INLAND RAIL

Table of Contents

Executive Summary

Gowrie to Helidon

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_1434

COVER IMAGE

A visualisation of a double-stacked freight train entering the eastern tunnel portal of the Toowoomba Range Tunnel at Ballard south-east of Mt Kynoch, looking west towards the Toowoomba Range.

Visualisations are for illustrative purposes and not to scale. Please note, the reference design may change as a result of further investigations, government approvals or during detailed design.

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.

TABLE OF CONTENTS

INLAND RAIL

GOWRIE TO HELIDON 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_1536

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

Chapter 26

Appendices

Figures

Executive Summary

Chapter 1

Chapter 2

Chapter 3

Chapter 4

Chapter 5

Chapter 6

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

Photographs

Chapter 11

Tables

Executive Summary

Chapter 1

Chapter2

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

INLAND RAIL

Executive Summary

GOWRIE TO HELIDON 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_1536

Contents

Figures

Tables

Executive summary

This draft Environmental Impact Statement (EIS) has been prepared to assess the impacts and benefits associated with the Gowrie to Helidon Project (the Project). The Project consists of approximately 28 kilometres (km) of new track, which generally follows the existing Queensland Rail (QR) West Moreton System rail corridor and the protected Gowrie to Grandchester future state transport corridor, with a 6.24 km long undrained tunnel between Gowrie, to the west, and Helidon, to the east (refer Figure 1). It is one of 13 distinct projects that, together, make up the Inland Rail Program. Five of these projects are located in Queensland.

The Project is a predominantly greenfield corridor, creating a more efficient and direct route through the Toowoomba Range compared to the existing railway, which commenced operation in the 1870s. The Project also connects the QR's Western Line to the Main Line providing interoperability between the two rail networks. The Project is identified as a priority development within the Inland Rail Program and by the Queensland Government for future growth in the Darling Downs and South East Queensland regions.

The Australian Government has committed to delivering Inland Rail, an interstate freight rail corridor between Melbourne and Brisbane, via central-west New South Wales (NSW) and Toowoomba in Queensland. Inland Rail is significant national transport infrastructure, which will enhance Australia's existing rail network and service the interstate freight market.

The Inland Rail route, which is approximately 1,700 km, will involve:

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

Further information on the Inland Rail Program is at **inlandrail.artc.com.au**.

The Gowrie to Helidon (G2H) section of the Inland Rail Program is described as one of the 'missing links' in the Inland Rail Program by connecting two other Inland Rail projects:

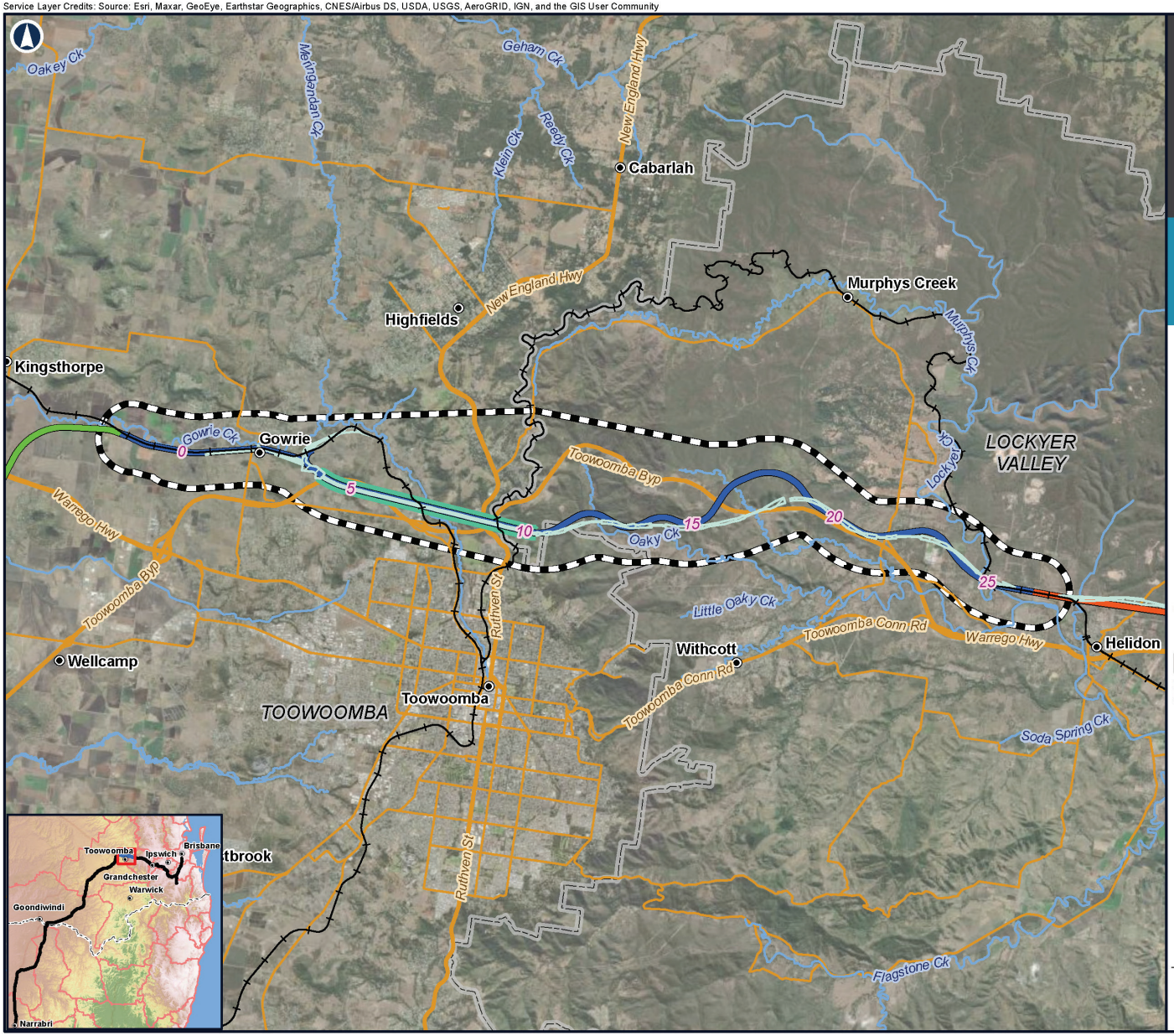
- Border to Gowrie (B2G) to the west, where B2G connects to the West Moreton System rail corridor between Kingsthorpe and Gowrie
- Helidon to Calvert (H2C) to the east, connecting to the West Moreton System rail corridor north-west of Helidon.

This EIS documents the assessments undertaken by the Australian Rail Track Corporation (ARTC) for the proposed construction and operation of the Project. The objective of the EIS is to ensure that all relevant environmental, social and economic impacts of the Project are identified and assessed. The EIS demonstrates that the Project is based on sound environmental principles and practices.

The EIS has followed the process established by the *State Development and Public Works Organisation Act 1971* (Qld) (SDPWO Act). The EIS responds to the Terms of Reference (ToR) for the Project issued by the Queensland Coordinator-General in August 2017.

The EIS also addresses matters relevant to the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) and Referral 2017/7882. That is, the EIS process under the SDPWO Act has been accredited under *'A bilateral agreement between the Commonwealth and State of Queensland under Section 45 of the Environment Protection and Biodiversity Conservation Act 1999 relating to environmental assessment'* (the bilateral agreement) with the then Department of the Environment and Energy (now DAWE) advising that the bilateral assessment applies to the Project.

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



INLAND RAIL

ARTC

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GOWRIE TO HELIDON

Figure 1: Location of the project

LEGEND

- 5 Chainage (km)
- Localities
- Existing rail
- B2G project alignment
- G2H project alignment
- H2C project alignment
- Gowrie to Grandchester corridor
- Tunnel
- Watercourses
- Major roads
- Minor roads
- Local Government Areas
- EIS investigation corridor

0 3 6 km

Coordinate System: GDA 1994 MGA Zone 56

Date: 1/04/2020
Author: FFJV GIS
Data Sources: FFJV

Paper: A4
Scale: 1:150,000

Map by: <CB> Z:\GIS\GIS_3200_G2H\Tasks\320-EAP-201807110917_G2H_Project_Figures\320-EAP-201807110917_ARTC_Fig1_LocationOfProject_rev4.mxd Date: 14/06/2021 13:38

The Proponent

ARTC is the proponent for the Project. ARTC was created in 1997, after the Australian Government and the state governments agreed to the formation of a 'one stop shop' for all operators seeking to access the national interstate rail network. Since its formation, ARTC has focused on infrastructure investment and the modernisation of the rail network. This work has extended to building and upgrading existing track to allow for the capacity the market requires.

ARTC plays a critical role in the transport supply chain and in the overall economic development of Australia, managing and maintaining 8,500 km of rail network across five states, investing in building, extending, and upgrading the rail network to move freight off the road and onto rail. The ARTC network supports industries and businesses that are vital to the nation's economy by facilitating the movement of commodities including general freight, coal, iron ore, other bulk minerals, and agricultural products.

As the operator and manager of Australia's national rail freight network, ARTC has successfully delivered more than $5 billion of capital upgrades to the national rail freight network. Having emerged from this period of significant investment and network growth, ARTC has now been tasked with delivering Inland Rail under the guidance of the Australian Government Department of Infrastructure, Transport, Regional Development and Communications.[1]

Contact details for the Inland Rail Program are:

Inland Rail
Australian Rail Track Corporation

ABN: 75 081 455 754

Level 16, 180 Ann Street
Brisbane QLD 4000

GPO Box 2462
Brisbane QLD 4001

Telephone: 1800 732 761

Further information on ARTC is at: **artc.com.au**.

Project rationale

Justification

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. Inland Rail provides a significant opportunity to change the fundamentals of the freight logistics supply chain in Australia based on:

- Freight volumes on Australia's east coast are forecast to more than double by 2050—existing road and rail networks will not be able to cope with this increase in freight without further investment
- The existing rail line between Melbourne and Brisbane travels along the coast and is constrained by passing through the congested hub of Sydney and an inability to accommodate double-stacked trains
- The coastal rail corridor cannot provide a service that is competitive with road transport and capacity constraints are likely unless significant capital works are undertaken
- Relying on road for freight transport will result in increasing safety, environmental and community impacts
- Without action, the cost of congestion on urban roads to the wider community could be more than $50 billion each year by 2031 with the demand on many key urban roads and rail corridors exceeding capacity by this time (ARTC, 2015a, ARTC, 2015b and Infrastructure Australia 2016).

1. Department and Minister titles current at the time of writing.

Inland Rail will transform the way freight is moved around the country, connect regional Australia to markets more efficiently, drive substantial cost savings for producers and consumers, and deliver significant economic benefits.

Previous studies and investigations have considered alternatives to the Inland Rail Program, including progressive road upgrades for road freight, maritime shipping, air freight, or other rail solutions such as upgrading the existing east coast railway. Overall, constructing an inland railway was the preferred option.

Benefits of Inland Rail and the Project

Inland Rail presents a unique opportunity to establish a competitive freight system by providing trunk rail infrastructure that supports a network of intermodal terminals and local sidings used to distribute commodities at the national, regional and local level.

The service that Inland Rail is offering (referred to as the 'service offering') is central to the delivery and competitiveness of Inland Rail and reflects the priorities of freight customers.

Key characteristics of the Inland Rail service offering include:

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

The Program will also provide a rail link between Melbourne and Brisbane that is interoperable with train operations to Perth, Adelaide, and other locations on the standard-gauge rail network, to serve future rail freight demand, and stimulate growth for inter-capital and regional/bulk rail freight.

As a component of the larger Inland Rail Program, the potential benefits of this Project are fully realised when considered with the benefits of the full Melbourne to Brisbane alignment. Key benefits specific to the Project include:

- A more direct and efficient route across the Toowoomba Range compared to the existing West Moreton System. The Toowoomba Range section of the West Moreton System has been identified by stakeholders a major constraint to shifting to rail:
  - 1.5 hours to traverse and has only two passing loops, which restricts rail capacity and efficiency
  - Lack of passing loops at other points on either side of the range
  - Train lengths limited to 650 metres (m) by constricted sidings and passing loops and level-crossing designs
  - Height restrictions in the tunnels, which restrict the use of 9 feet 6 inches high containers and some non-containerised break bulk cargo, e.g. railway lines or material for the coal seam gas industry.
- A dedicated freight line has the potential for faster cycle times, higher axle mass limits, and increased capacity (up to 20 new train paths), which would increase competitiveness and efficiency of the rail freight transport task
- Employment for up to 596 people in construction, including people living in the vicinity of the Project and in nearby local government areas, with indirect employment also stimulated
- Training opportunities provided by ARTC and the development of career pathways for young people, Indigenous people and unemployed people, which will minimise disadvantaged in the labour market
- Real opportunities for local, regional and Indigenous businesses to participate in the Project's (and broader programs') construction supply chain
- Development of labour force skills and business capacity that will enable future employment and business growth opportunities for the region
- Opportunities in secondary service and supply industries, such as retail, hospitality and other support services, for businesses in proximity to the Project.

Consequences of not proceeding with Inland Rail

The continuing growth in freight demand calls for urgent attention. Not progressing with Inland Rail could have significant negative impacts on the future growth potential of the national economy. Without a decision to make a step-change in rail efficiency and performance, pressure on the road networks will continue to increase, freight

costs will continue to rise, consumers will pay more for products and productivity in important industrial sectors could decline.

If investment in the east coast/Inland Rail freight corridor is not undertaken to increase capacity and minimise supply chain costs, the following additional risks are highly likely to eventuate. For example:

- There will be an increase in the number of trucks on urban and regional roads to move increasing freight volumes
- Larger trucks, such as B-doubles and B-triples will be mixing with smaller passenger vehicles on major highways
- Governments will need to invest heavily in major arterial and rural roads to cater for worsening road traffic
- An increase in the number and size of heavy vehicles on roads will require governments to spend more on maintenance and upgrades
- Greater truck volumes may result in more accidents causing injury or death on roads
- Carbon emissions and noise pollution will increase as road traffic increases
- Without an incentive to invest in rail supply chains, companies will potentially be locked into road-based logistic options.

The benefits of implementing the Inland Rail Program provide a strong justification for the Project to proceed.

Consequences of not proceeding with the Project

On a Project scale, the consequences of not proceeding with the Project, will require the upgrade of the existing QR rail network and/or alternative mechanisms (road transport) to move freight between Toowoomba and Brisbane. Both options would potentially impact on the Inland Rail Program's objective of providing a road-competitive service that will see freight delivered from Melbourne to Brisbane in less than 24 hours, with reliability, pricing and availability that is equal to, or better than, road.

QR has undertaken works to improve the efficiency and capacity of the Toowoomba Range section of the West Moreton System as per the West Moreton System Information Pack (QR, 2016); however, despite these works, additional upgrades of the existing rail network would be required to accommodate the rail traffic generated by Inland Rail because:

- Existing track is narrow gauge, which limits the type of locomotives and rollingstock that can be used
- Rollingstock planned for the Project will not be able to use the narrow-gauge track, as the Project design incorporates a dual-gauge track, which allows for connections between the Inland Rail and QR networks
- Existing West Moreton System supports low-axle limits (15.75 tonne axle limits (TAL) and less), with the Inland Rail Project catering for 25 TAL, with capacity to increase to 30 TAL
- Existing track has a maximum design speed of 80 kilometres per hour (km/hr) compared to 115 km/hr for the Project; although, the topography traversed by both alignments, limits the operating speeds
- Existing rail tunnels are of sufficient capacity to accommodate 40-foot containers, but would not be able to accommodate double-stacked freight. In addition, the existing rail tunnels are heritage-listed, having been constructed in the 1860s, which will also constrain any future upgrades
- Sidings and crossing loops associated with the existing rail network are designed for smaller train consists (up to 680 m) compared to the train consists proposed on Inland Rail (up to 1,800 m)
- Existing track was impacted by floods in 2011, which is one of the reasons the current alignment was adopted for the Project (Inland Rail Implementation Group, 2015).

The *Melbourne–Brisbane Inland Rail Alignment Study* (ARTC, 2010a) noted that the termination of Inland Rail at Toowoomba would require a longer pickup and delivery time by road from Toowoomba to Brisbane (approximately 125 km, or 2 to 3 hours) and would have a negative impact on estimated coal freight demand and halve the expected inter-capital tonnage. This resulted in a 60 per cent decrease in below-rail revenue, while the economic benefit–cost ratio decreased by around 80 per cent relative to the full Melbourne–Brisbane scenario, indicating lower efficiency of expenditure.

Project approvals

Environmental Impact Assessment

An EIS is a systematic analysis of a proposed development in relation to existing environmental values. The objective of the EIS is to ensure that all relevant environmental, social and economic impacts of the Project are identified and assessed to demonstrate that the Project is based on sound environmental principles and practices. The EIS includes a Draft Outline Environmental Management Plan (EMP), which proposes a framework to implement mitigation measures to avoid or minimise adverse impacts during construction.

Queensland approval process

On 15 February 2017, ARTC submitted an Initial Advice Statement (IAS) to the Coordinator-General as part of an application for a 'coordinated project' declaration under the SDPWO Act. On 16 March 2017, the Coordinator-General declared that the Project was a 'coordinated project for which an EIS is required'.

The final ToR for the Project was approved by the Coordinator-General under Section 30 of the SDPWO Act and was released on 9 August 2017. The ToR sets out the general and specific matters that ARTC must address in preparation of the EIS.

Following submission and public display of the EIS, the Coordinator-General will prepare a report (the Coordinator-General Evaluation Report) evaluating the EIS. The Coordinator-General's Evaluation Report may state conditions for, or make recommendations with respect to, subsequent approvals required for the Project to proceed and may also impose conditions to manage potential impacts. As the Project has not progressed to detailed design as yet, stated conditions are not being sought for environmentally relevant activities under the *Environmental Protection Act 1994* (Qld), nor are approvals under the *Water Act 2000* (Qld) and the *Fisheries Act 1994* (Qld).

Commonwealth approval process

The EPBC Act provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places, defined as Matters of National Environmental Significance (MNES).

On 10 February 2017, ARTC submitted an EPBC Act referral to the Australian Government Minister for the Environment. On 17 March 2017, the Australian Government Minister for the Environment determined the Project to be a 'controlled action', requiring approval under the EPBC Act before it can proceed. The relevant controlling provision for the Project is listed threatened species and communities (sections 18 and 18A of the EPBC Act).

As the Project has the potential to impact on both Commonwealth and state environmental matters, the EIS will be assessed under the Bilateral Agreement between the Commonwealth and the State of Queensland under Section 45 of the EPBC Act relating to environmental assessment.

Submissions on the Environmental Impact Statement

Any person, group or organisation can make a submission about the EIS to the Office of the Coordinator-General during the public notification period. Any submissions that are Properly made submissions must be accepted by the Coordinator-General and considered in evaluating the EIS. Submissions that do not meet the necessary requirements listed under the SDPWO Act may still be accepted by the Coordinator-General.

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 matters of concern or interest and list points to help with clarity
- Reference the relevant sections of the EIS
- Ensure the submission is legible.

The Coordinator-General may also accept submissions that are not properly made.

Submissions regarding this EIS should be addressed to:

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

Submissions can be made electronically at: **inlandrailg2h@coordinatorgeneral.qld.gov.au**.

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

For further enquiries, please contact

Telephone: 13 QGOV (13 74 68)

After the public notification period, the Queensland Coordinator-General considers the draft EIS, all properly made submissions, and any other material that the Queensland Coordinator-General considers relevant to the Project. The Queensland Coordinator-General must then decide whether or not to accept the Draft EIS as final under Section 34A of the SDPWO Act and issues a notice advising of the decision.

Where the Queensland Coordinator-General decides not to accept the Draft EIS, the Coordinator-General must request additional information and advise whether or not public notification of the additional information is required under Section 34B(2) of the SDPWO Act.

Where the Queensland Coordinator-General requests further information under Section 34B(2) of the SDPWO Act, a revised draft EIS is provided and public notification undertaken, where required.

When the Queensland Coordinator-General accepts the draft EIS as final, the Queensland Coordinator-General will evaluate it, any submissions, any other relevant information and prepare an Evaluation Report.

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

The process for environmental impact assessment and consultation is shown in Figure 2, showing the stages of the EIS approval process.

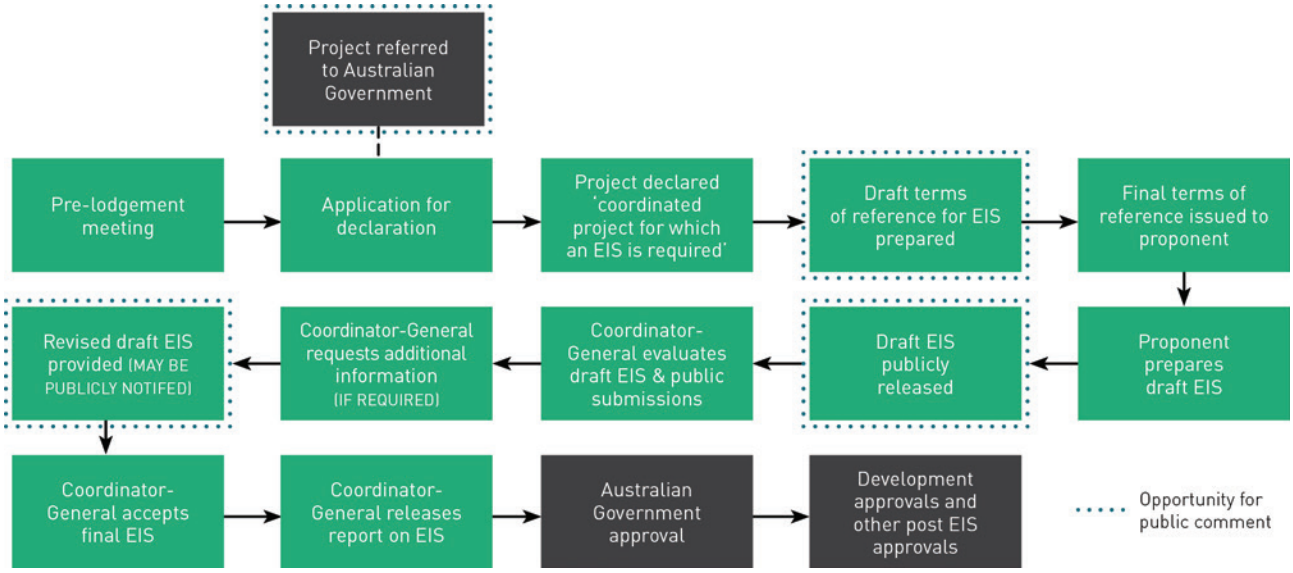

FIGURE 2: THE ENVIRONMENTAL IMPACT ASSESSMENT AND CONSULTATION PROCESS UNDER THE SDPWO ACT AND THE EPBC ACT

Other approvals

The Project will trigger the requirement to obtain a number of approvals, permits and authorities under Queensland Government legislation. In the event that the Project is recommended to proceed, under the EPBC Act and the SDWPO Act the Project will seek to obtain these approvals after completion of the EIS process when detailed design has sufficiently progressed to satisfy the information requirements for the relevant development application or other secondary approval.

Where a proposed development has been the subject of an EIS under the SDPWO Act, certain aspects of the development assessment process under the *Planning Act 2016* (Qld) (Planning Act) are modified. In addition, Chapter 3 of the *Environmental Protection Act 1994* (Qld) (EP Act) includes provisions for an EIS process that applies only to projects other than coordinated projects that are mining and resource activities. The relationship between the three act is illustrated in Figure 3.

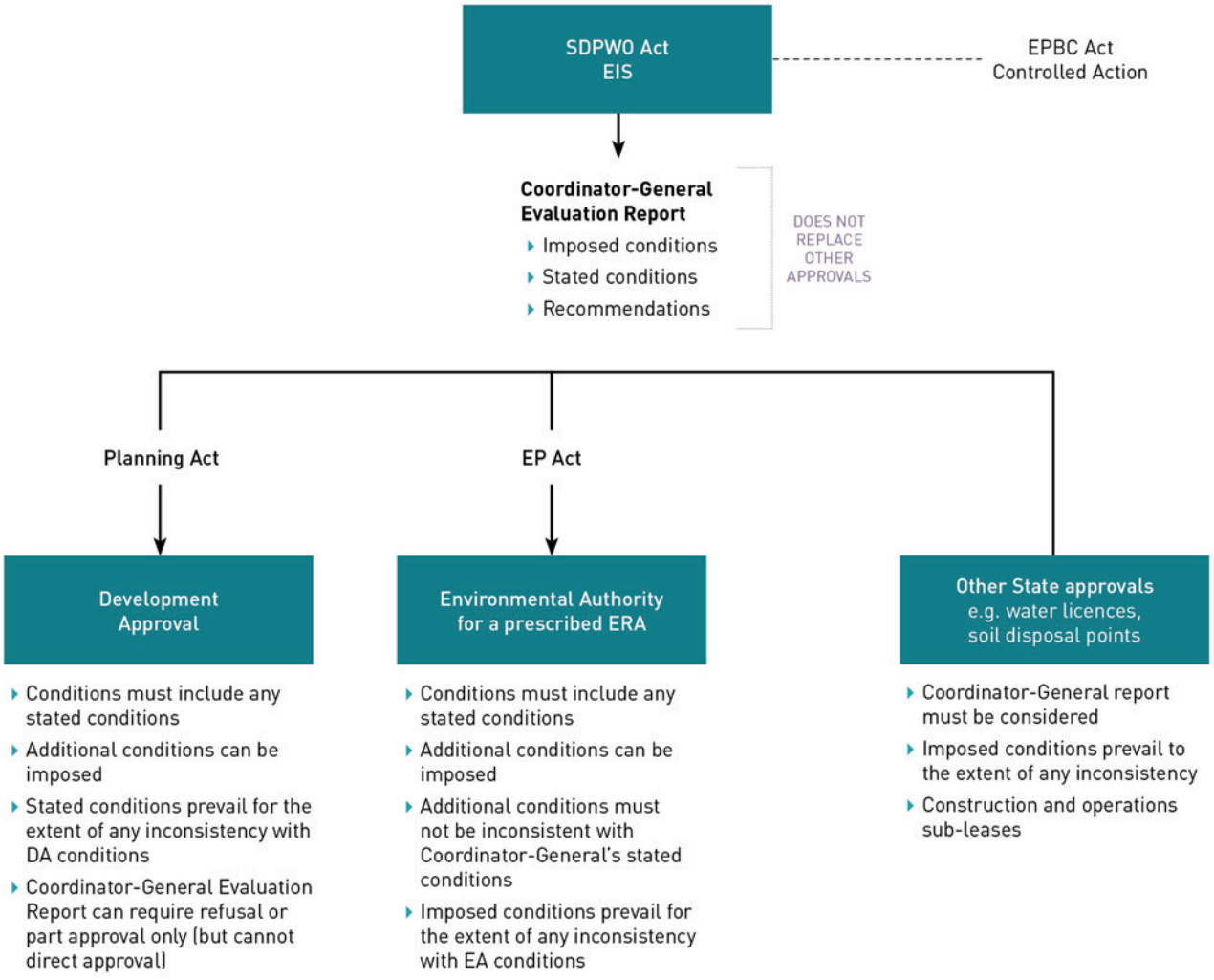

FIGURE 3: RELATIONSHIP BETWEEN THE STATE DEVELOPMENT AND PUBLIC WORKS ORGANISATION ACT, THE PLANNING ACT AND THE ENVIRONMENTAL PROTECTION ACT, INCLUDING OTHER STATE APPROVALS

Local government plans and policy

The Project is located within the local government areas (LGAs) of Toowoomba and Lockyer Valley. The Project will adhere to and be carried out in accordance with relevant local laws and planning schemes, where applicable.

As part of the 2008 Queensland local government reform, the former Gatton and Laidley Shires were amalgamated to form the Lockyer Valley Regional Council (LVRC). Under the transitional arrangements for amalgamated councils, the planning schemes operating in each former shire remain applicable to guiding development assessment until such time as a consolidated regional planning scheme is prepared. As of April 2020, a proposed Lockyer Valley Planning Scheme has been prepared and is being reviewed by the Queensland Government. Following review and approval, the proposed Lockyer Valley Planning Scheme will be released for public consultation. Once the Lockyer Valley Planning Scheme is in effect, this planning scheme will supersede the current Gatton and Laidley Shire Planning Schemes as well as the Grantham Reconstruction Area—Development Scheme and Temporary Local Planning Instrument 01/2019 Flood Regulation.

The Project's disturbance footprint is currently located within the area of the following planning schemes:

- Toowoomba Planning Scheme
- Gatton Shire Planning Scheme.

In accordance with Schedule 6, Part 5, Section 26(2) of the Planning Regulation 2017 (Qld), development for the construction of transport infrastructure, where the infrastructure is 'government supported transport infrastructure', cannot be made assessable development under a relevant local categorising instrument. Inland Rail is considered to be government supported infrastructure. Accordingly, the provisions of these local government planning schemes do not apply to the Project. Notwithstanding this, the zoning intent for these areas and relevant local laws as determined by the planning schemes has been taken into consideration when determining potential impacts of the Project.

Assessment approach

The EIS has taken a conservative approach to identifying the potential impacts of construction and operation of the Project, including cumulative impacts. This has involved defining the study area, reviewing relevant studies, reports and spatial datasets, and undertaking field assessments and modelling.

Where environmental impacts have been identified through the assessment process, efforts have been made, where practicable, to avoid or minimise those impacts through development of the design. Where attempts to avoid or minimise impacts through design have a limited effect, further proposed mitigation measures have been outlined to implement in future phases of the Project, including detailed design, construction and commissioning, and operation. Proposed measures relevant to detailed design and construction and commissioning are documented in Chapter 23: Draft Outline Environmental Management Plan.

The need for environmental offsets to address adverse residual impacts was also assessed. A consolidated description of commitments to implement management measures, including monitoring and offsets, is in Appendix F: Proponent Commitments.

Opportunities to maximise the economic and social benefits of the Project have been identified and include local employment, local industry participation, and opportunities for complementary investment with continued community benefits. These opportunities are further detailed in the Social Impact Management Plan, and associated action plans outlined in Appendix Q: Social Impact Assessment.

Community and stakeholder consultation

Stakeholders and members of the community have helped to shape the scope of this EIS by providing submissions on the draft ToR, the Project referral under the EPBC Act, and by participating in community consultation processes that have been ongoing during the preparation of this EIS.

The consultation program was structured to inform individuals and groups directly and indirectly affected by the Project. The consultation process was also structured to allow input from:

- Stakeholder groups with specific interests in the Project, such as Traditional Owners, community groups (via Community Consultative Committee meetings (members and observers)), and industry associations
- Australian Government departments, Queensland Government departments, and local governments, including those with either a regulatory or an advisory role in the design, construction or operation of the Project.

Stakeholder and community feedback and comments have informed the preparation of this EIS including:

- Identifying community values and local conditions in proximity to the Project
- Describing the environmental values of the local and regional area, including temporal variation
- Appropriately assessing potential impacts and key benefits and opportunities of the Project's construction and operation
- Proposing measures and actions to minimise or avoid potential impacts from the Project
- Recommending strategies to maximise or enhance potential Project benefits.

Community consultation is an ongoing process to inform the community about the Project and involve them throughout the life of the Project.

Project description

Overview

The objectives of the Project are to:

- Provide rail infrastructure between Gowrie and Helidon that meets the Inland Rail Program service offering
- Provide a more efficient route through the challenging terrain of the Toowoomba Range, along with interoperability between the Inland Rail and Queensland Rail (QR) networks, which will benefit all rail operators
- Minimise the potential for adverse environmental, social and economic impacts.

The Project alignment begins at Charlton and follows the existing West Moreton System rail corridor on the southern side (Western Line) for approximately 4.8 km eastwards through Gowrie. The Project deviates from the existing rail corridor to the south-east, before passing into the proposed western tunnel portal within the vicinity of the Boundary Street and the Toowoomba Bypass interchange at Gowrie Junction.

The alignment then continues with a 6.24 km tunnel under the Toowoomba Range, passing under the localities of Cranley, Mount Kynoch and Ballard (including under the Toowoomba Bypass) and emerging on the eastern side of the Great Dividing Range at the eastern tunnel portal, within the vicinity of Mt Kynoch. The eastern tunnel portal is in a rural area predominantly consisting of undisturbed natural vegetation. At each of the tunnel portals, ventilation and other tunnel infrastructure are proposed, along with an intermediate ventilation shaft and supporting infrastructure at Cranley.

The Project then crosses through the northern edge of an area of Commonwealth land, previously used by the Department of Defence. Continuing east, the alignment passes on the northern side of Withcott and traverses areas of native vegetation and grazing properties, with proposed crossings over the valleys of Rocky Creek, Six Mile Creek and over the Toowoomba Bypass. The alignment continues to the north of the Toowoomba Bypass through Postmans Ridge, Lockyer and Helidon Spa, crossing Lockyer Creek, before tying into the existing West Moreton System rail corridor north-west of Helidon. The alignment runs parallel to the West Moreton System rail corridor on the northern side (Main Line) for approximately 0.8 km before joining the proposed H2C project alignment.

The significant vertical difference (350 m) between Gowrie at 500 m relative level (RL) and the base of the Toowoomba Range, at 150 m RL, created a significant challenge for the rail alignment design in producing a safe and efficient route for trains to traverse the range. Multi-criteria analyses (MCAs) were undertaken as part of the EIS and design development process to refine the alignment and create the EIS investigation corridor and rationalise any deviations from the protected Gowrie to Grandchester future state transport corridor, if there was an opportunity for significant efficiencies in constructability and reduction in environmental impacts to be realised. The resulting Project design and disturbance footprint was assessed in the EIS.

Key components of the Project include:

- Approximately 28 km of single-track, dual-gauge rail line with three crossing loops, initially constructed for 1,800 m double-stacked trains, and designed not to preclude the future extension of crossing loops to accommodate trains up to 3,600 m long
- A 6.24 km tunnel through the Toowoomba Range as well as bridges and viaducts to accommodate the topography of the region and cross waterways and other infrastructure

- An intermediate ventilation building to be constructed at Cranley at the halfway point of the Toowoomba Range Tunnel to facilitate ventilation of the tunnel
- Tie-ins to the existing QR West Moreton System Rail corridor at the Project boundaries and spur line allowing access to and from Toowoomba
- Construction of associated rail infrastructure, including maintenance sidings and signalling infrastructure to support the train control system
- Rail crossings, including grade separations and road overbridges, occupational and private crossings, fauna crossing structures, signage and fencing
- Significant embankments and cuttings along the length of the alignment
- Ancillary works, including road and public utility crossings and realignment (excluding enabling works)
- Construction worksites, laydown areas and access roads

Enabling works are those works undertaken by or for third parties, primarily for the relocation or re-provision of public utilities, or existing QR assets. These works are not part of the Project works. These works will be undertaken in accordance with the relevant environmental or regulatory framework applicable to the works of public utility.

Timing and cost

Subject to approval of the Project under the SDPWO Act and EPBC Act, construction is planned to start in 2022 and is expected to be completed and commissioned in 2027. The anticipated timing of phases for the Project are shown in Table 1.

TABLE 1: ANTICIPATED TIMING OF PROJECT PHASES

Project phase	2021	2022	2023	2024	2025	2026	2027
Detailed design							
Pre-construction and early works							
Construction							
Commissioning							
Operation							

A construction contractor is expected to be appointed in the second half of 2021, coinciding with the commencement of the detailed design phase of the Project. The Toowoomba Range Tunnel is the longest single construction task associated with the Inland Rail Program, with a construction duration closely approaching four years.

Train operations are not anticipated to commence until all 13 sections of the Inland Rail Program are completed in 2027. However, subject to relevant infrastructure access agreements there is the potential for West Moreton System rail traffic to access the alignment prior to the completion of the Inland Rail Program.

The estimated capital expenditure for the construction of the Project is approximately $1.35 billion.[2]

Local context

The Project is located within the Toowoomba and Lockyer Valley LGAs.

The Project will generally be located within the protected Gowrie to Grandchester future state transport corridor, which was protected under the *Transport Planning and Coordination Act 1994* (Qld) in 2005. Extensive public consultation and technical, environmental and cultural heritage studies were undertaken before the Gowrie to Grandchester future state transport corridor was protected. The Gowrie to Grandchester future state transport corridor provided a base alignment for the Project to be designed on.

[2] This figure includes both direct and indirect costs. Indirect costs include items such as design services, contractor overhead and margin, contingency and escalation, together with ARTC Program costs such as management, train control systems, property requirements, insurances and utilities. The total investment makes provision for expected Project contingency and risk.

Table 2 defines the key terminology used across the EIS assessments.

TABLE 2: TERMINOLOGY USED ACROSS THE ENVIRONMENTAL IMPACT STATEMENT

Term	Definition
EIS investigation corridor	An approximately 2 km wide study area, 1 km either side of the proposed rail alignment. The EIS investigation corridor includes the disturbance footprint, which encompasses all areas where Project works are proposed, including both permanent and temporary works, and land within a 1 km radius either side of the proposed Project alignment. The EIS investigation corridor accommodates the topography and options analysis that was undertaken for the Project (the Toowoomba Range Tunnel, for example).

Project disturbance footprint	The Project disturbance footprint includes:
	▸ Permanent disturbance footprint (approximately 354 hectares (ha) in size):
	  ▸ The rail corridor includes the rail tracks and associated infrastructure as well as other permanent works associated with the Project (for example, where changes to the road network are required)
	  ▸ Preservation of an underground corridor approximately 50 m wide and approximately 28 ha in area for the 6.24 km long Toowoomba Range Tunnel has also been considered, where applicable (i.e. disturbance calculations for land use, agricultural land and vegetation communities do not include this area as there is no surface disturbance proposed)
	▸ Temporary (or construction) disturbance footprint (approximately 100 ha in size): temporary storage and laydown areas to be used on a temporary basis during the construction phase. This area may also encompass the permanent disturbance footprint, or portions of it.

Technical study areas	Some technical assessments used a different study area to the EIS investigation corridor or disturbance footprint depending on the requirements of the environmental aspect being assessed.

Relationship to other Inland Rail projects

The Project forms part of the overall Inland Rail Program and is one of the missing links across the Program.

At its eastern limit, the Project will connect with the H2C project. An EIS is currently being prepared for this project. At its western limit, the Project will connect to the B2G project. This project is also in the process of undergoing an EIS investigation.

The Project does not have a direct relationship with any other coordinated projects, major projects, or developments. However, it will provide connectivity opportunities between the existing QR West Moreton System rail corridor and ARTC interstate lines, as well as being a potential catalyst for the development and growth of regional intermodal hubs, such as those associated with InterLinkSQ, Toowoomba Enterprise Hub, and the Bromelton Intermodal Hub.

Design features

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 implemented a consistent set of design requirements and parameters to be applied across the Inland Rail Program.

Key design features are described in the following sections.

Land

Land requirements for the Project vary depending on whether the land is located in the greenfield corridor (i.e. new rail corridor between Morris Road and Lockyer Creek), or in the brownfield corridor (i.e. collocated with the existing West Moreton System), or in the tunnel, and also whether the land is required on a temporary or permanent basis. Ultimately, land will be required for the purposes of either rail or road infrastructure, with some of the land requirements associated with existing rail or road corridors.

The Project disturbance footprint (temporary and permanent works) is approximately 454 hectares (ha) and it is assumed that all lands within the footprint will be directly impacted by the Project, including land clearing, ground disturbance and land acquisition. This requirement will be confirmed during detailed design in consultation with the construction contractor and the constructing authority and in response to the findings of baseline surveys (e.g. ecological studies, cultural heritage assessments), recommendations from the EIS and any relevant approval conditions.

Within sections of brownfield development, reasonable endeavours have been made to remain within the existing rail corridor, widening the corridor only where required to accommodate new rail infrastructure to support the Project or to accommodate the relocation of existing services associated with the QR Network (e.g. road maintenance access roads). The permanent disturbance footprint also incorporates the existing West Moreton System rail corridor.

The Project rail corridor has adopted a minimum width of 62.5 m through the greenfield area of the alignment (excluding the tunnel), to accommodate earthworks, drainage structures, rail infrastructure, access tracks and fencing. The maximum width of the corridor also varies in response to the undulating terrain of Lockyer Valley due to earthwork requirements and the location of rail maintenance access roads, with the maximum width being approximately 300 m.

Changes to the existing road networks as a result of the Project are also considered as part of the permanent disturbance footprint. Reasonable endeavours have been made to ensure that the changes remain within the existing road reserves, wherever possible. Following construction, these roads will be managed by the relevant road authority (i.e. the Department of Transport and Main Roads (DTMR) or local council).

The Project disturbance footprint (temporary and permanent works) comprises 151 land parcels. Additional land may be acquired where impacts cannot be avoided or appropriately mitigated, or where acquisition is otherwise agreed with landholders. It is expected that the impacted properties will be acquired (freehold) or leased (state land) by the relevant constructing authority, converted to unallocated state land and dedicated as 'railway corridor land' under the *Transport Infrastructure Act 1994* (Qld), or in some cases a road under the *Land Act 1994* (Qld). For example, the existing QR rail corridor cannot be acquired for this Project, with the existing rail corridor likely to be expanded to incorporate the land required for the Project's rail corridor, and a sublease arrangement between the State and ARTC (i.e. lands lease tenure) executed.

Where the Project requires the permanent acquisition of properties, acquisition will be undertaken in accordance with the requirements of the *Acquisition of Land Act 1967* (Qld) (AL Act) or under the *Land Act 1994* (Qld) for state land, including land subject to volumetric resumption. This process is likely to start during detailed design when the Project disturbance footprint is confirmed and the Project has achieved primary approval.

The Proponent will continue to engage with the State of Queensland to protect and acquire the rail corridor and land required to facilitate the Project (e.g. road changes).

Where land is acquired by the compulsory acquisition process in the AL Act, compensation will be able to be claimed by every person with an estate or interest in the land after the 'Taking of Land Notice' is published in the Queensland 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.

Where only part of a land parcel is acquired, an owner may also claim compensation for the severance caused and for the impact of the Project on the balance land. Where impacts on the balance land cannot be appropriately mitigated and managed to the satisfaction of the landholder, the landholder will be able to receive compensation for the property in its entirety at an independently valued market rate.

Rail

The Project alignment is a new, single line of dual-gauge track, standard (1,435 mm) and narrow (1,067 mm) gauge with crossing loops.

The mainline track structure is a ballasted track system consisting of continuously welded rail. Figure 4 shows a typical section for a dual gauge ballasted track. Within the tunnel, a track slab is proposed to be used, which comprises a continuously welded rail on a continuous concrete slab.

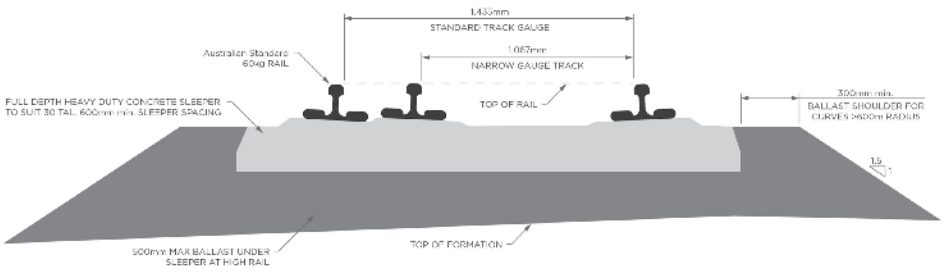

FIGURE 4: INDICATIVE DESIGN FOR NEW TRACK

Tunnel infrastructure

The Project proposes a 6.24 km long undrained tunnel through the Toowoomba Range (refer to Figure 5 for a sketch of the conceptual Toowoomba Range Tunnel). The tunnel is oriented west-north-west to east-south-east at an approximate grade of 1 in 64.

The western tunnel portal (Ch 4.10 km) is located within the Gowrie to Grandchester future state transport corridor near the Boundary Street/Toowoomba Bypass interchange and has been designed to ensure a flood immunity of 1:10,000 Annual Exceedance Probability (AEP). The surface level is 510 m Australian Height Datum (ADH) and the rail level is 490 m AHD. The approximate 600 m long western approach box cut will be up to 26 m in height at the western tunnel portal face, gradually reducing in height towards the west.

The eastern tunnel portal, location with the Gowrie to Grandchester future state transport corridor south-west of Mount Kynoch, involves a 100 m long cut and a portal face that approximately 13 m in height. The portals are drained and there is the potential for groundwater inflows during construction and operations.

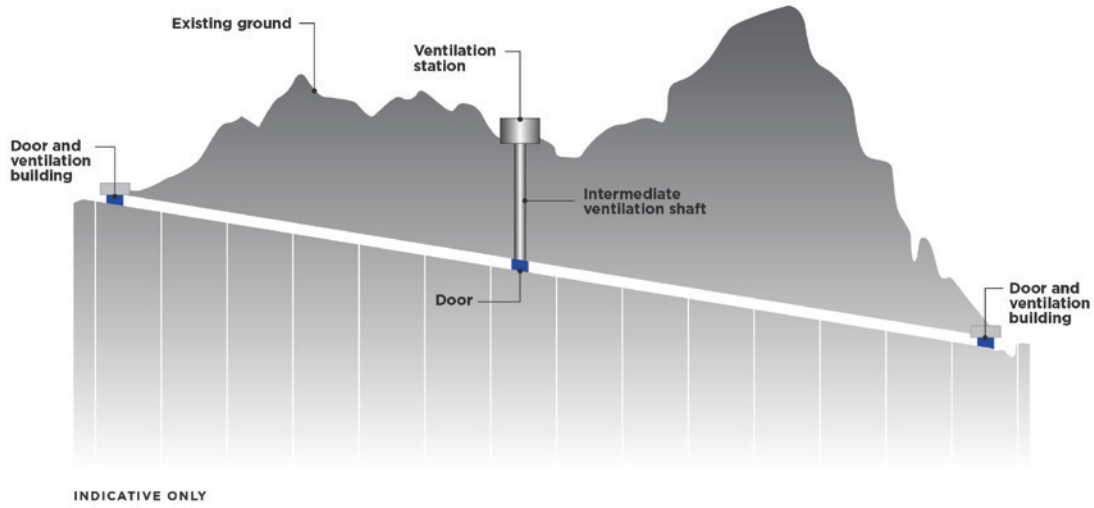

FIGURE 5: CONCEPTUAL TUNNEL CROSS SECTION SKETCH THROUGH THE TOOWOOMBA RANGE

The tunnel is proposed to have a bored diameter of approximately 12.2 m and a finished internal diameter of approximately 10.8 m, with a cross-section area of 73 square metres (m^2). A free cross-sectional of 60 m^2 in the tunnel is the minimum size required to provide sufficient train cooling with the assistance of portal doors.

The tunnel would include rail tracks, emergency systems and services such as communication and overhead lines. An intermediate ventilation shaft at Cranley, approximately 100 m deep and approximately 17 m in diameter is also proposed as part of the tunnel ventilation system.

The water collected inside the tunnel (groundwater, storm water carry-in, wash-down, firefighting) would be collected through a common tunnel drain and stored in a sump at the eastern portal. This water would include first-flush separation and likely be processed through a water treatment plant. The tunnel alignment grades stormwater towards the western tunnel portal, which would need to be collected as clean prior to the portal and diverted or pumped to a nearby drainage line of Gowrie Creek.

The alignment on approach and through the tunnel includes a constant 22 km sustained grade of 1:64 from Helidon to the west of the tunnel. This presents significant challenges for rail operations and tunnel ventilation to aspirate the locomotives on the climbing grade in the tunnel and to purge the tunnel of heat and emissions.

There are three ventilation buildings for the tunnel, one at each portal and one at the intermediate ventilation shaft. The portal ventilation buildings sit directly over the track and house the smoke control fans and longitudinal egress passage (maintenance and evacuation route) fans. The intermediate ventilation shaft building houses both smoke control fans and purge fans.

The tunnel ventilation system would provide purging capability to flush pollutants from the tunnel after passage of the up-grade heavy freight trains. The purge cycle will be capable of occurring within a 6-minute period, which would require significant fan and power infrastructure. The ventilation system would also provide bidirectional smoke control in the event of a train fire in the tunnel. The same fan system would be used to provide ventilation for maintenance activities but at a reduced air exchange rate.

In case of the train stopping in the tunnel due to fire or other emergency, the tunnel fire and life safety strategy requires a longitudinal egress passage (LEP) as a conventional evacuation passage for passengers, drivers and crew. The LEP would provide for egress every 240 m and communication facilities to contact the operator at the Network Control Centre.

The water collected inside the tunnel (e.g. groundwater seepage, stormwater carry-in, wash-down, firefighting) will be collected (if or where required) through a common tunnel drain and stored in a sump at the eastern portal. This water will be processed through a water treatment plant and potentially discharged to a tributary of Oaky Creek. Stormwater will be collected into a sump prior to the western portal so that it does not flow down the tunnel and will be treated prior to discharge.

Crossing loops

Crossing loops are places on a single line track where trains in opposing directions can pass each other. These are double ended and connected to the main track at both ends. Crossing loops are typically a little longer than any of the trains that might need to cross at that point. In operation, one train enters a crossing loop through one of the turnouts and idles at the other end, while the opposing train continues along the mainline track to pass the now stationary train. Figure 6 shows an indicative design for crossing loops and maintenance sidings.

The Project incorporates three crossing loops, designed to accommodate 1,800 m train lengths, with consideration of future provision for train lengths up to 3,600 m. The proposed locations of the crossing loops are:

- Western end of the Toowoomba Range Tunnel
- Eastern end of the Toowoomba Range Tunnel
- Postmans Ridge—located in the vicinity of Murphys Creek Road.

The location of crossing loops was informed by the operational modelling for the Inland Rail Program and considered how close the loops are in proximity to sensitive receptors and existing infrastructure and allowing flexibility for future extension.

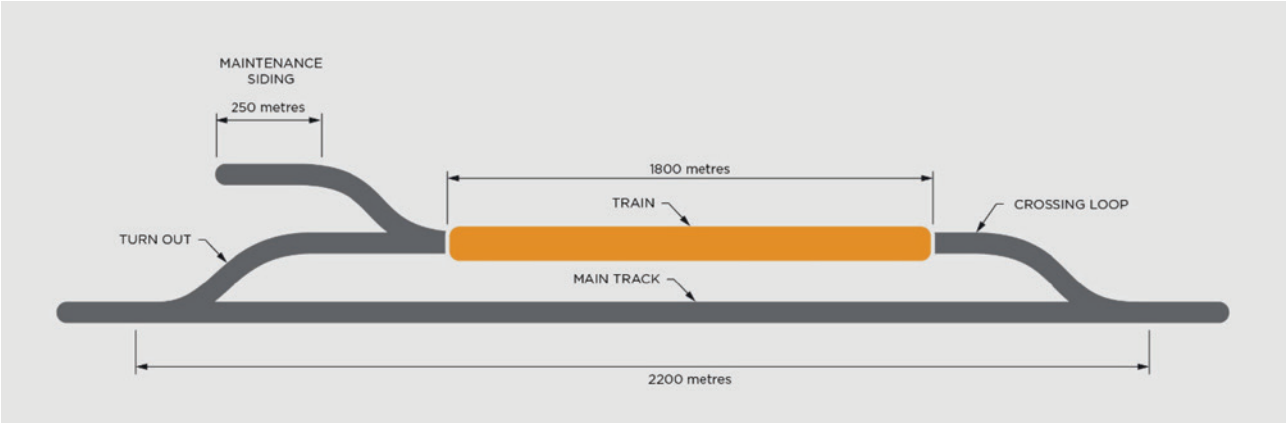

FIGURE 6: INDICATIVE DESIGN FOR CROSSING LOOP AND MAINTENANCE SIDING

Connections

Connections are provided to allow trains to move between the existing QR Network (narrow gauge) and Inland Rail (dual gauge). A connection is also proposed with the InterLinkSQ facility. The anticipated locations for connections for the Project are:

- InterLinkSQ connection to the Project approximately 1 km east of Draper Road, Gowrie Junction
- West Moreton System connections to the Project at:
  - Approximately 1 km west of Gowrie Junction Road, Gowrie Junction
  - Spur line, approximately 1.5 km east of Gowrie Junction Road, Gowrie Junction (allowing trains to access Toowoomba)
  - Approximately 2.5 km west of Helidon train station along Airforce Road, Helidon.

Bridges and viaducts

There are no existing bridges that require reinstatement or reconstruction along the alignment as a result of the Project.

The Project traverses the steep slopes through the Toowoomba Range at Ballard, Withcott and Lockyer, which requires significant earthworks and structures to maintain the operational gradient. The Project requires three new bridge and ten viaduct structures.

Viaducts are a type of bridge that are made up of multiple small spans that cross waterways, terrain, roads or transport infrastructure. The heights of the viaducts will vary between 16 m and 45 m in response to the local terrain. Bridges, within the context of this Project, are shorter structures with a simpler design that span waterways, roads or rail, but not terrain.

Bridge and viaduct structures also allow drainage across the corridor; access for roads and rail, farm tracks, stock crossings or pedestrians; span waterways, riparian zones and large valleys; provide for native fauna connectivity; and replace large height embankments where required to reduce the operational footprint.

The bridge types that are required for the Project include:

- Two rail-over-waterway viaducts
- Three rail-over-terrain-and-waterway viaducts
- Four rail-over-terrain-road-and-waterway viaducts
- One rail-over-road-rail-and-waterway viaduct
- One rail-over-waterway bridge
- One road-over-rail-and-waterway bridge
- One road-over-rail bridge.

Retaining walls

Due to the tight constraints of the alignment between the existing QR tracks and Airforce Road at the eastern end of the Project, the alignment embankment is proposed to be supported on a varying height reinforced soil slope retaining wall. The reinforced soil slope wall comprises two sections. The section to the north of the alignment is approximately 470 m long (Ch 25.46 km to Ch 25.93 km) and has an average height of 2.85 m and a maximum height of 5.5 m. The section to the south of the alignment is approximately 660 m long (Ch 25.35 km to Ch 26.01 km) and has an average height of 3.25 m and a maximum height of 6.3 m.

No change to the width of Airforce Road is proposed as part of the works, although there may be some disruptions to traffic during construction.

Cross-drainage infrastructure

Cross-drainage infrastructure has been incorporated into the design where the alignment intercepts existing drainage lines and watercourses. The type of cross-drainage structure used depends on various factors such as the natural topography, rail formation levels, design flow and soil type. Cross-drainage structures, including culverts, have been designed to meet the adopted design criteria for a 1% AEP event. AEP refers to the probability of a flood event occurring in any year. The probability is expressed as a percentage. For example, a large flood may be calculated to have a 1% chance of occurring in any one year, is described as 1% AEP.

Culverts are structures that allow water, either in a watercourse or drainage line, to pass under the rail alignment. Culverts are incorporated into the design as part of the cross-drainage solution to ensure no additional permanently ponded areas will be created upstream of the Project. Culverts also help to maintain overland flow paths for surface water. Culverts will be a mix of reinforced concrete pipe culverts and reinforced concrete box culverts. Scour protection measures will generally be installed around culvert entrances and exits, on disturbed stream banks, and around waterfront land to mitigate and help manage erosion. A typical cross section of a cross drainage culvert is shown in Figure 7.

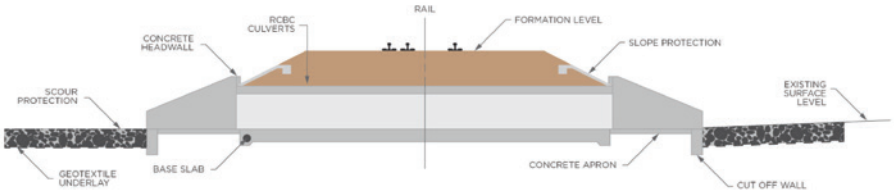

FIGURE 7: TYPICAL SECTION OF A CROSS-DRAINAGE CULVERT

Longitudinal drainage

Longitudinal drainage removes water that has percolated through the track ballast and diverts surface water runoff to the nearest bridge or culvert before it reaches the subgrade – that is the ground under the rail-related structures. Without adequate track drainage, the subgrade may become saturated, weakening and perhaps leading to additional maintenance of the subgrade.

The Project will include the following types of longitudinal drainage:

- Cess drains—running directly adjacent to the rail formation in cuts
- Embankment drains—longitudinal drains adjacent to the track in embankment conditions
- Catch banks—longitudinal banks on the uphill side of cuttings.

Rail–rail interfaces

In addition to the connections, the Project will involve grade separation (i.e. Lockyer Creek Viaduct) over the West Moreton System between Lockyer Creek and Airforce Road, Helidon. The Toowoomba Range Tunnel will also cross under, at a depth of over 100 m, the Western Line at Cranley and the Main Line at Ballard.

Public road–rail interfaces

Road–rail interfaces are a point at which the rail intersects with public roads or private accesses. The Project requires the crossing of state-controlled roads (SCRs) managed by DTMR, and local government roads managed by either Toowoomba Regional Council (TRC) or LVRC.

The public road–rail interfaces relevant to the Project include two SCRs, four roads where the road authority is TRC and seven roads where the road authority is LVRC. Preferred options for public road–rail interface treatments currently applied over the length of the Project include a mix of grade separation, consolidation, realignments and diversions. No level crossings are proposed for the Project.

Grade separation is proposed for the two SCRs, while Morris Road will be closed where the existing Gowrie to Grandchester future transport corridor intersects the road. Gowrie Junction Road will be realigned and a road-over-rail bridge, which will also span Morris Road, Paulsens Road and Gowrie Creek is proposed. The existing QR level crossing at Gowrie will therefore be eliminated.

Road network changes

To facilitate the Project, changes to the local road network are required to safely accommodate the railway and maintain local and regional connectivity. The majority of road network changes are within Gowrie Junction, with the road authority being TRC. The proposed road network changes will be undertaken in accordance with relevant DTMR, TRC or LVRC design standards.

The elimination of the existing Paulsens Road level crossing which is in line with *Queensland Level Crossing Safety Strategy 2012–2021* (DTMR, 2012), requires a new grade separated crossing to maintain north-south connectivity. To safely meet road and rail standards, Gowrie Junction Road would be realigned (approximately 500 m) with a road-over-rail bridge proposed approximately 400 m west of the existing level crossing. The new grade separation will encroach onto private land and will cross over the existing rail corridor, along with the Project's rail alignment, Paulsens Road, a realigned section of Morris Road and Gowrie Creek. The bridge is approximately 350 m in length and provides a minimum clearance between 5.4 m and 7.1 m.

To mitigate impacts from the realignment of Gowrie Junction Road, the following is proposed:

- Krienke Road/Gowrie Junction Road intersection will be relocated approximately 300 m south, adjacent the existing Gowrie Junction Road/Ganzer Road intersection. The intersection solution is to be determined and is discussed in Appendix U: Traffic Impact Assessment. A new section of road approximately 200 m long will also

be required to connect Gowrie Junction Road to Krienke Road, with the road primarily located in an undeveloped road reserve.

- Morris Road will be extended to the west under the proposed road-over-rail bridge and will provide access via the existing and realigned section Krienke Road to Gowrie Junction Road. This will ensure access is maintained to the properties fronting Gowrie Junction Road and Morris Road.
- McMahons Road will also be slightly raised at the existing intersection with Gowrie Junction Road to maintain access.
- New access, to the south, from Krienke Road will be provided to the houses that front the existing Gowrie Junction Road.

The rail corridor deviates to the south-east from the existing West Moreton System, within the Gowrie to Grandchester future state transport corridor, east of Gowrie. Within this area, a new rail connection to the east is also proposed. Morris Road will be closed, approximately 750 m east of Gowrie Junction Road and 650 m west of Boundary Street, to facilitate the rail corridor at this location. No provision for access over the rail corridor is proposed due to the presence of a crossing loop and because the realigned Gowrie Junction Road provides north-south connectivity. East–west connectivity will also still possible via Hermitage Road. To the west of the Project, Morris Road will be realigned to the south and west to ensure access is maintained to properties within this area.

It is also proposed to close the existing rail underpass linking East Paulsens Road to Morris Road. Access will be maintained through the upgrade of East Paulsens Road (for approximately 1 km) between Old Homebush Road and the underpass. The works will also include improved drainage works noting this area is impacted by flooding.

Other proposed changes to the road network include:

- Closure of Draper Road, where the section runs east–west parallel to the existing West Moreton System rail corridor. This road is also subject to the InterLinkSQ intermodal development
- Closure of a section of Ganzer Morris Road, currently an unformed road corridor and is not required for property access (access via Ganzer Road) or to maintain network connectivity
- Realignment of an approximately 700 m section of Wallens Road to the east (approximately 300 m) under the proposed Oaky Creek Viaduct (i.e. grade separation)
- Closure of a 400 m wide undeveloped section of Howmans Road near Ch 17.8 km. The eastern section of Howmans Road will also be extended at least 250 m to the rail corridor. The western section from Gittins Road, approximately 1.3 km, will also upgraded
- Closure of an Unnamed Road near Ch 18.4 km, currently an unformed road corridor and is not required for property access or to maintain network connectivity
- Realignment of the existing Cattos Road near the intersection with Airforce Road. The road currently services one property and it is proposed to realign the road to the west and extend it north parallel to the West Moreton System and under the Lockyer Creek viaduct. The road will then link back to Airforce Road with a new intersection approximately 1.2 km from the existing intersection (the existing intersection will be closed). The change, a new 1.2 km section of road, is located within the existing road reserve
- Installation of a water pipeline, approximately 1.2 km in length, along Ganzer Morris Road road reserve, south under the Toowoomba Bypass to Hermitage Road. The water pipeline will connect the tunnel fire management system into the TRC water network.

Private road–rail interfaces

The Project interfaces with 36 private accesses, with no level crossings proposed. The impact on each individual property will differ and ARTC will continue engaging with landholders to find ways to minimise potential disturbances to properties, which includes access.

The final number of crossings within private property will be determined during detailed design. The design and layout of occupational crossings will be based on the following considerations:

- Feedback from consultation with landholders about specific property requirements
- Safety standards such as criteria for minimum sight distances for trains and vehicles
- Alternative access arrangements
- Rail design and landform

- Stock movements
- Vehicle access requirements, such as farm machinery and frequency and use

Typical treatments will include:

- Underpasses for stock passage or multiple-use vehicles, subject to topography
- Diversion to adjacent public roads or public road crossings.

Rail maintenance access roads

Rail maintenance access roads are required to facilitate maintenance for critical infrastructure, such as turnouts, and to provide access for emergency recovery. Figure 8 shows the positioning and typical formation of a rail maintenance access road.

The Project has a considerable number of bridge abutments that will need access for inspection and maintenance; therefore, a surface-level access road has been proposed unless there are other reasons for providing a formation level access road. From a surface level access road, access to the formation level at abutments can be achieved by provision of stairs or bridge walkways. This solution has been proposed to avoid the need for turnarounds at each bridge abutment, considerable lengths of formation level roads and ramps, and additional service roads to connect with public roads.

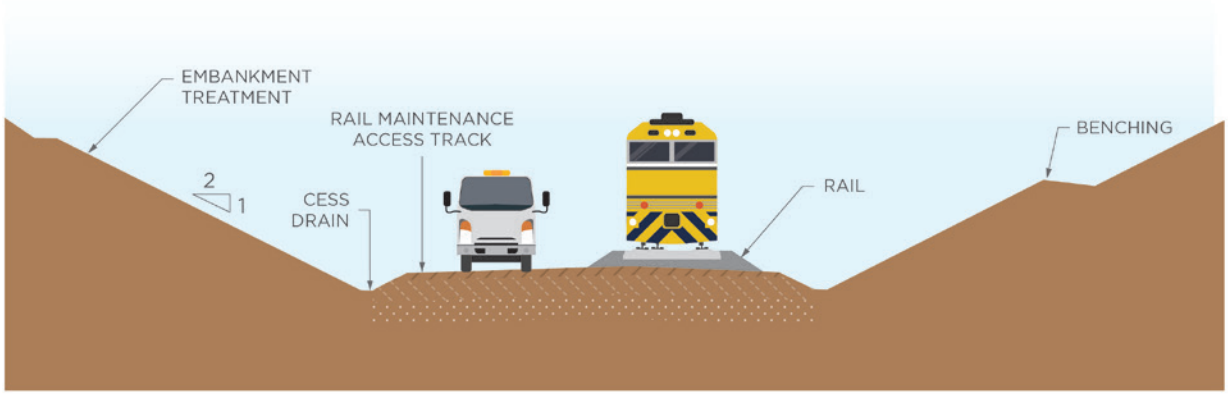

FIGURE 8: TYPICAL SECTIONAL DIAGRAM OF RAIL FORMATION SHOWING RAIL MAINTENANCE ACCESS TRACK

Utility and services interfaces

There are currently 184 potential clashes identified with existing utilities and services within the Project disturbance footprint that will potentially be impacted by the Project, including communications, electricity, oil and water, owned by multiple entities.

Utility owners have different requirements and drivers for how the Project should treat these impacted assets. It is also common for impacted assets owned by the same utility owner to have varying requirements depending on the conditions, characteristics and criticality of each asset to the owner.

Fencing

Fencing will be provided for the extent of the rail corridor, primarily to limit access to the railway. Fencing will extend between the corridor and the land adjoining the railway, with any specific requirements designed in consultation with the adjoining landholders.

As the Project comprises substantial greenfield works in rural agricultural and grazing areas, standard rural fencing will typically be provided according to ARTC's fencing strategy.

Fencing will act to protect adjoining land from trespass and help present stock on such adjoining land from gaining access to the railway. Where superior fencing is required, for example where tracks are proximate to roads or communities, or where trespass is anticipated, a 1.8 m chain-link boundary fence may be provided.

Gates will be provided at suitable corridor entry and exit locations for convenient access across the alignment.

Signalling and communications

A safeworking system consisting of signalling and communications equipment will be installed to ensure the safe movement of trains is delivered as part of the Inland Rail Program. 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 most likely be monitored and controlled from an existing ARTC train control centre.

Environmental treatments

Fauna exclusion fencing, sediment basins, scour protection, noise mitigations and waterway crossings considerate of fish passage will be installed as part of the Project.

Embankments and cuttings

Embankments and cuttings will be required in response to topographical constrains along the length of the alignment. Constructing the foundation of the railway line will require earthworks and engineering fill to provide a platform designed for the rail. This work will use heavy earthmoving plant and equipment.

Embankments and cuttings will be required along the length of the alignment, including road and rail infrastructure within the alignment such as crossing loops and road-over-rail bridges. The total length of embankments required for the Project will be approximately 15.4 km with a maximum embankment height of approximately 33.3 m.

The total length of cut for the Project will be approximately 6.65 km with a maximum cut depth of approximately 45.7 m.

Material sourcing

Established quarries will be used to source construction materials. Seven operational quarries have been identified as potentially suitable for use as material source locations during construction activities. Investigations into additional quarry material sources will continue throughout the detailed design phase. Options have been identified to reuse excess cut material within the Project and will be further investigated during detailed design.

All groundcover, topsoils, and other organic and/or unsuitable material will be stripped from the site. Wherever possible and appropriate, such material will be stockpiled and recycled within the Project footprint. Spoil and excess material from the construction of the Project and excavation of the Toowoomba Range Tunnel is proposed to be stored at a permanent stockpile to be located adjacent to the proposed western tunnel portal.

Construction

Subject to approval of the Project under the SDPWO Act and the EPBC Act, construction is planned to commence in 2022 and is expected to be completed and commissioned in 2027. A construction contractor is expected to be appointed in the second half of 2021, with this also coinciding with the commencement of the detailed design phase of the Project. The Toowoomba Range Tunnel is the longest single construction task associated with the Inland Rail Program, with a construction duration closely approaching four years.

Construction of the Project will commence once the detailed design is complete and required approvals have been obtained. The construction program consists of several stages and activities, including:

- Site preparation: vegetation clearing, establishment of site compounds and ancillary facilities, installing temporary and permanent fencing, installing drainage and water management controls, and establishing construction access tracks and temporary haul roads
- Civil works: bulk earthworks which may involve blasting and/or hydraulic rock-breaking, construction of cuts and embankments, construction of tunnel portals and the main line tunnel, installation of permanent drainage controls, construction of bridge and watercourse crossing structures
- Track works: installation of ballast, sleepers and rails
- Rail systems infrastructure and wayside equipment: installation of signals, turnouts and asset monitoring infrastructure
- Commissioning: integration testing and handover needed to achieve operational readiness
- Clean-up and restoration: works to stabilise, reinstate and rehabilitate temporary works areas.

The tunnel construction timeline of approximately four years, includes the procurement and set up of the tunnel boring machine (TBM), which is approximately 12 months. The construction phase of the tunnel including cut and cover, and mined tunnel construction (at the eastern tunnel portal) and the operation of the TBM is expected to be approximately 24 months. Following the tunnel construction phase, decommissioning of the TBM and fit-out of

the tunnel and associated buildings will occur. The duration of the tunnelling activities, particularly for the TBM will be dependent on the type of TBM procured for the Project during detailed design.

Tunnel construction

The proposed tunnel will be constructed through the Toowoomba Range and will be approximately 6.24 km long and has a maximum cover of approximately 220 m. The tunnel has a bored diameter of approximately 12.2 m and a finished internal diameter of approximately 10.8 m.

The Toowoomba Range Tunnel will intersect the following geological units:

- Tertiary age Main Range Volcanics consisting mainly of basalt
- Undifferentiated Tertiary Sediments
- In-filled Paleo Valley sediments consisting of basalts, tuffs, sandstones to mudstones
- Jurassic sandstones and siltstones of the Koukandowie Formation
- Basaltic colluvium mainly on the eastern side of the range and
- Quaternary alluvium.

The suitability and extent of the material intercepted by the Toowoomba Range Tunnel cannot be estimated with accuracy due to the variable nature of basalt flows deposited on the undulating Jurassic sedimentary paleo topography.

The construction methodology is based on a shielded TBM, allowing for undrained construction. It is expected that the TBM will be driven from west to east mainly due to availability of early access to the portal, an appropriate road network, and the availability of power supply. The western tunnel portal is also located in terrain more conducive to the use of a TBM as the land can readily accommodate the setup and operation of the TBM.

The presence of the colluvial sediments at the eastern tunnel portal represents a significant risk for the construction of the tunnel, and therefore a mined tunnel and cut and cover construction method is anticipated. This approach will establish the portal and a section of tunnel (less than 500 m) before the TBM finishes the tunnel.

The cut and cover approach is preferred due to the steep terrain and presence of colluvium geometry, with a driven tunnel requiring longer and wider excavations to obtain a stable face, which will also be prone to future landslides, compared to the cut and cover approach. The cut and cover section will include contiguous bored pile walls and a roof slab, with seepage likely to occur (i.e. drained structure).

The mined tunnel and cut and cover construction method approach will establish the eastern tunnel portal and a section of tunnel (approximately 700 m) before the TBM finishes the tunnel. That is the TBM will breakthrough into the mined tunnel and continue to erect the segmental lining as it pushes forward with the annulus between the segmental lining and the mined tunnel to be grouted as soon as possible to provide support and waterproofing. The TBM is planned to be removed following construction.

The duration of the tunnelling activities, particularly for the TBM is not known at this stage of the Project and will be dependent on the type of TBM procured for the Project during detailed design.

Excavation by TBM's in Sydney Sandstone (double shield) resulted in an average advance rate in the order of 15-20 m/day with peak performances up to 30 m/day (Camus et al, 2015). When tunnelling underneath the Sydney Harbour (clay with high water pressure), the average advance rate reduced to 8 m/day (**tunneltalk.com**). Jain et al. (2013) noted low advance rates in porphyritic basalt (7 m/day) due to their very high strength, which have similar properties to the basalts likely to be encountered during the excavation of the Toowoomba Range Tunnel.

For the purposes of the EIS it is assumed that a slurry TBM will be used due to the groundwater conditions and that the excavation rate for the TBM is 10.5 m/day and 1.7 m/day for the mined tunnel area.

Construction hours

The construction program will be based on the following worksite hours (unless approved otherwise):

- 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 holiday
- Tunnel construction activities

- 24-hours a day, 7-days a week.

- Track possessions will proceed on a 7 day/24-hour calendar basis.

QR and ARTC track possessions will generally be allocated over weekend periods, with extended track possessions occurring over holiday or non-seasonal periods (i.e. outside of grain movement periods).

Works outside of standard construction hours will occur throughout the duration of the construction program and may be required for activities such as:

- Works in a rail corridor associated with track possessions including tamping, ballast profiling, earthworks and formation works
- Delivery of concrete, steel, and other construction materials delivered to site by heavy vehicles
- Movements of heavy plant and materials. Arrival and departure of construction staff during shift change-overs
- Roadworks to arterial roads
- Traffic control crews, including large truck mounted crash attenuator vehicles, medium rigid vehicles, and lighting towers
- Emergency works and incident response including tow-trucks for light, medium, and heavy vehicles
- Various low intensity activities.

Construction workforce

Construction of the Project is expected to require a workforce of up to 596 full-time equivalent (FTE) personnel. Throughout the course of the assumed construction period, the average number of FTE workers required is approximately 264 persons.

The size and composition of the construction workforce will vary depending on the construction activities being undertaken and the staging strategy adopted. The core construction workforce will consist of professional staff, supervisors, trades workers and plant operators, with earthworks crews, bridge structure teams, capping and track-works crews working at different periods through the construction period.

Accommodation camps for the construction workforce are not expected to be required for the Project. It is anticipated that the construction and operation workforce would be sourced locally and/or accommodated in the Toowoomba and Lockyer Valley region, with some specialist skills and technical expertise expected to be sought intra- or interstate and potentially internationally (e.g. tunnelling crew).

The Project is part of the larger Inland Rail Program. The Inland Rail Program is expected to generate more than 21,500 at the peak of construction jobs with an average of 800 jobs per annum over the 10-year construction period., with 700 ongoing jobs during operations (ARTC, 2015a).

Commissioning

All construction works will be subject to approved Testing and Commissioning Plans, as required, and appropriate Inspection and Test Plans. Final testing and commissioning (checking) of the track and systems is programmed for approximately six months after the completion of construction works.

Testing and commissioning 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 operational requirement.

For the connections to the existing QR and ARTC networks, a rail systems testing and commissioning plan will be required and must include the existing QR and ARTC signalling system and also be approved by ARTC and QR. 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.

Operation

The Project would be ready for operation once the adjoining H2C and B2G projects are complete, which is anticipated to be in 2027. Inland Rail as a whole will be operational once all 13 Inland Rail projects are complete, which is also anticipated to be in 2027. Depending on timing, this section of the Program may allow access for local traffic (i.e. access to the QR network) prior to full delivery of the Program.

The Project will form part of the rail network managed and maintained by ARTC, which currently includes 8,500 route km of track in NSW, Queensland, South Australia, Victoria and Western Australia. Inland Rail will be an

open access rail service, meaning ARTC will not run trains directly but will allow access to the rail line by rail operators.

Operational train modelling for the Project estimates that the Gowrie to Helidon section of Inland Rail will involve an annual average of approximately 33 train services per day in 2027. This is likely to increase to approximately 47 train services per day in 2040. The hours of operation are anticipated to be 24-hours a day, 7-days a week.

Train services will be provided by a variety of rail operators and will be a mix of grain, bulk freight, livestock, coal, other general transport services, along with the Westlander passenger service. The future use of the Project alignment by passenger trains would be dependent on the rail operators ensuring that the train configurations are suitable to use the alignment, including the current tunnel design, noting that the Project basis of the design is for freight services

The trains services per day includes the existing traffic on the QR West Moreton System. The majority (in the order of 24 per day) of these current train services consist of coal trains with two freight services from the South Western System (i.e. do not operate on the Western Line). The proposed spur line allows trains to access Toowoomba from Project alignment, including the South Western System and trains requiring access to Toowoomba (e.g. Westlander and coal trains accessing Willowburn Rail Facility). The spur line also allows for trains from Toowoomba to access Brisbane via the Project alignment. It is expected that the source of the train services will be evenly split across both the ARTC and QR Networks in 2040. This is in response to the Project alignment catering for larger train sizes and axle loads, reducing the likely number of coal services per day, while allowing for additional agricultural rail movements along the QR Network.

Train control will be managed via ARTC's existing control centres, with a new control centre proposed at the western tunnel portal to manage tunnel operations (refer Figure 9). The safe working systems, including the Australian Train Management System, a digital train management solution with real-time monitoring of trains with GPS and mobile technology, will support ARTC's objectives of improving rail network capacity, operational flexibility, train service availability, transit times, rail safety and system reliability.

Train movements within this section of the QR Network are controlled and communicated via QR's Control Centre in Brisbane, while the corresponding signalling system is Direct Traffic Control.

Interfaces between the ARTC and QR Network, including signalling systems will be subject to detailed discussions between ARTC and QR during detailed design.

Annual freight tonnages are also anticipated to increase in parallel, from approximately 39 million tonnes per year in 2027 to 59 million tonnes per year in 2040 (ARTC, 2015a).

FIGURE 9: SCHEMATIC OF THE PROPOSED WESTERN TUNNEL PORTAL, WITH A TRAIN ENTERING THE VENTILATION BUILDING

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 rail 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 and clearing/slashing rail corridor
- Major periodic maintenance such as ballast cleaning, formation works, reconditioning of track, adjustment, turnout replacement and correction of track level and line.

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

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. 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 plan, which would be developed in consultation with relevant stakeholders and regulatory authorities.

Community and stakeholder consultation

A project of this size and significance requires a far-reaching communication and stakeholder engagement approach to provide opportunities for involvement at all levels.

Input from a variety of key stakeholders and community members has been and will continue to be required to understand constraints, values and impacts.

The overarching purpose of the community and stakeholder engagement program is to:

- Raise awareness about the Project, including the need for the Project, its benefits and the process undertaken to develop the design and EIS
- Verify the appropriateness of assessment methodologies adopted for the EIS
- Provide stakeholders with opportunities to inform investigations being undertaken for the design and EIS about local values and issues
- Inform government agencies, stakeholders and the community about the progress of the Project and to seek their input into the development of the design and EIS
- Understand stakeholder and community issues and where possible address any issues raised.

Key assessment methodologies adopted for the purpose of this EIS have been presented to, and discussed with, relevant regulatory agencies.

Stakeholder and community feedback and comments received from the consultation process has informed the preparation of the EIS including:

- Identification of community values and local conditions in proximity to the Project
- Assessment of potential benefits and impacts of the Project's construction and operation
- Identification of strategies to minimise or avoid potential impacts and maximise or enhance potential Project benefits.

The consultation program was structured to inform individuals and groups directly and indirectly affected by the Project. The process was also structured to allow input from:

- Stakeholder groups with specific interests in the Project, such as Traditional Owners, community groups (via Community Consultative Committee meetings (members and observers), and ARTC's online Social PinPoint and CollabMap tools) and industry associations
- Queensland government agencies, local governments, including those with either a regulatory or an advisory role in the design, construction or operation of the Project.

Community and stakeholder consultation will continue throughout the life of the Project.

A Community and Stakeholder Engagement Plan will be developed to guide and monitor future engagement activities, in accordance with the Community and Stakeholder Engagement Action Plan within the Social Impact Management Plan (SIMP). The Community and Stakeholder Engagement Plan will:

- Establish and maintain engagement mechanisms which build relationships between the Proponent and its stakeholders, and enable adaptive management of impacts on amenity, connectivity and community values during construction
- Support adaptive management of impacts on amenity, connectivity and values during construction
- Support mitigation of impacts on amenity, community cohesion and local character through stakeholder engagement and in partnership with community and government stakeholders
- Enable implementation of the measures identified in the SIMP to address:
  - cultural landscapes, land acquisition, amenity and lifestyle, disadvantage and community cohesion, connectivity and pedestrian safety during detailed design
  - amenity and lifestyle, connectivity and sense of place during pre-construction
  - residential amenity, cultural landscapes, connectivity and pedestrian traffic safety, sense of place/ local character during construction.

Sustainability

In recognition of the role the Inland Rail Program has in demonstrating sustainability leadership, ARTC has developed an Environment and Sustainability Policy. The sustainability commitments embedded into the Environment and Sustainability Policy have guided the Project's approach to sustainability and are supported by identified targets for Inland Rail projects as part of the program-wide Sustainability Strategy. This includes the implementation of a Sustainability Management Plan for the Project, and the pursuit of an 'Excellent' rating against version 1.2 of the Infrastructure Sustainability Council of Australia's Infrastructure Sustainability rating scheme for the Program.

Key findings of the environmental impact statement

Land use and tenure

The Project generally follows the existing QR West Moreton System rail corridor and the Gowrie to Grandchester future state transport corridor, complying with the Queensland Government State Planning Policy (SPP) and state interests relevant to transport infrastructures.

Land use in proximity to the Project predominantly comprises grazing land, together with other agricultural uses including cropping, irrigated seasonal horticulture. Other land uses include residential, other minimal use areas (e.g. residual native vegetation) and services. Notable land uses in proximity to the Project include recreational and commercial use areas as well as uses of state significance, such as the Wetalla Wastewater Treatment Plant, Baillie Henderson Hospital, Harlaxton Key Resource Area, Withcott Quarry, Withcott Seedlings and the Helidon Magazine Reserve. The Project also traverses infrastructure, including highways, main roads, local roads, gas pipelines and other utilities.

Between Gowrie and Helidon and excluding untenured land (such as waterways and road reserves) the Project traverses 151 land parcels, including 94 within the TRC LGA and 57 within LVRC LGA. The Project also intersects 41 interests including easements, six strata parcels and two volumetric parcels associated with the Toowoomba Second Range Crossing pilot tunnel. Of the 151 land parcels:

- The Project traverses 20 land parcels (13 per cent) associated with the existing West Moreton System rail corridor, including the Toowoomba Range Tunnel passing under a property on Western Line and the Main Line. Ten of these land parcels are also within the Gowrie to Grandchester future state transport corridor
- 82 land parcels (54 per cent) are located within the Gowrie to Grandchester future state transport corridor, including 28 land parcels associated with the Toowoomba Range Tunnel
- 59 land parcels (39 per cent) are located outside of both the West Moreton System rail corridor and the Gowrie to Grandchester future state transport corridor, including seven land parcels associated with the Toowoomba Range Tunnel.

Land tenure within the Project is predominately freehold, and lands lease where the existing West Moreton System rail corridor is to be used. The Project is located within one native title claim area. This claim, which is registered for the Yuggera Ugarapul People, is yet to be determined by the National Native Title Tribunal.

The construction and operation of the Project has the potential to result in adverse direct and permanent impacts to land use and tenure within the Project disturbance footprint, and indirect impacts on the land use study area. Potential impacts include:

- Changes in tenure and loss of property
- Disruption to land over which native title has not been extinguished or suppressed
- Change in land use, including the sterilisation of agricultural land and disruption to agricultural practices
- Impacts to accessibility within the land use study area, including impacts to the existing road network and to property access
- Disruption to services and utilities.

The Project is also likely to result in a number of benefits to land use: supporting future industries, improving access to and from regional markets, and acting as a catalyst for development in the area.

There are 109 land parcels required for the rail and road infrastructure (i.e. the permanent disturbance footprint), with 21 land parcels entirely within the permanent disturbance footprint. This includes 15 land parcels associated with the existing Queensland Rail West Moreton System rail corridor and 6 freehold land parcels (2 owned by DTMR at the intermediate ventilation shaft). Noting that an additional 12 freehold land parcels are only required for construction.

In addition to the aboveground acquisition, 36 land parcels will require volumetric acquisition as the Project passes beneath each of the land parcels when within the proposed Toowoomba Range Tunnel. Locations where volumetric tenure is required include Gowrie Junction, Cranley, Mount Kynoch and Ballard, including residential properties, grazing properties, land owned by TRC and DTMR, land owned by businesses and development companies, a property owned by Teen Care Challenge Queensland Inc., a reserve for recreation and drainage (TRC is the trustee) and a reserve currently used by the Toowoomba Horse Riding for the Disabled Association, with TRC the trustee.

Further, 28 of these land parcels have also previously been identified as potentially impacted properties through the *Gowrie to Grandchester Rail Corridor Study* (Queensland Rail and Queensland Transport, 2003), 12 of which have been acquired, including where the western tunnel portal is located, 7 land parcels associated with the Toowoomba Bypass and 3 land parcels where the intermediate ventilation shaft is located.

The other 8 properties (7 freehold and 1 reserve), which include residential housing along Westview Drive, Cassidy Terrace and McShane Driver at Mount Kynoch, are subject to volumetric acquisition as a result of the provisional area around the tunnel (i.e. the tunnel is not directly below these properties).

A summary of land required for the permanent disturbance footprint is provided in Table 3. The extent of area associated with these properties within the permanent disturbance footprint, as well as tenure and existing land uses of these properties, are detailed in Appendix V: Impacted Properties. The properties identified will be confirmed following detailed design.

A number of properties are held in ownership by QR (26 properties, with 20 associated within the West Moreton System), DTMR (35 properties, mainly associated with the Toowoomba Bypass) or TRC (three properties). In addition to the lots held by QR, DTMR or TRC, partial and full acquisition of freehold lots will be required. The acquisition process will be undertaken by, and in consultation with, the Constructing Authority. The land resumption process will only commence once the Project is approved and all or part of a property is identified as directly affected by the Project works.

TABLE 3: LAND REQUIRED FOR THE PERMANENT DISTURBANCE FOOTPRINT

Tenure and ownership	No. of properties within permanent disturbance footprint
Properties within permanent disturbance footprint, also within the existing QR West Moreton System rail corridor (surface acquisition)	
Lands lease	18
Properties within permanent disturbance footprint, also within Gowrie to Grandchester future state transport corridor (surface acquisition)	
Freehold	45

Tenure and ownership	No. of properties within permanent disturbance footprint
Lands lease	3
Properties within permanent disturbance footprint, outside of Gowrie to Grandchester future state transport corridor and outside of existing QR West Moreton System rail corridor (surface acquisition)	
Freehold	40
Lands lease	3
Properties within the proposed Toowoomba Range Tunnel corridor (Volumetric acquisition)	
Freehold	26 (excluding 6 properties where surface acquisition is also required))
Lands lease	2
Reserve	2

Table notes:

Lands lease: land held by the state, where leases are issued for several purposes including pastoral, grazing and commercial or industrial purposes, or where land is leased to the State for a rail transport purpose.

Freehold: land is alienated from the state and the ownership rests with the owner as an estate in fee simple and is dealt with under *the Land Title Act 1994* (Qld).

Reserve: land that has been dedicated as a reserve for a public or community purpose.

State Land: land that is unallocated state land.

The Project will potentially interact with 184 public and private utilities, including electrical, communication and water. The proposed Toowoomba Range Tunnel passes approximately 120 m beneath the Roma Brisbane Gas Pipeline at Cranley, with the alignment also crossing the pipeline at Ballard and Helidon Spa/Heldion.

Consultation with affected landholders, relevant stakeholders and communities has been key to obtaining an understanding of individual property operational arrangements in proximity to the Project. The rail alignment has been positioned to align with existing road and rail corridors, the Gowrie to Grandchester future state transport corridor and property boundaries, where possible, to reduce the severance of land parcels, and reduce potential property impacts particularly in relation to private access, services or agricultural operational arrangements.

A number of land use planning instruments have been considered in the EIS including the Queensland Government State Planning Policy (SPP) (2017), *Darling Downs Regional Plan* (Department of State Development, Infrastructure and Planning, 2013) and *South East Queensland Regional Plan 2017—ShapingSEQ* (DILGP, 2017a). The Project has been recognised within the SPP, *Darling Downs Regional Plan*, and *ShapingSEQ* as region shaping infrastructure, and its design aligns with the land use intent and relevant land use planning principles of these instruments.

Where impacts cannot be avoided, mitigation measures have been proposed to reduce and manage the potential impacts of the Project. ARTC will undertake consultation with property owners and occupants, utility providers and resource holders to identify individual property mitigation measures and reduce the potential impacts to an acceptable and/or agreeable level. Where land is temporarily required outside of the permanent disturbance footprint, the land will be rehabilitated where applicable in accordance with a rehabilitation strategy and the relevant landholder agreement. To address potential impacts on the road network during construction, a Traffic Management Plan will be developed and implemented within the CEMP for the Project.

Land resources

The landscape from Gowrie approaching the Great Dividing Range consists of a gentle incline before reaching a peak elevation of approximately 644.5 m Australian Height Datum (AHD), as the alignment traverses under the New England Highway and Toowoomba Bypass at Mount Kynoch at a depth of approximately 200 m. A steep drop (the Great Escarpment) in elevation occurs after the alignment passes the Great Dividing Range to the east with periodic and isolated peaks featuring with reducing elevation as the alignment reaches Helidon. The lowest elevation for the rail alignment occurs at Lockyer Creek, 1 km to the west of Helidon, with an approximate elevation of 148.5 m AHD.

The geology of the Project corridor comprises rocks and sediments of the Clarence–Moreton Basin, which unconformably overlay the basement rocks. Eight geological layers were found to underlie the EIS investigation corridor between Gowrie and Helidon, which reflect the history and topography of the area that was the centre for volcanic activity during the Tertiary era with large quantities of basaltic lava covering a landscape of flat-lying Mesozoic sedimentary rock (Thompson & Beckmann, 1959).

The existing environment for the Project was investigated, and the Project's impact on land resources assessed through a desktop assessment of existing information together with field assessments. The existing environment, the risks arising from disturbance and excavation of land, as well as the disposal of soil were evaluated. A quantitative and qualitative risk assessment of soil properties, including agricultural and problematic soils, and contaminated land was also undertaken.

The assessment identified the following in the content of existing land resource aspects:

- High variability in soil type along the land resources study area, with seven distinct soil types identified as occurring—vertosols, dermosols, ferrosols, hydrosols, chromosols, rudosols and sodosols
- Geotechnical investigations, which included site walkovers and geotechnical sampling, did not identify the presence of acid sulfate soils or acid rock
- A range of soil textures exist within the land resources study area, with an even mixture of heavy clay to clay loam featuring between Gowrie and the Great Dividing Range, while beyond the Great Dividing Range, predominantly heavy clays becoming loams of silt or sandy clay typically feature
- There is generally a medium to high potential of salinity occurring within the land resources study area.

A desktop assessment of contaminated land together with some targeted identified potential sources of contamination in the vicinity of the Project, including agricultural activities, quarries, landfilling and waste disposal, existing and former rail corridors, road crossings, housing/sheds and unknown fill material. A number of properties within the Project disturbance footprint are listed on the Environmental Management Register (EMR), this includes the Toowoomba Waste Management Centre which the Project passes under and a number of land parcels associated with the West Moreton System (i.e. hazardous contaminant and a railway yard).

QR also notes, that due to the previously agreed approach to listing rail corridor parcels by the applicable regulator (for hazardous contaminants associated with arsenic herbicide use), some rail corridor parcels may not be listed on the EMR but have the potential for contamination due to similar historic land use. No exceedances of the guidelines for commercial or industrial settings were noted during the contaminated land surveys within the rail corridor, including the lots listed on the EMR. While discussions with TRC indicated that there was negligible risk from the leachates from.

A search of the Department of Defence online mapping for unexploded ordnances (UXOs) identified two areas of UXO categorised as 'other' (that is, land that has been used for military training but not confirmed as a site where life firing was undertaken), one intersected by the Project at Ballard, and the second located adjacent to the Project disturbance footprint, north of Helidon at the Queensland Government Explosives Reserve. The Project also passes through the former Mount Lofty Rifle Range where there is a low risk of UXOs being present.

Potential impacts of the Project on land resources include:

- A permanent change in landform and topography in catchments, influencing their ability to retain and move water
- Loss of natural soil resources including Class A and Class B agricultural land, and Important Agricultural Areas (IAAs)
- Unexpected encounter of acid sulfate soils or acid rock
- Introduction of weeds, which may change physical and chemical properties of soil
- Feral animal impedance
- Increased salinity of the landscape causing water table salting, irrigation water salting and erosion scalding
- Disturbance of contaminated land (soil and groundwater)
- Project activities leading to the generation of new contaminated land (soil and groundwater).

The quantitative and qualitative risk assessment identified change to landform and topography, loss of soil resources and disturbance of existing contaminated land during the construction phase of the Project to present a medium residual risk.

Soil conditions across the Project disturbance footprint will be appropriately characterised at an acceptable suitable scale by a qualified soil practitioner through additional geotechnical surveys during the detailed design phase of the Project to inform design and environmental management measures. Subject to land access, the soil sampling will be of an intensity to enable mapping at a 1:10,000 scale. Soil investigations 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). This sampling will include identification of potential and actual acid sulfate soils, acid rock,

reactive soils, erosive soils, dispersive soils, salinity, acidic soils, alkaline soils, wetness, depth and contaminated land.

The viability of material to be reused will be assessed as per the ARTC Earthworks Material Specification and the Earthworks and Material Management Framework, including potential environmental harm from the material and the extent of material that may need treatment.

For work activities undertaken within the property identified on the EMR within the Project disturbance footprint or for any other sites identified, a Contaminated Land Management Strategy and Contaminated Site Management Plan will be implemented to reduce the risk of adverse impacts to surrounding environments. A contaminated and hazardous materials survey will be undertaken prior to the demolition of structures (e.g. sheds, housing/buildings). In the event that hazardous materials are identified, a Contaminated and Hazardous Materials Management Plan will be developed and implemented. To mitigate issues of soil and land conservation, an Erosion and Sediment Control Plan, prepared by a Certified Professional in Erosion and Sediment Control in accordance with the International Erosion Control Association (ICEA) Best Practice Erosion and Sediment Control (ICEA, 2008) will be implemented.

Landscape and visual amenity

A Landscape and Visual Impact Assessment (LVIA) was undertaken in accordance with the ToR and relevant standards and guidelines. The assessment describes the existing landscape or visual values of the LVIA study area (a 10 km buffer around the Project) and identifies landscape, views and visual receptors likely to experience impacts on these landscape and visual values from the Project. The assessment also identifies key Project risks to the landscape and visual values, evaluates the significance of any impacts on landscape, views and visual receptors and outlines proposed mitigation and management measures.

The landscape and visual impact assessment was investigated through a desktop analysis and field work, analysis of geographical information systems, visibility analysis mapping and the preparation of illustrative cross-sections and visualisations. The landscape surrounding the Project is highly varied, comprising irrigated agriculture and dry croplands and pastures interspersed with a network of creeks through the Toowoomba Plateau, with densely vegetated landscapes associated with the Great Dividing Range. The West Moreton System rail corridor and Toowoomba Bypass are significant linear features present in parts of the LVIA study area

The key landscape and visual impacts of the Project relate to the removal of vegetation, the raising of embankments and the creation of new rail bridges and viaducts up to 45 m high. Eight landscape character types (LCTs) have been identified throughout the LVIA study area, of which seven are potentially affected by the Project with impacts of up to Major significance on the landscape character and amenity of one LCT: LCT G: Forested Uplands. This is due in part to the Project being primarily situated in this LCT, and the LCT being the dominant LCT in the LVIA study area.

Impacts of up to Moderate significance were identified for four LCTs: LCT C: Dry Croplands and Pastures; LCT D: Vegetated Grazing; LCT E: Rural Settlement; and LCT F: Rural Living. These impacts relate to direct impacts of cuts and embankments on the rural landscape and the settling of landscape areas.

For part of the LVIA study area there are relatively few visual receptors with the landscape comprising isolated farmsteads set on large private farms. However, the landscape around Toowoomba is quite densely settled, with numerous settlements located within the potential viewshed of the Project. This includes suburbs to the north and east of Toowoomba, Gowrie Mountain, Gowrie Junction, Kingsthorpe, Withcott, Postmans Ridge, Helidon Spa and Helidon. Visual impacts are typically contained by the presence of vegetation, including along creek lines, and localised undulations in landform. Visual impacts are also contained through the use of a tunnel for a significant length of the Project. Elevated and panoramic views over the Project are also available from the edge of Toowoomba and the Forested Uplands associated with the Toowoomba Range, including from lookouts and walking trails around Picnic Point and from parts of the Toowoomba Bypass.

As part of the LVIA, 20 representative viewpoints were selected and assessed for both the construction and operational phases of the Project.

During construction, the greatest visual impact identified was up to High significance, relating to three viewpoints: Viewpoint 13: Keira Court, Blue Mountain Heights looking south-east; Viewpoint 14: Katoomba Point Lookout, Prince Henry Heights looking north; and Viewpoint 15: Looking north-east from Picnic Point Lookout within Picnic Point Parklands, Rangeville. Other impacts of up to Moderate significance are anticipated at seven other viewpoints.

For visual impacts during operation, seven visual impacts of up to High significance were identified. These are associated with Viewpoint 4: near 10 Paulsens Road, Gowrie, looking southwest towards Gowrie Junction Road bridge; Viewpoint 5: near 14 Junction Street, Gowrie, looking east towards the western tunnel portal; Viewpoint 13: Looking south-east from Keira Court, Blue Mountain Heights; Viewpoint 14: Looking north from Katoomba Point Lookout on Prince Henry Drive, Prince Henry Heights; Viewpoint 15: Looking north-east from Picnic Point Lookout within Picnic Point Parklands, Rangeville; Viewpoint 17: Warrego Highway near Gittins Road, Postmans Ridge, looking west; and Viewpoint 18: Murphys Creek Road near Toowoomba Bypass, looking north. These impacts relate to elevated views from significant locations over the wider Project and/or viewpoints situated in close proximity to the Project. Other visual impacts during both construction and operation are of lower significance, typically relating to views experienced by relatively small numbers of homesteads or with a lower magnitude of change to the existing view.

Three viewpoints will experience visual impacts of up to High significance during construction and operations: Viewpoint 13: looking south-east from Keira Court, Blue Mountain Heights; Viewpoint 14: looking north from Katoomba Point Lookout on Prince Henry Drive, Prince Henry Heights; Viewpoint 15: looking north-east from Picnic Point Lookout within Picnic Point Parklands, Rangeville. These viewpoints are located on top of the Great Dividing Range overlooking Lockyer Valley, where the Project is predominantly located.

For lighting impacts, the most significant effect during construction is up to Moderate for Viewpoint 8: looking west from Boundary Street bridge over the Toowoomba Bypass. Further, the greatest impact identified during operation is up to Low significance for 13 viewpoints.

Landscaping and rehabilitation of disturbed areas will be undertaken in accordance with the Project's landscape design, Reinstatement and Rehabilitation Plan and the Landscape and Rehabilitation Management Plan, which will define performance criteria required from rehabilitation.

Flora and fauna

The Project is situated within the South-East Queensland and Brigalow Belt bioregions, which have experienced a long history of human disturbance as a result of agricultural practices, urban development and resource development. At a regional level, large tracts of remnant vegetation are typically fragmented, occurring in the areas that are less attractive to development (i.e. rocky ranges, sloping topography) and roadside vegetation, or as relatively small, isolated patches subject to edge-related impacts.

The Project disturbance footprint intersects a variety of landscapes from the agricultural areas on top of the Toowoomba Plateau to the forested foothills of the Great Dividing Range.

During the surveys works, 274 plant species were identified within the ecology study area during Project EIS field assessments. This included a total of 202 (74 per cent) native species and 72 (26 per cent) non-native species. Of these species, one species is listed as threatened under the provisions of the EPBC Act and the *Nature Conservation Act 1992* (Qld) (NC Act), with three other threatened plant species listed under the NC Act.

- Brush Sophora (*Sophora fraseri*)—Vulnerable under the EPBC Act and NC Act
- Finger Panic (*Digitaria porrecta*)—Near threatened under the NC Act
- A tufted grass (*Cyperus clarus)*—Vulnerable under the NC Act
- Slender milkvine (*Marsdenia coronata*)—Vulnerable under the NC Act.

Seventeen restricted matters under the *Biosecurity Act 2016* (Qld) were also identified, with weed infestation prevalent along the Escarpment area in the vicinity of the eastern tunnel portal.

During the surveys works, 102 fauna species were detected, including 99 (97 per cent) native species and three (3 per cent) non-native species, two of which are a restricted matter. Recorded species consisted of 75 birds, 21 mammals, eight reptiles and one frog. Only two threatened fauna species were detected during field surveys, although there was evidence of habitat for a number of other threatened fauna species found during the field surveys.

The threatened species that have been identified from the ecology study area, consist of the following:

- Koala (*Phascolarctos cinereus*)—Vulnerable under the EPBC Act and the NC Act
- Collared Delma (*Delma torquata*)—Vulnerable under the EPBC Act and the NC Act.
- Five Special Least Concern species under the NC Act were also detected during the surveys.

There is one Threatened Ecological Community (TECs) listed under the EPBC Act confirmed as present within the ecology study area and a further two TECs potentially occurring. No TECs are located within the Project disturbance footprint.

A number of 'Endangered', 'Of concern' and 'Least concern' regional ecosystems (REs) are also present within the ecology study area, which are protected under the *Vegetation Management Act 1999* (Qld) (VM Act). Other sensitive environmental receptors, including protected areas, high-value regrowth vegetation and bioregional corridors (of local, regional and state significant) also occur within the ecology study area.

Wetland habitats were depauperate across the ecology study area and were mainly associated with riverine habitat and constructed waterbodies. There is, however, 13.5 lineal km of watercourse within the footprint, although the majority are drainage lines under the *Water Act 2000* (Qld) or are not mapped as waterways under the *Fisheries Act 1994* (Qld). With the Project design incorporating viaducts over the floodplains of Oaky Creek, Six Mile Creek and Lockyer Creek, and a bridge over Gowrie Creek.

For the purposes of the impact assessment, a sensitive environmental receptor is one that constitutes a MNES (as defined by the EPBC Act) or a Matter of State Environmental Significance (MSES) (as defined by the Queensland E*nvironmental Offsets Regulation 2014* (Qld)) (e.g. regulated vegetation, threatened species as listed under the provisions of the NC Act, wetlands.).

The sensitive environmental receptors (i.e. MNES and MSES) 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.

The nature of each unmitigated potential impact was considered in relation to the identified sensitive environmental receptors to derive an initial assessment of impact significance for the Project by assigning sensitivity and magnitude ratings. The impacts considered included, but were not limited to, habitat loss and degradation from vegetation clearing/removal, edge effects, habitat fragmentation, barrier effects, aquatic habitat degradation and tunnelling activities.

These ratings were then allocated a significance via a significance assessment matrix. The potential impacts on the sensitive environmental receptors were then assigned a major, high, moderate, low or negligible rating. The proposed avoidance and mitigation measures for the Project were identified to reduce the significance of the potential impacts on the sensitive environmental receptors. After applying the mitigation hierarchy (i.e. avoid, minimise, mitigate), which included a range of mitigation measures and management plans, the impacts to the identified sensitive environmental receptors were generally reduced.

Following an initial impact assessment and the application of mitigation measures, each sensitive environmental receptor (where applicable) was analysed to determine if the Project would result in significant residual impact in accordance with the relevant Commonwealth or State significant impact guideline.

In accordance with the outcomes of the MNES significant impact guideline, it is anticipated that there is potential for the Project to result in significant residual impacts for the following listed threatened species. Noting that the assessment considered a range of impacts not just the habitat loss, with the numbers provided to inform offset requirements:

- Flora
  - Brush sophora (*Sophora fraseri*)—2.36 ha of *Habitat critical to the survival of the species*
- Fauna
  - Red goshawk (*Erythrotriorchis radiatus*)—84.79 ha of *Habitat critical to the survival of the species*
  - Swift parrot (*Lathamus discolor*)—8.54 ha of *Habitat critical to the survival of the species*
  - Australian painted snipe (*Rostratula australis*)—8.9 ha of *Habitat critical to the survival of the species*
  - Black-breasted button-quail (*Turnix melanogaster*)—9.18 ha to *Habitat critical to the survival of the species.*
  - Spotted-tail quoll (*Dasyurus maculatus maculatus*)—24.46 ha of Habitat critical to the survival of the species
  - Koala (*Phascolarctos cinereus*)—189.01 ha of *Habitat critical to the survival of the species* and 70.6 ha of potential habitat
  - Grey-headed flying-fox (*Pteropus poliocephalus*)—201.19 ha of *Habitat critical to the survival of the species*
  - Collared delma (*Delma torquata*)—197.41 ha of I*mportant habitat for the species*

Habitat for a number of other threatened flora and fauna species is present within the Project disturbance footprint (modelled and ground-truthed); however, the loss of habitat and impacts from fragmentation and barrier effects currently do not constitute a significant residual impact. This impact includes on two flora species where there are known records in the Project disturbance footprint:

- *Picris evae* (A hawkweed)
- Austral cornflower (*Rhaponticum australe*).

Other species where the assessment indicates a potential for a significant residual impact include the Four-tailed grevillea (*Grevillea quadricauda*), New Holland mouse (*Pseudomys novaehollandiae*) and Condamine earless dragon (*Tympanocryptis condaminensis*).

Assessment of prescribed MSES was undertaken in accordance with the MSES significant impact criteria. Analysis indicates that the Project is likely to result in significant residual impacts to the following sensitive environmental receptors, with all remaining sensitive environmental receptors unlikely to be subject to a significant residual impact in accordance with the SRI guidelines:

- 'Endangered' REs: 9.8 ha
- 'Of Concern' REs: 89.62 ha
- Remnant vegetation within the defined distance of a watercourse: 4.30 ha
- MSES Wildlife habitat: 105.66 ha
- Essential Habitat (EH) under the *Vegetation Management Act 1999* (Qld): 112.36 ha
- Connectivity areas 128.7 ha
- Protected wildlife habitat for the following NC Act listed conservation significant flora and fauna species:
  - Glossy Black-cockatoo (*Calyptorhynchus lathami lathami*): 21.58 ha
  - Powerful owl (*Ninox strenua*): 99.05 ha
  - Bailey's Cypress (*Callitris baileyi*): 108.47 ha
  - Finger Panic grass (*Digitaria porrecta*): 49.47 ha
  - Slender milkvine (*Marsdenia coronata*): 51.02 ha
- Nature Conservation (Koala) Conservation Plan (2017) areas:
  - Koala Habitat Areas: 213.73 ha.

Additional ecological surveys in accordance with Australian Government and Queensland Government guidelines are currently being undertaken to confirm the assessment and address known gaps in the approach (e.g. shift in the Project alignment subsequent to surveys). These additional works will inform relevant approvals and management plans, along with necessary offset requirements and disturbance limits.

An offset strategy for the Project, which also incorporates the other Queensland Inland Rail projects, has been developed to offset impacts on MNES and MSES (Appendix Y: ARTC Offset Strategy). This Strategy informs the development of offset delivery components including a Detailed Environmental Offset Delivery Plan and Offset Area Management Plans.

The significance of the predicted cumulative impact as a result of the Project added to the seven other similar projects that occur within 50 km of the Project boundary are likely to be higher on the following sensitive environmental receptors:

- EPBC Act listed, non-threatened migratory species:
  - Black-faced Monarch (*Monarcha melanopsis*)
- NC Act listed species habitat:
  - Slender milkvine (*Marsdenia coronata*), Finger panic grass (*Digitaria porrecta*) and Platypus (*Ornithorhynchus anatinus*)
- MNES flora and fauna species habitat:

- *Paspalidium grandispiculatum* (a grass), Brush sophora (*Sophora fraseri*), Regent honeyeater (*Anthochaera phrygia*), Collared delma (*Delma torquata*), Red goshawk (*Erythrotriorchis radiatus*), Grey falcon (*Falco hypoleucos*), Swift parrot (*Lathamus discolor*), Spotted-tail quoll (*Dasyurus maculatus maculatus*), Koala (*Phascolarctos cinereus*), Long-nosed potoroo (*Potorous tridactylus tridactylus*),and Grey-headed flying-fox (*Pteropus poliocephalus*).

Air quality

An air quality impact assessment (AQIA) was undertaken to assess air quality emissions from the Project during construction, commissioning, and operation. Emissions from the Project during construction were assessed qualitatively through a review of anticipated construction activities, plant and equipment. Further, a quantitative compliance assessment was undertaken for air quality impacts during the operational phase of the Project. The quantitative assessment considered existing air quality along the Project alignment and dispersion modelling of emissions from train travel along the Project alignment, trains idling at crossing loops, and emissions from the ventilation of the Toowoomba Range Tunnel.

A total of 2,829 sensitive receptors relevant to the Project were identified as part of the AQIA. In addition to assessing impacts to residential dwellings and agricultural land uses, the assessment of the operational phase also considered the potential for impacts to the health and biodiversity of ecosystems.

In the construction phase of the Project, dust sources will be variable and transitory. The potential for impacts will depend on the proximity of sensitive receptors. The results of the qualitative air quality risk assessment determined that, without mitigation, there is a potential 'high risk' of human health impacts from the construction of the Project, and a 'medium risk' of impacts from dust deposits. By implementing the proposed mitigation measures, the impacts to air quality from both dust deposits and human health will be reduced to acceptable levels.

The quantitative operational assessment was undertaken for 2040 (potential worst-case operations) included consideration of existing air quality and dispersion modelling of emissions from train travel along the Project alignment, trains idling at crossing loops, and emissions from the Toowoomba Range Tunnel portals, along with emissions from the Toowoomba Bypass and Harlaxton Quarry.

The predicted air quality concentrations and deposition rates were compared to Project air quality goals adapted from the national and state legislation, guidelines and policies (e.g. *Environmental Protection (Air) Policy 2019* (Qld), National Environment Protection (Ambient Air Quality) Measure (Air Quality NEPM) (National Environmental Protection Council (NEPC) 1998a)) relating to ecosystems, protecting agriculture uses, and protecting the aesthetics of the environment.

The assessment of the operational phase determined that compliance is predicted for all pollutants at all sensitive receptors outside the Project disturbance footprint, with and without veneering for typical and peak operations.

Veneering is consistent with management measure currently applied to trains that use the Bowen Basin coal rail lines and the West Moreton System (South West Supply Chain). For coal trains, veneering involves the application of a biodegradable, non-toxic, binding agent onto the loaded wagon coal surface, which forms a crust over the coal load and minimises coal dust lift off when exposed to air passing over the surface in transit.

Tunnel ventilation design and the assessment of in-tunnel air quality was undertaken as part of the design work for the Project. One of the primary objectives of the tunnel ventilation system design was maintenance of acceptable air quality inside the tunnel and at the tunnel portals. The ventilation system was designed to allow for a purge cycle following train passages, to ventilate the tunnels of any residual pollutants and heat, and ensure a suitable environment prior to the next train entering the tunnel. The purging methodology for the tunnel was incorporated in the dispersion modelling of emissions from the tunnel portals.

Modelling shows the potential for elevated concentrations of pollutants near the eastern and western portals of the Toowoomba Range Tunnel. Impacts are predicted to be localised in nature.

The impact of odour from agricultural trains using the Project alignment was assessed qualitatively. Odour emissions from agriculture freight are considered unlikely to result in significant impact to neighbouring sensitive receptors due to the frequency and duration of the train pass-by and the predominantly rural nature of the AQIA study area.

Investigations into the deposition of dust emissions at sensitive receptor locations showed that predicted pollutant water concentrations would be compliant with the Australian Drinking Water Guidelines, and significantly lower than the assessment criteria. Predicted dust deposition levels are also well below the levels that have been shown to impact crops and livestock; therefore, the impact of dust deposition on agricultural uses within the AQIA study area is not anticipated to be significant.

Overall, the operation of the Project is not expected to significantly adversely impact environmental values, including human health and wellbeing; the aesthetic environment; health and biodiversity of ecosystems; and agricultural uses.

Surface water quality

The Project traverses two sub-catchments of the Lockyer Creek and one sub-catchment of the Condamine River Basin and is expected to cross the floodplain of four major watercourses: Gowrie Creek, Oaky Creek, Six Mile Creek and Lockyer Creek.

There is over 13 linear km of watercourses within the Project disturbance, with the majority of these watercourses considered to be drainage lines under the *Water Act 2000* (Qld) (Water Act). There is one defined watercourse, Gowrie Creek, and 24 unmapped watercourses under the Water Act in Gowrie Creek catchment. There are four defined watercourses (Oaky Creek, Rocky Creek, Six Mile Creek and Lockyer Creek) and approximately 80 unmapped watercourses and drainage lines under the Water Act in Lockyer Creek Catchment.

A review of the Queensland Waterways for Waterway Barrier Works spatial data layer confirmed that there are 24 individual waterways, including three waterways mapped as 'purple' under the *Fisheries Act 1994* (Qld). The purple waterways includes Gowrie Creek, Rocky Creek and Lockyer Creek. For any waterways that are not represented on the spatial data layer, Queensland Waterways for Waterway Barrier Works, it is essential that the subject waterway is attributed a colour as per the spatial data layer to inform whether the proposed work is able to be undertaken in accordance with the *Accepted Development Requirements for operational work that is constructing or raising waterway barrier works* (DAF, 2018b), or alternatively is assessable development.

The Project design provides for bridges and viaducts across Gowrie Creek, Oaky Creek, Six Mile Creek and Lockyer Creek, reducing the extent of infrastructure within the associated floodplains, riparian zones and below the high water banks.

Existing surface water conditions were ascertained via a desktop study of publicly available data and complemented by contemporary field water quality samples (with seasonal variation) to enable an assessment of existing environmental condition.

Construction activities may result in increased debris, changes to receiving surface water quality and hydrology (principally from increased water turbidity and sedimentation load), water chemistry and hydrology (principally from the alteration of overland flow paths as a result of clearing activities, as well as contamination and introduction of exotic species), salinity, erosion and sedimentation. In addition, tunnel dewatering activities may also cause changes to water quality. Exacerbation of these impacts are likely to occur if inadequate rehabilitation occurs.

The Project proposes to divert groundwater inflow at the western tunnel portal during operations to a tributary of Gowrie Creek, noting that the water quality of the groundwater is considered suitable, which is reflected in the groundwater resources in the local area being used as drinking water. A water treatment plant will manage groundwater inflows during operations, with specific water quality objectives to be developed for the release of untreated and treated water from this plant. The release of water from the Project has the potential to alter the current systems from ephemeral to perennial. Further groundwater investigations are required to confirm the volume and quality of groundwater inflow.

Measures to manage impacts to surface water quality include developing and implementing the CEMP, an Erosion and Sediment Control Plan, a Reinstatement and Rehabilitation Plan and a construction water quality monitoring program.

A surface water monitoring framework will be developed as part of the CEMP and the construction water quality monitoring program. This framework will identify monitoring locations at discharge points and selected locations in watercourses near where works are being undertaken. The surface water monitoring framework will outline water quality objectives, standards and parameters to measure any changes to water quality.

Hydrology and flooding

The Project alignment crosses the floodplain of four high-risk watercourses: Gowrie Creek, Oaky Creek, Six Mile Creek and Lockyer Creek. Detailed hydrologic and hydraulic assessments have been undertaken due to the catchment size and flows associated with each of these watercourses. Gowrie Creek forms part of the Condamine River system, while Oaky Creek, Six Mile Creek and Lockyer Creek all form part of the larger Brisbane River system.

The Project alignment passes near the localities of Murphys Creek, Postmans Ridge, Gowrie, Lockyer, Helidon Spa, Helidon, Ballard and Withcott. A number of these localities, including properties and infrastructure, and the QR

West Moreton System rail corridor, are sensitive to flood conditions with flood sensitive receptors identified along the Project alignment.

A hydrology and flooding assessment was undertaken by reviewing existing assessments, modelling the environment without the Project, and modelling the environment with the Project. The results were then compared to the flood impact objectives, which were also used to guide the design of the Project.

The Project may cause changes to the existing flood regime, such as: changes in peak water levels and associated inundation, concentration of flows, redirection of flows, increased velocities leading to localised scour and erosion, and changes to duration of inundation or increased depth of water.

The Project has been designed to achieve the hydraulic design criteria including 1% AEP flood immunity to rail formation level, while simultaneously minimising unacceptable impacts on the existing flooding and drainage regime. Bridge and culvert structures have been located and sized to avoid increases in peak water levels, velocities or duration of inundation, and changes flow distribution. The predicted impacts on the flood regime generally comply with the Project's flood impact objectives, noting the following impacts from the Project under the 1% Annual Exceedance Probability (AEP):

- Project alignment near Gowrie Creek resulted in the exceedance of the peak water level objective. These areas are generally agricultural land and the area upstream of East Paulsens Road, where the road is being raised as part of the Project design.
- There are no changes in peak water levels on any state controlled roads for all events up to and including the PMF event.
- There are two locations on the QR Western Line where increases in peak water levels exceed 100 mm.
- Under the 1% AEP existing case the QR Western Line overtops for a length of approximately 250 m at Gowrie. Under the 1% AEP developed case, event flood waters are retained behind the new rail embankment essentially throttling the flow reaching the Western Line. For the Western Line there is a very localised increase in peak water levels by up to 200 mm, which occurs over a length of approximately 20 m; however, this section of the QR Western Line remains free from overtopping and flood levels are below the existing formation level. The rest of existing Western Line has improved immunity with the 250 m of rail that was previously overtopped now dry.

In future stages further discussions with QR and TRC will be undertaken regarding the proposed alignment design and associated drainage structures.

Acceptable localised impacts will ultimately be determined during detailed design on a case-by-case basis, in consultation with stakeholders and landholders using the flood impact objectives as a guide. The Australian Government and the Queensland Government have established an independent international panel of experts for flood studies (the Panel) to provide advice on the flood models and designs developed by ARTC 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 notification of the EIS will be provided to the Panel for consideration as part of its review.

Information on the Panel can be viewed at:

tmr.qld.gov.au/projects/inland-rail/independent-panel-of-experts-for-flood-studies-in-queensland.

Groundwater

The groundwater study area is located within the Clarence–Moreton bioregion assessment area where strong evidence of interaction between groundwater and surface water has been reported (Raiber et al., 2016). This supposition is based on several lines of evidence inclusive of assessment of groundwater and surface water quality, streamflow time-series data, groundwater hydrographs and streambed elevation.

The groundwater resources underlying the Project are administered under the following water plans:

- Under the Water Plan (Great Artesian Basin and other regional aquifers (GABORA) 2017) the groundwater study area is located within the Hutton Sandstone and Springbok Walloon groundwater units. These groundwater units include the Eastern Downs Marburg, Murphy's Creek Marburg and Eastern Downs Walloon Sub-Areas of the Water Plan (GABORA, 2017). Water from the Koukandowie Formation is administered under this plan.
- Under the Water Plan (Moreton) 2007, the groundwater study area is located within the Lockyer Valley Groundwater Management Area (GMA) and the Tenthill Creek and Ma Ma Creek (implementation area 2B), with the latter consisting of alluvial and hard rock aquifers (groundwater units 1 and 2 respectively). Within this GMA

the Project is within tunnel for approximately 1.5 km, along with 6.7 km of viaducts and a large number of cuts and embankments. The hard rock aquifers relevant to this plan include the Main Range Volcanics (MRV).

- For Water Plan (Condamine and Balonne) 2019, the groundwater study area is within the Condamine and Balonne Underground Water Management Area and the Upper Condamine Basalts Underground Water Management Unit. Within this unit the Project intercepts MRV aquifers is associated with the following groundwater units:
  - Toowoomba City Basalts sub-area: the tunnel is primarily located within this unit (i.e. area west of Boundary Street to the Toowoomba LGA boundary in the east)
  - Toowoomba South Basalts limitation area: the western extent of the Project, west of Boundary Street area south of Gowrie Creek is located within this area. This includes the eastern tunnel portal and the start of the tunnel
  - Toowoomba North Basalts limitation area (i.e. local road network changes north of Gowrie Creek).

These plans, along with the management protocols, provide a framework for the management of groundwater resources within the respective water plan areas. This management includes, but is not limited to, licensing requirements (e.g. extraction of groundwater for domestic or stock supply does not generally need a water authorisation), allocations and water quality objectives. The water pans within the groundwater study area indicate groundwater allocations are at capacity for most of the relevant units.

The water table is typically a subdued version of topography, with the depth to groundwater increasing beneath topographic highs (for example the Great Dividing Range and Great Escarpment), and shallower groundwater in lower lying reaches (such as close to surface water drainage lines). This is particularly evident in the tertiary volcanics and intrusives (Main Range Volcanics (MRV)) and Gatton Sandstone. The presence of shallow aquitards, surface water features, and groundwater extraction would locally affect depths to groundwater.

The water table occurs in the alluvial/colluvial sediments or outcropping MRV across much of the groundwater study area west of and within the Great Dividing Range. The Koukandowie Formation, east of the Great Dividing Range, and the Gatton Sandstone in the eastern portion of the groundwater study area form the upper (water table) aquifer in these areas.

Existing registered bores identified within the groundwater study area indicate there are 202 registered bores comprising 30 water supply bores, and the remaining 172 bores with an undefined use. There were no petroleum or gas exploration bores registered, Water entitlements indicate the MRV unit is most extensively used in groundwater study area (60 per cent of all entitlement are in MRV) and the main purpose is irrigation (90 per cent of allocations are for irrigation), although there is a large allocation 3,800 megalitres) for an urban purpose.

Bores constructed prior to 2002 were not required to register with the Department of Regional Development, Manufacturing and Water (DRDMW) (formerly Department of Natural Resources Mines and Energy) and as a result the (DRDMW) groundwater database is not a complete record of bores within the groundwater study area; however, it is the most accurate and recent information available publicly. A groundwater bore survey will be undertaken during the detailed design phase to accurately capture all groundwater bores (registered and unregistered) within the groundwater study area.

There are a number of Groundwater Dependent Ecosystems (GDEs) within the study area, including Gowrie Creek.

The construction and operation of the Project has the potential to impact on groundwater and groundwater users through:

- Loss of, or damage to, registered and unregistered bores
- Water licences on land acquired for the Project will automatically expire and would need to be reinstated
- Changes to groundwater level and flowpaths from embankment loading
- Reduced groundwater levels due to seepage into cuttings
- Changes to groundwater quality from spills and uncontrolled releases, or from acid rock drainage.

Predictive groundwater modelling was undertaken for the Toowoomba Range Tunnel for the construction and operational phases. The model was used to estimate preliminary drawdown and inflows for the MRV, Koukandowie Formation (Marburg Subgroup) and colluvium to inform an assessment of the potential to construct the Toowoomba Range Tunnel (undrained), and adjacent portal cuts (drained) and cut and cover (drained) and the intermediate ventilation shaft (undrained) on these groundwater resources.

The construction of the Toowoomba Range Tunnel with resulted in an estimated inflow of 1,700 ML during construction. Approximately half the inflow is from the MRV within across both the Toowoomba City Basalts Sub-area and Toowoomba South Basalts limitation area. About 10 per cent is from the Koukandowie Formation, with the remained form the hard rock units in the Lockyer Valley GMA. Water authorisations (e.g. water permit) under the relevant water plans will need to be soured for these groundwater inflows.

The groundwater inflows will also result in groundwater down in the surrounding environment, the largest extents predicted in week 107 of construction for both the deep MRV (up to 30 m) and the Koukandowie Formation (up to 40 m at the tunnel). The extent of drawdown extends outside of the groundwater study area. These estimates are conservative and do not consider any water control mitigation techniques that are likely to be used for construction such as the operation of the TBM in closed mode, or any probing and grouting ahead of the excavation.

The Toowoomba Range Tunnel is an undrained design and once construction is complete, the extent of groundwater inflow will be significantly reduced, about 10 ML/year predominantly from the Koukandowie Formation aquifers. Groundwater modelling, however, predicted that that the long-term groundwater inflows at the western tunnel portal, which is a drained the design, will be up to 84.5 ML/year. There are no bores within the Koukandowie Formation within the modelled drawdown extent for this aquifer type.

ARTC has committed to refine these model predictions to further understand the impacts on groundwater and their significance. Fourteen monitoring bores have been constructed along the tunnel alignment as part of the Project, with these bores providing information on groundwater level and quality, in some instance in real time. This information, along with detailed geotechnical information, will inform any model refinement and detailed design activities.

ARTC is committed to rectify any impairments for groundwater bores as a result of the construction and operation of the Toowoomba Range Tunnel.

The potential impacts of the Project on groundwater levels, flow and quality were identified and a significance assessment carried out, with the key findings being:

- A moderate residual significance risk was identified for the potential of reduced groundwater levels to impact groundwater users (bores and potential GDEs) due to the Toowoomba Range Tunnel and associated cuts and portals:
  - Ground-truthing of GDEs is required to confirm GDEs exist within predicted drawdown extents
  - Continued baseline groundwater level monitoring will confirm groundwater levels at the tunnel and inform additional investigations and modelling
- A moderate residual significance risk during the construction phase was identified for potential contamination, or degradation of groundwater quality, including from spills and uncontrolled releases, water mixtures and emulsions from washdown areas, and wastewater from construction sites
- Low residual significance risks were identified as being low for all other potential impacts, including loss of registered bores due to destruction or loss of access, changes to groundwater levels due to loading from embankments (i.e. upstream mounding and damming, and downstream groundwater level reductions), acid rock drainage from cuts and vegetation removal:
  - Proposed additional geotechnical works, including investigation and monitoring of groundwater levels at deep cuttings, Toowoomba Range Tunnel and areas of foundation treatment in low lying floodplain areas will further inform detailed design.

A groundwater management and monitoring program, including a landholder bore survey, will be developed to provide ongoing assessment of the potential impacts. Groundwater monitoring will be conducted before, during, and after the completion of construction works. The program will set out groundwater sampling locations, frequency of sampling, and the analytical program. Roles and responsibilities will be set out to clearly establish the review and approval process that will be used to evaluate the data collected as part of the monitoring program.

ARTC has consulted with DRDMW about the water authorisation required under the various water plans because of Project activities (e.g. construction water and interference with groundwater, short term and long term, because of the tunnel's construction and operation). DRDMW has noted the complexities of the groundwater resources in the area and the overarching legislation, and further consultation is proposed to confirm the approval process(es) and to ensure that the Project complies with the legislative requirements under the Water Act and associated water plans.

Ongoing consultation with the DRDMW, along with key stakeholder and groundwater users, will be critical to resolve some of the complexities associated with the Water Act and supporting water plans relevant to the Project, noting that the majority of the complexities relate to availability of water due to current groundwater allocations.

ARTC are committed to minimising potential impacts to existing water users and groundwater resources. ARTC have included specific measures to rectify any impairments to existing bores due to the Project.

Noise and vibration

Both construction and operational noise and vibration impact assessments have been undertaken for the Project. These assessments included consideration of airborne noise, construction blasting, ground-borne vibration, tunnel construction, ground-borne noise, construction road traffic noise, and assessment of the potential residual noise and vibration impacts with implementation of proposed mitigation measures.

Ambient noise monitoring was conducted at 10 locations within the noise and vibration study area. This monitoring included both long-term monitoring and short-term attended measurements. The long-term monitoring was used to identify existing sources of noise within the study areas, quantify and characterise the existing noise environment and establish background noise levels referenced in establishing relevant noise criteria.

Noise management levels were established to determine acceptable levels of noise and vibration from construction and operational activities at a 'sensitive receptor'. Examples of sensitive receptors include residential dwellings, schools and childcare centres, places of worship, hospitals, open space—passive use (for example parkland, bush reserves) and open space—active use (for example sports field, gold courses). Industrial land use was classified as a sensitive receptor for vibration emissions and was not included as a sensitive receptor within the airborne noise impact assessments.

A total of 3,811 existing sensitive receptors were identified for the construction assessment and 3,910 for the operational assessment. The difference in number of sensitive receptors reflects the methodology adopted, including where the operational assessment identified multiple structures (buildings with area greater than 9 m^2) on the same property as sensitive receptors.

Construction noise and vibration

The construction noise and vibration assessment identified the potential for the established noise management levels to be exceeded at various sensitive receptors, while construction activities are conducted nearby. While both temporary and transient, the construction activities in proximity of nearby communities can be inherently noisy. The number of sensitive receptors affected at any one time and the duration of the impact depends on the type of works and the progression of works along the alignment.

Baseline noise measurements were used to determine applicable construction noise criteria under the *Transport Noise Management Code of Practice Volume 2: Construction Noise and Vibration* (CoP Vol 2) (DTMR, 2015a).

Reasonable worst-case construction scenarios have been assessed for each of the main construction activities. The worst-case impacts are:

- Construction noise (earthworks) during non-standard work hours is predicted to exceed the noise management levels at up to 2,131 sensitive receptors
- Construction vibration is expected to be exceeded at up to 175 sensitive receptors during non-standard hours
- Construction traffic on five roads is predicted to exceed the established noise management levels
- During tunnel construction, 72 residential receptors are predicted to exceed the non-standard hours ground-borne noise management levels
- There are no predicted exceedances of ground-borne vibration from tunnel construction at any sensitive receptors
- Blasting charge masses are not known at this stage. Therefore, maximum allowable instantaneous charge masses have been provided at indicative distances from potentially affected sensitive receptors.

Maintaining Project work construction hours to within the CoP Vol 2 standard hours has the potential to significantly reduce the number of sensitive receptors impacted by the construction of the Project. During CoP Vol 2 standard hours, less stringent construction noise and vibration management levels apply. Having key noise generating activities undertaken in line with the planned construction hours (generally consistent with CoP Vol 2 standard hours), reduces the number of potentially impacted receptors by approximately 40 per cent for drainage works, rail and road civil works, and up to a 65 per cent reduction for site setup, The change for earthworks, based on intensity and location of anticipate construction activities has a reduction of approximately 20 per cent.

Specific mitigation measures will be incorporated into the Construction Noise and Vibration Management Plan for works during both standard and non-standard hours. Construction progress and planned activities will be regularly communicated to local residents and stakeholders, particularly when noisy or vibration-generating activities are scheduled, such as vibratory compaction and piling. Where the application of mitigation measures is found to not be sufficient to reduce noise and vibration impacts to acceptable levels, additional mitigation measures will be investigated and implemented, in consultation with affected sensitive receptors.

Based on the construction noise assessment and proposed mitigation, construction noise impacts at 46 per cent of receptors are not predicted to be feasibly mitigated to below the appropriate noise management levels by physical attenuation alone. Where further mitigation is also similarly unfeasible or unreasonable, residual impacts may need to be managed. The management of residual impacts will be undertaken in consultation with the community and affected residents. Residual construction noise impacts present after the application of mitigation will be temporary and will cease once construction finishes. It is proposed that residual construction noise impacts be managed through:

- Temporary relocation of affected occupants
- Respite periods
- Architectural treatments.

Operational noise and vibration

The operation of rail freight on the Project is a recognised source of noise and vibration that could potentially impact existing sensitive receptors and environment surrounding the alignment. The Project will introduce new (approximately 22.5 km) and upgraded railway infrastructure (where co-located with the West Moreton System) along its alignment. The daily pass-by of trains and trains idling at crossing loops were considered as sources of noise, along with the operation of fixed rail infrastructure associated with the operation of the tunnel.

For the operations along the railway the assessment considered airborne noise and ground-borne noise and vibration, including from within the Toowoomba Range Tunnel and the viaducts.

Fixed infrastructure

A detailed assessment of noise and vibration from these rail freight operations was undertaken in accordance with the ToR. An assessment of the operational fixed infrastructure noise was carried out using *ISO 9613-2:1996: Acoustics—Attenuation of sound during propagation outdoors—Part 2: General method of calculation* (International Organization for Standardization (ISO), 1996). Operational fixed infrastructure noise is predicted to meet the *Environmental Protection (Noise) Policy 2019* (EPP (Noise)) acoustic quality objectives at all sensitive receptors.

Airborne railway noise

The assessment of airborne noise from these railway operations applied railway noise management levels implemented by ARTC on Inland Rail. The railway noise management levels are more stringent than the requirements of the ToR for airborne railway noise. For the assessment of ground-borne noise and vibration the assessment has considered guidelines from DTMR and recognised Australian and international standards and assessment criteria.

Analysis of predicted airborne noise levels determined the railway noise management levels would be met at the majority of the identified sensitive receivers. The assessment also considered train movements on the adjacent West Moreton System.

At 32 of the 3,910 sensitive receptors within the noise and vibration study area for the operational rail noise assessment (31 properties assumed to be residential and the Gowrie State School) the predicted noise levels at the commencement of operations (2027) were above the noise management levels and triggered a review of reasonable and practicable measures to reduce noise levels. Because the majority of train movements are expected at the Project opening, the growth in forecast rail traffic has identified an additional sensitive receptor (residential) triggering the noise mitigation review for the design year of 2040 (total 33 receptors triggering a review of mitigation—one additional potentially affected receptor at year 2040 compared to commencement of Inland Rail operations).

Of the 32 senstive receptors triggering mitigation 19 are associated with the brownfield section (1 at Helidon and the rest at Gowrie) and 13 are associated with the greenfield section (Lockyer Valley). The noise management levels were most frequently trigged by the night-time L_{Aeq} rail noise levels with the majority of the exceedances (60 per cent) by 1 to 3 dBA, as the number of trains per hour is greater during the night-time and the noise management levels are 5 dBA more stringent than the daytime.

However, with consideration to the existing surrounding environment, it is reasonable to expect that noise from railway operations could be audible even where the adopted noise management levels are achieved.

At the 32 identified sensitive receptors and the Gowrie State School where the predicted noise levels were above the noise management levels a review of reasonable and practicable measures in accordance with the principles of ARTC's management of noise on Inland Rail Program, to reduce potential railway noise levels was undertaken.

It is important to note that the Project's noise management levels do not require noise from railway operations, including where noise mitigation is implemented, to be inaudible at an existing sensitive receptor. It is not unreasonable for outdoor noise from railway operations to be audible at a distance of 1 km from the railway alignment. The potential for annoyance or disturbance from rail noise is subjective and can remain perceptible even where noise mitigation is implemented, and noise levels are well within the adopted noise management levels.

The specifics of at-property treatments will be determined by ARTC on a case-by-case basis that will consider a range of factors, including received railway noise levels, pre-existing condition of the buildings and habitable rooms, construction and design of the property, engineering feasibility, cost, and consultation with the affected landholders.

The reasonable and practicable approach to noise mitigation for the Project is expected to be at-property treatments. The at-property treatments do not address the source emission of rollingstock noise or the external (outdoor) rail noise levels within the environment surrounding the rail corridor. On this basis, the rail noise levels can remain above the external rail noise assessment management levels, and be perceptible, at the sensitive receptors with the implementation of at-property noise mitigation measures. Nonetheless, the at-property treatments would be implemented to reduce the internal railway noise levels to achieve targeted improvements to the indoor acoustic environment of habitable rooms.

Ground-borne noise and vibration

Previous measurement and assessment of ground-borne vibration from existing rail freight corridors with similar geotechnical considerations indicates that tactile vibration impacts would be limited to sensitive receptors located within 100 m of the proposed rail alignment. There are no sensitive receptors within this offset distance, noting that bridge and viaduct structures are expected to be constructed from reinforced concrete and a ballasted track system and will have resilient matting for ballast retention (at least in the vicinity of residents) and this also provides benefits in terms of vibration isolation.

At a distance of greater than 50 m from the track, the most stringent internal ground-borne noise criterion of L_{ASmax} 35 dBA is expected to be achieved.

The movement of the trains through the Toowoomba Range Tunnel will induce vibration of the track system and the tunnel structure. The vibration can then propagate into the surrounding soil and this ground-borne vibration can potentially be experienced at sensitive receptors sufficient to impact the amenity of the sensitive receptors through perceptible vibration and the generation of noise within properties (ground-borne noise).

The ground vibration and ground-borne noise model accounted for the key parameters of the track design, ground conditions and proposed rail operations to calculate the required off-set distance where forecast ground-borne vibration and ground-borne noise levels would achieve the assessment criteria. Furthermore, ground-borne noise can be perceptible even where the ground-borne vibration management levels are comfortably achieved.

The assessment concluded that predicted ground-borne noise and ground-borne vibration from railway operations within the Toowoomba Range Tunnel would not be expected to trigger the ground-borne noise and vibration management levels at the nearest sensitive receptors (e.g. residential dwellings at Mount Kynoch).

On this basis, the assessment did not identify a need for specific vibration treatments beyond the highly resilient trackform proposed for slab track and proposed resilient matting for retention of ballast on bridge and such elevated track sections.

The relocation of existing railway services on to the new Project infrastructure and the removal of the existing level crossing is likely to reduce railway noise levels on the existing West Moreton System between Gowrie and Helidon, via Toowoomba and Murphys Creek.

Operational road traffic noise

A desktop assessment of road traffic noise impacts from the eight road segments changed by the Project was undertaken to predict the potential noise impacts associated with each road alteration. These roads were assessed against relevant criteria from the *Transport Noise Management Code of Practice: Volume 1—Road Traffic Noise* (CoP Vol 1) (DTMR, 2013). The desktop assessment considered the increase in traffic flows and relative distance

to the nearest sensitive receptors for each road, along with the influence from other dominant noise sources has not been considered.

The subjective response to the different noise levels and noise characteristics of the intermittent sources of transport noise are such that individuals are less likely to perceive or determine impacts based on a cumulative exposure of the combined transport noise. Consequently, the ToR requires road traffic and noise and railway noise to be assessed, and if necessary mitigated, separately.

The proposed new roads, Morris Road, Gowrie Junction Road, Paulsens Road and Old Homebush Road will result in exceedances at nearby sensitive receptors of the road traffic noise criteria for proposed new roads. Specific measures to mitigate operational road traffic noise include:

- Realignment of these road segments during detailed design such that they are located further from noise sensitive receptors
- Reduction of speed limits along these segments
- Pavement surface treatment
- Acoustic façade treatments to affected sensitive receptors
- Noise barrier in the form of a landscaped earth mound and/or a noise fence.

Noise and vibration from railway operations will continue to be assessed during the future phases of the Project to verify the outcomes of this assessment. During the initial commencement of railway operations on the Project to confirm noise and vibration levels at sensitive receptors and the requirements for reasonable and practicable mitigation measures. Operational mitigation measures proposed include:

- Effective community communication
- Attenuation of the tunnel ventilation plan
- Architectural treatments.
- Mitigation of impacts will be undertaken in consultation with affected occupants.

Social

A social impact assessment was undertaken and drew on the results of ARTC's stakeholder engagement processes. Stakeholders who were engaged included directly affected and nearby landholders, traditional custodians, government agencies, businesses, and community, environmental and economic groups.

As for all major projects located near human settlements, negative impacts are more likely to be experienced by those living closest, while Project benefits usually accrue at a broader regional level. Potential impacts to these stakeholders include:

- Property impacts such as land acquisition and the severance of productive agricultural land
- Community conflict regarding the Project, which may affect community cohesion and family networks
- Amenity impacts due to noise, vibration, dust, changes to the landscape and increased traffic
- Traffic delays during construction of bridges, viaducts, the Toowoomba Range Tunnel and other Project infrastructure
- Periodic traffic delays at rail–road interfaces during construction, potentially delaying traffic including emergency service vehicles en route to an emergency
- Inconveniences to motorists as a result of the closure of public roads that are not required for network connectivity or property access, to accommodate the Project.

At a regional level, potential impacts identified were:

- If multiple infrastructure projects are constructed at the same time, there may be a significant draw on trades and construction labour
- The construction phase represents an important source of training and career development for young people and Indigenous people
- The Project facilitates the growth of industries associated with logistics and freight terminal hubs, supporting the establishment of businesses which will be a source of long-term employment for Project region residents

- The coincidence of several major Projects' construction phases has potential to strain the capacity of the Project region's construction labour force, with a cumulative increase in numbers of non-local personnel and consequent impacts on rental housing availability
- The Project may change the settlement pattern in the areas designated for rural living at Helidon Spa and Postmans Ridge Road where land is within 250 m of the alignment.

In contrast the local community will benefit from construction and operation of the Project. The Project would generate employment for up to 596 people over the construction period. This is expected to contribute to financial and housing security, self and family care and social connections. Training opportunities will also be provided for people who are disadvantaged in the current labour market, including young people and Indigenous people.

Project supply opportunities during the construction phase may represent a substantial source of trade and an opportunity for local business growth. Local businesses will have the opportunity to supply the Project with fuels and oils, construction materials and services, including fencing, electrical installation, trades services, professional services, rehabilitation and landscaping and earthworks. Businesses located in Toowoomba, or near the Warrego Highway at Helidon or Withcott, include fuel stations, cafes and hotels that are likely to benefit from construction personnel's expenditure as they pass through the Project region. For the operational period, services will be required for truck maintenance, rehabilitation, maintenance of electrical and signalling infrastructure, level crossing and access track maintenance.

A Social Impact Management Plan (SIMP) was developed to address social impacts, invest in local communities and offset impacts on distributional equity. There are five action plans under the SIMP for:

- Community and stakeholder engagement
- Workforce management
- Housing and accommodation
- Health and community wellbeing
- Local business and industry content.
- Each action plan includes objectives and desired outcomes, mitigation measures, and the timing for delivery of these mitigation measures.

Economics

At a local level, the economic impact of the Project will promote community development by supporting local and regional employment, businesses and industries.

The Project will support regional development through opportunities:

- To encourage, develop and grow local (including Indigenous) businesses through the supply of resources and materials for the construction and operation of the Project. ARTC has developed a Sustainable Procurement Policy that will ensure that local, regional and Indigenous businesses will have opportunities to supply the Project
- 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 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 unlock the construction of ancillary and complementary infrastructure, industrial development and logistics operations within the local area. Specifically, the Project may act as a significant catalyst for development in the planned and existing industrial areas at the Toowoomba Enterprise Hub and Gatton West Industrial Zone
- As a predominately greenfield development, the Project comprises new dual gauge track to create a more direct rail freight corridor for freight operators. As part 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 estimate that the Project is expected to provide a total of $81.54 million ($2019 present value terms) in incremental benefits (at a 7 per cent discount rate). These benefits result from improvements in freight productivity, reliability and availability, and benefits to the community from crash reductions, reduced environmental externalities and road decongestion benefits.

A regional economic impact analysis found that the Project would promote regional economic growth across the Toowoomba labour market region. Using recent labour market trends and projected construction sector activity to inform workforce capacity and capability within the local region, it was 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 $595 million higher than the baseline level. Under a slack labour market scenario, the Project is also expected to deliver an additional 1,027 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 pandemic are highly effective, the economy may grow much faster than expected resulting in significantly more activity in the construction sector than anticipated.

A quantitative assessment of the cumulative macroeconomic impact resulting from the construction of the Queensland sections of the Inland Rail Program was undertaken. Under the assumption of slack labour markets the incremental economic impacts of the Queensland sections include an increase in real Gross State Product of $1.75 billion (measured in 2019 dollars) and an increase in the average number of jobs over the construction period of 2,059. If labour markets are tight, the incremental benefits are smaller, with real GSP increasing by $0.83 billion and the average number of jobs increasing by 485.

The sections of the Inland Rail Program that are located in the Toowoomba regional economic catchment area are the Project and the western portion of the H2C section of the Inland Rail Program. Construction activities related to these sections will directly impact the Toowoomba economy. The direct and indirect increment to jobs in the Toowoomba economy was estimated to be 1,027 under the assumption of slack labour markets and 225 under the assumption of tight labour markets.

When all the Queensland projects are considered jointly, the analogous increment to jobs (direct and indirect) in Toowoomba labour market region increases to 1,071 (under a slack labour market scenario) and 258 (under a tight labour market scenario). In the joint scenario the increment to jobs in Toowoomba labour market region peaks in 2022 at 2,106 and 523 jobs under slack and tight labour market conditions respectively.

The remaining Queensland sections of the Inland Rail Program, which are located in the Greater Brisbane and Darling Downs and Maranoa regions, will impact Toowoomba labour market region indirectly.

A qualitative assessment of cumulative impact of 11 other projects, along with five Inland Rail projects on local and regional labour markets, the supply chain and local businesses was undertaken.

The results of the regional economic impact assessment indicate that it is reasonable to assume that the regional labour market will have the capacity to supply a portion of the workforce requirements of the Project, without major disruption; however, these conditions may change in the context of cumulative labour market demand. Prior to the COVID-19 shock, the major infrastructure projects in the adjacent and surrounding areas, including those associated with Inland Rail, had the potential to put some pressure on labour markets if inopportune scheduling resulted in cumulative and competing demand for trades and construction labour; however, the overall labour demands of the interacting projects were modest and scheduling could be optimised to minimise market impact.

The prevailing trends in the Toowoomba labour market and the ability of workers to mobilise to project locations suggested that the risks of labour market disruption were limited. In the current economic environment, this risk has now been further reduced.

The expansion in construction activity and regional employment is also likely to increase demand for a range of local infrastructure and services, including in the construction supply chain and for local retail and hospitality businesses.

ARTC is committed to enhancing the economic benefits of the proposal while avoiding, mitigating or managing any adverse economic impacts. Accordingly, ARTC has developed a SIMP, which outlines the objectives, outcomes and performance measures for, and the actions that ARTC will undertake or require its contractor to undertake to manage the social and socio-economic impacts of the Project, while enhancing the Project benefits and opportunities.

Cultural heritage

Indigenous cultural heritage

As a requirement of the Indigenous heritage component of the Project ToR, a Cultural Heritage Management Plan (CHMP) was to be developed with the relevant Aboriginal Parties for the disturbance area and be approved by the

Chief Executive of the Department of Seniors, Disability Services and Aboriginal and Torres Strait Islander Partnerships (DSDSATSIP (formerly Department of Aboriginal and Torres Strait Islander Partnerships (DATSIP)).

This process was undertaken by ARTC in 2018 with the Yuggera Ugarapul People and the Western Wakka Wakka People 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, 2005).

The CHMP (CLH017009) was approved under the ACH Act and consequently meets all the requirements for the identification, assessment and management of Indigenous heritage under the ToR. As such, the EIS defers to the CHMP in all matters related to the management of Indigenous heritage. The CHMP is confidential and will not be made available as part of the EIS process, noting that the relevant Aboriginal Parties are currently undertaking Project Activity Assessments (by way of survey) of the Project disturbance footprint.

Non-indigenous cultural heritage

An assessment of non-Indigenous heritage values and impacts was undertaken by a team of appropriately qualified heritage specialists, informed by the legislative and ToR requirements for the Project, as well as the guideline, *Assessing cultural heritage significance: Using the cultural heritage criteria* (Department of Environment and Heritage (DEHP), 2013). The assessment targeted areas of cultural heritage potential that fall within the Project's disturbance footprint and designated cultural heritage study area (a 50 m buffer around the Project disturbance footprint).

The non-Indigenous assessment identified 17 heritages places relevant to the Project. These places include five places of state significance, including the Main Range Railway (601480), which the Project traverses under (~100 m) at Ballard (i.e. the West Moreton System rail corridor) and 11 sites listed as locally significant under the relevant planning scheme, with the Project traversing one of these sites: the Bicentennial National Trail. The landscapes associated with the Great Dividing Range, which the Project passes through, are also listed on the non-statutory Register of National Estate.

The Project also traverses part of the Mount Lofty Rifle Range, which has also been identified as a locally significant heritage site, with the site yet to be ratified under the *Toowoomba Regional Council Planning Scheme* (TRC, 2012).

Each of the registered sites (excluding the landscapes of the Great Dividing Range) were assessed in accordance with the Guidance on Heritage Impact Assessments for Cultural World Heritage Properties (International Council on Monuments and Sites (ICOMOS), 2011) based on their value of place or sensitivity and the magnitude of change to the heritage values as a result of the Project. Potential impacts on heritage sites can be divided into two main types:

- Direct impacts occur if a heritage place or site is located directly in a development area and/or would be physically impacted by development. Such impacts include the demolition or substantial alteration of a building, or the disturbance of an archaeological site
- Indirect impacts are those that alter the surrounding physical environment in such a way that a heritage place or site is affected. Indirect impacts might include extra vibration from construction activities or subsequent traffic load, as well as additional water runoff or sediment deposition due to changing hydrology.

The accepted methodology for managing impacts on heritage places is to avoid wherever possible, minimise as far as is practical, and then mitigate where avoidance and minimisation is not possible.

The assessment found that, with appropriate measures, the Project impacts are neutral (no impact) for 14 of the registered sites, and slight for the Main Range Railway and neutral/slight for the Bicentennial National Trail. The Mount Lofty Rifle Range impacts were also considered to be neutral.

The non-Indigenous heritage assessment also identified 36 Areas of Interest (AOI) within the cultural heritage study area, including the Bicentennial National Trail at Gittins Road, Withcott and a rail bridge on the Main Line at Mount Kynoch, which is part of the Main Range Railway (601480). In preparation for a targeted survey, the areas were ranked based on proximity, priority and heritage potential to inform the site inspections. Of the 36 sites, 30 sites were subject to a visual inspection, with the remaining six sites deemed a low priority (i.e. not assessed). The identification of potential AOIs comprised a review of previous heritage assessments, analysis of historic aerials, topographic and cadastral maps and a search of the relevant heritage registers and planning schemes.

Of the 30 AOIs that were inspected, 18 of the AOIs did not possess any historic structures, remains, or areas of archaeological potential. The significance of the remaining 12 AOIs, which possessed a range of heritage values, significance or potential, were assessed in accordance with the *Queensland Heritage Act 1992* (Qld) (QH Act) and *Assessing cultural heritage significance: Using the cultural heritage criteria* (DEHP, 2013). The assessment determined that six of the AOIs are of local heritage significance (but currently unlisted) meaning that they have 'aesthetic,

historic, scientific or social value for past, present or future generations'. The Bicentennial National Trail was also considered to be locally significant.

The sites were mostly related to early homesteads, single structures and rail infrastructure. Each of the six sites were assessed against the ICOMOS guidelines (2011). The assessment found that, with appropriate measures, the Project impacts could be reduced to neutral or slight for all six sites.

Traffic, transport and access

The Project will provide a more efficient and direct route through Toowoomba Range, along with interoperability between the QR and ARTC networks, which aligns with a number of planning and transport plans. This will provide benefit to new and existing rail operators, along with potentially reducing train traffic through Toowoomba city centre and Murphys Creek.

The Project generally follows the Gowrie to Grandchester future state transport corridor, protected under the *Transport Planning and Coordination Act 1994* (Qld) in 2005. Inland Rail is an open access rail corridor and, as such, does not preclude the use of the corridor by passenger trains; in addition, the design does not preclude the construction of a high-speed passenger service within the Gowrie to Grandchester future state transport corridor at a future date.

In addition, the Project proposes grade separation of exiting QR West Moreton System and will be co-located with this rail corridor for 5.6 km. The Project also proposes to eliminate an existing public level crossing on the QR network at Gowrie, while no new public level crossings are proposed for the Project. To facilitate the closure of the existing crossing Gowrie Junction Road will be realigned, with a new road-over- rail bridge providing north–south connectivity across Gowrie Creek and the new and existing rail corridors.

With the exception of Morris Road, which is proposed to be closed, all road–rail interfaces are grade separated. As a result of the closure of Morris Road, along with the new road-over-rail bridge, a number of changes to the road network (and access) at Gowrie are proposed. The traffic analysis predicts that these changes are not likely to impact connectivity or capacity in the short term and long term.

In addition to connections in to the QR Network, two grade separations are proposed. Along with the spacing, the design allows for the two assets to operate autonomously during construction and operation, though there will be some distributions during construction due to track possession, which may impact the supply chain. ARTC and QR will continue to discuss interfaces between the networks at a Program level.

To facilitate the Project, a number of local road network changes are warranted in the Gowrie area to maintain access for landholders and provide connectivity for current and future demands. Traffic analysis indicates that the changes will have limited impact on traffic connectivity.

The Project-related traffic consists of traffic generated by both construction and operational activities. The construction transport mode for the Project will primarily be road and rail. It is anticipated that the impacts would predominantly be during the construction phase of the Project.

Construction activities will impact travels times and access on these affected roads, with some of these roads being known school routes, cycle routes or haulage routes. The transportation of materials, equipment and personnel will also impact some of these roads, along with the boarder network with material being sourced from the Toowoomba and Lockyer Valley regions and as far away as northern NSW. These construction routes mainly occur via existing SCRs and local government roads and a traffic analysis was undertaken.

Certain sections of the Project will generate construction related traffic volumes in excess of 5 or 10 per cent of the background traffic during the construction phase. The results of the level of service (LOS) comparison between the 'with' and 'without' development scenarios indicated that the Project may potentially cause a minor change in the 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 local road network for such a short duration of impact, but adequate traffic and road use management strategies and mitigation measures would be required. A Traffic Management Plan will be developed before the start of construction activities.

During the operational phase, it is anticipated that occasional access to and from the track will be required to conduct routine inspection and maintenance works. Maintenance vehicles will use the rail maintenance access roads that will be constructed for most of the inspection and maintenance activities. However, these activities are likely to be infrequent and the related traffic volumes are likely to be minimal with no envisaged impact to operational conditions of the surrounding road network.

Rail operational traffic volumes are likely to be negligible with no envisaged impact to operational conditions of the surrounding road networks, cycle routes or school bus services.

The overall aim of the construction and operation of the Project is to maintain the safety and efficiency of all affected transport modes for the Project workforce and other transport system users; avoid or mitigate impacts on the condition of existing transport infrastructure; and ensure any required works are compatible with existing infrastructure and future transport corridors.

Continued engagement with DTMR, QR, TRC, LVRC and where applicable emergency services to be undertaken to formalise the design and end of life requirements for the impacted road and rail networks, undertake safety assessment and develop and implement measures such as a Traffic Management Plan and Road Use Management Plan.

Hazard and risk

The Project has incorporated risk identification and assessment practices throughout the design development phase and ARTC has a strong commitment to implementing and maintaining appropriate safety practices throughout operations. A preliminary hazard identification and risk assessment was undertaken in accordance with the requirements of Australian and NZ Standard/International Standards Organization AS/NZ ISO 31000:2009 *Risk Management—Guidelines* (Standards Australia, 2009a) which is consistent with *ISO 31000:2018 Risk management – Guidelines* (International Organization for Standardization, 2018).

Hazards were identified for each of the Project phases and were evaluated qualitatively to determine residual risks following the implementation of risk management strategies and mitigation measures. No risks were assessed as having a high residual risk ranking, with the majority of the hazards were determined to have a low residual risk. Potential impacts that were given a medium residual risk included:

- Natural hazards
  - Bushfire
  - Flooding or severe weather events
  - Natural events exacerbated by climatic conditions
  - Impacts of project on greenhouse gas emissions
  - Landslide, sudden subsidence, movement of soil of rocks (construction)
- Project hazards
  - Employee fatigue and/or heat stress
  - Rail accidents caused by increased rail movements
  - Increased use of road vehicles for the Project
  - Operating live trains in the disturbance footprint (operations)
  - Construction and operation of the Toowoomba Range Tunnel
  - Bridges/viaducts
  - Interaction with existing underground and overhead utilities
  - Health and environmental impacts from contaminated land (construction)
  - Interference with emergency access
- Dangerous goods and hazardous chemicals
  - Construction and maintenance chemicals
  - Transport of dangerous goods freight (operations)
  - Potential use of explosives for construction.

A residual rank of medium is considered tolerable if the risks is reduced so far as reasonably practicable given the low frequency of occurrence (or probability or likelihood) or minor impact if the event of such incidents occurring following the proposed mitigation measures. For these residual risks, the Inland Rail Program Safety Management System will include monitoring activities to ensure the ongoing effectiveness of the risk controls, and identification of risk opportunities for further improvement.

ARTC's existing Emergency Management Procedure, which provides a systematic approach to incident response and recovery or incident investigation on the ARTC network, will be applied to the Inland Rail Program and the Project. An Incident Management Plan will be developed for the Inland Rail Program to detail the procedures and resources with which emergencies will be responded to and managed. The Emergency Management Procedure itself will be used for emergency management including emergency response and emergency planning. The procedures required to manage incidents and emergencies will be the responsibility of ARTC and rail operators. Security and crisis management will be developed for the Inland Rail network and will be in line with business continuity plans that will be issue specific.

The Project has been and will continue to be developed in consultation with relevant emergency management authorities to ensure that external support will be provided by these services in an event of an emergency, including:

- Lockyer Valley and Toowoomba Local Disaster Management Groups
- Emergency Services including:
  - Toowoomba Hospital
  - Queensland Fire and Emergency Services, including:
    - Rural Fire Service (e.g. South Western Region Headquarters, Charlton fire station, Gowrie Little Plain Rural fire brigade, Helidon fire station, Murphys Creek rural fire brigade, Withcott Rural Fire Brigade, Toowoomba fire station and Gatton fire station)
    - Queensland State Emergency Service.
  - Queensland Police Services (e.g. Toowoomba police station, Highfields neighbourhood police beat, Wilsonton police beat, Harlaxton police beat, Helidon police station and Gatton police station)
  - Queensland Ambulance Services (e.g. Fairview ambulance station, Highfields ambulance station, Toowoomba ambulance station and Gatton ambulance station).

Risk assessment is an ongoing process and as the Project design evolves, the impact of risks will be regularly reviewed to and mitigation measures applied to eliminate or manage hazards and reduce risk to an acceptable level.

ARTC's *Safety Policy* (ARTC, 2020d) and *Fatal and Severe Risk Program* (ARTC, 2017c) will be fully implemented.

Waste and resource management

Existing waste disposal predominately comprises construction and demolition waste and general municipal waste, as well as commercial and industrial and green waste. Established waste management facilities in proximity to the Project are located throughout Toowoomba and Lockyer Valley, with the Toowoomba Waste Management Centre identified as the major facility that has the greatest potential to service the Project due to its annual capacity and proximity to the Project. When construction timing is confirmed, waste acceptance criteria and available and permissible annual disposal rates will be determined in consultation with the waste facility operators.

The construction phase of the Project will generate the majority of waste through vegetation clearing, access track and bulk earthworks as well as tunnel portal development and topsoil stripping. Municipal solid waste will be generated by the Project through activities occurring at construction locations and on multiple work fronts.

The Project is anticipated to generate approximately three million cubic metres (m^3) of excavated material from tunnelling and earthworks during construction. Approximately 2,100,000 m^3 of the excavated material is proposed to be reused within the Project as fill, leaving an excess of approximately a 1,000,000 m^3 as spoil. The majority of the excess material, approximately 730,000 m^3, will result from the construction of the tunnel (excluding the portals). The design allows for the storage of excess material (i.e. spoil) from the construction of the tunnel as a stockpile within the proposed rail corridor at the western tunnel portal.

The following spoil reuse options as per the requirements of the ARTC Earthworks Material Specification and the Earthworks and Material Management Framework will be considered for the management of any material that is not suitable to be reused within the Project (e.g. basalt intersected by the tunnel may be suitable for capping and structure) and is stockpiled at western tunnel portal:

- The material may be used for the construction Rail Maintenance Access Roads, road embankments and mounds within short haulage distance of the source, reused for rehabilitation and landscaping

- The material may potentially be used as fill material for other projects including the Inland Rail B2G and H2C projects, along with TRC's Charlton Sports Precinct development
- Rehabilitation of the existing quarries within the vicinity (50 km) of the Project, as identified through discussions with operators (e.g. Harlaxton and Withcott quarries)
- Daily cover for waste management facilities (e.g. Toowoomba Waste Management Centre)
- Noise attenuation mounds and/or landscaping mounds
- Profile and capping soils (subject to demonstration of compliance with material specifications) for waste management facilities that are anticipating closure in the near future (e.g. Clifton, Goombungee, Pittsworth landfills.)
- Fill material for the extension of the rail formation for future passing loops
- Beneficial use off-site, subject to treatment and/blending of unsuitable material (due to contamination or geotechnical aspects) with chemical additives, which will allow for reuse and avoid disposal
- Subject to suitability, incorporation into commercial soil manufacturing processes (e.g. Candy Soil)
- Rehabilitation of the Toowoomba Bypass laydown area at Withcott
- Any spoil material that cannot be reused without treatment e.g. due to contamination, saturation or geotechnical reasons will be disposed at a designated waste facility that accepts spoil with those characteristics.

With the exception of spoil, which will arise during construction, no significant waste streams have been identified for the Project. Therefore, the waste streams have been categorised at a broad level and will be managed in accordance with standard industry practice and accommodated within the capacity of existing waste management arrangements that exist in the Project locality.

In combination with the application of mitigation measures, wastes generated during operation of the Project are expected to be typical of the current networks of freight rail and assumed to be of significantly less when compared to wastes generated during construction of the Project.

The identified waste streams will be managed through waste avoidance and mitigation strategies to minimise potential impacts on surrounding environmental values and sensitive receptors, in accordance with the *Waste Reduction and Recycling Act 2011* (Qld) waste management hierarchy, avoiding or reducing as highest preference, followed by re-use, recycle or recover for energy, treat, and dispose as the least preferable option. A Waste Management Sub-plan will be developed as part of the CEMP, which will guide these strategies. In addition, a Spoil Management Strategy has been prepared as part of the EIS.

Cumulative impacts

When numerous projects occur within close proximity to each other, they can cause cumulative impacts. The cumulative impact assessment of the Project considered up to 15 additional projects within a wide geographic extent as possibly contributing to cumulative impacts. For some environmental aspects such as Social and Traffic, transport and access projects such as the Cross River Rail project were also considered.

Spatial areas of influence as well as temporal (time) overlaps of project activities were considered for the various environmental, social and economic aspects. A standard approach was adopted for the majority of the environmental aspects, though some disciplines accounted for the cumulative impacts as part of the modelling outputs (e.g. air quality, noise and vibration) or involved a different methodology such as for the social, economic and landscape and visual amenity impact assessments.

Potential cumulative impacts on environmental aspects were considered of low significance, with the exception of potential cumulative impacts on the following environmental aspects:

- Land resources due to change to landform and topography, permanent loss of soil resources within the projects footprints and erosion which were all considered to be of medium significance
- Landscape and visual amenity due to the operational impacts associated with views of combined, successive, and sequential views of adjoining projects. Though it is noted that the Inland Rail projects will, in practice, be viewed as a continuous section of railway
- Flora and fauna due to the impacts of habitat loss from vegetation clearing on MNES, along with other ecological values relevant to the projects (e.g. priority back on track species and special least concern species) with the impacts deemed to be of medium significance for most matters considered. Of threatened species listed under the NC Act, the impact is considered to be of high significance

- Mitigation measures are no possible for a number of these ecological values. An offset strategy for the Project, which also incorporates the other Queensland Inland Rail projects, has been developed to offset impacts on MNES and MSES (Appendix Y: ARTC Offset Strategy). This strategy informs the development of offset delivery components including a Detailed Environmental Offset Delivery Plan and Offset Area Management Plans. This strategy will also offset some of the cumulative impacts outlined
- Social impacts due to the combined effects of adjoining projects on social matters including the labour force, traffic volumes, land acquisition, traffic safety, and rural amenity for landholders
- Cultural heritage was considered to be of medium significance due to loss of non-Indigenous cultural heritage sites
- Traffic, transport and access was considered to be of medium significance due to the impacts of construction traffic on local traffic volumes and the extent to which adjoining properties may intensify these effects.
- It is considered that potential cumulative impacts associated with the loss of biodiversity and cultural heritage aspects within the respective areas of impact are common to all projects included in the cumulative impact assessment (CIA); therefore, these impacts are by their nature cumulative. Similarly, projects included in the landscape and visual amenity CIA are likely to exacerbate impacts from the Project through combined, successive and sequential views of adjoining projects.
- Several of the projects included in the CIA may also have overlapping construction schedules, which is likely to lead to increased traffic congestion on certain roads within the traffic area of influence and the availability of skilled labour in the region in the short term.

Due to the nature of the projects considered in this cumulative impact assessment, it is anticipated that this process of assessment will occur for all projects that have the potential to result in cumulative assessment. That is, each of these projects will be required to mitigate and minimise these potential cumulative impacts to acceptable levels.

The key mitigation measures for reducing potential cumulative impacts have been incorporated into the Draft Outline EMP.

The proposed delivery approach for the Gowrie to Helidon, Helidon to Calvert and Calvert to Kagaru Projects, and, where applicable, other Inland Rail Projects, provides opportunities to coordinate the management of cumulative impacts generated as a result of construction traffic movements, workforce requirements (including accommodation requirements), spoil management and reuse, and strategic identification and provision of environmental offsets (for ecological receptors). These aspects will be considered collectively across these three projects in future delivery stages.

Approach to environmental management

A Draft Outline EMP has been prepared for the Project to:

- Provide an environmental management framework to enable the identified environmental and social outcomes to be achieved for the detailed design, pre-construction, construction and commissioning
- Establish the subsequent process for the preparation and implementation of the Outline Environmental Management Plan and Construction Environmental Management Plan.

The Draft Outline EMP includes discipline-specific sub-plans, drawing on the outcomes of the environmental assessments documented in the draft EIS. The Draft Outline EMP establishes the framework for the CEMP. The Draft Outline EMP identifies:

- Environmental outcomes
- Performance criteria
- Proposed mitigation measures
- Monitoring requirements.

Aspects addressed in the Draft Outline EMP include:

- Land use and tenure
- Land resources
- Landscape and visual amenity
- Flora and fauna

- Air quality
- Surface water and hydrology
- Groundwater
- Noise and vibration
- Cultural heritage
- Traffic, transport and access
- Hazard and risk
- Waste and resource management.

Social and economic matters are addressed under the Social Impact Management Plan.

Any conditions imposed by the Coordinator-General in the EIS evaluation report or by the Australian Government Minister for the Environment (or their delegate), along with any approval conditions from regulators post-EIS approval will need to be incorporated into future versions of the Outline EMP and the CEMP to ensure that all works are authorised and consistent with those conditions.

ARTC has also executed a CHMP with each of the respect Aboriginal Parties relevant to Project, in accordance with the requirements of Part 7 of the *Aboriginal Cultural Heritage Act 2003* (Qld) and the *Cultural Heritage Management Plan Guidelines (* (DATSIP, 2005), and approved by the Chief Executive of DATSIP in 2018 (CLH017009). The resulting CHMPs (CLH017009) entered into with the Aboriginal Parties will allow for the identification, assessment and management of Aboriginal cultural heritage in the plan area (as defined in the CHMP) throughout all Project delivery phases.

Concluding statement

The Project, and the Inland Rail Program as a whole, provides a 'step change' opportunity to revolutionise the capacity and mode of freight travel in Australia. Inland Rail offers a safe and sustainable solution to existing freight bottlenecks and provides opportunities for complementary development to maximise the economic growth opportunities associated with the Project.

As part of the wider Inland Rail Program, the Project 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 farms with domestic and international export markets.

The Project will also provide for a more direct and efficient route across the Toowoomba Range which would benefit existing and future rail operators, benefiting south-west Queensland as well as SEQ, which aligns with a number of state and regional plans for the area.

The Project is consistent with the objectives of the EPBC Act, including providing for MNES. the Project aligns with the core objectives and the guiding principles of Ecologically Sustainable Development, is consistent with the Queensland Freight Strategy (DTMR, 2019a), the Inland Rail Business Case (ARTC, 2015a) and Australian Government expectations.

The EIS has undertaken a conservative and 'worst case' approach to identifying the potential impacts of the Project, including cumulative impacts. Where environmental impacts have been identified through the assessment process, efforts have, in the first instance, been made where practicable to avoid or minimise those impacts through development of the design. Where attempts to avoid or minimise impacts through design have been of limited effect, further mitigation measures have been nominated for implementation during future phases of the Project. This demonstrates the integration of the principle of conservation biological diversity and ecological integrity in the impact assessment process.

With regards to intergenerational equity, as part of the wider Inland Rail Program, the Project would benefit existing and future generations by providing a safer, more efficient, means of transporting freight between Melbourne and Brisbane. Conversely, should the Project (and therefore Inland Rail) not proceed, the principle of intergenerational equity may be compromised. Future generations would experience increasingly worse safety and environmental impacts due to continued growth in road transport between Melbourne and Brisbane.

The principle of improved valuation, pricing and incentive mechanisms requires that environmental factors should be included in the valuation of assets and services. It is difficult to place a monetary value on the Project's environmental impacts. However, the value placed on environmental resources within and surrounding the

alignment is recognised in the environmental investigations undertaken to inform the Project design and mitigation measures. The estimated costs associated with environmental design and mitigation measures have also been built into the overall Project cost.

Opportunities have also been identified through the assessment to maximise the potentially significant economic and social benefits of the Project, through local employment, local industry participation and opportunities for complementary investment that provides for continued community benefit.

Effective mitigation measures to address potential impacts of the Project are detailed within the EIS. The measures will be further developed, implemented and maintained as the Project progresses through future stages of development.

Implementing recommended mitigation and management measures, and adopting each commitment made, will minimise environmental issues.

The Project, and the wider Inland Rail Program, provides significant opportunity to deliver long-term and substantial economic benefits for Australia's future, by connecting regional and urban markets to buyers and increasing the capacity of the existing passenger and road network.

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. The EIS demonstrates that the residual impacts and benefits can be appropriately managed and therefore it is recommended that the Project should proceed, subject to reasonable and relevant conditions that reflect the proponents' commitments as listed in Appendix F: Proponent Commitments.