition of the Project
- A climate change assessment has been incorporated into the design of cross drainage structures for the Project in accordance with the Australian Rainfall and Runoff Guidelines (Ball et al., 2016) for the local drainage catchments for the 1% AEP design event, to determine the sensitivity of the design to the potential increase in rainfall intensity
- Potential blockage of hydraulic structures caused by floodplain debris, as highlighted by stakeholders, has been factored into the reference design by allowing an additional 25 per cent flow capacity in culverts, and by placing bridges over major debris transportation paths
- Flood-sensitive receptors and corresponding acceptable design outcomes have been identified through discussions with potentially affected landowners, where possible.

Proposed mitigation measures

Where impacts cannot be avoided, the extent of impacts will be managed, mitigated and/or compensated. Management, mitigation and compensation measures for impacts to hydrology and flooding include, but are not limited to:

- Design modifications during the detail design phase will be subject to re-runs of the existing flood models, to demonstrate continued compliance with the design objectives of the Project, including for extent and time of inundation, afflux and flow velocities
- Consultation with impacted stakeholders will continue through detail design to ensure that alterations to the design and its impacts are communicated back to landowners
- The design requirements for modifying the existing Yelarbon levee will be confirmed through further consultation with GRC and incorporated into the detail design. It is anticipated that the modified levee would be considered a Category 2 levee (Schedule 10 of the *Water Regulation 2016*). This is code-assessable development, with local government (GRC) as the assessment manager. Development approval for the modification of Yelarbon levee will be obtained prior to the commencement of any modification works.
- 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 government and Queensland Fire and Emergency Services (QFES).
- Laydown areas and other temporary construction facilities that are located within the 1% AEP will be short-term in use. 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 used for construction purposes.
- During operation, inspections will be carried out in accordance with ARTC's engineering codes of practice to identify defects and conditions that may affect waterway and drainage system capacity or indicate increased risk of flooding, such as:
    - Scour
    - Blockages due to debris build up
    - Indication of floods overtopping a structure
    - Culvert or drain damage or collapse.

The hydrologic and flooding assessment undertaken has demonstrated that the Project is predicted to result in impacts on the existing flooding regime that generally comply with the flood impact objectives. A comprehensive consultation exercise has been undertaken to provide the community with detailed information and certainty around the flood modelling and the Project design. In future stages, ARTC will continue to work with:

- Landowners concerned with hydrology and flooding throughout the detail design, construction and operation phases of the Project
- Directly impacted landowners affected by the alignment throughout the detail design, construction and operation phases of the Project
- Local governments, State government agencies and local flood specialists throughout the detail design, construction and operation phases of the Project.

7.8 Groundwater

Existing environment and potential impacts

There are three main aquifer systems present, which are considered relevant to the Project:

- Cainozoic to recent alluvial/colluvial sediments (Quaternary/Tertiary): of shallow alluvial systems along river valleys (Border Rivers and Condamine River alluvial units) and volcanic basalt aquifers in the eastern portion of the Project
- Tertiary Main Range Volcanics (MRV): fractured basalt aquifers in the eastern portion of the Project
- Jurassic WCM: interbedded sandstone, claystone, shale, and major coal seams.

These aquifer systems are part of the larger Great Artesian Basin and have potential to be sensitive to impacts from Project activities. While the Hutton Sandstone is a regionally significant aquifer, it is not considered to be susceptible to impacts by the Project due to the depth at which it occurs.

A search of registered groundwater bores within the impact assessment area was completed using the DNRME Groundwater Database and Queensland Globe (State of Queensland, 2018). The search identified a total of 439 registered bores within the impact assessment area. Of the 439 registered bores identified, 156 were excluded from further evaluation in the draft EIS due to no data being available on aquifer lithology, bore construction details or water levels. Details of the remaining 283 bores are summarised in Table 21.

TABLE 21 SUMMARY OF DNRME REGISTERED BORES WITHIN THE IMPACT ASSESSMENT AREA

Aquifer	Number of bores	Standing water level (mbgl)				Yield (L/s)			
		Min	Max	Mean	Count	Min	Max	Mean	Count
Border Rivers Alluvium	6	7.6	9.0	7.4	5	0.5	1.8	1.1	4
Condamine Alluvium	81	6.9	36.2	20.0	55	0.4	25.0	6.2	26
Main Range Volcanics	148	1.8	60.1	18.7	55	0.1	18.9	3.9	63
Kumbarilla Beds	21	0.0*	133.0	24.8	19	0.2	5.5	1.7	17
Walloon Coal Measures	27	0.0*	102.0	35.0	22	0.1	22.9	4.1	21
Total	**283**								

Table note: *Free flowing bores encountered.

Analysis of water entitlements within the impact assessment area indicates that irrigation is the primary groundwater entitlement licence type for the key aquifers near the Project footprint. For the shallow aquifers (being the Border Rivers Alluvium, the Condamine Alluvium, and the MRV) irrigation comprises 70 to 85 per cent of the annual assigned groundwater take. This is followed by stock, industrial and urban takes from these shallow aquifers. In the Border Rivers Alluvium, the majority of the assigned entitlements are for supplementing surface water supplies during drought periods, which often results in only a small proportion of the groundwater allocation being used (OGIA, 2016b).

Numerical predictive models were developed to support the hydrogeological design and assessment of impacts for the Project. These local-scale groundwater models were developed as 2D cross-sectional models oriented perpendicular to the Project alignment. The primary objectives of the predictive modelling were to:

- Assess potential groundwater drawdown due to drainage of cuts
- Estimate groundwater seepage rates for cuts
- Assess groundwater quality parameters to inform reference design for earthworks and cuts.

Five indicative cuts along the Project alignment were identified as best representing the local geological conditions and worst-case potential impacts on groundwater resources (deepest cuts into each stratigraphy), and were subsequently modelled to evaluate potential drawdown, changes to flow regime and estimate potential seepage rates.

The models were used to estimate steady state inflows to deep cuts and the resulting drawdown impacts from excavations. As numerical models are a simplified representation of a real system, there are inherent uncertainties. Sensitivity analysis was incorporated into the methodology to account for potential uncertainties in the 2-D modelling, such as heterogenous geological conditions, variable aquifer characteristics (as encountered in the alluvium and MRV) and paucity of location-specific data.

Seepage rate estimates were obtained for the entire length of each cut, through the multiplication of modelled seepage rates by the total length of cut. The modelled geology and cut geometry for each section modelled were extrapolated across the entirety of each cut such that calculated seepage rates are considered to be conservative estimates. The estimated seepage results are presented in Table 22. Initial inflow rates to excavations will be higher than the average (steady state) inflows predicted.

TABLE 22 PREDICTIVE MODELLING RESULTS—SEEPAGE ESTIMATES

Cut ID	Model section chainage (km)	Cut length (m)	Cut depth (mbgl)	Expected seepage for entire cut (m^3/year)	Upper range seepage for entire cut (m^3/year)
310–C08	Ch 57.67	3,450	17.4	1,750	11,100
310–C25	Ch 114.46	380	15.4	30	280
310–C31	Ch 164.60	1,680	29.5	260	740
310–C37	Ch 174.52	2,290	29.7	7,100	105,000
310–C44	Ch 188.91	1,500	26.4	1,870	17,500

Predictive simulation results indicate:

- Seepage is concentrated at the bottom of the cuts, on both sides of infill material
- Initial inflow of seepage will be higher than the average rate predicted for steady state scenarios then will plateau
- Seepage values simulated are considered to be low and attributed to the low hydraulic conductivity (K) values applied, based on an average of site-specific data
- Temporary increases in seepage may be observed in cuts with sandy soil or weathered sandstone, following rainfall events
- Seepage of groundwater from bedrock is anticipated to be low except where enhanced by weathering of fractures.

It is anticipated that seepage water, in general, will evaporate due to local climate conditions and relatively small volumes when considered with the length of the cuts. Cut 310–C37 is predicted to encounter seepage volumes of 7,100 m^3/year to 105,000 m3/year, which equates to rates of 0.23 L/s and 3.3 L/s across the entire surface of a 2.29 km cut, to 29.7 m depth. Such a large estimated range is expected to be refined during detail design when additional site-specific hydrogeological data is combined with the finalised design for model re-calibration and re-run of predictive simulations.

Modelling results indicate that drawdown is only expected to occur at three of the five modelled locations. In these locations, there are no registered bores located outside of the Project footprint that are also within the extent of predicted drawdown. At the locations where drawdown is anticipated to occur, the maximum extent of drawdown is predicted to range from 15 m to 80 m from the centre of the Project alignment.

Table 23 presents the predicted drawdown results where the range in drawdown extent represents the upper value steady state results.

TABLE 23 PREDICTED DRAWDOWN VALUES (BASE CASE) AT MODELLED CUTS

Cut ID	Model section, chainage (km)	Estimated drawdown at rail centreline (m)	Extent of drawdown from centreline (m)	Drawdown threshold applied (m)*
310–C08	Ch 57.67	3.7	Up to 15	2
310–C25	Ch 114.46	<1.0	N/A	N/A
310–C31	Ch 164.60	<1.0	N/A	N/A
310–C37	Ch 174.52	12.2	Up to 60	5
310–C44	Ch 188.91	11.7	Up to 80	5

Table note:

* Drawdown thresholds of 2 m and 5 m are from the ESR/2016/1999 Baseline assessment guideline: **environment.des.qld.gov.au/assets/documents/regulation/rs-gl-baseline-assessments.pdf**

The numerical simulations undertaken for this assessment are considered to be suitable for developing coarse relationships between groundwater extraction locations and rates and associated impacts (Barnett et al., 2012). Further, these models are considered an initial assessment of the Project on groundwater resources. Revised 2-D cross-sectional modelling of finalised cut dimensions will be required through the detail design process to reconfirm potential drawdown and potential seepage rates at cut locations and ensure that appropriate controls are included in the design.

Project activities have potential to impact on groundwater resources via:

- Loss or damage to existing landowner bores. There are 30 registered bores within the Project footprint. These bores, plus unregistered bores that also occur within the Project footprint, are likely to be decommissioned for the progression of the Project.
- Temporary drawdown of localised groundwater levels with the potential to temporarily affect the availability of groundwater from bores (registered and unregistered) in proximity to the works, which are not otherwise decommissioned by the Project. Preliminary modelling results indicate that there are no registered bores located outside of the Project footprint that are also within the extent of predicted drawdown.
- Deep cuttings could create voids that intersect shallow groundwater and perturb the antecedent groundwater flow regime. Piles or other structures spaced closely together also have potential to influence the natural groundwater flow regime.

- Long-term dewatering is not considered to be required for the operation of the Project; however, long-term seepage is likely to occur at one cut location. Dewatering will be managed via engineering controls (e.g., drainage blankets, shotcrete). Seepage prevention measures will be investigated through the detail design process for inclusion in the design, as appropriate.
- Reduced permeability of the substrate beneath embankments may modify the flow direction of shallow groundwater in portions of the alluvium and possibly the saturated portion of weathered bedrock.
- Bridge and piling can cause alteration of aquifer parameters (lower permeability), altered groundwater flow patterns (mounding or drawdown up and down gradient of the piles; upward leakage along the pile/soil interface) and reduction in groundwater resources through extraction of wet soil/rock during piling.
- Subsidence/settlement of compressible substrates and possible damage to adjacent structures (i.e. proposed bridges or embankments can occur).
- Contamination/reduction of groundwater quality due to:
  - Unintended spills and leaks of hydrocarbons (i.e. oils, fuels and lubricants) and other chemicals related to use of heavy plant and equipment (accidental discharge)
  - Water mixtures and emulsions related to washdown areas (accidental discharge)
  - Upward seepage along piles/soil interfaces of saltier groundwater from the deeper confined aquifers into the fresher alluvium aquifers.

The majority of potential impacts related to groundwater are considered temporary in nature and primarily associated with the construction phase of the Project. Impacts that may occur through the operation phase are, in most instances, an extension of issues that will initially arise through the construction phase of the Project.

Development of reference design

The reference design for the Project has been developed to respond, where possible, to potential impacts to groundwater resources. Measures that have been incorporated into, or commenced in parallel with, the reference design development are as follows:

- Geotechnical and groundwater field data has been used to derive design criteria for structures and rail formation. This has enabled the Project to be designed to cater for field-verified geotechnical and groundwater conditions.
- Design and ratings of earthworks in support of culverts, viaducts, and bridges are in accordance with AS 5100 *Bridge Design* and AS 7363 *Railway Structures* and other applicable Australian Standards
- The reference design has allowed for the application of a 300 mm drainage blanket to be applied to the face of all cuts where groundwater is encountered within 2 m of the base of the cutting. Alternative seepage control measures will be considered and assessed through the detail design, on a cut-by-cut basis.
- The Project alignment has been located to avoid, where possible, steep terrain and topographical constraints to optimise the number, width and depth of cuts and the potential for interaction with groundwater resources
- Groundwater sampling was conducted on all 27 monitoring bores installed for the Project for the collection of baseline water quality, durability, and salinity parameters. This data has been used to establish design criteria for structures and rail formation.

Proposed mitigation measures

Where impacts cannot be avoided, the extent of impacts will be managed, mitigated and/or compensated. Management, mitigation and compensation measures for impacts to groundwater resources include, but are not limited to:

- Further geotechnical investigations will be undertaken in parallel to the detail design process to ensure site-specific geotechnical and groundwater conditions are reflected in the final design solution. Investigations will be targeted to specific locations, such as:
  - Locations of bridge abutments
  - Locations of significant cuts
  - Locations of significant fill.
- Predictive numerical modelling will be re-run using additional information obtained from further geotechnical and hydrogeological investigations, in addition to finalised cut dimensions. This revised modelling will be completed to better understand seepage estimates and groundwater level variation resultant from cuts. Seepage analysis will be used to advise drainage blanket specifications, or alternative design controls, for deep cuts into hard rock.

- Re-confirm the predicted extent of drawdown impacts based on finalised cut dimensions. Where drawdown impacts are anticipated to extend to registered bores that would not otherwise be decommissioned by the Project, consultation will occur with each licensed user to determine and agree an appropriate mitigation approach (e.g., monitoring with bore-specific impact thresholds for intervention and 'make good' agreements).
- Landowners affected by the Project will be consulted to confirm the location of registered bores and to establish the presence of any unregistered bores within the Project footprint that may be decommissioned to enable construction and operation of the Project. Where a groundwater bore is expected to be decommissioned or have access to it impaired as result of the Project, 'make good' measures will be agreed in consultation with the affected landowner.
- Where embankment height allows, toe benching and drainage blankets are to be provided for all transverse slopes greater than 7° (1V:8H). A minimum 300 mm drainage blanket is to be applied in all cuttings where there is known or suspected groundwater within 2 m of the base of the cutting.
- Where embankment height allows, full embankment benching is to be provided for all transverse slopes greater than 14° (1V:4H).
- The reference design provides for a minimum 300 mm drainage blanket to be applied in all cuttings where there is known or suspected groundwater to within 2 m of the base of the cutting. Alternative, more effective seepage-control measures will be considered and assessed through the detail design phase, on a cut-by-cut basis.
- A Groundwater Management and Monitoring Plan (GMMP) will be developed to provide an ongoing assessment of the Project impacts during construction. The GMMP will be developed using baseline groundwater data collected for the Project and will be subject to approval from the relevant regulatory agencies prior to implementation. Baseline groundwater monitoring data will be used to:
  - Derive location/bore-specific groundwater monitoring procedures
  - Establish location/bore-specific impact thresholds
  - Establish responses to impact threshold exceedances, including 'make good' agreements.
- All groundwater supply and/or monitoring bores that require decommissioning will be decommissioned in accordance with the *Minimum Construction Requirements for Water Bores in Australia—Edition 3* (National Uniform Drillers Licensing Committee, 2012).
- Undertake monitoring of existing registered bores outside of the Project footprint for which drawdown impacts are anticipated, as determined through revised modelling during detail design. The duration and frequency of monitoring will be agreed with individual bore owners and will reflect the scale and duration of construction activities that may cause the drawdown impacts, e.g. excavation of deep cuts.
- The use of groundwater to supplement the construction demand for the Project may be considered if private owners of licensed/registered bores have capacity under their water licence or entitlement that they wish to sell to, or trade with, ARTC under a private agreement. In circumstances where groundwater access is secured through private agreement, the licensed capacity of existing bores will not be exceeded. Flow- and volume-monitoring during extraction will be required for each bore, with extraction logs maintained.

7.9 Noise and vibration

Potential construction impacts

A construction noise and vibration impact assessment has been carried out in accordance with the ToR and involved:

- Identification and classification of noise and vibration-sensitive receptors
- Baseline monitoring to establish existing environmental conditions
- Calculation of relevant criteria from noise monitoring results
- Modelling of construction noise
- Assessment of noise model predictions against criteria for construction works as well as construction road traffic
- Establishment of safe working distances for vibration-intensive construction works
- Identification of feasible and reasonable mitigation and management measures, where appropriate.

Sensitive receptors identified throughout the impact assessment area were established in accordance with the *Transport Noise Management Code of Practice: Volume 2 – Construction Noise and Vibration* (CoP Vol 2) (DTMR, 2016) and the *Environmental Protection (Noise) Policy 2019*, which outline sensitive land uses and receptors to construction noise and vibration.

Airborne noise

A construction noise impact assessment was carried out in accordance with the *Transport Noise Management Code of Practice: Volume 2—Construction Noise and Vibration* (CoP Vol 2) (DTMR, 2016).

Ambient noise monitoring was conducted at 11 locations within the impact assessment area in December 2018. Noise monitoring locations were selected as representative of clusters of sensitive receptors, particularly those most at risk of being impacted by construction noise. At each site, both long-term monitoring and short-term attended measurements were taken in accordance with the CoP Vol 2. The long-term monitoring was used to establish the noise criteria for the impact assessment area, as shown in Table 24.

The external noise criteria and the number of sensitive receptors that exceed each limit for different construction activities are presented in Table 24. These are the predicted construction noise impacts over a worst-case 15-minute interval, while construction equipment is positioned at the nearest location to each sensitive receiver location. Both lower and upper criteria exceedances are included for standard and non-standard construction hours. Non-standard hours have been conservatively assessed against the more stringent night-time criteria. Due to the low background noise levels measured during both standard and non-standard hours of construction the lower and upper limit are both set to the minimal level as per CoP Vol 2.

Particularly noisy activities, such as piling, are likely to persist for only a portion of the overall construction period. In addition, the predictions use the shortest separation distance to each sensitive receiver, however in reality separation distances vary between plant and sensitive receptors.

TABLE 24 NUMBER OF SENSITIVE RECEPTORS WHERE NOISE CRITERIA EXCEEDANCES MAY BE EXPERIENCED

Time of day		Standard hours		Non-standard hours
Limit: Façade $L_{A,eq(15min)}$		Lower: 50 dB(A)	Upper: 65 dB(A)	45 dB(A)
Number of sensitive receptors exceeding criterion	Establishment of drainage	877	302	1,356
	Earthworks	1,533	452	2,169
	Site setup/laydown	889	101	1,494
	Rail civil works	1,135	363	1,978
	Road civil works	976	266	1,721
	Structures	1,024	20	1,911
	Flash-butt welding	3	1	7
	Concrete batching	3	1	4

An overview of the number of noise criteria exceedances for critical facilities for each construction activity is shown in Table 25. Each critical facility has a specific internal construction noise limit as determined as part of the assessment. An assumed attenuation of 7 dB(A) through the building envelope has been applied to the predicted noise level and is supported by *AS 3671-1989—Acoustics—Road traffic noise intrusion—Building siting and construction* (Standards Australia, 1989).

For some activities, receptors fall within the construction footprint: the area within which construction equipment is expected to operate. It is anticipated that land within the Project footprint will either be gazetted as rail corridor or will be temporarily used to accommodate construction activities. As a result, the count of receptors exceeding a criterion does not include those within the Project footprint.

Fugitive sources, such as unapproved or unexcepted construction techniques, poorly maintained or fitted equipment (such as selecting an inappropriate engine muffler) cannot be foreseen and therefore have not been assessed.

TABLE 25 NUMBER OF CRITICAL FACILITIES WHERE NOISE CRITERIA EXCEEDANCES MAY BE EXPERIENCED

Critical facility		Community buildings	Educational facilities	Medical facilities
Limit: Internal $L_{A,eq(15min)}$		45 dB(A)	45 dB(A)	40 dB(A)
Number of sensitive receptors exceeding criterion	Drainage	0	2	0
	Earthworks	3	4	0
	Site setup/laydown	0	2	0
	Rail civil works	1	3	0
	Road civil works	0	2	0
	Structures	1	2	0
	Flash-butt welding	0	0	0
	Concrete batching	0	0	0
	Non-resident workforce accommodation	0	0	0

Ground-borne vibration

Vibration assessments of the Project were undertaken by modelling worst-case scenarios of the most vibration-intensive activities that are expected to be used during construction. The model results found that exceedances of the construction vibration criteria were predicted at several sensitive receptors in the event that vibratory roller use or vibratory/percussive piling were to occur in proximity to them.

The minimum working distances presented in Table 26 should not be exceeded in order to comply with the building damage criteria established in *German Standard DIN 4150: Part 3 1999 Structural Vibration in Buildings—Effects on Structures* (Deutsches Institut für Normung, 1999).

TABLE 26 RECOMMENDED MINIMUM WORKING DISTANCES FOR VIBRATION INTENSIVE EQUIPMENT

	Predicted setback distance (m) from each receptor type						
	Human Comfort—Lower Limit (night)	Human Comfort—Lower Limit (day) Upper limit (night)	Human Comfort—Upper Limit (day)	Building Damage Limit—historical heritage building	Building Damage Limit	Buried pipework (masonry, plastic or metal construction)	Buried pipework (steel construction)
Plant Item	0.3 mm/s PPV	1.0 mm/s PPV	2.0 mm/s PPV	3.0 mm/s PPV	5.0 mm/s PPV	50 mm/s PPV	100 mm/s PPV
Vibratory roller—Vibration start-up/run down	330	130	80	60	40	<5	<5
Vibratory roller—steady state	200	90	60	40	30	<5	<5
Vibratory piling	290	110	60	40	30	<5	<5
Percussive piling	690	275	160	135	80	< 5	<5

Table notes:
PPV = Peak particle velocity

Blasting

Locations where blasting may be required to progress earthworks within the Project footprint have been identified based on information derived from the geotechnical data collected in support of the reference design. The maximum permissible charge weight to meet the sensitive structure vibration criteria in CoP Vol 2 is shown in Table 27. A detailed blasting assessment will be completed once blasting locations have been finalised through detail design. The information in Table 27 is based on a worst-case assumption of a confined blast and geotechnical parameters for good vibration transmission.

TABLE 27 CHARGE MASS RANGES FOR SET DISTANCES

Distance to receptor	Total number of receptors for the Project in proximity to one or more blast locations	Maximum permissible charge weight (kg)			
		Ground vibration—human comfort	Ground vibration—structural damage	Airblast overpressure—human comfort	Airblast overpressure—structural damage
0 to 200 m	62	N/A—Specific blast design required or blasting not feasible at these distances.			
200 to 400 m	30	180	710	<1	30
400 to 800 m	51	720	>2,000	<5	250
800 to 1,600 m	226	>2,000	>2,000	30	>2,000

Thirty-four receptors were identified as being areas of interest for heritage purposes. The maximum permissible charge weight to meet the heritage building criteria outlined in CoP Vol 2 has been calculated for indicative setback distances in Table 28 and is based on a worst-case assumption of an unconfined blast.

TABLE 28 CHARGE MASS RANGES FOR SET DISTANCES FOR HERITAGE BUILDINGS

Distance to receptor	Total number of receptors for the Project in proximity to one or more blast locations	Maximum permissible charge weight (kg)
0 to 200 m	1	N/A—Specific blast design required or blasting not feasible at these distances
200 to 400 m	2	57
400 to 800 m	1	230
800 to 1,600 m	1	920

Road traffic noise

The road traffic noise assessment was undertaken using current and forecast traffic flows to predict the $L_{A10(1hr)}$ for each year from 2021 to 2026 both with and without the expected construction traffic. $L_{A10(1\ hour)}$ is the A-weighted sound pressure level that is exceeded for 10% of a one-hour period. The difference between the noise levels with construction traffic and without construction traffic is the noise impact of the construction traffic.

The construction traffic noise is predicted to exceed the criteria for 44 roads within the impact assessment area, with a maximum predicted increase of 22 dB(A). Table 29 presents the numbers of roads where the increase in the $L_{A10(1\ hour)}$ due to construction traffic exceeds 3 dB(A). These roads are primarily in rural locations and the existing base traffic volumes quantities are insignificant. As such, the initial airborne road traffic noise levels are low, before the addition of construction traffic, and the criteria for these roads is stringent.

TABLE 29 ADDITIONAL AIRBORNE NOISE LEVELS FROM CONSTRUCTION TRAFFIC PER YEAR

Increase in $L_{A10(1\ hr)}$ due to construction traffic	Number of roads 2021	2022	2023	2024	2025	2026
More than 3 dB(A), but less than 5 dB(A)	7	15	12	7	4	1
More than 5 dB(A), but less than 10 dB(A)	10	12	9	5	3	1
More than 10 dB(A), but less than 15 dB(A)	4	7	9	0	0	0
More than 15 dB(A), but less than 20 dB(A)	8	10	4	0	0	0
More than 20 dB(A)	0	1	0	0	0	0
TOTAL	**27**	**40**	**28**	**9**	**6**	**2**

Potential operation impacts

Road traffic noise

A desktop assessment of 35 new road sections and 46 upgraded road sections was undertaken to predict the potential noise impacts associated with each road alteration. These roads were assessed against relevant criteria from the *Road Traffic Noise Management: Code of Practice Volume 1* (CoP Vol 1) (DTMR, 2013a). Nearest sensitive receptors to the proposed works have been taken into consideration, as well as the realignment distance to predict the change in noise levels brought about by the realignment of the road closer to residents.

Operational noise from four new road sections is predicted to exceed the façade corrected $L_{A10(18\ hour)}$ criterion at one or more sensitive receptors. $L_{A10(18\ hour)}$ is the arithmetic mean noise level in dB(A) exceeded for 10 per cent of each hour over the period 6:00 am to 12:00 am. Results of the operational road traffic noise assessment of these sections are given in Table 30. Impacts presented are predictions of operational road traffic noise levels in 2035 at the nearest receptor.

TABLE 30 PREDICTED OPERATIONAL ROAD TRAFFIC NOISE—NEW ROADS

Location	Chainage (km)	Existing alignment—distance to nearest receptor (m)	2035 alignment—distance to nearest receptor (m)	2035 alignment—Façade Corrected $L_{A10(18\ hour)}$ (dB(A))	Number of receptors which exceed criterion
Cunningham Highway	25.20	14	14	73	29
Quibet Road	171.0	45	45	61	2
Lochaber Road	172.6	54	25	63	1
Biddeston–Southbrook Road	183.0	80	55	61	1

Three sections of the Gore Highway, upgraded as part of the Project, will result in exceedances of the façade corrected 68 dB(A) $L_{A10(18\ hour)}$ criterion at the nearest sensitive receptors. The predicted façade corrected $L_{A10(18\ hour)}$ at the nearest sensitive receptor for these segments is presented in Table 31. Impacts presented are predictions of operational road traffic noise levels in 2035 at the nearest receptor.

TABLE 31 OPERATIONAL ROAD TRAFFIC NOISE—UPGRADED ROADS EXCEEDANCES

Location	Chainage (km)	Distance to nearest receptor (m)	2035 Façade Corrected $L_{A10(18\ hour)}$ (dB(A))	Number of receptors which exceed criterion
Gore Highway	146.6	47	71	2
Gore Highway	153.0	65	69	2
Gore Highway	183.4	60	70	1

Airborne rail

ARTC is implementing consistent criteria for the assessment and management of operational railway noise across the Inland Rail Program to ensure the potential noise-related impacts to public health, amenity and disturbance are managed the same, regardless of which state the sensitive land-uses are located in. The airborne railway noise assessment criteria for residential receptors are detailed in Table 32.

ARTC has elected to assess and manage railway noise on the entire Project, applying the noise criteria for new railways. The Project, for the purpose of operational railway noise, is being considered a greenfield railway infrastructure project for its entire length. On this basis, an assessment or quantification of noise levels from existing railway operations on the Project alignment has not been undertaken.

TABLE 32 AIRBORNE RAILWAY NOISE ASSESSMENT CRITERIA FOR RESIDENTIAL RECEPTORS

	Noise management levels (external)	
Type of development	**Daytime (7.00 am to 10.00 pm)**	**Night-time (10.00 pm to 7.00 am)**
New rail line development[1]	Predicted railway noise levels exceed:	
	$L_{Aeq(15\ hour)}$ 60 dB(A)	$L_{Aeq(9\ hour)}$ 55 dB(A)
	L_{Amax} 80 dB(A)	L_{Amax} 80 dB(A)

Table notes:

$L_{Aeq(9\ hour)}$ = A-weighted equivalent noise level measured in decibels over a period of 9 hours

$L_{Aeq(15\ hour)}$ = A-weighted equivalent noise level measured in decibels over a period of 15 hours

L_{Amax} = The maximum A-weighted noise level during a measurement period

$L_{Aeq(period)}$ = A-weighted equivalent noise level measured in decibels over an unspecified period of time

1 A new rail line development is a rail infrastructure project on land that is not currently an operational rail corridor

The predicted railway noise levels at the sensitive receptors are reported as the L_{Aeq} and L_{Amax} noise metrics and include the contributions from the train movements (pass-bys) on the main rail line and crossing loops, along with the noise emissions from level crossing alarm bells and the train horns.

A total of 1,600 sensitive receptors were included in the railway noise modelling. The predicted noise levels identified that noise mitigation would need to be investigated for up to 130 sensitive residential receptors at which adopted criteria (refer Table 32) would be exceeded by noise levels in 2026 (Project opening). The adopted criteria would be exceeded by 131 sensitive residential receptors in 2040 (design year).

A summary of the number of sensitive residential receptors where the predicted rail noise levels at the commencement of railway operations are above the assessment criteria, and trigger the investigation of noise mitigation, are provided in Table 33. The investigation of noise mitigation is primarily triggered by the night-time operations because the number of trains per hour is greater during the night-time. The noise criteria are also 5 dB(A) more stringent for the night-time period than the daytime period.

TABLE 33 SENSITIVE RESIDENTIAL RECEPTORS TRIGGERING THE OPERATIONAL RAILWAY NOISE CRITERIA

Assessment criteria margin	Sensitive residential receptors triggering the criteria
Year 2026—Project opening	
1 dB(A) to 3 dB(A)	58
>3 dB(A) to 5 dB(A)	14
>5 dB(A) to 10 dB(A)	36
>10 dB(A)	22
Total receptors triggering noise mitigation—Project opening	**130**
Year 2040—design year	
1 dB(A) to 3 dB(A)	58
>3 dB(A) to 5 dB(A)	15
>5 dB(A) to 10 dB(A)	36
>10 dB(A)	22
Total receptors triggering noise mitigation—design year opening	**131 (includes the 130 receptors triggering the criteria in 2026)**

A review of predicted noise levels determined noise levels at further than 2 km from a level crossing would be expected to be below L_{Aeq} 40 dB(A) and below L_{Amax} 60 dB(A). Noise from the level crossings at these sensitive receptors has been reported accordingly and would not be a cumulative influence on the railway noise levels from train movements on the main rail line and crossing loops.

In addition to the sensitive residential receptors detailed in Table 33, there are five non-residential sensitive receptors where internal railway noise levels are estimated to trigger the relevant assessment criteria from 2026, being:

- Yelarbon State School
- Yelarbon Scouts Hall
- Pampas Memorial Hall
- Brookstead State School
- Pittsworth and District Assembly of God church.

Ground-borne noise

The most stringent ground-borne noise criterion of L_{ASmax} 35 dB(A) is calculated to be achieved at a distance of greater than 50 m from the rail line. Based on this 50 m off-set distance, there are approximately three sensitive receptors where the screening assessment has identified that ground-borne noise levels may be above the assessment criteria. These are a residence off:

- Yelarbon–Kurumbul Road, west of Kurumbul Station
- Ware Street in Brookstead
- Quibet Road to the north of Pittsworth.

At the 50 m offset distance, the outdoor noise environment would be dominated by the airborne noise, which would likely mask the potential ground-borne noise content at the nearest habitable rooms facing the rail corridor. Within other habitable rooms, where the airborne noise component can be lower, there is potential for the airborne noise to not fully mask potential ground-borne noise and perceptible ground-borne noise impacts may be experienced.

While ground-borne noise levels at all other sensitive receptors were calculated to be within the assessment criteria and do not trigger investigation of mitigation, there can still be a risk of minor perceptible ground-borne noise at sensitive receptors. Consequently, the assessment outcomes will be reviewed during the detail design phase to verify any future requirements to mitigate ground-borne noise.

Ground-borne vibration

The ground-borne vibration levels have been assessed as a vibration dose value (VDV), which considers both the level of vibration during a train pass-by event and the number of pass-by events in each daytime and night-time period. The VDV vibration levels were calculated based on the daily train movements for the 2026 opening year and 2040 design year rail operations.

The vibration levels were applied to determine the minimum offset distance from the outer rail where the ground-borne vibration criteria would be expected to be achieved. The assessment determined that the vibration criteria would be achieved where receptors are greater than 10 m from the closest rail. Acknowledging that some properties are within the Project footprint, there were no sensitive receptors triggering the ground-borne vibration criteria from railway operations.

The assessment of potential vibration induced impacts to these cultural areas of interest identified the following will need to be subject to a structural survey where the property and structures are determined to be within 15 m of the outer rail:

- Yelarbon Railway Complex (20 SP120712 and 21 SP120712)
- Grass Tree Creek bridge (4 RP16058)
- Yandilla Station (202 SP124721)
- Condamine River bridge (114 SP113906)
- Pampas Station (23 SP124720)
- Sheds opposite the Millmerran Branch Line (1 RP14242)
- Condamine River bridge #2 (2 RP37132).

Development of reference design

The reference design for the Project has been developed to respond, where possible, to potential impacts due to noise and vibration. Measures that have been incorporated into, or commenced in parallel with, the reference design development are as follows:

- Construction noise and vibration:
  - Laydown areas and other construction-phase facilities have been located to avoid impacts to environmental and social receptors, with the aim of achieving compliance with the adopted construction noise and vibration criteria, as per CoP Vol 2
  - The horizontal and vertical alignment has been established to optimise the earthworks required and achieve as close to a net balance as is possible. By minimising the material deficit for construction of the Project, the volume of material required to be imported has been reduced. Less imported material equates to fewer construction phase truck movements and less construction traffic noise.
- Operational railway noise and vibration:
  - The Project has been co-located with existing transport corridors as much as possible, including being positioned within the existing South Western Line and Millmerran Branch Line rail corridors, to avoid introducing a new linear infrastructure corridor in proximity to receptors potentially sensitive to noise and vibration
  - The Project has been aligned to avoid, where possible, steep terrain and topographical constraints to provide for smoother, more efficient operational track geometry and grade
  - Crossing loops at Yelarbon, Inglewood, Kooroongarra, Yandilla and Broxburn have been positioned to avoid, where possible, the exposure of sensitive receptors to noise and vibration from idling trains
  - The Project has been designed with the aim of achieving the operational noise criteria adopted from the CoP Vol 1 for operational road traffic noise.
- Operational road noise and vibration:
  - The Project has been aligned to minimise the number of road–rail interfaces, where possible, thereby limiting the number of:
    - Road upgrades or new roads required in the reference design, which may result in an increase in road traffic noise for adjacent sensitive receptors
    - Level crossings where wayside horns, alarm bells or other types of audible warning may be required for safety purposes.

Proposed mitigation measures

Where impacts cannot be avoided, the extent of impacts will be managed, mitigated and/or compensated. Management, mitigation and compensation measures for impacts due to noise and vibration include, but are not limited to:

- The vertical and horizontal alignment of new and upgraded road components will be designed to minimise the number of receptors at which CoP Vol 1 criteria are predicted to be exceeded. Where CoP Vol 1 criteria may be exceeded at a sensitive receptor, the potential mitigation measures for both upgraded and new road sections will be investigated for effectiveness and incorporated into the detail design, as appropriate.
- Development of a Noise and Vibration Management Sub-plan in accordance with the Outline Environmental Management Plan in this EIS, as a component of the Construction Environmental Management Plan. The purpose of the sub-plan will be to specify management procedures and management measures that, when implemented, will reduce construction noise and vibration impacts as far as practicable.

Building condition/dilapidation surveys at:

- Receptors which are expected to exceed the structural damage vibration criteria recommended by the CoP Vol 2.
- Receptors identified as being particularly sensitive to vibration including:
  - Heritage buildings within:
    - 60 m of possible vibratory roller start up/run down—six identified
    - 135 m of percussive piling—none identified.
  - Other buildings within:
    - 40 m of possible vibratory roller start up/run down
    - 80 m percussive piling.

- Structures within the damage radius of a blast location, calculated based on charge mass
- Receptors that are expected to exceed the structural damage vibration performance criteria as stipulated within the Outline EMP
- Vibration monitoring will be undertaken at representative locations where the potential for building/structural damage risk has been identified due to potential exceedance of the Project structural damage performance criteria as specified in the Outline EMP. Monitoring will occur for the duration of vibration-causing construction activities that have the potential to result in exceedance of criteria at one or more receptor locations.
- Noise-generating construction activities outside of standard hours (CoP Vol 2) will only be undertaken where:
  - A location and activity specific noise assessment has been undertaken
  - Assessment has concluded that there are no nearby sensitive receptors or impacts to receivers can be appropriately managed, as defined by the CoP Vol 2
  - Consultation with the local community is demonstrated.
- A licensed blasting contractor will be engaged to plan and undertake the necessary blasting activities for excavation of non-rippable rock. Vibration impacts from blasting will be assessed by the Principal Contractor once the locations and depths of blasting and the charges to be used are confirmed. This assessment will confirm the receptors/locations at which blasting impacts are expected to exceed the Project blasting vibration performance criteria as specified in the Outline EMP, if at all.
- A Blast Management Plan will be produced by the appointed Blasting Contractor, in consultation with geotechnical engineers and safety personnel, in support of each blasting event for the Project. Where blasting impacts are expected to exceed the Project blasting performance criteria, mitigation measures will be included in the Blast Management Plan to avoid, then minimise, potential impacts.
- Alternative construction methods will be assessed and adopted, where practicable, to reduce noise and vibration impacts.
- The need for and practicability of temporary noise barriers will be assessed following confirmation of the construction methodology for the Project during the detail design phase. Acoustic shielding will be considered where works are expected to occur close to sensitive receptors for lengthy periods. Temporary noise barriers or enclosures can provide between 5 and 10 dB(A) of attenuation, based on preliminary calculations.
- Noise walls or barriers will only be considered at Yelarbon, Brookstead and Pittsworth, where the mitigation can effectively control noise at groups of sensitive land uses and receptor buildings and where noise level reductions, generally in the order of 5 dB(A) or more, are required at sensitive receptors.
- In circumstances wherein rail corridor mitigation is not found to be feasible and all other mitigation options are exhausted, property controls will be investigated and implemented. The implementation of architectural treatments and other measures to private property would likely be subject to the agreement of commercial and legal terms between ARTC and the property owner.
- Operational maintenance scheduling and upcoming activities will be communicated to local residents and stakeholders, particularly when noisy or vibration generating activities are planned, such as vibratory compaction and piling.

7.10 Social

A social impact assessment (SIA) was undertaken to identify how the Project may affect local and regional communities and inform how ARTC will work with stakeholders to manage and mitigate the identified social impacts while enhancing Project benefits.

Social baseline

The SIA impact assessment area includes the Project footprint (including the temporary and permanent footprints), potentially impacted communities, and the Goondiwindi and Toowoomba Local Government Areas (LGAs).

The Goondiwindi LGA is a primarily agricultural region located in the south-west Darling Downs. The main towns are Goondiwindi, Inglewood and Texas, and the balance of residents live in smaller townships, including Yelarbon, or on rural properties. Goondiwindi is the main services centre and a transport hub for the southwest Darling Downs and the northern tablelands in NSW. Inglewood is a smaller service centre supporting communities further north.

Toowoomba LGA is home to both city and rural communities and occupies a large region west of the Toowoomba Range, some 130 km west of Brisbane. Toowoomba City is the main administrative and regional centre for the Northern and Western Darling Downs. Key economic strengths include agriculture, manufacturing, construction, and health care and education services.

The population of the Goondiwindi LGA was estimated at 10,629 people in 2016, unchanged since 2011. By comparison, Toowoomba LGA's population increased 6.34 per cent over this period, growing to an estimated 160,777 people by 2016.

Potentially impacted communities include rural localities with sparse populations and towns with populations ranging from approximately 300 people to 3,300 people, including:

- The towns and urban settlements of Yelarbon, Inglewood, Millmerran, Brookstead, Pittsworth, Southbrook, Gowrie Junction, Gowrie Mountain, Kingsthorpe and Westbrook
- The rural localities of Kurumbul, Whetstone, Canning Creek, Bringalily, Millwood, Clontarf, Pampas, Umbiram, Athol, Biddeston, Wellcamp, Yarranlea, and Charlton.

Key features of the social baseline that are relevant to local sensitivity to social impacts and benefits include:

- Family households were the most dominant household type across the SIA impact assessment area, but at slightly lower levels than the Queensland average
- Both LGAs recorded slightly higher median ages than the Queensland median. More than half the potentially impacted communities had higher median ages than the Queensland median.
- Socio-Economic Index for Areas (SEIFA) scores indicate that potential socio-economic disadvantage is evident in areas near the Project footprint, including near Pittsworth, Millmerran and Southbrook
- Indigenous populations are more highly represented in most communities in the SIA impact assessment area than is typical for Queensland
- Family households were the most dominant household type across the SIA impact assessment area, but at slightly lower levels than the Queensland average
- Median incomes were differentiated by proximity to Toowoomba, with areas such as Brookstead, Gowrie Junction, Gowrie Mountain and Westbrook having higher median household incomes than the Queensland median, while the rural areas had lower median incomes
- Residents have no access to public transport and are heavily reliant on private transport
- Rental vacancy rates in all relevant postcodes were relatively low, with little local capacity to provide housing for Project workers without displacing other residents
- Police and emergency service agencies are well organised and coordinated to respond to major Project construction, and require ongoing cooperation with the Project
- Hospital facilities in potentially impacted communities are small and will require advance notice on the workforce profile to prepare for any changes to demands
- At the regional level, both Toowoomba and Goondiwindi LGAs are relatively well supplied in terms of labour skills and education according to the Index of Education and Occupation, with Toowoomba LGA leading Goondiwindi LGA.

The extended drought affecting South East and South West Queensland has had a negative effect on the financial resources of families and businesses throughout the Project region, as have COVID-19 restrictions, and the 2021 Census may reveal decreases in incomes and socio-economic indicators, such as labour force participation.

Stakeholder engagement

The SIA engagement process was designed to ensure the involvement of a broad range of stakeholders. SIA engagement activities were integrated with the Project's overall engagement process for the draft EIS, including participation in community information sessions throughout the SIA impact assessment area, and in ARTC's Southern Darling Downs Community Consultative Committee (CCC) and Inner Darling Downs CCC meetings. Additional SIA-specific stakeholder engagement included a community survey, workshops, meetings and interviews.

Key issues identified by stakeholders, which are considered in the SIA in relation to Project construction and operation include:

- Impacts on cultural landscapes and local character
- Impacts of property acquisition and property severance on the use and amenity of properties
- Impacts on farm management
- Impacts of changes to flood patterns on homes, farms and agricultural land
- Impacts of Project construction and operation on rural amenity
- Changes to connectivity, within and between properties, on the road network, and with respect to level crossings
- Potential for the Project to have negative impacts on property values
- Growing community stress and desire for better information about the Project
- Effects of Project-related stress on mental health, and need for support for affected residents
- Impacts of noise, vibration, and air-quality changes on community wellbeing
- Impacts of construction on groundwater access for farms and businesses
- The potential for Project traffic to use school bus routes, leading to safety issues
- The importance of access to employment and training for local people
- The need for engagement and capacity building to ensure local businesses benefit from Project opportunities.

Social benefits and opportunities

The SIA has identified that the Project would result in social benefits, primarily in relation to employment, training and business supply opportunities for residents in the SIA impact assessment area. Social benefits include:

- Employment opportunities in Project construction during 2021–2026, including employment for Goondiwindi and Toowoomba LGA residents and groups that are disadvantaged in the labour market, and with a peak workforce of up to 950 personnel required
- Training and career pathway development for young people, Indigenous people and unemployed people in the SIA impact assessment area
- Significant opportunities for local, regional and Indigenous businesses (including construction, transport or logistics businesses) to participate in its construction supply chain. Transport, logistics and warehousing industries may be catalysed by the Project in Goondiwindi and Toowoomba.
- Increased trade for local businesses from workers residing at the non-resident workforce accommodation and from supply opportunities offered by the accommodation provider
- Direct permanent employment for approximately 15 people as a result of Project operations, some of whom may be drawn from the SIA impact assessment area. Indirect employment benefits are also likely as the result of the Project facilitating economic development.
- As part of the Inland Rail Program, the Project has potential to improve the agricultural industry's access to freight transportation and stimulate business and industry development, including at the Toowoomba Enterprise Hub.

Social impacts

Without appropriate mitigation strategies, the Project has potential to result in the following social impacts:

Construction

- Potential to affect Aboriginal cultural landscapes or heritage values, by adding additional infrastructure to the natural and rural landscapes, potentially affecting feelings of connection to Country
- Concern related to property acquisition discussions and/or fears about Project impacts on property use and amenity, environmental qualities, or potential for changes to flooding risks
- Impacts on the use and management of agricultural land, including severance of and between land parcels, intrusion on farm infrastructure, temporary disruptions to access to landholdings, and impacts on on-farm and off-farm movements, including the ability to move machinery, stock and supplies across the corridor
- Property owners have expressed concern about the potential for property values to decrease as a result of Project impacts e.g. noise, severance and visual amenity factors. Individual property values may be affected by a range of factors related and unrelated to the Project.
- Noise, dust and increased traffic related to construction activities and sites may affect residential amenity while works are near homes and businesses
- Community cohesion may be reduced through displacement of residents, physical severance between properties, disruption to the road network and/or, potentially, community conflict
- There is potential for noise from construction activities and/or Project traffic near the Brookstead, Southbrook and Yelarbon State Schools to impact on the learning environment of the schools
- Temporary non-resident workforce accommodation will be established near Millmerran/Turallin, Inglewood and Yelarbon, and while largely self-sufficient, there is potential for impacts on town character due to worker influxes to town facilities or businesses
- While non-resident workforce accommodation will include access to paramedic services, some additional demand is anticipated on local health and police services
- Potential for impacts on rental housing availability in Goondiwindi, Millmerran, Pittsworth and Inglewood
- Construction labour demand may contribute to shortages in specific trades and labour, particularly if a number of projects are constructed during the same period.

Operation

- Level crossings will result in periodic disruptions to traffic, including potential to delay emergency vehicles during operation
- The quiet rural amenity of properties near the Project may be impacted by rail freight noise during operations
- Property severance and changes to landowners' movements from one side of the rail corridor to the other
- There is potential for rail noise to affect the learning environments of the Brookstead and Yelarbon State Schools
- There is potential for rail noise to affect the amenity and use of the Pittsworth Assembly of God/Harvest Life church
- The presence of a freight rail line may increase the risk of road/rail accidents and rail fatalities, resulting in social impacts for individuals, families, communities and rail staff.

Flood-sensitive receptors that are impacted by changes in peak water levels under the 1% AEP event that exceed the flood impact objectives include nine dwellings (five between Pampas and Yandilla and four at Yelarbon), one shed at Pampas, three commercial buildings (grain silos) at Yandilla, one State-controlled road (Cunningham Highway at Yelarbon) and one local public road (Leesons Road between Kingsthorpe and Gowrie Junction).

Changes to flooding patterns may affect feelings of security, the amenity of homes, and the use and condition of sheds, silos and other infrastructure on affected properties.

Social impact management

The SIA includes a Social Impact Management Plan (SIMP), which outlines the objectives, outcomes and measures for mitigation of social impacts. Measures intended to enhance Project benefits and opportunities are also provided. Management sub-plans are provided for:

- Community and stakeholder engagement
- Workforce management
- Housing and accommodation
- Health and community wellbeing
- Local business and industry content.

The Community and Stakeholder Engagement Plan describes how the Project will communicate and engage with community members and other stakeholders throughout the pre-approval, detail design, pre-construction and construction phases of the Project. Upon the completion of the construction phase, the Project will be commissioned as part of the Inland Rail network. Before the completion of the construction phase, ARTC and/or its contractor will develop community and stakeholder engagement strategies for the commissioning phase and operations, in accordance with ARTC's established practices.

The Workforce Management Sub-plan describes how ARTC will maximise training and employment opportunities for residents in the Goondiwindi and Toowoomba LGAs, manage the potential for impacts on other industries, and support workforce wellbeing. ARTC is establishing the Inland Rail Skills Academy, which is a collection of projects and partnerships to deliver targeted local training and business capacity building programs that are being developed in cooperation with community, council and government stakeholders.

The Housing and Accommodation Sub-plan describes the measures that ARTC will undertake to mitigate potential impacts on housing and accommodation access in the SIA impact assessment area, and support management of the Project's non-resident workforce accommodation. The Project proposes the provision of three non-resident workforce accommodation facilities, to be located near Yelarbon, Inglewood and Turallin (near Millmerran). This is expected to minimise the potential for Project personnel's housing demands to affect local housing access and also minimise demands on short-term accommodation, which could affect tourists' access.

The Health and Community Wellbeing Sub-plan addresses the potential for impacts on community facilities and services, community safety and mental health, and the potential for impacts on community wellbeing due to changes to local amenity, community cohesion or local character. The sub-plan includes measures for cooperation with community and government organisations to maintain the amenity of community facilities and local access to services, including emergency services and mental health services. A more detailed Community Wellbeing Plan will be developed in cooperation with key stakeholders during the detail design phase.

The Local Business and Industry Sub-plan addresses the potential for Project impacts on businesses, including farms, agribusinesses and tourism-related businesses, and describes ARTC's commitments to ensuring that local and regional businesses benefit from the Project.

ARTC is committed to providing full, fair and reasonable opportunities for capable local businesses (within the Goondiwindi and Toowoomba LGAs and nearby LGAs) and Indigenous businesses to compete and participate in the Project's supply chain. An Australian Industry Participation Plan (AIP Plan) will be prepared to support opportunities for businesses to supply the Project. This will include capacity building programs for local and Indigenous businesses to be delivered as part of the AIP Plan and within the Inland Rail Skills Academy.

A monitoring strategy that will enable the Project to report on the delivery and effectiveness of the SIMP is also provided.

7.11 Economics

At a local level, the Project is expected to promote community development by supporting local and regional employment, businesses and industries. The findings of the economic impact assessment suggest that the Project will support regional development through:

Opportunities to encourage, develop and grow Indigenous, local, and regional businesses through the supply of resources and materials for the construction and operation of the Project

Opportunities in secondary service and supply industries (such as retail, hospitality and other support services) for businesses in close proximity to the construction footprint. The expansion in construction activity is also likely to support additional temporary flow-on demand and additional spending by the construction workforce in the local community.

As part of the Inland Rail Program, the Project has the potential to stimulate business and industry development at the Toowoomba Enterprise Hub in Wellcamp. By providing efficient transport access to intrastate and interstate markets, the Project may act as a catalyst for further private sector investment in this area, particularly for freight and logistics operations.

The Project alignment has been designed to minimise impacts to local business and industry, however the Project may result in the disruption to the tourism and agriculture business through:

The loss of agricultural land (through disturbance, acquisition, or sterilisation), disruption to farm management, or changes in accessibility or connectivity to market. Without appropriate ameliorative measures, this may negatively impact on the productive capacity and total economic value add from the local agricultural industry. ARTC will work with individual landowners to develop suitable management solutions based on individual farm-management practices to mitigate and manage these impacts.

Changes to the amenity of, or connectivity to, local attractions. The SIA concludes that a significant decrease in visitation as a result of this impact is unlikely. Nevertheless, ARTC will work with tourism associations so that impacts on tourism values are reduced wherever possible.

As a critical link of the broader Inland Rail Program, the Project offers opportunities to support the local agricultural industry, by driving savings in freight costs, improving market access, and reducing the volume of freight vehicles on the region's road network.

The economic benefits assessment estimates that the Project is expected to provide a total ($2019 present value terms) of $674.36 million in incremental benefits (at a 7 per cent discount rate). These benefits would result from improvements in freight productivity, reliability and availability, and benefits to the community from crash reductions, reduced environmental externalities and road decongestion benefits.

Using recent labour market trends and projected construction sector activity to inform workforce capacity and capability within the local region, it has been concluded that it is likely that the labour market conditions that will prevail during the construction phase of the Project will most likely be closer to those characterised by the 'slack' labour market scenario. Under this scenario, over the construction phase, real Gross Regional Product is projected to be $334 million higher than the baseline level.

Under a 'slack' labour market scenario, the Project is also expected to deliver an additional 344 jobs (direct and indirect) per year over the construction period.

The possibility of some tightness in the labour market cannot be completely dismissed. If the government's health and economic policy responses to the COVID–19 virus are highly effective the economy may grow much faster than expected, resulting in significantly more activity in the construction sector than anticipated. For example, the government may seek to bring forward projects to stimulate the economy. If this transpires, labour market conditions may tend towards somewhere between the 'slack' and 'tight' scenarios.

7.12 Indigenous cultural heritage

The ToR requires that one or more Cultural Heritage Management Plans (CHMPs) be developed with the relevant Aboriginal party or parties for the Project area and be approved by the Chief Executive of the Department of Aboriginal and Torres Strait Islander Partnerships (DATSIP).

A search of the DATSIP database identified two Aboriginal parties with coverage across parts of the Project footprint. These parties are summarised in Table 34.

TABLE 34 ABORIGINAL PARTIES FOR THE PROJECT

QC ref number	QUD ref number	Name	Project chainage
QCD2016/012	QUD101/2009	Bigambul People Part A	Ch 31.4 to 37.0 (NS2B) km, Ch 0.0 to 62.0 km
QC19999/004	GUD6004/99	Western Wakka Wakka People	Ch 148.0 to 206.9 km

CHMPs for the Project were developed between ARTC and the relevant Aboriginal parties in 2018 (CLH017009) in accordance with the requirements of Part 7 of the *Aboriginal Cultural Heritage Act 2003* (Qld) (ACH Act) and the *Cultural Heritage Management Plan Guidelines* (DATSIP, 2015). The scope of the CHMPs only covers the construction of new rail transport infrastructure and associated structures as well as the corridor owned/managed by ARTC. Management of cultural heritage for QR maintenance of the existing rail corridor will be undertaken under separate agreement.

There are no 'automatic' Aboriginal parties in respect of the area lying between the Plan Areas for the Bigambul People and Western Wakka Wakka People CHMPs (known colloquially as the 'Gap Area'). That is because there has not, since the commencement of the ACH Act on 16 April 2004, been a native title claim registered in respect of this area. As a result, to develop the CHMP for this area, ARTC was required to publish a public notice in a local newspaper and then 'endorse' and deal with each of the respondents to that notice on the basis that they were 'traditional' Aboriginal parties for the purposes of s.35(7) of the ACH Act. There were five such respondents, representing groups claiming this area of the Southern Darling Downs as their traditional country. Each of them is a party to ARTC's CHMP.

CHMPs that have been developed, agreed and approved for the Project are summarised in Table 35.

TABLE 35 CULTURAL HERITAGE MANAGEMENT PLANS WITH ARTC

CHL number	Sponsor	Party	Approved
CLH017009	ARTC Inland Rail	Bigambul People	9 April 2018
CLH017009	ARTC Inland Rail	Endorsed Party s35(7)	4 October 2018
CLH017009	ARTC Inland Rail	Western Wakka Wakka People	19 November 2018

The CHMPs have been approved under the ACH Act and consequently meet all the requirements for the identification, assessment and management of Aboriginal heritage under the Project's ToR. Accordingly, the draft EIS defers to the CHMP in all matters related to the management of Aboriginal cultural heritage.

7.13 Non-Indigenous cultural heritage

Existing environment and potential impacts

An assessment of non-Indigenous heritage values in proximity to the Project was conducted using a combination of registers searches and historical and archival research.

A review of the relevant Australian Government, State and local heritage registers was completed to identify previously registered heritage and archaeological sites within 1 km of the Project footprint, including:

- World Heritage List
- National Heritage List
- Commonwealth Heritage List
- Register of the National Estate (non-statutory)
- Queensland State Heritage Register
- Toowoomba Regional Planning Scheme Local Heritage Places
- Goondiwindi Region Planning Scheme Local Heritage Places
- QR Heritage Register
- Queensland World War II Heritage Register (non-statutory)

A summary of all register searches is presented in Table 36.

TABLE 36 SUMMARY OF REGISTER SEARCHES

Register	Within 1 km of the Project footprint	Within the impact assessment area (50 m of the Project footprint)
World Heritage List	0	0
National Heritage List	0	0
Commonwealth Heritage List	0	0
Register of the National Estate (non-statutory)	0	0
State Heritage Register	0	0
Cultural Heritage Information Management System (non-statutory)	3	2
QR Heritage Register (non-statutory)	1	0
Toowoomba Regional Council Local Heritage Register	1	0
Goondiwindi Regional Council Local Heritage Register	3	1
Queensland World War II Historic Places (non-statutory)	0	0

In addition, historical aerial imagery and local historical archives were reviewed to identify other, non-registered areas of cultural interest. In combination, a total of 34 registered and non-registered Areas of Interest (AOI) were identified for inspection. Land access approval was obtained for 21 of these AOI. Inspections were conducted for each of the accessible AOIs, and any standing structures, significant views, garden plantings, surface archaeological deposits or areas of subsurface archaeological potential were identified and recorded using global positioning system (GPS), written notes and photography. The remaining 13 sites for which land access was not granted were viewed and photographed from adjacent public areas.

An assessment of heritage significance was undertaken against standard criteria as defined in the *Queensland Heritage Act 1992* (Qld) (QH Act). The QH Act prescribes eight criteria that may be used to measure the heritage value of a place and determine its significance. A place need only fulfil one of these criteria to be considered to be of heritage significance. Following inspection, it was determined that 14 of the AOI meet the criteria for local heritage significance and one meets the criteria for State heritage significance.

Likely impacts (direct or indirect) to each AOI were identified based on proximity to the Project. The potential impacts of the Project on each AOI were assessed both before and after the implementation of mitigation measures. This assessment was conducted using the guidelines prepared by the International Council on Monuments and Sites (ICOMOS), the peak professional body working for the conservation of cultural heritage places (ICOMOS, 2011).

Direct impacts are those that occur within the Project footprint and may result in the demolition or substantial alteration of a building or the disturbance of an archaeological site. The heritage places that are within the Project footprint and subject to direct impact are listed in Table 37 along with the potential nature of impact and likely magnitude of change as a result of the Project.

TABLE 37 HERITAGE PLACES AT RISK OF DIRECT IMPACT

Description	Site description	Lot/Plan	Potential impact	Likely magnitude of change
Kurumbul Station	Railway station established in 1908 as a part the South Western Line. No original station buildings remain.	481/SP119198	Removal of any remaining station elements	Negligible
Gibinbell shearing complex	Large significant shearing shed complex and associated structures	413/SP119197	Removal of shearing shed and associated yards	Major
Gibinbell siding	Railway siding established in 1908 as a part the South Western Line. No original station buildings remain.	413/SP119197	Removal of any remaining siding elements	Negligible

Description	Site description	Lot/Plan	Potential impact	Likely magnitude of change
Cancer charity tree	Tree planted for cancer charity	N/A	Removal of tree	Major
Yelarbon Mill 2	Timber mill, likely dating to the mid–late 20th century	99/SP222802	Removal of mill	Major
Yelarbon railway complex	Railway station established c1908 as a part the South Western Line. No original station buildings remain.	20/SP120712 21/SP120712	Removal of all remaining station elements	Low
Homestead complex	Homestead complex, including two houses and a number of outbuildings	511/RP226715	Removal of house, disturbance of archaeological deposits	Major
Structure	Small timber structure	169/MH786	Removal of structure	Negligible
Sheds	Two skillion roofed timber and corrugated iron sheds	37/MH523	Removal of sheds	Negligible
House and outbuildings	Hipped roof dwelling and a small, gable roofed timber outbuilding	1/RP99467 2/RP99468	Removal of structures, disturbance of archaeological deposits	Major
Grass Tree Creek bridge	Low timber trestle and girder rail bridge over Grass Tree Creek	4/RP16058	Removal of bridge	Negligible
Yandilla Station	Railway station established c1911 as a part the South Western Line. No original station buildings remain.	202/SP124721	Removal of any remaining station elements	Negligible
Protest public art	Elaborate piece of public art protesting the implementation of the Inland Rail Project	2/RP61876	Removal of installation	Major
Condamine River bridge	Low timber trestle and girder rail bridge over the Condamine River	114/SP113906	Removal of bridge	Negligible
Pampas Station	Railway station established c1911 as a part the South Western Line. No original station buildings remain.	23/SP124720	Removal of any remaining station elements	Negligible
Pampas Memorial Hall	Mid-20th century timber community hall	84/SP109985	Removal of building	Major
Sheds	Two corrugated iron and timber farm sheds	1/RP14242	Removal of buildings	Negligible
Condamine River bridge 2	Low timber trestle and girder rail bridge over the Condamine River (North Branch)	2/RP37132	Removal of bridge	Negligible
Cecilvale Station	Railway station established in 1911 as a part the South Western Line at Cecil Plains. No original station buildings remain.	2/RP14245	Removal of station	Negligible
Murlaggan Station	Railway station established 1911 as a part the South Western Line. No original station buildings remain.	2/RP7479	Removal of buildings	Negligible
Archaeological site	Possible remains of late 19th century house or outbuildings	11/SP285307	Disturbance of archaeological deposits	Major

Indirect impacts may occur during any phase of the Project if construction or operation activities result in excessive dust, noise or vibration that affects heritage structures. Thirteen of the AOI have been assessed as being at risk of indirect impacts as a result of the Project.

Development of reference design

The reference design for the Project has been developed to respond, where possible, to potential impacts to non-Indigenous cultural heritage features. Measures that have been incorporated into, or commenced in parallel with, the reference design development are as follows:

The Project has been aligned to be co-located with existing rail and road infrastructure where possible, minimising the need to develop land that has not previously been subject to disturbance for transport infrastructure purposes and minimise the number of impacts to existing structures.

The assessment of alternative alignment options has been conducted using multi-criteria analysis, with the presence and proximity of known heritage places a criteria within the assessment.

The Project footprint has been established to provide the minimum-sized area required to safely and efficiently construct and operate the Project.

Proposed mitigation measures

Where impacts cannot be avoided, the extent of impacts will be managed, mitigated and/or compensated. Management, mitigation and compensation measures for impacts to heritage values include, but are not limited to:

- A Cultural Heritage Management Sub-plan will be developed as a component of the Construction Environmental Management Plan and will detail mitigation and management measures to be implemented during construction in relation to cultural heritage. The Cultural Heritage Management Sub-plan will be separate to the CHMPs for the Project and will relate to all heritage aspects of importance to all stakeholders. The sub-plan will include specific management requirements for sites/items that cannot be avoided during construction, as agreed with owners or managers of each site/item.
- Archaeological survey of heritage sites that are complexes within the Project footprint will be undertaken to map elements and identify areas of possible subsurface deposit. These complexes are:
  - Gibinbell shearing complex (413/SP119197)
  - Yelarbon railway complex (20/SP120712 and 21/SP120712)
  - Homestead complex (511/RP226715).
- If warranted by results of archaeological survey, a two-stage archaeological excavation will be conducted of heritage sites that are complexes, including:
  - Stage 1—Test excavation to confirm subsurface deposit
  - Stage 2—Salvage excavation of subsurface deposits (if required).
- Archival photographic recording of sites/places that will be directly impacted by the Project will be undertaken in accordance with the *Guideline: Archival Recording of Heritage Places* (DEHP, 2013b).
- Pre-construction and post-construction condition/dilapidation surveys will be undertaken at all heritage places at risk of vibration impact.
- If warranted by results of archaeological survey, archaeologists will monitor ground-breaking works to identify any subsurface deposits.
- Damage to heritage structures will be repaired in a way that conserves the heritage values of the place (refer Burra Charter Article 1.4).

7.14 Traffic, transport and access

Existing environment and potential impacts

The traffic and transport assessment evaluated a comprehensive range of issues encompassing potential impacts of the construction and operation phases of the Project on the surrounding transport infrastructure and its users. The assessment has also examined the potential traffic and pavement impacts from the movement of materials, workforce and equipment during the construction phase of the Project on the surrounding road network.

Key findings of this assessment are as follows:

- The Project requires the crossing of State-controlled roads and local government (GRC and TRC) roads. A summary of the number of interfaces with each public road type is presented in Table 38.

TABLE 38 SUMMARY OF PUBLIC ROAD INTERFACES IN THE REFERENCE DESIGN FOR THE PROJECT

Road type	Number of interfaces[1]
State-controlled	9
Goondiwindi Regional Council	18
Toowoomba Regional Council	26

Table note:

1. Only includes locations where a crossing solution is provided. Excludes interface locations where no crossing is provided in the reference design.

- Sixty-nine local government roads have been identified that are expected to experience construction traffic that exceeds 5 per cent of the background traffic. Twenty-five of these roads are in the GRC LGA and 38 of these roads are in the TRC LGA. Impacts to many of these roads are expected to be minimal, as the high percentage of construction traffic is a function of low existing traffic volumes.
- The results of the level of service (LOS) comparison between the 'with' and 'without' Project scenarios indicate that the Project may potentially cause a minor change in LOS for some road sections during each year of construction. Based on the LOS comparison, it is not expected that the Project would generate the need to upgrade the road network for such a short duration of impact, but adequate traffic and road use management strategies and mitigation measures would be required. The specific traffic and road use management strategies will be subject to agreement with relevant local governments.
- Intersection analysis has identified 26 locations where the addition of construction traffic warrants additional turning treatments to be applied in order to maintain operational safety. These upgrades are required only temporarily for construction traffic. Therefore, discussions will be required with DTMR and local governments during the Project design phase to determine the permanence of such upgrades. Given the short duration of construction-related traffic, traffic management strategies may be introduced as an alternative to more permanent treatments, in order to mitigate construction-related traffic impacts at intersections.
- The findings of the pavement impact assessment show that several State-controlled roads are likely to cross the 5 per cent standard axle repetitions threshold, with several road segments exceeding this threshold by a significant margin. This analysis assumes fully loaded vehicles moving in each direction, which is conservative, to ensure no underestimation of pavement impacts. Further road-specific analysis indicates that the State-controlled road segments located in Queensland and NSW would have a minimal pavement impact given the duration of construction activities and pavement loading. Detailed pavement design life assessments will be carried out prior to the commencement of construction, in consultation with DTMR, once specific construction routes are agreed in the next phase of the Project. Further detailed assessment will assist in identifying if contributions may be required towards the maintenance costs for the affected road sections as a result of additional pavement loading.
- Seventeen cycle routes are identified in Queensland and NSW that might be impacted by construction traffic. Some of the proposed construction routes are aligned through areas of moderate to high pedestrian activity through the areas surrounding the towns of Yelarbon, Inglewood, Millmerran, Brookstead, Pittsworth and Toowoomba. While increased heavy vehicle movements through these locations may adversely impact pedestrian movements, the majority of these routes currently facilitate a high proportion of heavy vehicle movements.
- Eleven public transport services in Queensland and NSW have been identified as having routes that are proposed to be used, in part, by construction traffic for the Project. None of the 11 public transport routes traverse, or are in proximity to, the Project footprint. The closest route to the Project is for the Ipswich to Toogoolawah (529) route, approximately 70 km to the east of the Project at its closest point. While roads used by the 11 identified services may be used by construction vehicles, the roads will not require temporary traffic controls. Therefore, driving conditions on roads used by public transport services will remain unchanged.
- One hundred and eighty-four existing school bus services share elements of proposed construction routes for the Project. Eleven of these bus services use road–rail intersections that will be newly established or upgraded for the Project. These services may experience longer journey times due to temporary traffic control measures, temporary or permanent road realignments and wait times at level crossings. Construction traffic on known school bus routes will be restricted to only essential movements during pick-up and set-down times on school days.

- Eleven existing long-distance coach services share elements of proposed construction routes for the Project; however, the impacts on these long-distance coach services are expected to be minimal due to the low frequency of the services.
- The reference design for the Project interfaces with the State stock route network in 12 locations. The reference design for the Project has, in all instances, maintained access stock route users. This has been provided through either:
  - The provision of a crossing point of the Project alignment in the location of the existing stock route
  - The provision of an alternative means of moving stock.
- In relation to rail operational traffic and maintenance processes, rail operational traffic volumes are likely to be negligible, with no envisaged impact to operational conditions of the surrounding road networks.
- The Project alignment is approximately 1 km from the northern end of the runway for the Toowoomba Wellcamp Airport. The Project has been positioned to ensure that double-stacked freight trains will not extend vertically into the obstacle limitation surface for this airport.

Development of reference design

The reference design for the Project has been developed to respond, where possible, to potential impacts to traffic, transport and access. Measures that have been incorporated into, or commenced in parallel with, the reference design development are as follows:

- Traffic:
  - The Project has been aligned to be co-located with existing rail and road infrastructure where possible, in an effort to minimise the number of new road network intersections
  - The reference design has been developed to minimise the potential for permanent alterations to the road configurations and traffic flow patterns
  - The horizontal and vertical alignment has been established to optimise the earthworks required and achieve as close to a net-balance as possible. By minimising the material deficit for construction of the Project, the volume of material required to be imported has been reduced. Less imported material equates to fewer construction truck movements on public roads.
  - Construction traffic routes have been proposed that provide the shortest journey time between origin and destination. These routes have been assessed as part of the traffic impact assessment.
  - The temporary footprint for the Project has been defined to provide sufficient space for the Project, including road modifications, to be safely and efficiently constructed.
- Rail incidents:
  - The Project alignment has been designed to minimise the likelihood of rail incidents for the types of trains projected to use the Inland Rail network. This has been achieved by adhering to the minimum design requirements of the Basis of Design, which are:
    - Design speed of 115 km/h
    - Maximum curve radius of 800 m, with 1,200 m target
    - Maximum grade of 1:80, with 1:100 the target
    - Initial train lengths of 1,800 m, with potential to increase up to 3,600 m.
  - The reference design includes mixed-gauge turnouts at locations where the Project interfaces with existing rail networks or infrastructure, to enable QR rollingstock to join and exit the Inland Rail network.

- Road–rail interfaces:
  - Grade separated crossings of existing roads have been adopted instead of level crossings, where possible. The specific design treatment at each road–rail interface has been selected based on a combination of factors, which include:
    - Topography
    - Road classification
    - Rail geometry
    - Road geometry
    - Community and stakeholder feedback through consultation.
  - Where grade separation has not been feasible, the design has been developed in accordance with the ARTC *Engineering Code of Practice—Level Crossings* (available on the ARTC extranet at: **extranet.artc.com.au/docs/eng/track-civil/procedures/grade/Section16.pdf)**. Level crossings have been subject to safe design studies and risk assessments in accordance with the Australian Level Crossing Assessment Method (ALCAM) to identify and reduce the potential risks associated with these crossings, so far as is reasonably practicable, in accordance with the Office of the National Safety Regulator (ONRSR) Guideline: *Meaning of duty to ensure safety so far as is reasonably practicable* (SFAIRP) (ONRSR, 2016b).
  - Additional physical controls at level crossings, such as boom gates and warning lights, are provided in accordance with the *Guide to Development in a Transport Environment: Rail* (DTMR, 2015), *Manual of Uniform Traffic Control Devices Part 7: Railway Crossings* (DTMR, 2019e) and ARTC *Engineering Code of Practice—Level Crossings.*
- Airport operation:
  - The reference design has been developed to be consistent with the intent of the *State Planning Policy—State interest guideline: Strategic airports and aviation facilities* (DILGP, 2016d).
- Access:
  - The reference design has been developed to maintain connectivity across the Project footprint. This has been provided through either:
    - The provision of a crossing point of the Project alignment in the location of the existing access
    - The provision of continued means of access, via an alternative location, with interconnectivity provided.

Proposed mitigation measures

The full impact of the Project on traffic, transport and access in the region will require the construction approach to be confirmed and the detail design to be progressed. Additional mitigation measures will be implemented in parallel to and following the conclusion of that process to ensure that confirmed impacts to traffic, transport and access are appropriately avoided or mitigated.

Where impacts cannot be avoided, the extent of impacts will be managed, mitigated and/or compensated. Management, mitigation and compensation measures for impacts to traffic, transport and access include, but are not limited to:

- A safety assessment of the detail design and proposed construction traffic routes will be required, in accordance with the *Guideline to Traffic Impact Assessment* (GTIA) (DTMR, 2018b). The safety assessment will determine the locations where road safety audits are required. As a minimum, road safety audits will be undertaken for all public level crossings included in the detail design.
- Opportunities to accommodate greater separation distances between rail and neighbouring roads will be investigated, in consultation with DTMR and in accordance with *AS 1742.7-2016* (Standards Australia, 2016b) and the *Road Planning and Design Manual—Edition 2: Volume 3, supplement to Austroads Guide to Road Design Part 4A: Unsignalised and Signalised Intersections* (DTMR, 2014)
- The traffic impact assessment will be updated and finalised, in accordance with the process specified in the GTIA, to reflect the detail design, construction method (including material sources and quantities) and the finalised construction traffic routes
- A Traffic Management Sub-plan will be prepared prior to the commencement of construction, as a component of the Construction Environmental Management Plan, as a joint effort between the Principal Contractor, ARTC, DTMR, local governments and an accredited road safety auditor, once preferred construction routes are confirmed. The purpose of this sub-plan will be to document the scope of the construction transportation task and to specify management measures and controls to minimise impacts to the existing road network and its users.

- Works identified within the Traffic Management Sub-plan may require the preparation of Traffic Control Plans (TCPs), also referred to as Traffic Guidance Schemes. Specific TCPs are required for each separate element of the works identified to be undertaken within the Traffic Management Sub-plan. TCPs detail the traffic control signs, devices and measures to be applied at work sites to warn traffic and guide it through, or past, a work area or temporary hazard.
- A Road Use Management Plan (RUMP) will be prepared for the Project in accordance with the GTIA, to support works to the existing road network. The RUMP for the Project will identify appropriate traffic and transport management strategies for the use of the State-controlled roads and local government roads for each of the construction stages of the Project, where required.
- Traffic management arrangements for construction sites, laydown areas or non-resident workforce accommodation requiring access directly off/onto a State-controlled road, will be negotiated with and approved by DTMR
  - All construction access points will be designed in accordance with Australian Standards, with:
  - Appropriate site distances in both the vertical and horizontal
  - Deceleration lanes for the trucks to slow down in
  - Acceleration lanes for re-entering construction traffic
  - Appropriate signage and line marking.
- The interoperability of the ATMS with QR's network will be confirmed through consultation with QR, with compatibility requirements incorporated into the detail design for the Project
- The construction approach for the components of the Project within the existing rail corridor for the South Western Line and the Millmerran Branch Line will be confirmed through discussion with QR and in consultation with stakeholders who are dependent on the operation of these existing lines. The agreed construction approach in these locations will require a wayleave agreement, or similar, between ARTC and QR.
- Physical controls, such as boom gates and/or warning lights, will be incorporated into the design at active level crossing locations in accordance with the *Guide to Development in a Transport Environment: Rail* (DTMR 2015), *Manual of Uniform Traffic Control Devices Part 7: Railway Crossings* (DTMR, 2019e) and ARTC *Engineering Code of Practice—Level Crossings*
- A detailed pavement impact assessment will be undertaken during the detail design phase on State-controlled roads that will be used by construction traffic. The assessment will be in accordance with the GTIA, once the Principal Contractor has been appointed and construction routes have been confirmed. The detailed pavement impact assessment will identify measures to avoid, reduce or mitigate effects on the pavement life of State-controlled roads that will be used by the Project.
- For sealed local government roads, a condition assessment will be conducted (e.g. National Association of Australian State Road Authorities roughness count) prior and post construction activities, as well as at annual intervals during construction
- For unsealed local government roads, a visual condition will be conducted (either manual or vehicle mounted high-speed condition survey) prior to and post construction activities. The scope for pavement assessments of unsealed local government roads will be agreed with relevant local governments before construction commences.
- The scope and frequency of pavement condition assessments that are to be required during the construction period will be documented in the RUMP.

7.15 Hazard and risk

Existing environment and potential impacts

Hazard identification and risk assessment have been undertaken in accordance with the requirements of *AS/NZS ISO 31000:2018 Risk management guideline* (Standards Australia, 2018b). The hazards and risks associated with the Project throughout the design, construction and operation phases have been assessed to identify the potential for impacts to people, property and the environment. This includes risks that may arise from natural events from which impacts could be increased by the Project.

Key hazards that have been assessed in the hazard and risk assessment include:

- Natural hazards: Bushfire, flooding, storms and cyclones, landslides, wildlife, biosecurity, climate change
- Project hazards:
  - Health: Fatigue and stress, asbestos (naturally occurring or in existing infrastructure in the Project footprint), respirable silica and other airborne contaminants, noise and vibration, contaminated land
  - Accidents: Road infrastructure, private access and stock routes, rail infrastructure
  - Safety: Infrastructure and services, unexploded ordnance, bridges, emergency access, abandoned mines.
- Dangerous goods and hazardous substances, associated with:
  - Construction and operation maintenance chemicals
  - Freight transportation of dangerous goods
  - Explosives use in proximity to the Project.

A preliminary risk assessment has been conducted for the Project, in compliance with the requirements of the ToR. The implementation of ARTC risk management policies and procedures are anticipated to effectively reduce most of the risks associated with the Project to a low to medium level. The residual risk that remains with medium risk ranking includes potential incidents related to:

- Bushfire
- Flooding
- Climatic conditions
- Landslide, sudden subsidence, movement of soil or rocks
- Fatigue and heat stress
- Contaminated land
- Rail incidents
- Road–rail interface
- Existing infrastructure and underground and overhead services
- Bridges
- Emergency access
- Freight dangerous goods

Development of reference design

The reference design for the Project has been developed to respond, where possible, to potential impacts and risks associated with identified hazards. Measures that have been incorporated into, or commenced in parallel with, the reference design development are as follows:

- Flooding: refer Section 7.7
- Landslide, sudden subsidence, movement of soil or rocks: refer Section 7.2
- Rail incidents and road–rail incidents: refer Section 7.14
- Utilities:
  - Subsurface utility investigations have been completed to confirm the presence, location and orientation of utilities within the Project footprint.
  - Minimum design requirements have been established for the Project to guide the treatment through design to avoid utility strikes. The design requirements have been developed to be consistent with recommendations in *AS 4799-2000 Installation of underground utility services and pipelines within railway boundaries* (Standards Australia, 2000).
  - Consultation with owners of assets located in the Project footprint has commenced. Asset owners include APA Gas, Energex, Millmerran Operation Co., QUU, Powerlink, Santos, Optus/Uecomm, National broadband Network and TPG.
  - The Project has been designed to avoid substantial earthworks over high-risk underground assets, therefore avoiding the need to relocate such utilities. Examples include APA's Roma–Brisbane gas pipeline and Santos' Moonie–Brisbane oil pipeline.
  - The Project's vertical alignment has been established to avoid direct impact to Powerlink's overhead transmission line asset, such as the 330 kV overhead lines at Whetstone (Ch 39.49 km) and Millmerran (Ch 120.89 km) and the 110 kV overhead line at Westbrook (Ch 193.39 km).
- Infrastructure:
  - The Project alignment has been positioned to avoid areas of previous workings or planned future workings associated with the Commodore Mine.
  - The Project alignment is approximately 1 km from the northern end of the runway for the Toowoomba Wellcamp Airport. The Project has been positioned to ensure that double-stacked freight trains will not extend vertically into the obstacle limitation surface for this airport.

- Bridges:
  - Track design on rail bridges is in accordance with ARTC's *Engineering Code of Practice—Ballast* (available on ARTC's extranet **at: extranet.artc.com.au/docs/eng/track-civil/procedures/ballast/Section4.pdf)**
  - Adherence to this code of practice reduces the likelihood of ballast being lost from rail bridge structures
  - Anti-throw screens have been incorporated into the design of road bridges to reduce the likelihood of objects being thrown off road bridges onto the rail track
  - Maintenance access to the deck level of all new bridge structures has been incorporated into the design
  - Bridge clearances have been established in consultation with the owners of existing assets over which the bridge structures span
  - No public pedestrian access is provided on road-over-rail bridges.
- Historical and abandoned mines:
  - The Project alignment has been positioned to avoid areas of previous workings associated with Commodore Mine
  - The Project alignment has been positioned to avoid recorded historical and abandoned mines.
- Freight dangerous goods:
  - The Project alignment has been designed to minimise the likelihood of rail incidents for the types of trains projected to use the Inland Rail network. This has been achieved by adhering to the minimum design requirements of the Basis of Design (refer Section 6.2.1).
  - ARTC have consulted with TRC, GRC, QPWS and QFES through the impact assessment and design development process. As a result, the reference design for the Project has, in all instances, maintained connectivity across the Project footprint for access by emergency services. The design also provides maintained access to private and State land. This has been provided through either:
    - The provision of a crossing point of the Project alignment in the location of the existing access
    - The provision of continued means of access, via an alternative location, with interconnectivity provided.

Proposed mitigation measures

For residual risks that remain after the implementation of the above-mentioned mitigation measures, opportunities to further reduce the level of risk will be investigated through the detail design process, in accordance with the following hierarchy of controls:

1. Elimination
2. Substitution
3. Engineering controls
4. Administrative controls
5. Personal protective equipment.

The hazard and risk assessment provided coverage across numerous risks that will be managed through the application of mitigation measures proposed as a result of other technical assessments. Of unique relevance to this assessment is the proposed management of hazards pertaining to dangerous goods and hazardous substances.

A Hazardous Materials Management Sub-plan will be prepared and implemented as a component of the Construction Environmental Management Plan. The sub-plan will be required to:

- Identify the materials and chemicals required to be stored and used in support of construction, including volumes of each, such as fuel and oil, greases, blasting chemicals, concreting, welding gases and pesticides
- Specify how dangerous goods and hazardous materials and chemicals will be handled, stored and transported for the Project
- Describe the response procedures in the event of an incident involving hazardous materials and chemicals or dangerous goods
- Establish the waste storage and disposal procedures for hazardous materials and chemicals and dangerous goods.

Where opportunities to further reduce risk are identified, these will be captured and documented in detail design drawings, environmental design drawings and the Construction Environmental Management Plan, as appropriate.

Occupational hazards will exist throughout the Project, including construction and operation maintenance risks. These hazards will be managed in compliance with the *Work Health and Safety Act 2011* (Qld) and *Work Health and Safety Regulation 2011*, relevant Australian Standards as well as the procedures and work instructions that form part of ARTC's Safety Management System. Ongoing workplace risk assessments will be carried out in accordance with the requirements of ARTC's Safety Management System and the ARTC Fatal & Severe Risk Program.

7.16 Waste management

Existing environment and potential impacts

Waste collection, recycling and disposal facilities and services for domestic uses are provided by local governments within the impact assessment area. Commercial and industrial land uses primarily rely on private waste transportation contractors for the collection and offsite transportation of wastes.

The proximity of existing waste-management facilities to the Project has been considered based on a commonly adopted haul route distance of 50 km for bulk waste and 15 km for municipal waste collected in domestic collection vehicles. Established waste-management facilities in proximity to the Project are located in Toowoomba, Wellcamp, Millmerran, Goondiwindi, Inglewood and Yelarbon.

Construction and maintenance activities for the Project are expected to result in the production of various waste streams. The waste stream that may be generated, and the potential Project source for each, is summarised in Table 39. The waste stream classifications that have been adopted are consistent with those established under the *Environmental Protection Regulation 2019* and used by the State Government for policy and planning purposes.

TABLE 39 WASTE TYPES, DESCRIPTION AND POTENTIAL PROJECT SOURCES

Waste type	Definition	Potential Project sources
Commercial and industrial (C&I) waste	Waste that is produced by business and commerce and includes waste from schools, restaurants, offices, retail and wholesale businesses, and manufacturing industries	▸ Non-resident workforce accommodation ▸ Site offices
Construction and demolition (C&D) waste	Non-putrescible waste arising from the construction or demolition activity. C&D waste includes materials such as brick, timber, concrete and steel.	▸ Demolition/removal of existing structures ▸ Work fronts ▸ Demobilisation of construction activity facilities
General waste	Wastes not defined as regulated waste under legislation. General wastes comprise putrescible wastes (easily decomposed, treated by composting) and non-putrescible wastes (not easily decomposed, may be recyclable).	▸ Kitchen and general waste from non-resident workforce accommodation ▸ Site offices ▸ Work fronts ▸ Laydown areas ▸ Excess spoil
Green waste	Includes grass clippings, tree, bush and shrub trimmings, branches and other similar material resulting from landscaping or maintenance activities	▸ Clear and grubbing activities ▸ Site preparation works
Recyclable waste	Waste types that can be reconditioned, reprocessed or reused	▸ Non-resident workforce accommodation ▸ Site offices ▸ Work fronts ▸ Laydown areas
Regulated waste	Wastes that are commercial or industrial waste and is of a type or contains a constituent of a type mentioned in Schedule 9 Part 1 Column 1 of the EP Regulation.	▸ Used containers and residues of hazardous chemicals and dangerous goods ▸ Kitchen waste from non-resident workforce accommodation (e.g. food processing waste, grease trap waste etc.) ▸ Vehicle, plant and equipment maintenance (e.g. tyres, lead acid batteries etc.) ▸ Demolition/removal of existing structures (e.g. asbestos, lead-based paint etc.)

The wastes types and volumes that are expected to be generated during the construction phase of the Project are presented in Table 40. Quantities of wastes have been estimated based on information from the constructability assessment, reference design documentation and bill of quantities for the Project. Where uncertainty exists regarding waste quantities, estimates have been rationalised through reference to the *Integrated Solid Waste Management: Engineering Principles and Management Issues Report* (Tchobanoglous et al.,1993). These details will be subject to further refinement during progression of the detail design as the construction approach is confirmed.

TABLE 40 ESTIMATED CONSTRUCTION WASTE QUANTITIES

Waste/resource description	Waste type	Estimated quantity produced over construction duration	Residual as proportion of existing annual waste generation in the region	Potential reuse
Vegetation	Green waste	14,641,267 m^2	Not applicable—to be reused within the Project	Yes
Topsoil	C&D waste (topsoil for onsite reuse)	100 mm depth: 274,587 m^2 200 mm depth: 5,265,173 m^2 300 mm depth: 55,510 m^2	Not applicable—to be reused within the Project	Yes All topsoil is expected to be reused on the Project.
Steel (existing rail)	C&D waste	5,822 t	5%	Yes Where practical, opportunities for reuse will be explored
Timber sleepers	Regulated waste (regarded as contaminated)	361,700 count	Data on regional proportion of regulated waste is not available	Yes Opportunities for reuse will be considered consistent with the intent of End of Waste (EOW) Code: Chemically Treated Solid Timber (ENEW07503218)
Ballast	Regulated waste (regarded as contaminated)	400,100 m^3	Data on regional proportion of regulated waste is not available	Yes Opportunities for reuse will be considered consistent with the intent of EOW Code: Rail Spoil Ballast
Occupying non-resident workforce accommodation	General waste	115 t	<0.1%	No
Occupying site offices	General waste	26 t	<0.1%	No
Concrete culverts	C&D waste	Assume 2% of 20,721 m^3	0.5%	No
Concrete (in situ)	C&D waste	Assume 2% of 91,076 m^3	2.5%	No
Concrete (pre-cast)	C&D waste	Assume 2% of 24,125 m^3	0.5%	No
Oils, lubricants and greases	Regulated waste	Cannot be determined at present. Waste quantity is dependent on confirmed construction method and the numbers and types of plant and vehicular fleet.	Unknown	No
Packaging	General waste	Cannot be determined at present. Waste quantity is dependent on confirmed construction method, material requirements and packaging of received goods.	Unknown	No

The ability of identified waste-receiving facilities to receive wastes generated by the Project has been determined based on initial consultation with operators, a review of environmental authority licencing under the EP Act and consideration of the Project's contribution to the regional waste-management network. Feedback from consultation with TRC and GRC has indicated that the identified facilities that are owned and/or managed by these councils are expected to have sufficient combined capacity to accept waste materials generated by the Project. The confirmation of waste acceptance criteria and available/permissible annual disposal rates will be undertaken in consultation with the relevant operator once the construction schedule and sequencing are confirmed.

The total fill requirement (i.e. rail, road and supporting infrastructure) for the Project based on the reference design is 13,347,369 m^3. If all unusable cut material is able to be treated for re-use, then the total material deficit for the Project will be 822,332 m^3; however, this deficit may be up to 971,237 m^3 depending on the feasibility and success of material treatment options. The fill deficit for the Project will be met through the importation of appropriate material type from operational licensed quarries or from borrow pits established for the Project.

Project impacts that relate to waste management have been identified, as follows:

- Waste disposal additional to current levels, resulting in increased consumption of airspace and reduction of community access to waste facilities surrounding the impact assessment area
- Uncontrolled release of waste from the improper storage or failure of management systems resulting in contamination of receiving environments (i.e. land, surface water and air)
- Increase in the incidence of vermin, insects and pests from the inappropriate storage and handling of putrescible wastes
- Reduced visual amenity of land uses adjacent to the Project
- Increased transportation of waste materials on and offsite, resulting in:
  - The increase of greenhouse gas emissions due to the combustion of hydrocarbons from the operation of vehicles/plant
  - Decreased amenity of land uses adjacent to the Project from the generation of dust and road deterioration.
- Risks to human health and safety of site personnel, through the release of pollutants from the poor management of regulated wastes.

The construction of the Project will generate several waste streams that will be managed by maximising opportunities to avoid or reduce, reuse and recycle; however, there will be waste streams (including municipal solid waste arising from non-resident workforce accommodation) for which this cannot be achieved, and these will be disposed of within appropriately licensed facilities.

Wastes generated during Project operation are expected to be typical of the current networks of freight rail. Waste quantities during this phase of the Project are not considered significant and are able to be managed using recognised and proven methods.

Development of reference design

The reference design for the Project has been developed to respond, where possible, to potential impacts associated with waste generation and management. Measures that have been incorporated into, or commenced in parallel with, the reference design development are as follows:

- The quantity of spoil to be generated by the Project has been reduced through development of the reference design to achieve as close to a net balance in earthworks as is practicable.
- A draft spoil management strategy has been developed to guide the decision-making process for the management of spoil material generated by the Project. The purpose of the spoil management strategy is to provide overarching principles to guide the storage, treatment, reuse or disposal of material generated during construction of the Project.
- A value management process has been implemented that focuses on identifying potential opportunities for defining, maximising and achieving efficiencies through the design, construction and operation of the Project.
- Consultation has commenced with the owners and operators of existing waste-management facilities in proximity to the Project to determine the wastes accepted, waste acceptance criteria and capacity to receive wastes from the Project during construction.

Proposed mitigation measures

Where impacts cannot be avoided, the extent of impacts will be managed, mitigated and/or compensated. Management, mitigation and compensation measures for impacts to heritage values include, but are not limited to:

- A Waste Management Sub-plan will be prepared for the Project in accordance with the Outline Environmental Management Plan, as a component of the Construction Environmental Management Plan. The sub-plan will:
  - Minimise waste generation and ensure appropriate handling and disposal of domestic and industrial wastes generated during design, construction, operation and maintenance
  - Have regard to the 2018 National Waste Policy and *Waste Reduction and Recycling Act 2011* (Qld) principles, especially the waste-management hierarchy of waste avoidance, reuse, recycling, treatment and disposal.
- Wastes to be disposed of at appropriately licensed facilities where disposal to landfill is unavoidable
- Regulated wastes and contaminated soils or other materials will be transported and disposed in accordance with the EP Act
- Waste-tracking documentation to be retained by the Principal Contractor for materials removed from site for disposal.
- Where practicable, spoil will be reused within the Project footprint through treatment, amelioration or drying. Offsite reuse options may also be considered subject to compliance with a current EOW code under the *Waste Reduction and Recycling Act 2011* (Qld). Material that cannot be treated for appropriate reuse may be disposed offsite. Offsite disposal to landfill will only occur if the material is considered unsuitable for other uses, e.g., due to geotechnical, contamination or saturation reasons.

Waste and resource recovery activities associated with the Project are not anticipated to pose a significant risk to the environment or public health, with the implementation of effective waste management and resource recovery control measures. The volume of waste generated by each of the waste streams will be further refined during detail design to more accurately assess the receiving waste management facilities and waste disposal options for the Project. Consultation with the owners and operators of existing waste-management facilities will continue to confirm their ability to receive waste materials from the Project in accordance with the schedule of construction activities.

7.17 Cumulative impacts

Overview

When numerous projects occur within proximity to each other they can cause cumulative impacts. It is a requirement of the ToR that ARTC consider potential cumulative impacts associated with the Project.

Projects with spatial and/or temporal overlap can result in cumulative impacts. Cumulative impacts may:

- Differ in magnitude from those of an individual project when considered in isolation
- Be positive or negative
- Differ in severity and duration depending on the spatial and temporal overlap of projects occurring in an area
- Occur at a local, regional or national level
- Accumulate over time
- Exacerbate the intensity, scale, frequency or duration of impacts in either isolation or combination with other known existing or planned projects.

Technical assessments that comprise the draft EIS have considered existing, operational projects where they are located within the defined impact assessment area for each of the studies. Consequently, existing, operational projects have been accounted for in the impact assessment of the Project. Therefore, the cumulative impact assessment only considers projects that meet one of the selection criteria listed below:

- Projects that have been approved but where construction has not commenced
- Projects that have commenced construction subsequent to issuance of the ToR for the Project, but have potential for overlap in construction activities with the Border to Gowrie Project
- Projects that have been completed subsequent to issuance of the ToR for the Project
- Are operational developments that have future plans for expansion
- Projects that are currently being assessed as 'coordinated projects for which an EIS is required' under the SDPWO Act.

The assessment draws on the findings of the technical assessments that comprise the draft EIS, as well as impact assessments of projects within the areas of influence of the issues assessed.

Where the potential for cumulative impacts have been identified with the adjoining projects in the Inland Rail Program, the North Star to NSW/Queensland Border Project and the Gowrie to Helidon Project of the Inland Rail Program, it is proposed that these potential impacts be managed through a combination of those mitigation measures proposed for the Project, in isolation, in addition to the implementation of Program-wide management measures. These will be consistent with the Inland Rail Environment and Sustainability Policy and environmental management framework contained within the Outline EMP for the Project.

ARTC will also facilitate communication between Principal Contractors of adjoining Inland Rail packages to ensure that construction methodologies and the scheduling of activities are compatible with one another and do not exacerbate the potential impacts of a single project.

Where cumulative impacts have been identified with other projects outside of the Inland Rail Program, individual proponents will be invited to participate in the Community Reference Group established for the Project. This will provide opportunities to verify outcomes of the cumulative impact assessment and, if necessary, identify further mitigation measures which can be implemented by ARTC within their area of control.

It is proposed that monitoring be undertaken during construction of the Project that is scheduled (i.e. groundwater, surface water and ecology) or in response to complaints (i.e. air quality, noise). Results obtained from these monitoring events will be compared to baseline data established during the detail design phase of the Project. Where exceedances in adopted criteria are observed, ARTC will investigate the cause of that exceedance. If the exceedance is found to be attributed to by non-Project activities, then one of the following actions may be taken:

- If the recorded impact is contributed to by coincident short-term activities, ARTC will consult with the proponent of the contributing activity to establish a shared understanding of activities and schedules so as to avoid the future compounding of impacts.
- If the recorded impact is contributed to by long-term activities by one or more developments, then additional measures may have to be implemented to mitigate impacts that are within ARTC's control. These additional measures would be bespoke to the type of impact, and the receptor(s) that is/are impacted.

Due to the nature of projects included in the cumulative impact assessment (i.e., mostly coordinated or otherwise assessable rail and road upgrades and high-density industrial infrastructure development), it is anticipated that this process of assessing potential cumulative impacts will occur for all of these projects. That is, each of the projects will also be required to mitigate and manage potential cumulative impacts to acceptable levels.

8. Approach to environmental management

ARTC's system of corporate governance comprises corporate policies and core values. This governance system applies to all works associated with the Inland Rail Program.

ARTC, through their Environmental Policy have made a clear commitment to a robust Environmental Management System (EMS) which supports effective management of environmental risk and legal obligations. On the commencement of operation of the Project, ARTC's existing EMS and procedures will apply, across the whole of the network, including from the NSW/QLD border to Gowrie.

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

An Outline EMP has been prepared that:

- Provides an environmental management framework to ensure that reasonable environmental and social outcomes are achieved for the detail design, pre-construction and construction of the Border to Gowrie Project
- Establishes the process for the preparation and implementation of the Construction Environmental Management Plan and the Operation EMP.

The Outline EMP is presented as a draft plan at the current stage of the Project for EIS purposes and will be further developed during the post-EIS stage, incorporating relevant approval and permit conditions, as the basis for the Construction Environmental Management Plan.

The Outline EMP:

- Describes the key elements of the Project
- Describes the environmental management framework for the Project
- Describes the relationship between the Construction Environmental Management Plan and other environmental management documents
- Describes monitoring, reporting, auditing, review and documentation requirements
- Describes processes for dealing with non-compliance, including corrective actions
- Includes requirements for training and awareness, community and stakeholder engagement
- Outlines the complaints management and response process
- Includes the following Outline EMP Sub-plans:
  - Land Resources
  - Landscape and Visual Amenity
  - Flora and Fauna
  - Air Quality
  - Surface Water
  - Groundwater
  - Noise and Vibration
  - Cultural Heritage
  - Traffic, Transport and Access
  - Hazard and Risk
  - Waste and Resource Management.

Each Outline EMP Sub-plan includes:

- **Environmental outcomes**—Environmental outcomes are mandatory and must be achieved.
- **Performance criteria**—If the performance criteria are met, then the environmental outcomes are deemed to be achieved. If the performance criteria are not met, this triggers the requirement for additional mitigation measures to be implemented in order to achieve the environmental outcomes.
- **Mitigation measures**—Measures that will be applied in order to achieve the environmental outcomes.
- **Monitoring requirements**—Establishes the monitoring requirements, parameters and frequency to demonstrate that the environmental outcomes have been achieved.

It is proposed that the Coordinator-General's conditions of approval will be incorporated into future versions of the Outline EMP and the sub-plans and incorporated into the contractor's Construction Environmental Management Plan to ensure that all works are authorised.

Prior to the commencement of Project operation, ARTC will prepare an Operation EMP to provide an environmental management framework that ensures reasonable environmental outcomes are achieved for the operation of the Project. The Operation EMP will support and be in accordance with existing ARTC policies and procedures. ARTC will also develop a SIMP for the operation phase of the Project, which will include community and stakeholder engagement activities (refer Section 7.10).

Where required, ARTC policies and procedures will be amended to provide appropriate coverage for concerns specific to the Project and the Inland Rail Program.

9. Concluding statement

The Border to Gowrie Project, as part of the wider Inland Rail Program, will help relieve pressure on existing road and rail corridors by providing a continuous rail freight route between Melbourne and Brisbane. The service offering will be competitive with road freight (i.e., a Melbourne to Brisbane transit time of less than 24 hours, with a reliability of 98 per cent), and will better connect regional producers with international export markets.

During Project development, environmental investigations and stakeholder consultation were carried out to identify potential impacts. Potential impacts have been avoided to the greatest extent possible. Where impacts cannot be avoided, mitigation and management measures will be implemented. Biodiversity offsets will also be provisioned.

The avoidance, mitigation and management strategies provided in each of the impact assessment sections in this draft EIS were developed to address both the potential impact of the Project and the effects of cumulative impacts.

Overall, the draft EIS found that the benefits afforded by the Project provide a strong justification for the Project to proceed and, while potential impacts have been identified, the proposed mitigation measures will minimise these impacts.

The delivery of the Project will provide a safe and sustainable solution to Australia's freight challenge, while seeking to minimise adverse environmental, social and economic impacts.