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IR_1434

COVER IMAGE

Aerial photo of the existing Queensland Rail railway line near Railway Street, Laidley, looking west towards the Laidley township.

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.

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EXECUTIVE SUMMARY

HELIDON TO CALVERT ENVIRONMENTAL IMPACT STATEMENT

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Introduction

The Project

This Environmental Impact Statement (EIS) has been prepared to assess the potential impacts and benefits associated with the construction and operation of the Helidon to Calvert Project (the Project). The Project consists of approximately 47 kilometres (km) of single-gauge rail track in South East Queensland (SEQ). Approximately 24 km of the alignment is shared with the existing Queensland Rail (QR) West Moreton System rail corridor. It is one of 13 distinct projects that make up the Inland Rail Program (Inland Rail).

The Helidon to Calvert section of Inland Rail, shown in Figure 1, is described as one of the 'missing links' in Inland Rail, and connects with the two other Inland Rail projects of:

- Gowrie to Helidon project to the north-west
- Calvert to Kagaru project in the south-east.

Freight trains of up to 1,800 m in length, and potentially double stacked, will be accommodated on the Inland Rail. The Australian Rail Track Corporation (ARTC) *Inland Rail Business Case* (2015a) adopts the year 2026 as the expected commencement of operations, with an average of 33 services per day. This may increase up to an average of 47 services per day in the year 2040.

Due to the Project's length, significant infrastructure elements (including the tunnel) and earthworks required for the crossing of Little Liverpool Range, a capital expenditure in the order of $1 billion is expected (ARTC, 2017a)—this includes both direct construction costs and indirect costs. Indirect costs include items such as: Contractor overhead and margins, contingency, and escalation. The total investment figure also includes ARTC Program costs such as project management, train control systems, property requirements, and insurances. The total investment figure makes provision for expected Project contingency and risk.

The EIS assumes an estimated capital cost profile of approximately $565 million, based on 2019 dollars, consistent with the *Inland Rail Programme Business Case* (ARTC, 2015a). The EIS capital cost profile is an estimate of direct construction costs—including, but not limited to: delivering environmental and heritage commitments; fencing and earthworks; tunnels and tunnel services; formation and roadworks; structures; track works (loops and crossings); delivery works (incidentals and utilities); and supply of track, sleepers and turnouts.

The Inland Rail Program

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 serve the interstate freight market.

The Inland Rail route is approximately 1,700 kilometres (km) and 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 SEQ.

The Inland Rail 'service offering' (**inlandrail.artc.com.au/service-offering**) is central to the delivery and competitiveness of the combined 13 projects and reflects the priorities of freight customers. It was developed in consultation with market participants and stakeholders.

Inland Rail will connect regional Australia to markets more efficiently, drive substantial cost savings for producers and consumers, and deliver significant economic benefits. The majority of freight transported via Inland Rail will be for domestic markets.

The Environmental Impact Statement

This EIS documents the environmental impact assessments undertaken by ARTC. 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. Potential benefits of the Project are also identified within the EIS.

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 for the Project issued by the Queensland Coordinator-General in October 2017. The EIS also addresses matters relevant to the *Environment Protection and Biodiversity Conservation Act (1999)* (Cth) (EPBC Act) and Referral 2017/7883.

INLAND RAIL

The Proponent

ARTC is the proponent for the Project. ARTC was created after the Australian Government and state governments agreed in 1997 to form 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 modernising the interstate rail network. This work has extended to building and upgrading existing track to allow for the capacity that the market requires.

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

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

Contact details for the proponent 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 can be found at: **artc.com.au.**

ARTC

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

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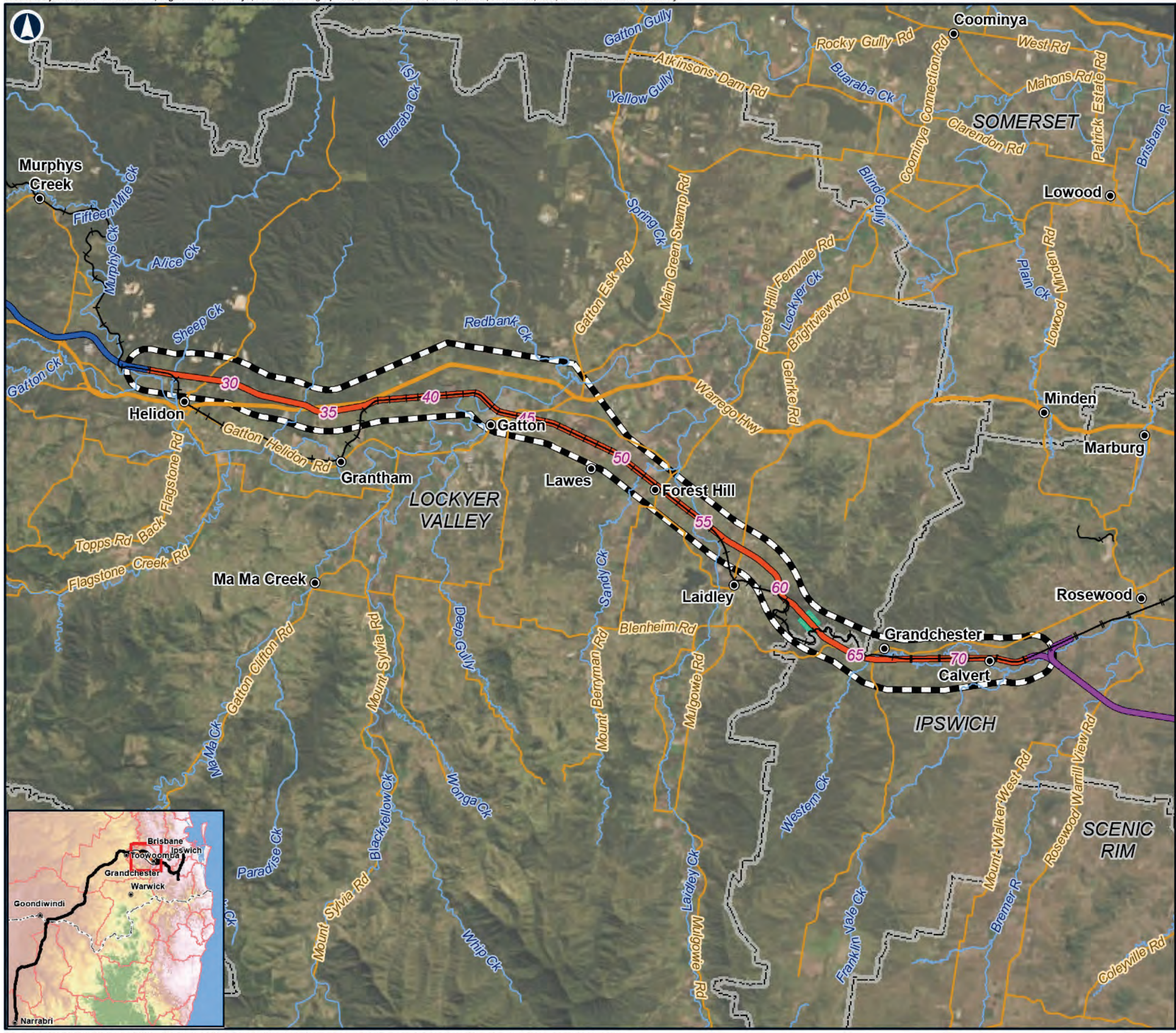

INLAND RAIL ARTC

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

HELIDON TO CALVERT

Figure 1: Regional Context

LEGEND

- 5 Chainage (km)
- Localities
- Existing rail
- G2H project alignment
- H2C project alignment
- C2K project alignment
- Tunnel
- Watercourses
- Major roads
- Minor roads
- EIS investigation corridor
- Local Government Areas

0 6.5 13 km

Coordinate System: GDA 1994 MGA Zone 56

ARTC makes no representation or warranty and assumes no duty of care or other responsibility to any party as to the completeness, accuracy or suitability of the information contained in this GIS map. The GIS map has been prepared from material provided to ARTC by an external source and ARTC has not taken any steps to verify the completeness, accuracy or suitability of that material. ARTC will not be responsible for any loss or damage suffered as a result of any person whatsoever placing reliance upon the information contained within this GIS map.

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Author: FFJV GIS Scale: 1:260,000
Data Sources: FFJV

Map by: LCT/RB Z:\GIS\GIS_3300_H2C\Tasks\330-EAP-201906130950_Figure_update\Figure1_Regional_context_rev5.mxd Date: 11/02/2020 15:35

Justification for Inland Rail

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:

- The existing rail freight route between Melbourne and Brisbane is expected to reach capacity after 2050—additional capacity will be required to accommodate increasing demand for interstate and regional rail freight
- 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, is not continuous, is constrained by passing through the congested hub of Sydney and cannot accommodate long 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, environment and social 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; Infrastructure Australia, 2016a).

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 Inland Rail, 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

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 to distribute goods at a 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. The service offering reflects the priorities of freight customers and responds to both current and expected market conditions.

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.

Project benefits

As a component of Inland Rail, the potential benefits of the Project will be fully realised when considered with the benefits of the full Melbourne to Brisbane alignment. Key Project-specific benefits include:

- Employment for up to 410 full-time equivalents at the peak of construction (an expected average workforce of 190 people on site over the construction period), including people living in the vicinity of the Project and in nearby local government areas, with indirect employment also likely to be stimulated
- Training opportunities provided by ARTC and the development of career pathways for young people, Indigenous people and unemployed people, who are disadvantaged in the labour market
- Opportunities for local, regional and Indigenous businesses to participate in the Project's construction supply chain
- Development of labour force and business capacity will enable future employment and business growth opportunities for businesses in the region
- Potential to catalyse improved employment and business opportunities by stimulating the establishment of businesses or industry
- 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 the Project

The continuing growth in freight demand calls for urgent attention. 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 rail corridor or the Inland Rail freight corridor is not undertaken to increase capacity and minimise supply chain costs, 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 provide a strong justification for the Project to proceed.

Project approvals

Environmental assessment

This EIS documents the environmental impact assessments undertaken by ARTC to support the delivery of the Project. 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 potential environmental, social and economic impacts of the Project are identified and assessed and demonstrate that the Project is based on sound environmental principles and practices.

The EIS includes a draft Outline Environmental Management Plan (draft Outline EMP), which proposes a framework to implement mitigation measures to avoid or minimise adverse impacts.

Queensland approval process

On 15 February 2017, ARTC submitted an Initial Advice Statement to the Coordinator-General in an application for a 'coordinated project' declaration under the *State Development and Public Works Organisation Act (1971)* (Qld) (SDPWO Act). On 16 March 2017, the Coordinator-General declared the project a 'coordinated project' for which an EIS is required.

The Terms of Reference for the Project was approved by the Coordinator-General under Section 30 of the SDPWO Act and was released on 5 October 2017. The Terms of Reference provides the general and specific matters that ARTC must address in preparation of the EIS. The EIS has been prepared in response of the Terms of Reference.

Commonwealth approval process

The Project was deemed a 'controlled action' on 17 March 2017, which means that it is also required to be assessed and approved under the EPBC Act before it can proceed. 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'. The controlling provision for the Project is listed threatened species and communities under sections 18 and 18A of the Act, as determined in the Referral (Reference 2017/7883) for the Project.

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 (Section 45) of the EPBC Act using the information presented in the EIS.

Submissions on the EIS

Any person, group or organisation can make a submission about the Project's EIS to the Office of the Coordinator-General during the public notification period. Properly made submissions will be considered by the Coordinator-General in evaluating the EIS.

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.

Any submissions regarding this EIS should be addressed to:

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

Submissions can be made electronically at the following email address:

inlandrailh2c@coordinatorgeneral.qld.gov.au

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

For further enquiries, telephone: 13 QGOV (13 74 68).

The EIS has been approved by the Queensland Coordinator-General for public exhibition. Any person, group or organisation can make a submission about the Project's EIS to the Office of the Coordinator-General during the public notification period. All properly made submissions are considered by the Queensland Coordinator-General in evaluating the EIS.

After the public exhibition period, the Queensland Coordinator-General considers the EIS, all properly made submissions, and any other material the Queensland Coordinator-General considers relevant to the Project. The Queensland Coordinator-General then decides whether or not to accept the EIS as the final EIS 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 EIS as the Final EIS, the Coordinator-General must request additional information and advise whether 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 Act, a revised EIS is provided and public notification undertaken, where required.

When the Queensland Coordinator-General accepts the EIS as the final EIS, they evaluate the EIS, any submissions made on the EIS, 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 in Figure 2, showing the stages of the EIS approval process.

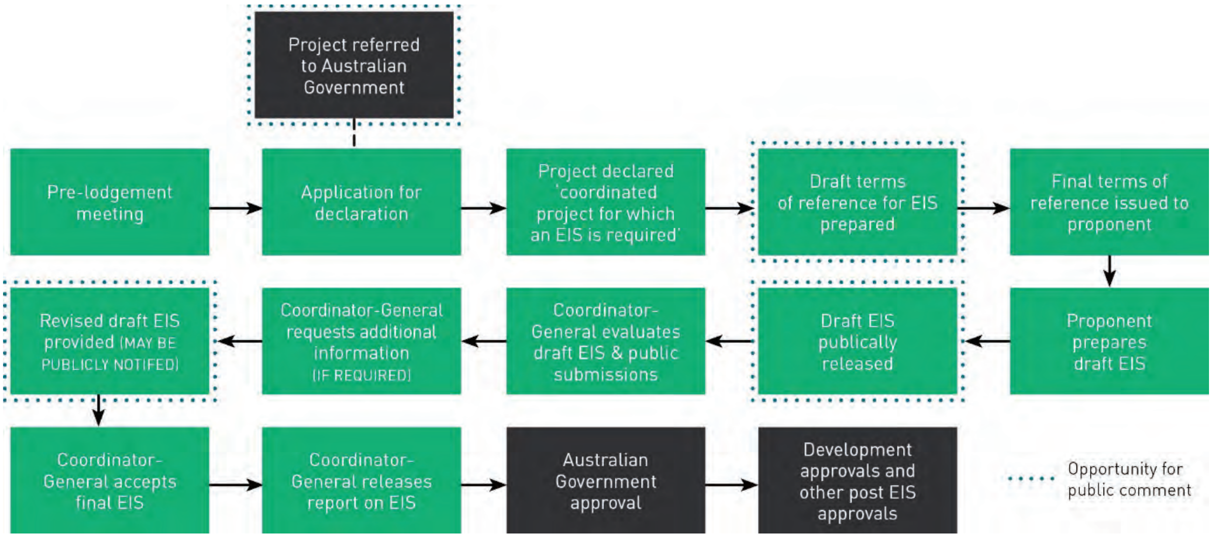

FIGURE 2: THE ENVIRONMENTAL IMPACT ASSESSMENT AND CONSULTATION PROCESS UNDER THE SDPWO ACT AND THE EPBC ACT

Assessment approach

This EIS has been prepared to address the Terms of Reference and provide analysis and assessment of potential environmental and socio-economic impacts from the Project.

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

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

The need to provide environmental offsets to address potential residual impacts was also identified. A consolidated description of commitments to implement management measures including monitoring and offsets, is provided as Appendix E: 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 (SIMP), and associated action plans.

Multi-criteria analysis was undertaken as part of the EIS and design development processes to refine the alignment within the EIS investigation corridor and consider refinements outside of the protected Gowrie to Grandchester future state rail corridor, as well as optimise road–rail interfaces and interfaces with the existing QR West Moreton system rail corridor. The analysis included consideration of environmental and social impacts and construction efficiencies. The resulting Project design and disturbance footprint was assessed in the EIS.

Key terms used across the EIS assessments include:

- EIS investigation corridor: An approximate 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 works are proposed, including both permanent and temporary works, and land within a 1 km radius either side of the proposed rail alignment. The EIS investigation corridor is wider to accommodate for the assessment of alternate options at Gatton as discussed in Chapter 2: Project rationale.
- Disturbance footprint: The disturbance footprint includes:
    - Permanent disturbance footprint: The rail corridor includes the rail tracks and associated infrastructure as well as other permanent works associated with the Project (e.g. where changes to the road network are required)
    - Temporary disturbance footprint: The permanent disturbance footprint and any temporary storage and laydown areas to be used on a temporary basis during the construction phase
    - 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.

Any consideration of passenger transport services proposed within the Gowrie to Grandchester future state transport corridor will be progressed by the DTMR and are excluded from this EIS.

A number of utility relocations, including for water, sewer and electricity, will be required prior to construction of relevant Project works. These utility relocations will be undertaken as 'enabling works' by the utility provider and are not assessed as part of the Project. These utility relocations will be subject to separate assessments, with all necessary approvals obtained prior to the relocation being undertaken.

Third-party infrastructure requirements will be determined during future Project stages. Complementary infrastructure such as freight terminals, precinct developments, and upgraded fleet and rolling stock are not included within the scope of the Project.

Community and stakeholder engagement

Stakeholders and members of the community have helped to shape the scope of this EIS by providing submissions on the draft Terms of Reference and the Project referral under the EPBC Act and by participating in community consultation processes.

The consultation program for the Project 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 as members and observers), and ARTC's online Social PinPoint and CollabMap tools) and via industry associations
- Australian Government departments, Queensland Government departments and agencies, and local governments with either a regulatory or an advisory role relevant to the design, construction or operation of the Project.

Stakeholders interactions are presented in Figure 3. Communication materials supported the consultation activities, provided stakeholders with information and generated awareness. These materials allowed information to flow between ARTC and stakeholders. Opportunities were created to discuss, capture and record feedback.

A summary of consultation methods presented in Figure 4.

Stakeholder and community feedback and comments have informed the preparation of this EIS. Specifically, consultation allowed the Project to:

- Identify community values and local conditions in proximity to the Project
- Appropriately assess potential impacts and identify key benefits of the Project's construction and operation
- Propose measures to minimise or avoid potential Project impacts
- Recommend 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.

Key themes identified from the EIS community and stakeholder engagement is provided as Figure 5.

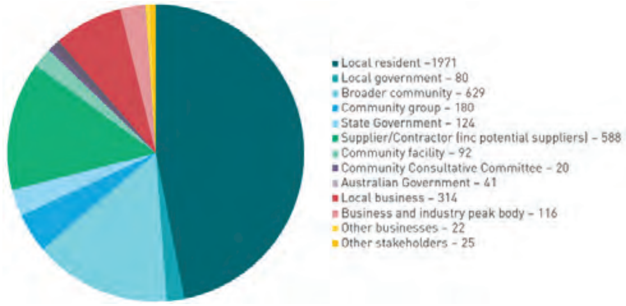

FIGURE 3: STAKEHOLDER INTERACTIONS

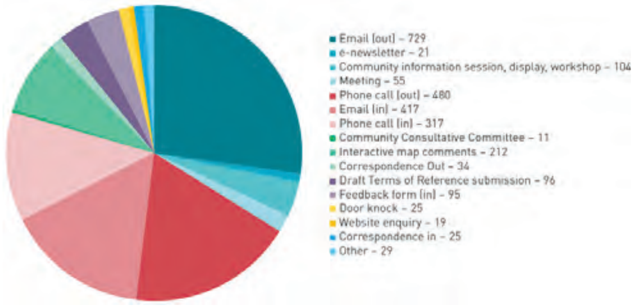

FIGURE 4: CONSULTATION METHODS

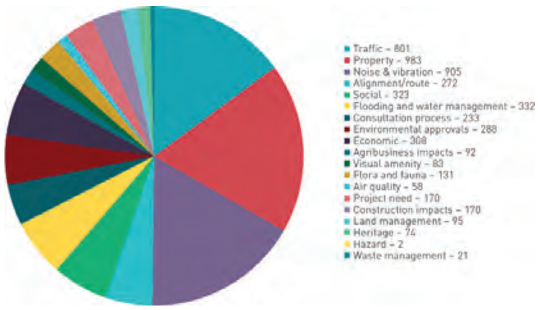

FIGURE 5: EIS KEY CONSULTATION THEMES

Project description

Overview

The Project is a new railway, approximately 47 km in length within both greenfield and brownfield corridors, with four crossing loops to accommodate double-stack freight trains of up to 1,800 m long. It also involves the construction of an 850 m long tunnel through the Little Liverpool Range to enable the required gradient for trains to cross the undulating topography.

The location of the Project and its regional context is shown in Figure 1, as well as the Project's interaction with the existing West Moreton System rail corridor, identified on Figure 1 as 'existing rail'.

The Project runs parallel to the existing QR West Moreton System rail corridor for approximately 50 per cent of the alignment, as well as using the Department of Transport and Main Roads' (DTMR) Gowrie to Grandchester future State transport corridor.

The co-location of the Project alignment with the existing rail corridor has been designed to minimise conflicts between local communities and the rail network, minimise visual intrusion in the area, and allow coordination of service lines with existing rail networks. The objectives of the Project design are to:

- Provide rail infrastructure that meets the Inland Rail specifications, to enable trains using the Inland Rail corridor to travel between Helidon and Calvert, connecting with other sections of Inland Rail to the west and east
- Minimise the potential for adverse environmental and social impacts.

The Project design has responded to key environmental features and has been developed in line with engineering constraints to produce a feasible rail design.

Key features of the Project include:

- Approximately 47 kilometres of single-track, dual-gauge rail line with four crossing loops, initially constructed for 1,800 metre long trains and designed so that the future extension of some crossing loops to accommodate 3,600 metre trains is not precluded
- An approximate 850 metre tunnel through the Little Liverpool Range and 31 bridges to accommodate the topography and to cross waterways and other infrastructure
- Tie-ins to the existing West Moreton Railway Line
- Construction of associated rail infrastructure, including maintenance sidings and signalling infrastructure to support the Advanced Train Management System
- Rail crossings, including crossings (level and occupational), grade separations. bridges, 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.

The Project is expected to represent an investment of up to $1 billion—this includes both direct construction costs and indirect costs (ARTC, 2017a).

The EIS assumes a capital expenditure profile of approximately $565 million, based on 2019 dollars, consistent with the *Inland Rail Programme Business Case* (ARTC, 2015a)—the EIS capital cost profile is an estimate of direct construction costs.

Local context

The Project is located within the Ipswich and Lockyer Valley local government areas (LGAs) in SEQ.

The Project is within the Ipswich local government area (LGA) (10.7 km of alignment) and Lockyer Valley LGA (36.8 km) in SEQ. The Project corridor is classed as both greenfield and brownfield, as part of the alignment will use existing rail corridors.

The Project starts at Helidon, deviating from the existing Queensland Rail (QR) West Moreton System rail corridor along Airforce Road and continues south-east, crossing the Warrego Highway then continuing east between the highway and the existing rail corridor until it runs immediately parallel with the existing rail line slightly north of Placid Hills.

The alignment runs parallel with the existing rail line at the following locations:

- Western end from Gowrie to Helidon Inland Rail project connection at Airforce Road
- Central portion through Gatton and Forest Hill
- Eastern end at Grandchester to the Calvert to Kagaru Inland Rail project connection at Calvert.

The new track continues parallel to the north of the existing rail corridor, through Gatton and the northern side of the existing Gatton rail station, through Forest Hill and then deviates from the existing rail corridor in a south-east direction just north of the Laidley township across Laidley Plainlands Road to the new tunnel section through the Little Liverpool Range.

After exiting the eastern tunnel portal at the Little Liverpool Range, the Project corridor crosses under the West Moreton System rail corridor and over Rosewood–Laidley Road, bypassing the existing Grandchester Station to the south, running parallel to the existing rail corridor, and then connecting into the West Moreton System rail corridor at the proposed Calvert to Kagaru project west of Calvert.

Relationship to other Projects

The Project forms part of Inland Rail and is one of the missing links across the program. It provides a link between:

- Gowrie to Helidon to the north-west. Declared a coordinated project for which an EIS is required under the SDPWO Act (EIS currently being prepared)
- Calvert to Kagaru project in the south-east. Declared a coordinated project for which an EIS is required under the SDPWO Act (EIS currently being prepared).

The Project does not have a direct relationship with any other coordinated projects, major projects or developments.

However, the Project will provide more direct connectivity opportunities between the existing West Moreton System and ARTC Interstate lines, as well as being a potential catalyst for the development and growth of intermodal hubs (InterLinkSQ, Bromelton Intermodal Hub) and regional industrial areas (Gatton West Industrial Zone, Willowbank Industrial Area).

Key features

The key characteristics of the Inland Rail 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 Inland Rail.

Key design features are described in the following sections and shown in Figure 6 to Figure 13.

Rail

The rail component of the Project is 47 km of new, single-track, dual-gauge railway—standard gauge (1,435 mm) and narrow gauge (1,067 mm). Typically, the Project will use a ballasted track system, with continuously welded 60 kg/m rail, resilient fasteners, rail pads and concrete dual-gauge, full-depth sleepers at 600 mm centres. Figure 6 shows a typical section for a dual-gauge ballasted track.

Tunnel

An 850 m tunnel will be built through the Little Liverpool Range to facilitate the required gradients due to the undulating terrain in this area.

The tunnel portal areas will require a substation building for power supply and distribution to electrical equipment, fire water tanks and a pump station for the tunnel hydrant system, and an emergency services staging area.

A tunnel control centre will be required at one of the portals that will be predominantly unmanned.

The tunnel will have a ventilation building (approximate dimensions with height: 23 m; length: 61 m; and, width: 22 m, fitted with attenuators and dampers) above each portal that will include large axial fans and air nozzles to control air-flow direction and heat in the event of degraded or emergency conditions (or if required during tunnel maintenance activities). The tunnel is sized so that fans are not required for normal train operation.

For emergency events, there is a fire-rated longitudinal egress passage provided throughout the tunnel with access every 60 m. Communication facilities to the operator will be provided inside this passage.

Crossing loops

Crossing loops are places on a single-line track where trains travelling in opposite directions can pass each other. The crossing loops for the Project are double-ended and are connected to the main track at both ends. Figure 7 shows an indicative design for crossing loops and maintenance sidings.

In operation, one train enters a crossing loop through one of the turnouts and idles at the other end, while the other train continues along the mainline track to pass the stationary train.

The Project proposes four new crossing loops at approximately 13 km intervals. The proposed locations for the crossing loops are:

- Helidon
- Gatton
- Laidley
- Calvert.

They will range in length to accommodate the surrounding area and topography and fit the design length of the train (1,800 m). The location of crossing loops was informed by the operational modelling for Inland Rail and considered separation distances from sensitive receptors and existing infrastructure, allowing flexibility for future extension.

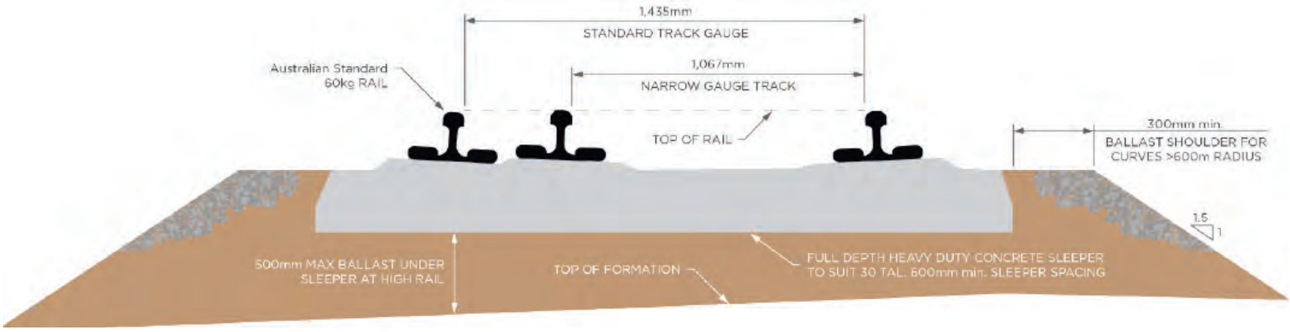

FIGURE 6: INDICATIVE DESIGN FOR NEW TRACK

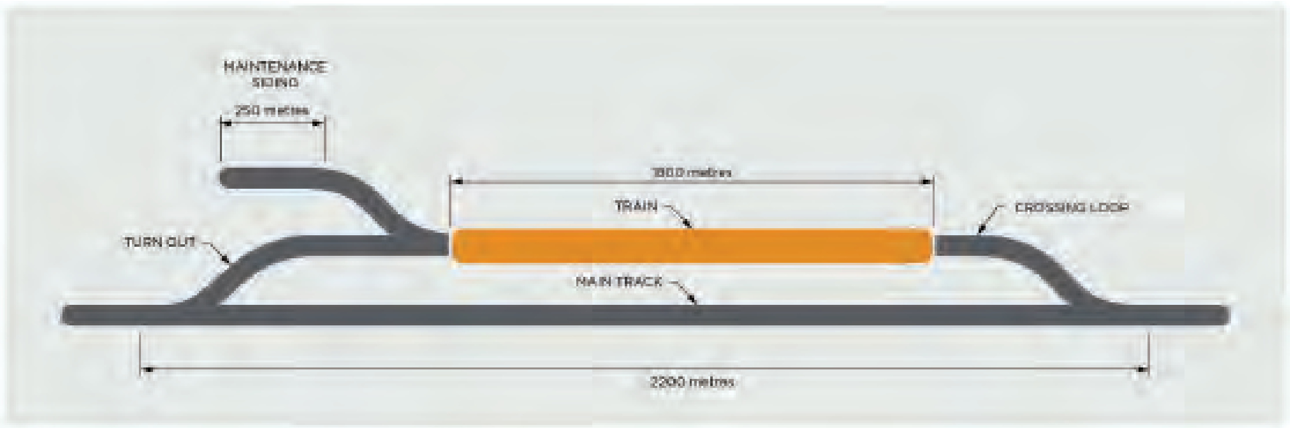

FIGURE 7: INDICATIVE DESIGN FOR CROSSING LOOP AND MAINTENANCE SIDING

Turnouts

Turnouts that tie-in to West Moreton System rail corridor and the proposed crossing loops will be incorporated as part of the Project

Bridges

Bridge structures are needed so that water, vehicles and, in some cases, stock and pedestrians can cross the rail corridor. The bridges are either rail-over-watercourse, rail-over-road, or road-over-rail structures, depending on local topography and rail or road alignment requirements. The type of bridge proposed for a specific location depends on a range of factors, such as topography, road usership, rail and road alignments at the crossing point, and access requirements.

Bridges have been provided for all major watercourse crossings along the Project alignment to minimise impacts to the local riverine system and to avoid having to divert watercourses.

Two existing bridges require reinstatement or reconstruction along the alignment as a result of the Project. The existing road bridge located on Eastern Drive in Gatton will require replacement to provide the required clearance over the rail alignment. The existing QR rail bridge over Lockyer Creek requires replacement to accommodate the Old College Road and Beavan Street upgrade.

31 new bridge structures are required for the Project, including:

- 13 rail-over-watercourse
- 6 rail-over-waterway and road
- 6 rail-over-road
- 4 road-over-rail
- 1 rail-over-rail
- 1 pedestrian-over-rail.

The new bridge structures will typically be founded on piles supporting in-situ reinforced concrete substructures. The bridges are of varying lengths and spans. Bridge superstructures will typically be formed from pre-stressed concrete girders (pre-stressed concrete slab span and pre-stressed concrete Super-T) with in-situ reinforced concrete decks incorporating walkways, guardrails and barriers, as shown in Figure 8.

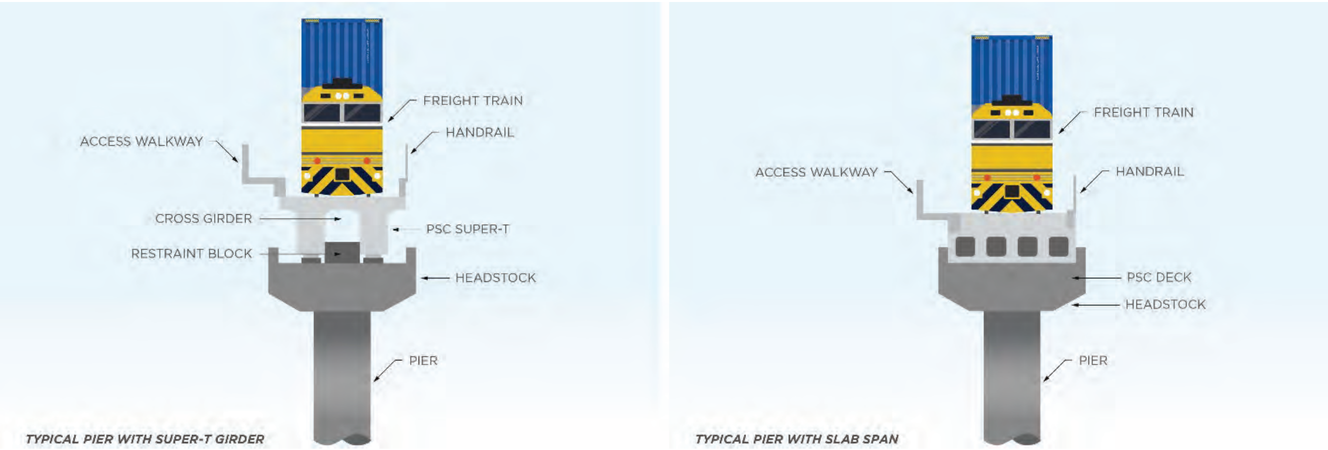

FIGURE 8: TYPICAL PIER WITH PRE-STRESSED CONCRETE SUPER-T GIRDER (LEFT); TYPICAL PIER WITH PRE-STRESSED CONCRETE SLAB SPAN (RIGHT)

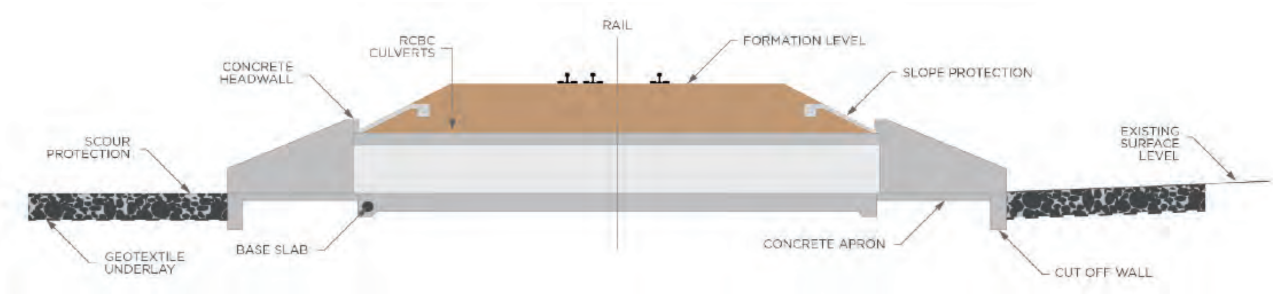

FIGURE 9: TYPICAL SECTION OF A CROSS DRAINAGE CULVERT

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 will depend 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 design criteria of a 1% Annual Exceedance Probability event. Annual Exceedance Probability refers to the probability of a flood event occurring in any year. The probability is expressed as a percentage. For example, a large flood calculated to have a 1% chance of occurring in any one year, is described as 1% Annual Exceedance Probability.

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 avoid erosion. A typical section of a cross drainage culvert is shown in Figure 9.

The total number of cross drainage structures are as follows:

- 19 bridges
- 51 reinforced concrete pipe locations (multiple cells in places)
- 35 reinforced concrete box culvert locations (multiple cells in places).

Road drainage structures have been incorporated into the design for: Eastern Drive (Lockyer Creek catchment); Gordon Street, Old Laidley Forest Hill Road (Forest Hill and Laidley catchment); and, Grandchester Mount Mort Road, Newman Road (Western Creek catchment).

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 failure of the subgrade.

Two types of track drainage are proposed:

- Embankment drains—longitudinal drains adjacent to the track in embankments (refer Figure 10)
- Catch drains—longitudinal drains on the uphill-side of cuttings (refer Figure 11)

With due consideration to topographic constraints, track drainage is proposed at specific locations along the alignment where the gradient is steep enough to divert surface runoff to the nearest bridge or culvert location. As with culverts, the design and location of track drainage will be refined during the detailed design phase to minimise potential impacts.

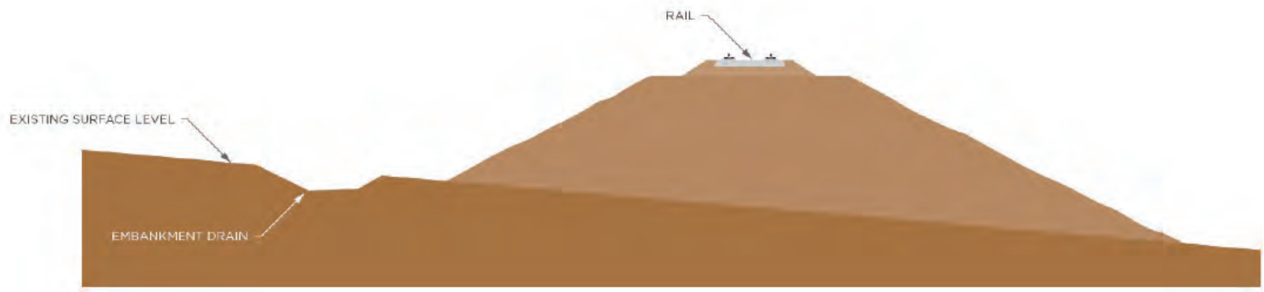

FIGURE 10: TYPICAL LONGITUDINAL DRAINAGE FOR RAIL FORMATION ON TOP OF AN EMBANKMENT

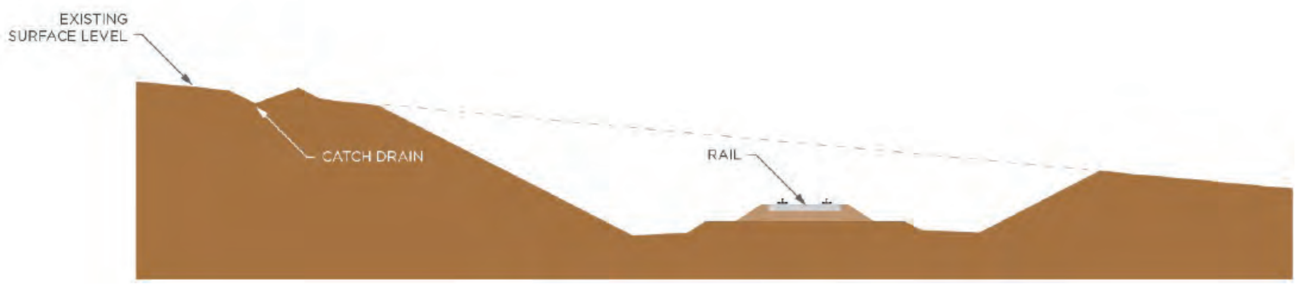

FIGURE 11: TYPICAL LONGITUDINAL DRAINAGE FOR RAIL FORMATION WITHIN A CUT

Public road–rail interfaces

The Project requires the crossing of both State-controlled roads managed by the Department of Transport and Main Roads, and local government roads managed by Lockyer Valley Regional Council and Ipswich City Council.

The appropriate road–rail interface treatment has been assessed on a case-by-case basis for design purposes, with consideration given to current and future usage of the existing asset, its location relative to other crossings of the rail corridor and the road and rail geometry at the crossing location. ARTC has also taken into consideration State and national guidelines and strategies by the Office of the National Railway Safety Regulator and the Department of Transport and Main Roads that focus on avoiding building any new level crossings or minimising any proposal to construct a public level crossing on a new rail line.

Proposed treatments include:

- Grade separation—roads and rail cross each other at different heights so that traffic flow is not affected. Grade separations are either road-over-rail or rail-over-road.
- Passive or active level crossings:
  - Passive level crossings have static warning signs, for example stop signs or give-way signs that are visible on approach. This signage is unchanging with no mechanical aspects or light devices
  - Active level crossings have flashing lights and some have boom barriers for motorists and automated gates for pedestrians. Active level crossing devices are activated before and during a train passing through the level crossing
  - Crossing consolidation, relocation, diversion or realignment is where existing road–rail interfaces may be closed, consolidated into fewer crossing points, relocated or diverted.

Preferred options for formed public road–rail interface treatments include:

- 36 public road (formed) interfaces
- 9 public road (unformed) interfaces
- 7 active road level crossings, comprising
  - 4 new; 3 upgrades to existing; 1 consolidation (replaced with a pedestrian crossing)
- 5 pedestrian crossings (including replacement of the existing pedestrian footbridge at Gatton Station)
- 12 rail-over-road grade separations (public road (formed) interfaces
- 2 road-over-rail grade separations (public road (formed) interfaces
- crossing consolidations, realignments and diversions.

Private road–rail interfaces

The Project interfaces with 50 private (occupational) accesses. The impact on each individual property will differ and ARTC will continue engaging with landowners to find ways to minimise disturbance to properties, which includes access to properties.

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 landowners 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 of use.

Typical treatments may include:

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

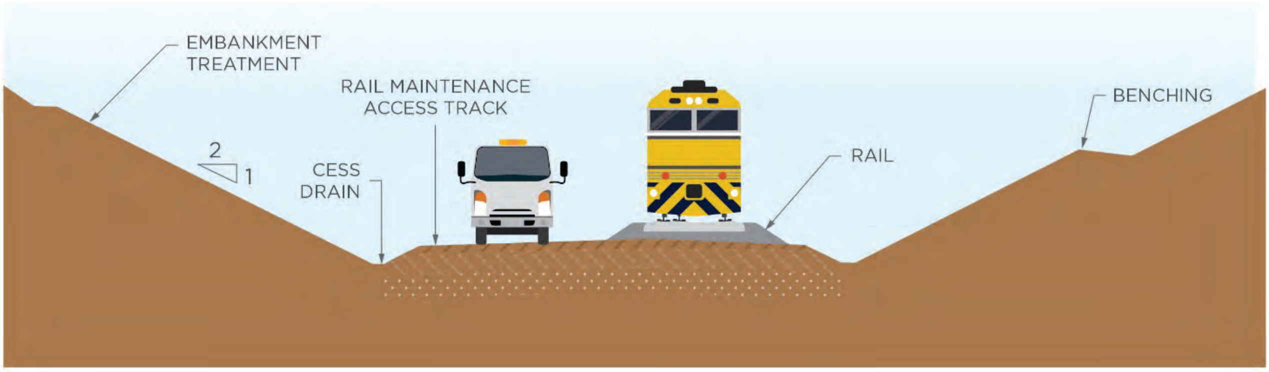

FIGURE 12: TYPICAL SECTIONAL DIAGRAM OF RAIL FORMATION SHOWING A RAIL MAINTENANCE ACCESS TRACK

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 12 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.

Utility and services interfaces

There are in the order of 662 utilities and services within the disturbance footprint that will potentially be impacted by the Project, including communications, electricity, oil, gas and water, owned by various 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 characteristics and criticality of each asset to the owner.

Consultation has commenced with the various utility owners regarding their requirements for relocation or protection of the utilities impacted by the Project to ensure there is no restricted access.

A number of utility relocations, including for water, sewer and electricity, will be required prior to construction of relevant project works. These utility relocations will be undertaken as 'enabling works' by the utility provider and are not assessed as part of the Project.

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 landowners.

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 procedure, 'Boundary Fencing ETM-17-02'.

Fencing will act to protect adjoining land from trespass and help prevent stock on such adjoining land from gaining access to the railway. Where superior fencing is required, for example where tracks are proximity 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 safe-working system consisting of signalling and communications equipment will be installed to ensure the safe movement of trains will be delivered as part of Inland Rail. 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 safe-working system is expected to be monitored and controlled from an existing ARTC train control centre.

Environmental treatments

Fauna exclusion fencing, sediment basins, scour protection, potential noise mitigations (subject to detailed design) and waterway crossings considerate of fish passage will be installed as part of the Project.

Land requirements

The corridor required for the Project generally varies in width between 40 m to 62.5 m, extending wider where earthworks, structures and other associated infrastructure are required. For the existing rail corridor, the existing width has been generally maintained (where possible), and locally widened to accommodate the works.

The corridor will be of sufficient width to allow future crossing loop extensions to accommodate 3,600 m trains.

Temporary tracks will be used to access Project construction sites. Where required, these temporary tracks will be retained to serve as rail maintenance access roads during Project operations.

Land requirements for construction will also include temporary workspaces, site offices and laydown facilities. Laydown areas will be located approximately every 5 km, avoiding 1% Annual Exceedance Probability floodplains where possible. Larger sites will be located approximately every 20 km. Additional laydown areas of approximately 2,500 square metres (m^2) will support bridge construction. Laydown areas will also be required to support flash-butt welding or rail assembly.

Embankments and cuttings

Embankments and cuttings will be required in response to topographical constraints 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.

Material sourcing

Established quarries will be used to source construction materials. Local 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.

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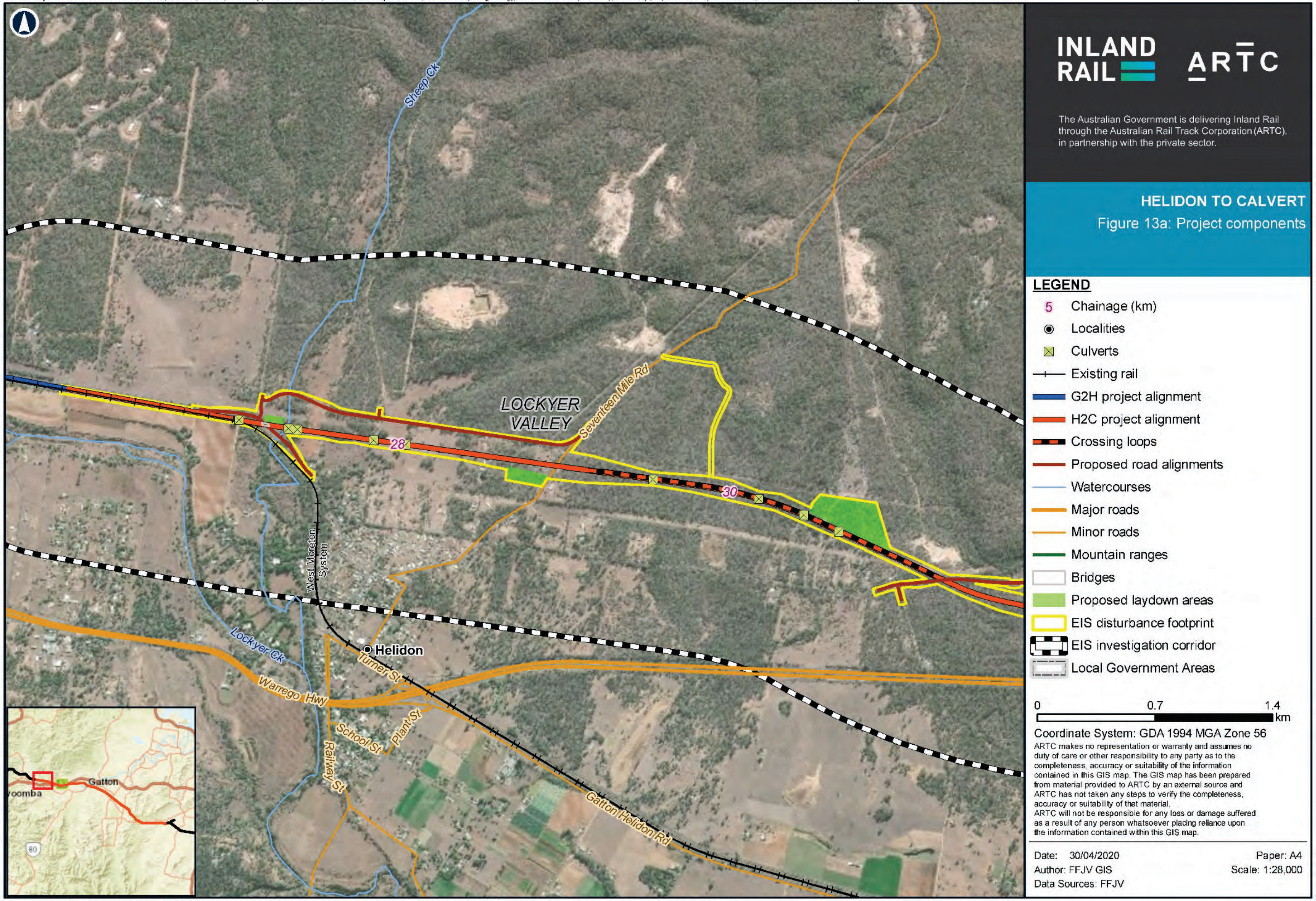

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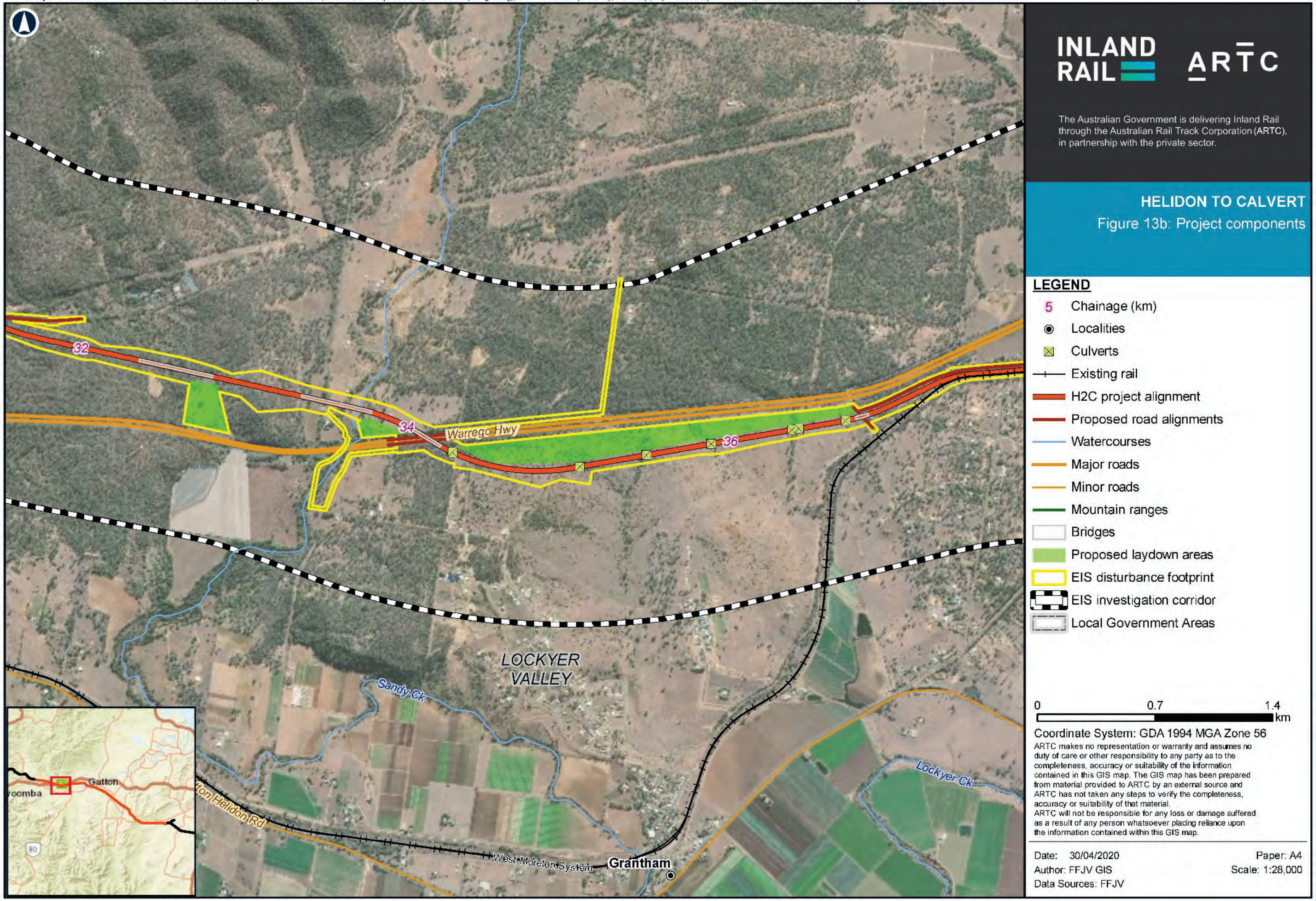

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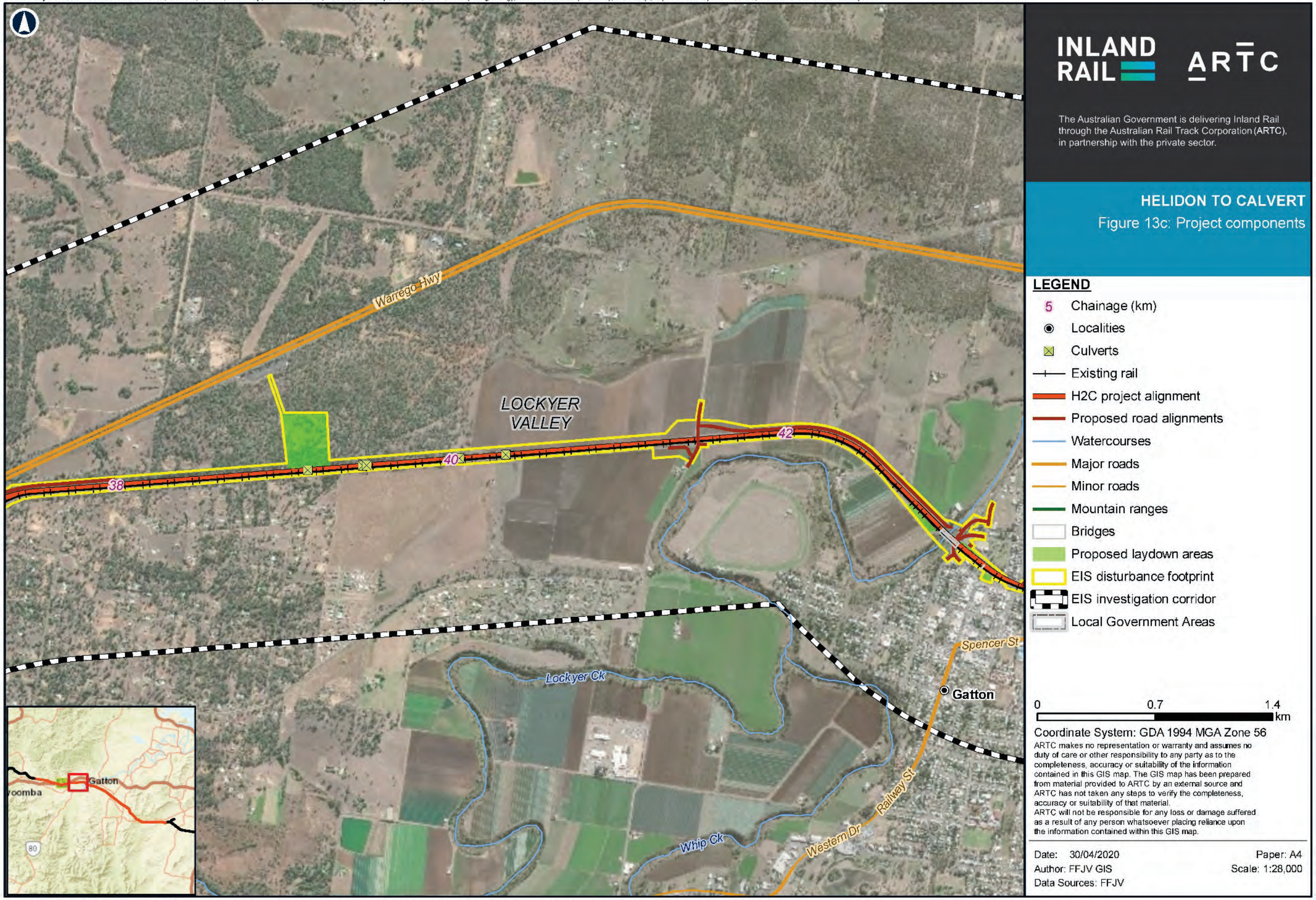

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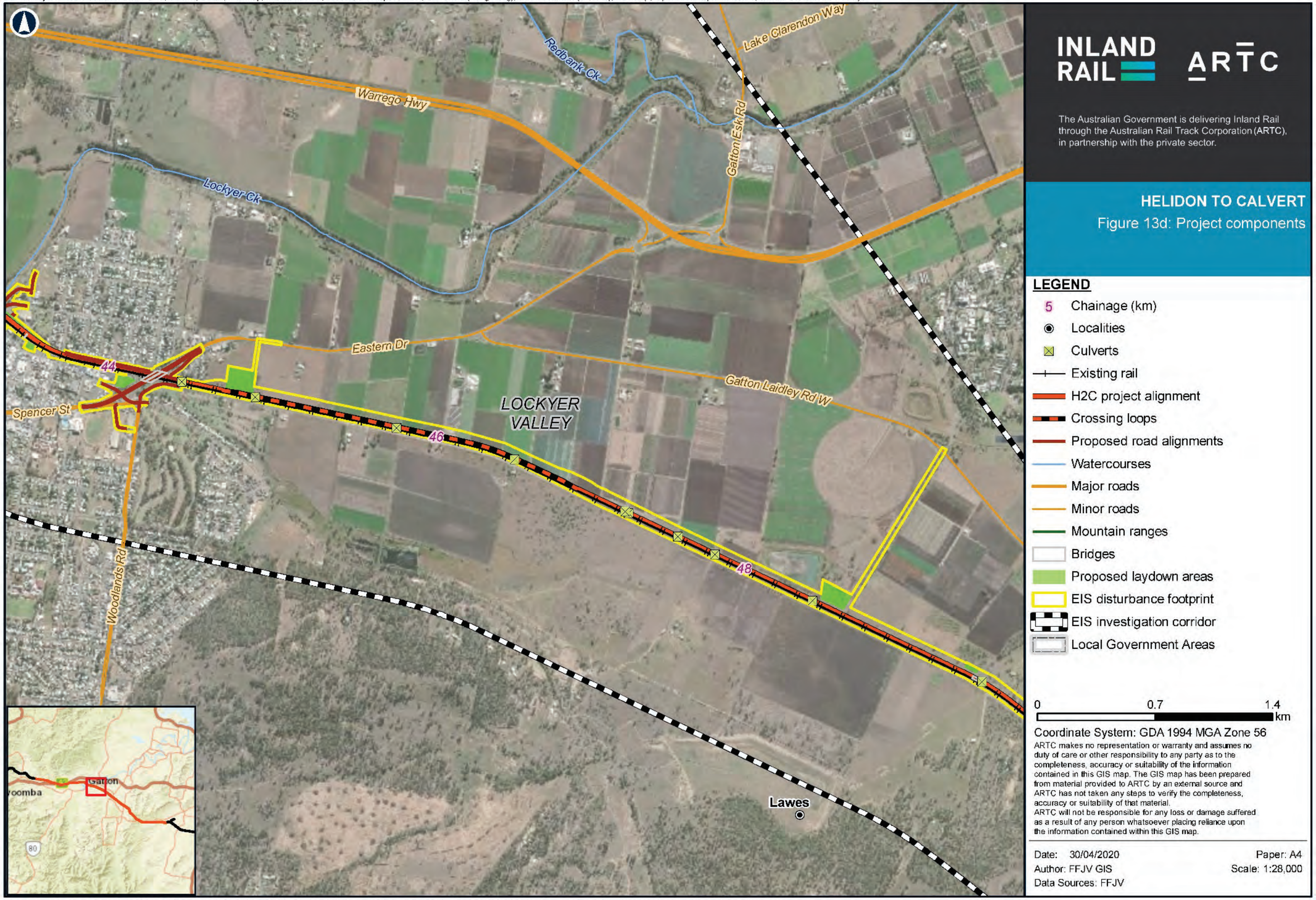

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INLAND RAIL

ARTC

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

HELIDON TO CALVERT

Figure 13e: Project components

LEGEND

- 5 Chainage (km)
- Localities
- Culverts
- Existing rail
- H2C project alignment
- Crossing loops
- Proposed road alignments
- Watercourses
- Major roads
- Minor roads
- Mountain ranges
- Bridges
- Proposed laydown areas
- EIS disturbance footprint
- EIS investigation corridor
- Local Government Areas

0 0.7 1.4 km

Coordinate System: GDA 1994 MGA Zone 56

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Author: FFJV GIS Scale: 1:28,000
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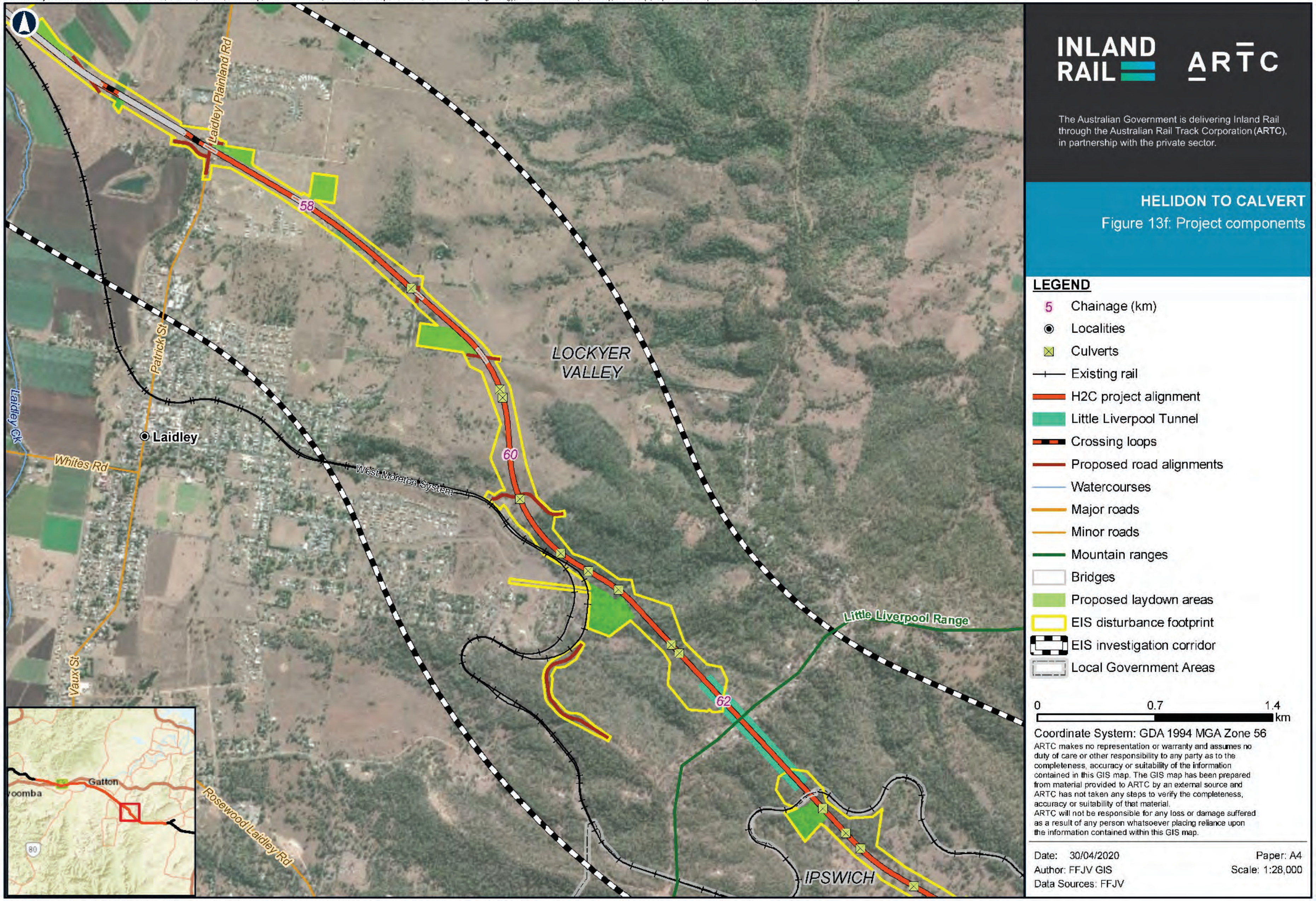

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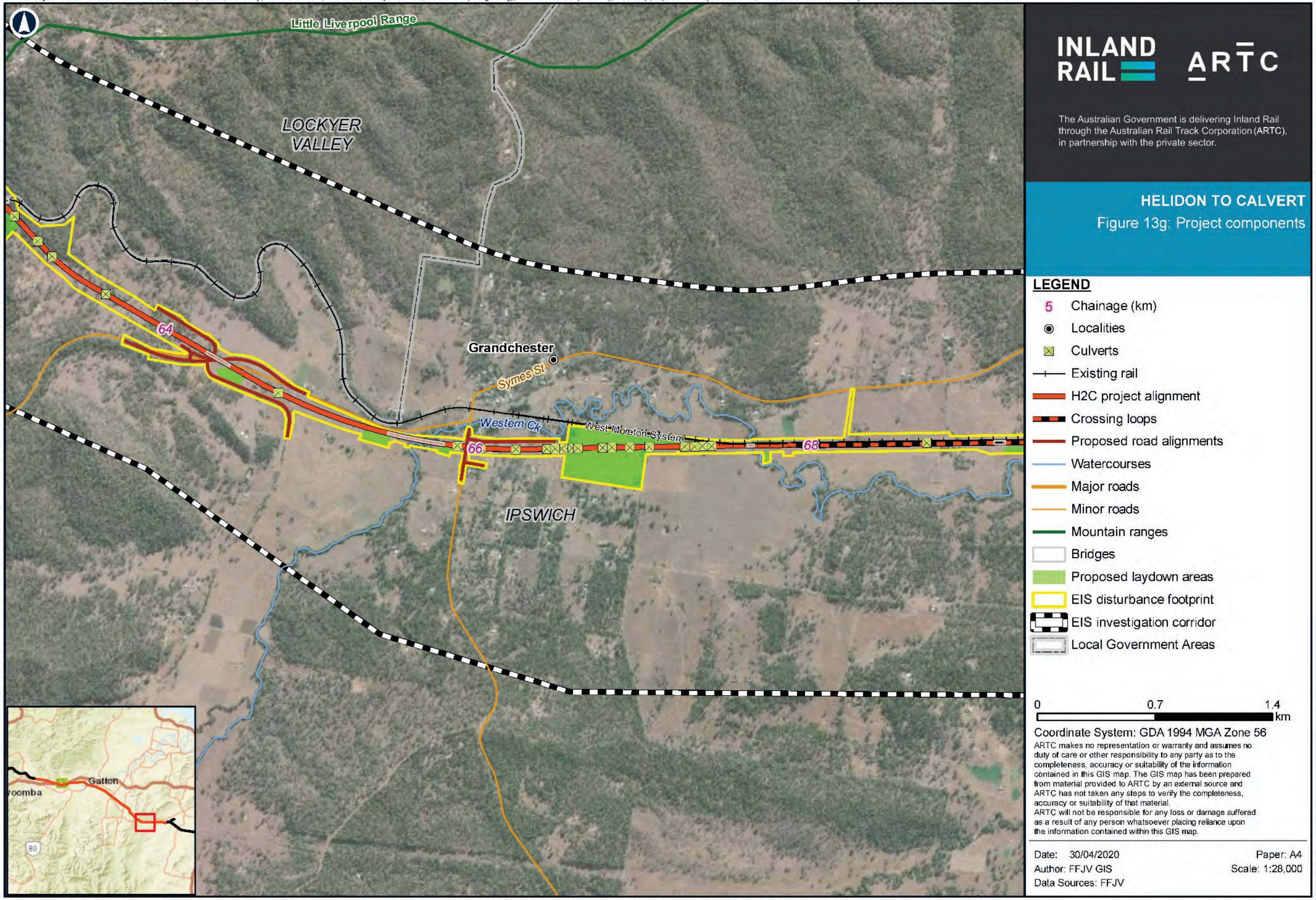

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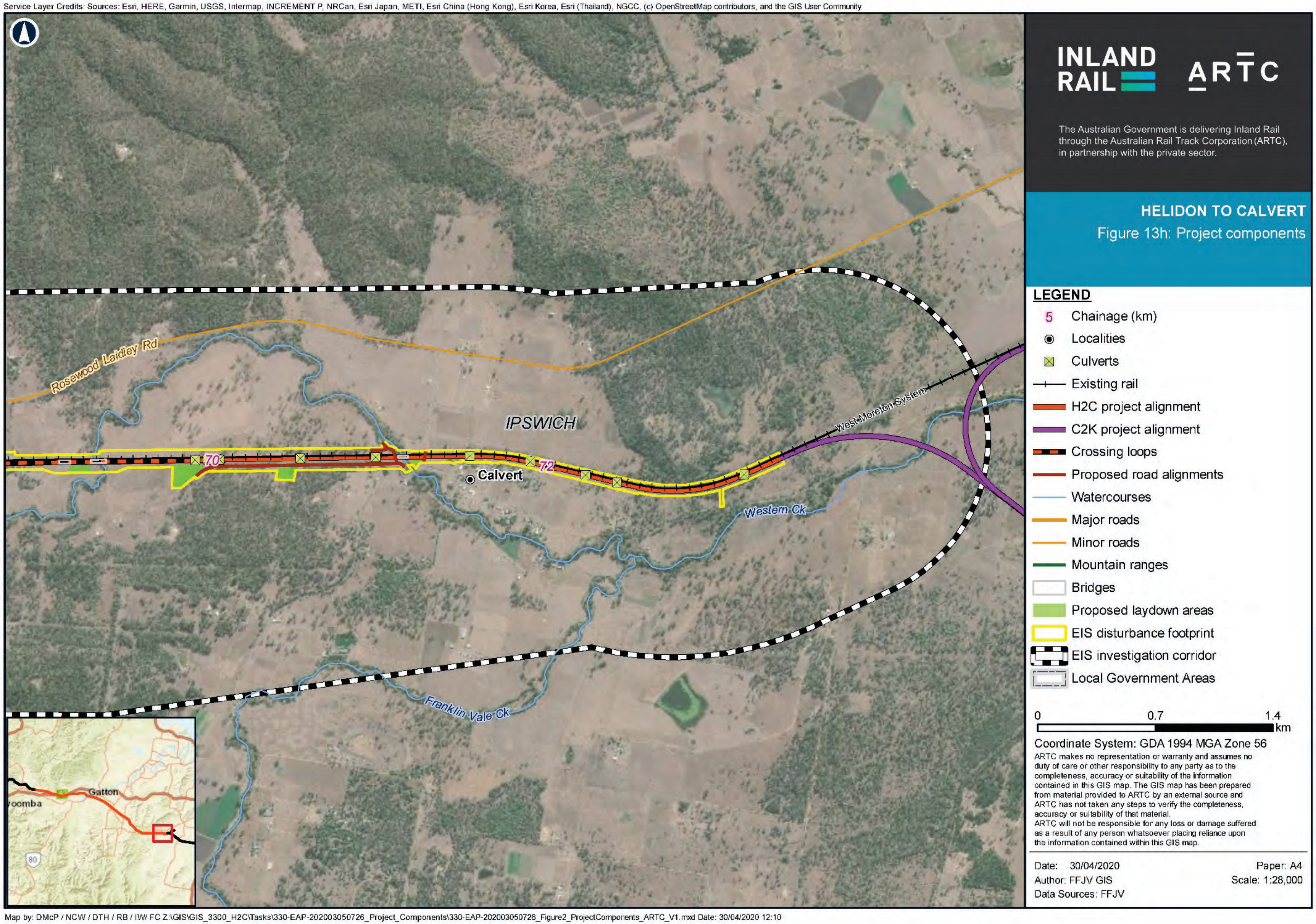
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INLAND RAIL
ARTC
The Australian Government is delivering Inland Rail through the Australian Rail Track Corporation (ARTC), in partnership with the private sector.
HELIDON TO CALVERT
Figure 13h: Project components
LEGEND
Chainage (km)
Localities
Culverts
Existing rail
H2C project alignment
C2K project alignment
Crossing loops
Proposed road alignments
Watercourses
Major roads
Minor roads
Mountain ranges
Bridges
Proposed laydown areas
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EIS investigation corridor
Local Government Areas
0 0.7 1.4 km
Coordinate System: GDA 1994 MGA Zone 56
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Author: FFJV GIS
Data Sources: FFJV
Paper: A4
Scale: 1:28,000
Rosewood Laidley Rd
IPSWICH
West Moreton System
70
72
Calvert
Western Ck
Franklin Vale Ck
Gatton
oomba
80
Map by: DMcP / NCW / DTH / RB / IW/ FC Z:\GIS\GIS_3300_H2C\Tasks\330-EAP-202003050726_Project_Components\330-EAP-202003050726_Figure2_ProjectComponents_ARTC_V1.mxd Date: 30/04/2020 12:10

Construction

Subject to procurement, detailed design, and obtaining the necessary approvals, it is anticipated the construction phase will start in 2021. Pre-construction activities include detailed design, land acquisition, surveys and geotechnical investigations, and some early works such as utility and service relocations. Construction is planned to be completed by 2026. The construction program consists of several stages and activities, including:

- **Site preparation**—vegetation clearing, establishing 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 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**—installing ballast, sleepers and rails
- **Rail systems infrastructure and wayside equipment**—installing signals, turnouts and asset monitoring infrastructure
- **Commissioning**—integrating testing and handover needed to achieve operational readiness
- **Clean-up and restoration**—works to stabilise, reinstate and rehabilitate temporary works areas.

Construction hours

Construction work will be undertaken during the following hours:

- Monday to Friday 6.30 am to 6.00 pm
- Saturday 6.30 am to 1.00 pm
- No work Sundays and public holidays.

Works outside of primary Project construction hours may be required for key activities such as:

- Delivery of concrete, steel, and other construction materials delivered to site by heavy vehicles
- Movements of heavy plant and materials
- Spoil haulage
- Tunnelling activities
- Arrival and departure of construction staff during shift change-overs
- Roadworks and works in rail corridors
- Traffic control crews, including large truck mounted crash attenuator vehicles, medium rigid vehicles, and lighting towers
- Incident response including tow-trucks for light, medium, and heavy vehicles.

Construction workforce

Construction of the Project is expected to require a peak workforce of up to 410 personnel, with an expected average workforce of 190 people onsite over the construction period.

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 though the construction phase.

It is anticipated that the construction and operation workforce would be sourced locally and/or accommodated in the Lockyer Valley/Ipswich region; therefore, accommodation camps are not proposed.

Operation

The Project would be ready for operation once the adjoining Inland Rail projects (Gowrie to Helidon and Calvert to Kagaru) are complete.

The Project will be managed and maintained by the proponent; however, train services will be provided by a variety of operators. The hours of operation are anticipated to be 24-hours a day, seven days a week.

On indicated commencement of operation in 2026 (through connection from Melbourne to Brisbane), it is anticipated that the Project will be used by an average of 33 services per day, increasing up to an average of 47 services per day in 2040. Annual freight tonnages will increase in parallel, from approximately 39 million tonnes per year in 2026 to 59 million tonnes per year in 2040. The provision of additional freight services in a future phase of the Project will be subject to further approval processes.

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.
- Operation and maintenance of tunnel ventilation and safety systems, and signalling systems.

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 decommissioning of the Project cannot be foreseen. However, if the Project, or elements of it, are subject to plans for decommissioning, it is envisaged the works would be undertaken in accordance with a decommissioning plan, which would be developed in consultation with relevant stakeholders and regulatory authorities.

Sustainability

Sustainability is important for the Project, especially with regard to maximising resource efficiency, enhancing local economic activity, and mitigating potential environmental and social impacts.

These key areas of focus align with the ARTC Inland Rail's *Environment and Sustainability Policy*, which outlines the sustainability objectives, targets and commitments for the Project. This policy can be found in Appendix F: Corporate Policies.

In recognition of the role Inland Rail 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. The Sustainability Strategy 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 Inland Rail.

Key findings of the EIS

Land use and tenure

Land use within and surrounding the Project is mostly grazing land, combined with other agricultural land uses such as seasonal irrigated horticulture and cropping.

Notable land uses also include the Helidon Magazine Explosives Reserve, sandstone mines, The University of Queensland Gatton Campus, poultry farming and the Bowman Park Koala Nature Refuge. The Project's disturbance footprint may also impact commercial and recreational services in Gatton and Laidley townships.

The land use study area incorporates the Lockyer Valley important agricultural area in Helidon, Gatton, Forest Hill and Laidley. In addition, areas of Class A and B agricultural land intersect parts of the land use study area.

The tenure of land in the permanent operational disturbance footprint is mainly freehold for the proposed greenfield rail corridor sections. Where the existing West Moreton System rail corridor is proposed to be used, tenure is state land (in the form of 'lands lease'). The Project is located within the Western sub-region of the SEQ region. This region encompasses Ipswich, Somerset, Toowoomba and Lockyer Valley and the Scenic Rim LGAs and contains SEQ's major rural production and regional landscape areas. The Project is located within one native title claim area. This claim is yet to be determined by the Native Title Tribunal and is for the Yuggera Ugarapul People.

Construction and operation of the Project may result in direct and permanent impacts to land use and tenure. Potential impacts include:

- Change in tenure and loss of property
- Disruption to land over which native title claims have been made
- Temporary and permanent changes in land use, including the loss of agricultural land and disruption to existing agricultural practices
- Impacts to accessibility, including the State and local road networks and access to private property
- Disruption, relocation and modification to existing services and utilities.

The Project will result in a number of benefits to land use, including the support of future industries, improved access to and from regional markets, and the Project will act as a catalyst for development in the area, including the Gatton West Industrial Zone and Willowbank Industrial Area.

The Project was designed to use the existing West Moreton System rail corridor and the protected Gowrie to Grandchester future State transport corridor where possible, minimising the extent of 'new' properties to be acquired.

Of the 193 properties within the permanent operational disturbance footprint, 23 are within the West Moreton System rail corridor and 57 are within the Gowrie to Grandchester future State transport corridor. These figures include up to five properties required for 'volumetric acquisition', where the Project passes beneath a property at the proposed Little Liverpool Range tunnel.

Additional properties may also be acquired, such as in locations where certain impacts cannot be avoided or appropriately mitigated, or where acquisition is agreed with affected landowners.

A summary of land acquisition within the permanent operational disturbance footprint is in Table 1. These acquisitions are indicative only and are to be confirmed following detailed design.

TABLE 1: LAND ACQUISITIONS WITHIN THE PERMANENT OPERATIONAL DISTURBANCE FOOTPRINT

Tenure and ownership	No. of properties within the permanent operational disturbance footprint
Properties within the permanent operational disturbance footprint, also within the existing West Moreton System rail corridor	
Lands lease[1]	23
Properties within the permanent operational disturbance footprint, also within protected Gowrie to Grandchester future State transport corridor	
Freehold[2]	54
Reserve[3]	1
State Land[4]	2
Properties within the permanent operational disturbance footprint, outside of protected Gowrie to Grandchester future State transport corridor and outside of existing West Moreton System rail corridor	
Freehold	104
Lands Lease	1
Reserve	3
State Land	5
TOTAL	**193**

Table notes:

1. 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.
2. 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).
3. Reserve: Land that has been dedicated as a reserve for a public or community purpose.
4. State Land: Land that is unallocated State land.

The permanent operational disturbance footprint also traverses 36 easements.

Other land use components of note include the Project:

- Crossing and running parallel to highways, main roads, local roads and private roads
- Potentially interacting with 662 utilities, including communication, electrical and water utilities.

The disturbance footprint will be further refined during detailed design to a size that is required to safely construct, operate and maintain the Project, while minimising land acquisition, severance and disruption to land use, tenure and transport networks.

Where impacts cannot be avoided, they will be carefully managed and mitigated. ARTC will continue to consult with landowners and utility providers and landowners. Specific mitigation measures for each individual or company will be identified to reduce impacts to acceptable levels.

Mitigation measures developed for the Project include:

- Refine the disturbance footprint further during detailed design to that required to safely construct, operate and maintain the Project, and minimise land acquisition, severance and disruption to land use, tenure and transport networks.
- Where feasible, detailed design and construction planning aims to minimise alteration to the surrounding road and transport network and maintain legal property accesses.
- Develop and implement a Reinstatement and Rehabilitation Plan for areas within the disturbance footprint that do not form part of the permanent works.
- Develop and implement a Landscape and Rehabilitation Management Plan to define progressive and post-construction installation of the Project landscape design, and establishment, maintenance, monitoring and completion criteria.

Land resources

A desktop assessment was undertaken for the existing environment. Field assessments of soils added to the desktop assessment. A risk assessment of soil properties, including agricultural and problematic soils, and contaminated land was also undertaken.

The assessment identified:

- Four distinct soil types occur in the study area—vertosols, sodosols, dermosols and chromosols. Sodosols, chromosols and dermosols are the most susceptible to dispersing and have potential for severe erosion along hillsides
- Geotechnical investigations did not identify any acid sulfate soils or acid rock
- Salinity has a medium to high potential of occurring in the study area.

The desktop assessment identified potential sources of contamination of the vicinity of the alignment, including agricultural activities, quarries, landfill and waste disposal, existing rail corridor and road crossings. Eight properties with Environmental Authorities within the land resources study area are listed on the Environmental Management Register.

The assessment of land resources identified the following potential Project-related impacts:

- Permanent change to landform and topography, influencing water retention and movement within soil catchment systems
- Loss of natural resources including Class A agricultural land, Class B agricultural land and important agricultural areas
- Unexpected acid sulfate soil
- Degradation of soil resources through invasive flora and fauna
- Increased salinity causing water table salting, irrigation water salting and erosion scalding
- Disturbance of existing contaminated land (soil and groundwater)
- Generation of new contaminated land (soil and groundwater) from Project activities.

After mitigation measures are applied, residual impacts on land resources are anticipated to be low, except for changes to landform and topography, loss of soil resources, and disturbance of existing contaminated land.

Soil conditions across the 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* (CSIRO/McKenzie et al., 2008), the *Australian soil and land survey field handbook* (CSIRO, 2009) and the *Guidelines for soil survey along linear features* (Soil Science Australia, 2015). This includes 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.

ARTC will undertake a targeted contaminated land investigation as part of detailed design to be incorporated into a Contaminated Land Management Strategy and Construction Spoil Management Plan before construction starts. To mitigate salinity, salinity management principles will be implemented and rehabilitation will be undertaken in accordance with the Reinstatement and Rehabilitation Plan.

To mitigate issues of soil and land conservation, an Erosion and Sediment Control Plan will be prepared by a Certified Professional in Erosion and Sediment Control in accordance with *Best Practice Erosion and Sediment Control* (IECA, 2008).

During detailed design, additional mitigation measures will be implemented to avoid any potential fragmentation and sterilisation of Class A and Class B agricultural land and important agricultural areas.

Landscape and visual amenity

The landscape and visual impact assessment examined the impact of the Project on landscape, visual and light amenity through a combination of desktop and field work, including geographic information system analysis, visibility analysis mapping and preparation of illustrative cross-sections and visualisations.

The landscape between Helidon and Calvert is a populated, working agricultural landscape. The landscape is characterised by generally flat, irrigated and non-irrigated croplands and undulating pastures, interspersed by a network of vegetated watercourses associated with Lockyer Creek and the Bremer River against a backdrop of forested ranges.

The main landscape and visual impacts of the Project are the removal of vegetation, construction of embankments, creation of new rail bridges and deep cuts at the foothills of the Little Liverpool Range.

Eight 'landscape character types' were identified within the landscape and visual impact assessment study area that are potentially affected by the Project. The landscape character type with the highest impact is Type H: Forested Uplands, comprising the regionally significant Teviot and Little Liverpool Range scenic amenity areas.

'Visual receptors' is the term used to describe people who 'view' a particular area either regularly—residents—or casually—tourists. Examples of visual receptors include residents in the various population centres close to the proposed alignment and transient receptors such as commuters, including the Warrego Highway and tourist drives such as part of the Cobb and Co. trail.

Seventeen representative viewpoints were used to assess potential impacts on existing views. Potential impact significance was categorised into high, moderate, low, negligible.

During construction, the greatest visual impact is of up to 'moderate significance'. Construction impacts will be mitigated as far as reasonably practical and the duration of many impacts are short-term construction impacts.

During operation, three visual impacts were assessed as being of up to 'high significance'. These impacts include the Warrego Highway rail bridge on Viewpoint 3: Warrego Highway looking east; the large embankment close to residential properties at Viewpoint 10: Hardy Drive looking down Rampton Street in the new Valley Vista subdivision to the north of Laidley; and embankments and deep cuts at the foothills of the Little Liverpool Range at Viewpoint 12: Douglas McInnes Drive near existing rail line, looking north-west, also in Laidley.

For lighting, the highest potential visual effect was assessed as being up to 'moderate significance' during construction—Viewpoint 5: Gatton RSL car park looking north-west towards existing Railway Station and pedestrian crossing. Elsewhere the Project is unlikely to cause any significant lighting impacts during its construction and operational phases.

Cumulative impacts, particularly the effects in combination with the adjoining Inland Rail projects and the Gatton West Industrial Zone development site have been considered. The potential consequence of these cumulative visual impacts is of 'low significance' during construction and up to 'medium significance' during operation.

The key mitigation measure proposed is the development of the Reinstatement and Rehabilitation Plan, which will define performance criteria for visual impact mitigation measures. This plan will include landscape objectives and principles, as well as outline landscape and rehabilitation treatments.

Flora and fauna

The works included a desktop analysis, field assessments and predicted habitat mapping, followed by an assessment under Commonwealth and State guidelines to determine if the Project will have a significant residual impact on prescribed environmental matters including matters of national environmental significance and matters of state environmental significance.

The Project is located within the SEQ bioregion, which has 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 less attractive to development (i.e. rocky ranges, sloping topography) and roadside vegetation, or relatively small, isolated patches subject to edge-related impacts.

The ecology study area provides suitable habitat for 26 Matters of National Environmental Significance (MNES) (i.e. species listed under the EPBC Act), and seven non-MNES species listed under the provisions of the *Nature Conservation Act (1992)* (Qld) (NC Act) (i.e. three plants and four animals) as well as potential habitat for 22 non-threatened, migratory species as listed under the EPBC Act. In addition, a number of endangered, of concern and least concern REs are also present within the ecology study area that are protected under the *Vegetation Management Act (1999)* (Qld) (VM Act). The ecology study area contains a suite of sensitive environmental receptors, including protected areas, HVR vegetation, conservation significant flora and fauna species regionally significant species as well as bioregional corridors (local, regional and State significant). For the purposes of the impact assessment sensitive environmental receptors are those that constitute non-threatened MNES or Matters of State Environmental Significance (MSES) (e.g. regulated vegetation, threatened species as listed under the provisions of the NC Act).

A total of 77 sensitive environmental receptors were identified within the ecology study area for the purposes of this assessment. These sensitive environmental receptors were grouped into high, moderate and low sensitivity categories based on factors including conservation status, exposure to threatening processes, resilience and representation in the broader landscape.

The construction phase will have the greatest potential impact on ecological receptors due to:

- Habitat loss and degradation from vegetation clearing and removal
- Fauna species injury or mortality
- Reduced biological viability of soil due to compaction or changes to groundwater conditions
- Displaced flora and fauna species from invasive weed and pest species
- Reduced connectivity of biodiversity corridors
- Edge effects, barrier effects and habitat fragmentation
- Noise, dust, or light emissions
- Increase in litter (waste)
- Degraded aquatic habitat
- Erosion and sedimentation.

Impacts on biological diversity and ecological integrity have been avoided as much as possible. For example, investigations into the location of threatened species and ecological communities informed the design and location of fauna crossings, fauna exclusion fencing, and landscaping, revegetation and rehabilitation works.

After applying the mitigation hierarchy (i.e. avoid, minimise, mitigate) to mitigation measures and management plans, the residual impacts to the identified ecological receptors were generally reduced. However, some Project-related activities may have cumulative, irreversible or permanent impacts on some ecological receptors. For example, proposed mitigation measures are not likely to significantly reduce impacts associated with the loss of vegetation due to clearing or removal.

Assessment of sensitive environmental receptors against Commonwealth or State significant impact assessment criteria, indicates the following species will be subject to 'significant residual impacts as a result of the Project':

- Matters listed under the EPBC Act (MNES) include:
  - **Flora:** Four-tailed Grevillea (*Grevillea quadricauda*); Blunt-leaved Leionema (*Leionema obtusifolium*); Lloyd's Olive (*Notelaea lloydii*); A grass (*Paspalidium grandispiculatum*)
  - **Fauna:** Spotted-tail Quoll (*Dasyurus maculatus maculatus*); Collared Delma (*Delma torquata*); Red Goshawk (*Erythrotriorchis radiatus*); Swift parrot (*Lathamus discolor*); Brush-tailed Rock-wallaby (*Petrogale penicillata*); Koala (*Phascolarctos cinereus*); New Holland Mouse (*Pseudomys novaehollandiae*); Grey-headed Flying-fox (*Pteropus poliocephalus*); Australian Painted Snipe (*Rostratula australis*).
- Prescribed matters for the State of Queensland (MSES):
  - Regulated vegetation (Category B (other than grassland) within a defined distance from the defining banks of a relevant watercourse or relevant drainage feature)
  - Essential habitat
  - Protected wildlife habitat for the following species: Bailey's Cypress Pine (*Callitris baileyi*); Swamp Tea-tree (*Melaleuca irbyana*); Glossy-black Cockatoo (*Calyptorhynchus lathami*); Powerful Owl (*Ninox strenua*).

- Provisions of offsets for the MNES with significant residual impacts will be required under the EPBC Act Offsets policy. For MSES, impacts to prescribed matters that are considered to constitute significant residual impacts will need to be offset consistent with the *Environmental Offsets Act 2014* (Qld).
- The ARTC's Environmental Offset Delivery Strategy—Qld (Strategy) will inform the development of offset delivery components including an Environmental Offset Delivery Plan and Offset Area Management Plans. A Detailed Environmental Offset Delivery Plan and Offset Area Management Plans will be developed and implemented by ARTC prior to construction commencement.

Other mitigation measures to be implemented include:

- Flora and fauna survey to verify previous surveys and assessments, refine potential offset calculations, inform micro-siting of infrastructure, support secondary approvals and establish baseline conditions against which relevant outcomes of the Reinstatement and Rehabilitation Plan can be compared.
- Fauna passage locations and associated rehabilitation areas will be refined during the detailed design to maintain infrastructure permeability, particularly at the three key locations identified as part of the EIS to maintain and/or re-establish habitat connectivity.
- Landscape design establishes the requirements for rehabilitation of disturbed areas for habitat recreation, landscaping and stabilisation, including for riparian zones and informs the development of the Reinstatement and Rehabilitation Plan and the Landscape Management Plan.
- Develop and implement the flora and fauna sub-plan within the Construction Environmental Management Plan.
- Develop and implement the Reinstatement and Rehabilitation Plan and the Landscape and Rehabilitation Management Plan.
- Develop a post-construction MNES Monitoring Plan in consultation with stakeholders. For the threatened ecological community or other MNES, the post-construction MNES Monitoring Plan will define:
  - Habitat location
  - Reference condition
  - Assessment framework
  - Infrastructure elements (e.g. erosion and sediment control devices, fauna crossing structures)
  - Corrective actions
  - Completion criteria
  - Monitoring timeframes.

ARTC will undertake additional ecological surveys in accordance with relevant Commonwealth and/or State surveys guidelines. Targeted surveys are to commence in Q1/Q2 2021, and will identify the occurrence and extent of threatened species and communities and the presence of threatened species and habitat suitable to support the presence of threatened species within and adjacent to the Project footprint.

These additional works will inform relevant approvals and management plans, along with necessary offset requirements and disturbance limits.

Air quality

The construction and operation of the Project has the potential to impact existing air quality.

Predicted air emissions from the construction phase were assessed qualitatively and operational emissions from freight trains using the rail line track were assessed with dispersion modelling.

Potential emissions during construction considered anticipated activities, plant and equipment. The results of the qualitative air-quality risk assessment show that the unmitigated air emissions from the construction phase pose a medium risk for airborne dust concentrations (human health) and a medium risk from dust deposition (amenity and aesthetic).

The construction dust sources associated with the Project are common emission sources. Mitigation measures to reduce dust emissions exist for all the identified sources. It is expected that emissions can be well managed through diligent implementation of control measures.

For operations, dispersion modelling addressed line-source emissions (freight trains travelling along the main line) and point-source emissions (freight trains idling at crossing loops) to assess the degree the Project complies with the specified air-quality goals at existing sensitive-receptor locations. Based on worst-case assumptions, conservative emission rates and conservative background concentrations, the assessment determined that compliance is predicted for all pollutant species for forecast traffic. However, this assessment assumes the coal trains are veneered[1]. The approach is consistent with the current practices on the West Moreton System rail corridor. Without veneering, assessments indicated particulate matter concentrations would be exceeded (annually averaged) when the modelled Project contributions were added to background concentrations.

Predicted dust deposition from operations was assessed for its potential to impact tank water quality. The assessment determined compliance with all drinking water guideline values prescribed by the *Australian Drinking Water Guidelines* (NHMRC and NRMMC, 2018) at all modelled receptors.

1. A biodegradable, non-toxic binding agent is applied to the loaded wagon coal surface. The veneer forms a crust over the coal load and minimises coal dust lift-off when exposed to air passing over the surface in transit.

Potential odour emissions from the Project are considered minor. Based on the nature of the sources associated with the Project and the receiving environment, it is expected that odour impacts on the nearest potentially affected sensitive receptors will not be significant.

Proposed mitigation measures for the Project's construction phase, incorporated into the Construction Environmental Management Plan, include:

- Water sprays to reduce dust emissions from excavation and disturbance of soil and materials, vehicles travelling on unsealed roads, and loading and unloading materials
- Timely rehabilitation of exposed areas, in accordance with the Reinstatement and Rehabilitation Plan
- Separation distances for fuel storage tanks from sensitive receptors.

In addition to these mitigation measures, methods for the monitoring, reporting and compliance management with the Project's air-quality objectives have been proposed.

The assessment of the operational phase assumed that a number of the operational management measures already required by the West Moreton System (required by the South West Supply Chain (QR West Moreton System) Coal Dust Management Plan), will apply to the Project when used for coal transport. For example, 'veneering' of coal wagons is currently required on the QR West Moreton System. Veneering involves applying a biodegradable, non-toxic binding agent onto the surface of loaded coal wagons, which forms a crust over the coal that minimises coal dust lifting off in transit.

The assessment of the operational phase showed compliance for all pollutants is predicted for all traffic-volume scenarios (at all receptors), with targeted recommendations in place.

Surface water and hydrology

The Project is located within the Lockyer Creek and Bremer River catchments, crossing four main waterways: Sandy Creek, Lockyer Creek, Laidley Creek and Western Creek, as well as and several unnamed tributaries.

Existing surface water conditions were assessed via a desktop study and complemented by field water quality samples (with seasonal variation) to determine existing environmental conditions. Low-flow conditions were observed during the investigations.

Based on sampling, current conditions within waterways in the water quality study area do not currently meet water quality objectives—principally for electrical conductivity, chlorophyll a, turbidity (and associated total suspended solids) and nitrogen species and phosphorus for the Lockyer Creek and Bremer River catchment. There was also evidence of existing impacts from nutrient concentrations and general water quality conditions (physical and chemical) across the water quality study area.

Construction activities may increase salinity, debris, contaminants, erosion and sedimentation within watercourses. In addition, tunnel dewatering activities may cause changes to water quality. If rehabilitation is inadequate, these impacts are likely to be exacerbated.

The Project may also cause changes to the existing flood regime:

- Change in peak water levels. The Project design meets the established Project hydraulic design criteria and flood impact objectives—with a number of localised areas along the Project alignment where these limits are slightly exceeded. These areas are generally agricultural land or local roadways. No existing flood-sensitive receptors are impacted by the changes in peak water levels under the 1% AEP event.
- Change in duration of inundation. There are localised increases in duration of inundation at the same locations where peak water levels are increased. These changes in inundation duration do not affect flood-sensitive receptors except for two local roads: Dodt Road and Hall Road. Potential impacts are minor and are considered a negligible impact on the amenity of the roadway.
- Flood flow distribution. The Project has minimal impacts on flood flows and floodplain conveyance or storage, with significant floodplain structures included to maintain the existing flood regime.
- Velocities. Changes in water velocities are minor, with most changes in velocity experienced immediately adjacent to the Project alignment and no existing flood-sensitive receptors impacted. Scour protection has been specified.

A range of industry-standard measures will be implemented during the detailed design, construction and operation phases to mitigate these potential impacts to surface water and hydrology.

Key measures to manage surface water quality impacts include an Erosion and Sediment Control Plan, Reinstatement and Rehabilitation Plan, Landscape and Rehabilitation Management Plan and Construction Water Quality Monitoring Program. The Project's permanent operational disturbance footprint has been minimised, while still allowing sufficient room for erosion and sediment control measures. Construction will be designed and staged to minimise vegetation clearing and the area of exposed soil.

A surface water monitoring framework will be developed as part of the Construction Environmental Management Plan. It will identify monitoring locations at discharge points and selected locations in watercourses where works are being undertaken. The surface water monitoring framework will include water quality objectives, standards and parameters against which any changes to water quality will be assessed, considering relevant water quality guidelines and ANZECC/ARMCANZ Guidelines (2000, 2018). Where alternate guidelines are used to establish water quality goals, justification will be provided.

Hydraulic performance criteria and flood impact objectives were used to guide mitigation of impacts. Refinement of the hydraulic design was undertaken iteratively, including sensitivity works, adjusting the numbers, dimensions and locations of major drainage structures (bridges and culverts).

To mitigate flooding impacts, the Project has been designed to achieve a 1% AEP flood immunity2, while at the same time minimising unacceptable impacts on the existing flooding and drainage regime. Bridge and culvert structures have been designed and located to maintain existing surface water flow paths and flood flow distributions, and avoid unacceptable increases in peak water levels, flow distribution, velocities and duration of inundation.

The Project alignment runs adjacent to the West Moreton System rail corridor (for approximately 50 per cent of the proposed Project alignment) as well as through, or close to, the townships of Helidon, Grantham, Gatton, Forest Hill, Laidley, Grandchester and Calvert. A significant portion of these localities, including properties and infrastructure, and the West Moreton System rail corridor, are sensitive to flood conditions with flood sensitive receptors identified.

The hydrology and flooding assessment was undertaken by reviewing existing assessments, modelling the environment without the Project and modelling the environment with the Project.

The impact of the Project on the existing flood regime was quantified and compared against flood impact objectives as detailed in Table 2. These objectives address the requirements of the Terms of Reference and have been used to guide the Project design.

The hydrologic and flooding assessment has demonstrated that the Project is predicted to result in impacts on the existing flooding regime that generally comply with the flood impact objectives.

The hydrology works were undertaken in close consultation with potentially affected community stakeholders. The consultation works were comprehensive and provided the community with detailed information and certainty around the approach, flood modelling works and the Project design.

Stakeholders provided photographic evidence and anecdotal accounts of previous flood extents and actual impacts to watercourses.

The commentary and information on historical flood events allowed:

- Validation and calibration of hydrologic and hydraulic models for the watercourses within the study area allowing the Project to more accurately assess impacts and identify appropriate mitigation measures as part of the EIS
- Identification of appropriate mitigation measures, with bridge and culvert structures designed and located to maintain existing surface water flow paths and flood flow distributions, and avoid unacceptable increases in peak water levels, flow distribution, velocities and duration of inundation.

In future stages, ARTC will continue to work with:

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

Acceptable impacts will ultimately be determined on a case-by-case basis, considering flood-sensitive receptors and land use within the floodplains. Direct interaction and engagement will continue with all potentially impacted stakeholders and landowners. The adopted flood impact objectives will be used as guidance. This will take into account flood-sensitive receptors and land use within the floodplains.

Independent International Panel of Experts

The Australian and Queensland governments established an Independent International Panel of Experts (the Panel) for flood studies, to provide advice to Commonwealth and State Governments on the flood models and structural designs developed by ARTC for Inland Rail in Queensland.

As an advisory body to government, the Panel is independent of the ARTC in respect of the development, public consultation and approvals for the Inland Rail EIS process. Relevant submissions received from public notification of the draft EIS will be provided to the Panel for consideration as part of its review.

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

2. The 1% AEP flood event is equivalent to the 100-year average recurrence interval flood event.

TABLE 2: FLOOD IMPACT OBJECTIVES

Parameter	Objectives				
Change in peak water levels[1]	Existing habitable and/or commercial and industrial buildings/premises (e.g. dwellings, schools, hospitals, shops)	Residential or commercial/ industrial properties/lots where flooding does not impact dwellings/ buildings (e.g. yards, gardens)	Existing non-habitable structures (e.g. agricultural sheds, pump-houses)	Roadways	Agricultural and grazing land/forest areas and other non-agricultural land
	⩽ 10 mm	⩽ 50 mm	⩽ 100 mm	⩽ 100 mm	⩽ 200 mm with localised areas up to 400 mm
	It is noted that changes in peak water levels can have varying impacts on different infrastructure and land and flood impact objectives were developed to consider the flood sensitive receptors in the vicinity of the Project				
Change in duration of inundation	Identify changes to time of inundation through determination of time of submergence For roads, determine the average annual time of submergence (if applicable) and consider impacts on accessibility during flood events Justify acceptability of changes through assessment of risk with a focus on land-use and flood-sensitive receptors				
Flood flow distribution	Aim to minimise changes in natural flow patterns and minimise changes to flood flow distribution across floodplain areas Identify any changes and justify acceptability of changes through assessment of risk with a focus on land use and flood-sensitive receptors				
Velocities	Maintain existing velocities where practical Identify changes to velocities and impacts on external properties Determine appropriate scour mitigation measures taking into account existing soil conditions Justify acceptability of changes through assessment of risk with a focus on land-use and flood-sensitive receptors				
Extreme event risk management	Consider risks posed to neighbouring properties for events larger than the 1% AEP event to minimise unexpected or unacceptable impacts				
Sensitivity testing	Consider risks posed climate change and blockage in accordance with *Australian Rainfall and Runoff* (2016) Undertake assessment of impacts associated with Project alignment for both scenarios				

Table note:

1. These flood impact objectives apply for events up to and including the 1% AEP event.

Groundwater

Much of the Project lies between the base of the Toowoomba Range in the west (near Helidon) and the Little Liverpool Range in the east (near Calvert). The western part of the alignment is typically underlain by the outcropping Woogaroo Subgroup sediments that form the higher relief along this section of the rail alignment (the Helidon Hills). In the central section of the alignment, the Gatton Sandstone is overlain by alluvial sediments of Lockyer Creek and Laidley Creek. Towards the east of the alignment, the alignment is underlain by the Koukandowie Formation, which forms the highest relief for the Project, where it crops out to form the Little Liverpool Range. On the eastern flanks of the range, the Koukandowie Formation is overlain by alluvial sediments of the Western Creek.

The water table is typically a mirrored version of topography, with the depth increasing beneath topographic highs (for example Little Liverpool Range) and shallower in lower-lying reaches close to surface water drainage lines.

Based on a search of the Department of Regional Development, Manufacturing and Water groundwater database, a total of 510 groundwater bores were identified within the groundwater study area (1 kilometre either side of the proposed alignment). Two are of unknown status, 124 decommissioned, abandoned or proposed, and the remaining 384 are designated as 'existing'.

Registered bores within the study area are primarily for water supply and town water. Other uses of groundwater in the EIS investigation corridor include stock, farming, and rural domestic uses.

A groundwater bore survey will be undertaken during the detailed design phase to confirm all groundwater bores within the groundwater study area.

The groundwater assessment for the Project included a desktop review, geotechnical and hydrogeological site investigations, an assessment of potential short- and long-term impacts of the Project, and an assessment of the significance of these impacts. Groundwater modelling assessed potential ingress and drawdowns associated with a free-draining (unlined) Little Liverpool Range tunnel, portals and cuts.

Water quality data for the Clarence–Moreton Basin and baseline groundwater sampling from geotechnical monitoring bores indicate variable water quality within and across the key hydrogeological formations. Groundwater in the alluvial sediments is generally fresher than the underlying sediments.

The construction and operation of the Project has the potential to impact groundwater and groundwater uses from:

- Loss of, or damage to, registered groundwater bores—including inaccessibility
- Altered groundwater availability (levels and flows)—seepage into cuttings and Little Liverpool Range tunnel
- Changes to groundwater quality from spills and uncontrolled releases, or from acid rock drainage
- Subsidence or consolidation due to groundwater extraction, dewatering or loading
- Vegetation removal and surface alteration affecting recharge/discharge and increasing associated salinity risks.

Mitigation and management measures will be implemented to mitigate potential impacts, including undertaking site inspections prior to the construction of cuts, visual examination of surface outcrops for sulfide minerals or evidence of sulfide mineralisation and additional monitoring of groundwater levels and quality.

The assessment concluded that the residual significance of potential impacts on the loss of registered bores within the disturbance footprint, subsidence, altered groundwater flow, seepage from the tunnel, acid rock drainage and removal of vegetation is expected to be low. A moderate residual significance of potential impacts may occur on altered or reduced groundwater levels.

During detailed design, hydrogeological conditions underlying the Project will be further investigated, especially concerning:

- Significant embankments that overlay alluvial sediments where shallow groundwater is present
- Drawdowns and inflow rates to deep cuts that intersect groundwater
- Proposed groundwater monitoring network
- Tunnel drainage/dewatering impacts.

A groundwater monitoring program has been proposed. This program will be further developed and implemented as part of the Project Groundwater Monitoring and Management Plan.

Noise and vibration

The construction and operation of the Project has the potential to be a source of noise and vibration emissions within the local environment. Detailed studies assessed the noise and vibration emissions and potential impacts associated with:

- Construction of the Project, including the railway infrastructure, civil earthworks, local road network upgrades and the Little Liverpool Range Tunnel and associated infrastructure
- Use of road networks during construction works and upgrades to road networks as a result of the Project
- Mechanical plant and ventilation infrastructure associated with the Little Liverpool Range tunnel
- Railway operations including train passbys on the main line track, within the Little Liverpool Range Tunnel, operation of level crossings and train movements at the crossing loops.

The assessment is consistent with the Terms of Reference and the strategies that ARTC will implement to inform the management of potential environmental impacts.

Construction noise and vibration

Scenarios were developed to assess the reasonable 'worst-case' noise and vibration emissions for each main construction activity. The assessment determined potential noise levels associated with temporary construction works at the fixed work sites and the mobile construction activities along the Project alignment, defined within noise catchment areas (NCAs).

While both temporary and transient, the construction activities in proximity of nearby communities can be inherently noisy.

A high number of exceedances against both the lower and upper external noise criteria was identified within the communities adjacent to the Project construction sites. The communities that have the highest predicted noise impacts are in Gatton and Forest Hill due to the proximity of sensitive receptors to the existing rail corridor. The 'earthworks' and 'rail civil works' construction stages are predicted to have the greatest impact from construction noise, due to the need for heavy-vehicle equipment and high-intensity works to complete these stages. Other construction stages may have greater overall impact depending on actual timing and duration of each construction stage.

Vibration-intensive work is likely to be undertaken at times as part of the construction works. This may include the use of piling rigs and vibratory rolling activities at the ground surface. These sources would be the primary source of ground-borne vibration and have been the subject to the development of recommended minimum safe working distances from nearby sensitive receptors to achieve the assessment criteria adopted for the control of cosmetic or structural damage and human discomfort impacts.

Mitigation measures will be implemented for construction noise impacts on nearby sensitive receptors. The measures represent standard industry best practices to reduce and control potential impacts. These measures will be included in the environmental management plans that are developed and implemented throughout the construction of the Project.

The primary form of mitigation of vibration would be ensuring vibration-intensive works do not occur within the minimum working distances. If vibration-intensive works are planned within the minimum working distances additional vibration management and mitigation measures may be required, such as adopting alternative construction techniques or equipment or implementing specific approaches to control vibration emissions. Requirements for vibration monitoring at sensitive locations, such as residential areas and heritage buildings and structures will be further developed during detailed design.

Road traffic noise

The Project is expected to influence local road traffic networks both temporarily during the construction works and long-term with new and upgraded local roads required as a result of the Project's railway infrastructure.

The additional traffic movements associated with Project construction will temporarily increase road network volumes. Road traffic noise levels will be highest during early construction activities due to the expected civil earthworks, with decreasing road traffic noise levels forecast from year three of the construction program.

As part of this assessment, 136 sections of roads have been identified as potential construction haul routes. The calculated road traffic noise triggered the assessment criteria at sensitive receptors adjacent to 16 of the road sections potentially accessed by the Project. The number of roads triggering the adopted criteria by 2025 drops significantly to just five roads.

An assessment of potential road traffic noise issues (future operational) for seven proposed new roads and 27 upgraded roads was undertaken.

The road traffic noise levels from three proposed upgraded roads—Eastern Drive, Glencore Grove Drive and Laidley Plainlands Road—are predicted to exceed the 68 dBA, $L_{A10(18hr)}$ criteria, at up to 84 existing sensitive receptors.

Of the seven new roads, five are predicted to exceed the new roads criteria of 60 dBA, $L_{A10(18hr)}$, at up to 17 existing sensitive receptors.

Measures to reduce road traffic noise, and manage associated impacts, have been recommended. Options to mitigate road traffic noise, such as transmission control or earth mounds, will be evaluated further during the detailed design and construction of the Project.

Noise from the operation of fixed infrastructure

The assessment determined standard noise control measures to be applied to the mechanical plant to control noise emissions and predicted noise levels at nearby sensitive receptors would meet recommended noise design objectives. Noise control measures will be verified during detail design and could include attenuators (silencers) for ventilation fans and acoustic lining within the ventilation shaft structures.

Noise and vibration from railway operations

A detailed noise prediction model for the Project was developed to assess airborne noise from railway operations, including daily train passbys, trains idling on crossing loops, the operation of level crossings (train horn and crossing alarms) and trains accessing the tunnel portals.

The assessment of noise and vibration from railway operations was undertaken in accordance with the terms of reference and considered the DTMR guidelines for the assessment and management of noise from railway infrastructure: *Policy for Development on Land Affected by Environmental Emissions from Transport and Transport Infrastructure* and the *Interim Guideline—Operational Railway Noise and Vibration Government Supported Transport Infrastructure*.

The assessment of railway noise has primarily adopted noise criteria proposed by ARTC to manage railway noise throughout Inland Rail, as in Table 3. These triggers provide best-for-community outcomes and demonstrate ARTC's best-practice approach to operational rail noise management.

TABLE 3: AIRBORNE NOISE ASSESSMENT LEVELS FOR RESIDENTIAL RECEPTORS

Type of development	Noise management levels (most exposed external façade, habitable room)	
New rail line development[1]	Day (7.00 am–10.00 pm)	Night time (10.00 pm–7.00 am)
	Predicted Project rail noise levels exceed:	
	$L_{Aeq(15hour)}$ 60 dBA	$L_{Aeq(9\ hour)}$ 55 dBA
	L_{AFmax} 80 dBA	L_{AFmax} 80 dBA
Redevelopment of existing rail line[2]	Project increases existing $L_{Aeq\ (period)}$ rail noise levels by 2dB or more, or existing L_{Amax} rail noise levels by 3dB, or more and predicted rail noise levels exceed:	
	$L_{Aeq(15\ hour)}$ 65 dBA	$L_{Aeq(9\ hour)}$ 60 dBA
	L_{AFmax} 85 dBA	L_{AFmax} 85 dBA

Table notes:
Airborne noise management levels applied the most exposed external façade of an existing habitable room at an existing sensitive receptor.
1. A new rail line development is a rail infrastructure project on land that is not currently an operational rail corridor.
2. A redeveloped line is a development on land that is within an existing operational rail corridor, where a line is or has been operational or is immediately adjacent to an existing operational rail line which may result in the widening of an existing rail corridor.

Airborne noise management levels were also adopted for non-residential sensitive receptors.

The noise predictions cover an approximately 180 km^2 area and applied train noise emissions specifically developed for the rolling stock proposed to be used on the Project and the existing trains that will access the new and upgraded railway corridors.

Railway noise levels were calculated at existing sensitive receptors for the commencement of railway operations, adopting forecast typical daily train movements in the year 2026 and the forecast railway operations for the future design year 2040.

The predicted noise levels were assessed against railway noise management criteria developed by ARTC for application on the Project and across Inland Rail. The triggers were developed with reference to regulatory guidelines for railway noise, including those outlined within the Terms of Reference. To provide a robust and equitable approach to manage railway noise on Inland Rail, the railway noise triggers adopted by ARTC are generally more stringent than the railway noise assessment criteria from the regulatory guidelines.

The assessment identified that railway noise levels would achieve the criteria at the majority of the 7,000 sensitive receptors identified to be within 2 km of the Project alignment. However, noise mitigation would need to be investigated for up to 285 sensitive receptors at project opening in 2026. An additional 30 sensitive receptors triggered the assessment criteria at the design year 2040, a total of 315 sensitive receptors, requiring a review of reasonable and practical measures to reduce and control railway noise for these sensitive receptors.

A range of standard, industry best practice noise mitigation options were identified to reduce railway noise levels and mitigate noise impacts, in a reasonable and practical manner.

Mitigation measures may include a range of options such as at-property treatment to reduce the intrusion of railway noise, measures to reduce railway noise at its source, or measures to prevent the noise from travelling outside of the railway corridor.

An assessment of the potential ground-borne vibration from railway operations determined that rail movements outside the tunnel achieved the vibration assessment criteria for managing impacts to human comfort and structural (cosmetic) damage at the majority of sensitive receptors. Based on the distance from the outer rail, the vibration criteria may trigger the consideration of mitigation measures during detail design for two sensitive receptors.

The vibration from train passbys can be a potential source of ground-borne noise. The assessment identified that sensitive receptors within 50 m of the outer rail may experience ground-borne noise levels above the relevant assessment criteria. However, the potential impacts of ground-borne noise may not be fully experienced as the airborne railway noise levels may be the dominant source of noise at the building façades nearest to and facing the rail corridor.

A screening assessment of ground-borne vibration from the train movements within the Little Liverpool Range Tunnel determined potential levels at the nearest sensitive receptors to the tunnel would achieve the vibration assessment criteria. The potential ground-borne noise levels from the train movements within the tunnel achieved the assessment criteria at most receptors but triggered a review of noise mitigation at seven sensitive receptors above the tunnel alignment in Laidley.

The assessment of noise and vibration from the railway operations concluded the assessment criteria were predicted to be achieved at the majority of the sensitive receptors within 2 km of the Project. The detailed design and construction will revise the assessment to verify the expected outcomes and, where required, confirm the measures to be implemented to control railway noise and vibration levels.

Noise and vibration management

Specific noise management and mitigation measures will be incorporated into the Construction Noise and Vibration Sub-plan, which will form part of the Construction Environmental Management Plan (EMP). Proposed mitigation measures include using temporary noise barriers, monitoring, appropriate selection and maintenance of equipment, scheduling of work during less-sensitive time periods, situating plant away from noise-sensitive locations, construction traffic management and including respite periods.

Based on the construction noise assessment and proposed mitigation, construction noise impacts at approximately 32 per cent of receptors are not predicted to be feasibly mitigated to below the appropriate criterion by physical attenuation alone. However, these residual impacts present will be temporary and will stop when construction finishes. Managing residual impacts will be undertaken in consultation with the affected landholders.

The draft Outline EMP includes measures to mitigate noise and vibration impacts on nearby sensitive receptors. Specific noise management and mitigation measures will be developed and implemented through the Noise and Vibration Sub-plan of the draft Outline EMP.

Management of residual construction noise impacts will be undertaken in consultation with the community and affected residents. Residual construction noise impacts are proposed to be managed through:

- Temporary relocation of affected occupants
- Respite periods
- At-property treatments.

For operational railway noise, many of the sensitive receptors are isolated and the predicted noise levels trigger the assessment criteria by less than 5 dBA (decibels) at the majority of sensitive receptors. The highest predicted railway noise level was 17 dBA above the relevant ARTC noise assessment criteria.

Where sensitive receptors are isolated along the alignment, it is usually not practical to construct rail noise walls or noise barriers. The feasible and practical noise mitigation is likely to be architectural acoustic treatment of the properties to manage noise impacts within habitable rooms.

At the Gatton, Forest Hill and Valley Vista Estate at Laidley, the sensitive receptors are more densely populated within 300 m of the rail corridor. Noise-mitigation options include concept noise barriers to screen railway noise levels adjacent to the rail corridor. The specific location, extent and height of noise barriers, if implemented, will be subject to a detailed review of feasible and reasonable options. Final options for noise pathway control based on concept railway noise barriers present in the EIS, will be determined during detailed design. Depending on final design, the noise assessment criteria may not be fully achieved for some sensitive receptors, and these receptors may need additional at-property treatment.

While at-property treatment can ameliorate potential noise impacts inside buildings, the external rail noise levels may still be clearly audible above the ambient noise environment in close proximity of the rail corridor.

The decisions to implement at-property treatments will be based on measured rolling stock noise levels and a survey of the property. Consultation with directly affected landowners will continue and railway noise levels will be verified when Inland Rail operations start on the Project.

Stakeholder and community engagement will be ongoing for potential noise and vibration matters during construction and operation.

Social

The social impact assessment identified how the Project may affect local and regional communities, and how the Proponent and its Contractors will work with stakeholders to mitigate negative social impacts and enhance Project benefits.

The social impact assessment drew on the results of ARTC's stakeholder engagement processes. Stakeholders include directly affected and nearby landowners, traditional custodians, government agencies, businesses, and community, environmental and economic groups.

As for all major projects located near human settlements, the level of potential impact experienced is higher for those living closest, while Project benefits usually accrue at a broader regional level.

Potential social impacts at a local level included:

- Property impacts such as land use and tenure impacts 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, level crossings and other Project infrastructure
- Periodic traffic delays at level crossings during operations, potentially delaying emergency service vehicles en-route to an emergency.

At a regional level, potential impacts include:

- If multiple infrastructure projects are constructed at the same time, there may be a significant demand on trades and construction labour
- Demand for local health and emergency services is likely to increase during the construction phase
- The presence of a freight rail line increasing the opportunity of rail-based interface hazards between trains and motorists, cyclists and pedestrians, with consequent trauma and loss for families, service providers, and social networks.

In contrast, the local community will benefit from construction and operation of the Project. The Project will generate up to 410 full-time equivalent jobs at the peak of construction (expected between weeks 56–57), with an anticipated average workforce of 190 people onsite over the construction period. Over the estimated construction period of 200–205 weeks, this equates to approximately 730–750 full-time equivalent jobs. This employment 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. Local businesses will have the opportunity to supply the Project with fuels, equipment, quarried material, and services including fencing, electrical installation, rehabilitation and landscaping, maintenance and trade services.

A SIMP has been developed to address social impacts, invest in local communities and offset potential impacts on distributional equity. The SIMP provides the processes and mechanisms to:

- Provide guidance for the mitigation of negative impacts on stakeholders and communities
- Incorporate stakeholder inputs on mitigation and enhancement strategies
- Support adaptive management of social impacts by enabling communication between stakeholders and the Project during the detailed design, pre-construction and construction process, to identify any need for improvements to management measures
- Describe ARTC's initiatives and partnership opportunities that will maximise local employment and business opportunities and bring about long-term benefits for local communities.

The SIMP includes five action plans. Each action plan includes objectives and desired outcomes, mitigation measures, and the timing for delivery of these mitigation measures:

- Community and Stakeholder Engagement
- Workforce Management
- Housing and Accommodation
- Health and Community Wellbeing
- Local Business and Industry.

Economics

The economic impact assessment undertaken for the EIS established and examined the existing economic environment and local context to form the basis to measure the economic impacts. It identified and assessed potential economic benefits and impacts on affected local and regional communities and businesses. It also assessed the economic significance of the Project on the regional, state and national economies through computable general equilibrium modelling (CGE) and evaluated the potential cumulative impacts on local and regional economies resulting from the construction and operation of related projects, including adjacent Inland Rail Projects.

It is noted that the economic impact assessment was largely completed before the economic shock associated with the 2020 Quarter 2 market conditions. In particular, the baseline representation of the economy does not account for the 2020 Quarter 2 market conditions.

The economic impact assessment for the Project established the existing economic environment and local context. Potential economic benefits and impacts were identified and assessed. The potential economic significance of the Project on a regional, state and national scale was assessed.

The findings of the economic assessment suggests that the Project will support local and regional development through opportunities:

- To encourage develop and grow Indigenous, local, and regional businesses through the supply of resources and materials for the construction and operation of the Project
- Secondary service and supply industries.

The expansion in construction activity is also likely support additional flow-on demand and additional spending by the construction workforce in the local community.

The economic benefits assessment estimates that the Project is expected to provide a total (2019 present value terms) of $147.40 million 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.

The Project will promote regional economic growth across the Toowoomba, Ipswich and Greater Brisbane regions. Over the construction phase, real gross regional product (GRP) for the Toowoomba and Greater Brisbane regions is projected to be $235 million and $814 million higher than the baseline level, respectively, under the assumption of slack labour markets.

As part of Inland Rail, 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 Ebenezer Regional Industrial Area, Willowbank Industrial Estate, and the Bromelton State Development Area.

The Project may also offer 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.

ARTC is committed to enhancing the economic benefits of the Project while avoiding, mitigating or managing any adverse economic impacts. To maximise the positive outcomes of the Project, a number of strategies to avoid, reduce or mitigate the negative economic impacts, and enhance and facilitate the capture of positive impacts have been proposed.

The SIMP will be implemented to manage the social and socio-economic impacts of the Project and enhance Project benefits and opportunities. The SIMP outlines 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. The SIMP includes a Local Business and Industry Action Plan.

Cultural heritage

Indigenous heritage

As a requirement of the Indigenous heritage component of the Project's Terms of Reference, a Cultural Heritage Management Plan (CHMP) was developed with the relevant Aboriginal Party 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) (former Department of Aboriginal and Torres Strait Islander Partnerships (DATSIP)).

This process was undertaken by ARTC and a CHMP for the Project was developed between ARTC and the relevant Aboriginal Party in 2018 (CLH017009) in accordance with the Cultural Heritage Management Plan Guidelines (DATSIP, 2005) and approved under the *Aboriginal Cultural Heritage Act (2003)* (Qld) (ACH Act).

The CHMP has been approved under the ACH Act and meets the requirements for identifying, assessing and managing Indigenous heritage for the Project. The CHMP is confidential and will not be made available as part of the EIS process.

Searches of the DATSIP (now DSDSATSIP) database show 12 reported Indigenous cultural heritage sites within 1 km of the Project alignment, but none within the cultural heritage study area. The majority of these sites consist of artefact scatters and scarred or carved trees, cultural sites, landscape features and resource areas.

Non-Indigenous heritage

An assessment of non-Indigenous heritage values and impacts was undertaken using a combination of register searches and historical and archival research. The assessment identified 42 Areas of Interest, including 26 registered local heritage places, and ten registered state heritage places, which were inspected and assessed against the relevant criteria.

The Project may directly or indirectly impact on the 26 Areas Of Interest that have local heritage significance and 10 Areas of Interest that have State significance due to their location within the cultural heritage study area.

Potential Project impacts on non-Indigenous heritage sites have been 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. Direct impacts include the demolition or substantial alteration of a building, or the disturbance of an archaeological site.
- Indirect impacts occur if the surrounding physical environment is altered 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 runoff or sediment deposition due to changing hydrology.

Potential Project impacts were assessed using the International Council of Monuments and Sites standard guidelines (ICOMOS, 2011; ICOMOS, 2013), both before and after the implementation of mitigation measures. The assessment concluded that, with appropriate measures, Project impacts could be reduced to moderate for two Areas Of Interest, and neutral/slight for the remainder. The two Areas Of Interest still experiencing moderate residual impacts include one local heritage place and one of state significance. Detailed design will ensure that the Project alignment attempts to avoid these sites if possible; if it is not possible, mitigations such as archaeological surveys and consultation with infrastructure owners will be undertaken.

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. A combination of mitigation measures will be implemented before the Project is constructed. These measures will include:

- Archival recording
- Archaeological surveys, excavations, surface collection, and monitoring
- Relocation of heritage items. Relocation is generally undesirable as setting forms an intrinsic part of heritage value. However, if impacts cannot be managed in any other way, it may be appropriate to relocate buildings or items of movable heritage to another location, such as a local historical society.

Traffic, transport and access

Construction traffic

During the construction phase, transporting materials, equipment and personnel will mainly occur via existing State-controlled roads and local government roads. Construction materials and equipment will be delivered to centralised laydown areas along the alignment, which have been designed with vehicle accessibility and safe maneuverability in mind.

The construction traffic analysis results indicated that:

- Five State-controlled roads have been identified that will interface with the Project alignment, and up to 11 State-controlled road sections may have construction traffic that exceeds 5 per cent of existing
- 34 local government roads (Lockyer Valley Regional Council, Ipswich City Council and Toowoomba Regional Council) have been identified that may have construction traffic that exceeds 5 per cent of existing background traffic; however, the overall impact to many of these roads is expected to be minor because the high percentage of construction traffic is a function of low existing traffic volumes
- 20 cycle routes are identified that may potentially be impacted by construction traffic; most of these routes currently carry a high proportion of heavy vehicle movements
- 22 existing public transport services may be impacted by construction traffic or proposed and existing road–rail crossings. Given the low frequency of existing services, it is considered there would be minimal impacts to the existing public transport services during construction works and operations
- 30 existing school bus routes may potentially be impacted by construction traffic, of which only six are expected to experience construction traffic in excess of 5 per cent of the background traffic— given the low frequency of school bus services (one to two per each route week day), it is expected that there will be minimal impact to services as a result of the construction of the Project
- Three existing long-distance coach services may be impacted by construction traffic. However, the impacts on these long-distance coach services are expected to be minimal due to the low frequency of the services
- No stock routes will be impacted within the transport study area.

Certain sections will generate construction-related traffic volumes in excess of 10 per cent of the background traffic during the construction phase. The level of service comparison between the 'with' and 'without' development scenarios indicate the Project may potentially cause a minor change in level of service for some road sections during each year of construction. However, it is not expected 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 Construction Traffic Management Plan will be developed before construction activities start.

Rail operations and maintenance

Construction of connections and tie-ins to the existing rail networks are planned during routine maintenance and rail possession periods—impacts to the existing rail network are therefore not expected.

Rail operational traffic volumes are not expected to impact operational conditions of the surrounding road network.

Due to the low volumes of road traffic associated with operation of the Project, impacts to the road network during operation are expected to be negligible. Traffic is expected to be limited to a small maintenance crew using rail maintenance access routes to conduct inspections on the new track.

The Project will maintain the safety and efficiency of all potentially affected transport modes and for the Project workforce and other transport system users. The condition of existing transport infrastructure, including pavements, will be maintained during construction works and operations.

The Project will be compatible with existing transport infrastructure, future transport corridors and the surrounding road network.

Road–rail interfaces

Level crossings can introduce risk as they represent points at which trains, cars and pedestrians can intersect.

The rail crossing impact assessment focused on vehicle delay and queueing analysis of Project traffic at rail crossings, and at neighbouring closely spaced intersections. This analysis was undertaken for the Project at proposed rail crossings. There are currently 14 road–rail interfaces within the construction-phase transport study area and 7 active level crossings proposed for the Project operations.

A safety-based risk assessment was undertaken for all road–rail interfaces proposed for the Project, with a 'high' risk rating assigned to each level crossing location.

Traffic, transport and access mitigation measures have been included as part of the Project design to reduce risk—with measures informed by key actions and areas of focus of the *Queensland Level Crossing Safety Strategy* (2012–2021) (DTMR, 2012).

A number of additional measures have been proposed and will be implemented during future delivery phases of the Project. With additional measures in place, the residual risk level of potential impacts will be further reduced.

Hazard and risk

The Project has incorporated risk identification and assessment practices throughout the design development phase; ARTC will implement and maintain appropriate safety practices throughout operations.

A preliminary risk assessment was undertaken consistent with the requirements of Australian and New Zealand Standard/International Standards Organisation AS/NZ ISO 31000:2018) *Risk Management: Principles and Guidelines* (Standards Australia, 2018).

Hazards were identified for each of the Project phases and evaluated qualitatively to determine residual risks following the implementation of risk management strategies and mitigation measures. With the implementation of mitigation measures, many hazards were determined to have a low residual risk.

Potential hazards assessed as having a medium residual risk for Project operations (post mitigation and management) were identified. From the risk assessment, all risk rankings are medium or below. This means that the risks have been reduced to a level that is tolerable or will be considered tolerable if they are reduced so far as reasonably practicable.

The residual risk associated with some particular incidents, included potential events related to dangerous goods freight transport, potential use of explosive for Little Liverpool Range tunnel construction, pedestrian and community safety, interface with live trains and derailment or involving private access route, overbridges and emergency access.

Risk assessment is an ongoing process and, as the Project design evolves, the impact on risks will be regularly reviewed to ensure they are reduced as far as is reasonably practical. This risk reduction can be demonstrated by ensuring all mitigation proposed and any other mitigation identified in detailed design are implemented.

Tunnel design will incorporate fire and life safety mitigation measures including limiting the amount of combustible materials used in construction, providing fire detection systems, preventing derailed trains from entering the tunnel, and preventing trains that are on fire from stopping in the tunnel.

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 Inland Rail and the Project. An Incident Management Plan will be developed for Inland Rail to detail the procedures and resources for responding to and managing emergencies. The Emergency Management Procedure will be used for emergency management including emergency response and emergency planning.

The ARTC *Safety Policy* (ARTC, 2020a) and the ARTC *Fatal and Severe Risk Program* (ARTC, 2017) will be fully implemented.

Waste and resource management

The construction phase will generate the majority of the Project's waste through vegetation clearing, topsoil stripping, excavation and the demolition of existing structures. Municipal solid waste will be generated by activities at construction locations and on multiple work fronts.

The waste generated during construction and operation will vary in different phases of the Project. The majority of spoil produced will be reused as fill and it is anticipated that a small portion will be required to be disposed of as waste.

The Project design calculates that approximately 3,638,000 m^3 of cut material (other than rock) from tunnelling and rail works may be generated during construction. Approximately two-thirds of the excavated material will be reused within the Project as fill, leaving approximately 1,349,000 m^3 of spoil that will need to be managed or treated for potential for re-use within the Project and on adjacent Inland Rail projects.

With the exception of spoil, no significant waste streams have been identified for the Project. As the waste streams are not considered significant, they 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 in the vicinity of the Project. The western extremities of the Project may use waste facilities in Toowoomba, while in the east waste disposal and composting facilities around Ipswich will be used. The ability of waste facilities to service the Project is based on initial consultation with operators, a review of existing environmental authority licensing under the Environmental Protection Regulation 2019 (Qld) for each facility, and the Project's contribution to the regional waste generation. Based on this preliminary analysis, the capacity of the potential waste facilities is sufficient to accommodate waste generated from the Project. This will be confirmation with operators when construction timing for the Project is determined.

A range of mitigation measures will be implemented to ensure that, during construction and operation, waste is avoided, reused or recycled wherever possible. A Waste Management Sub-plan will be prepared, including:

- Waste reduction targets
- Processes for documenting waste volumes and types
- Requirements for waste segregation and temporary storage onsite
- Waste tracking for when waste is disposed of offsite
- Appropriate record keeping and reporting.

A Waste Management Sub-plan will be developed as part of the Construction EMP, which will guide these strategies. In addition, a Spoil Management Strategy has been prepared as part of the EIS.

The volume of waste generated by each of the waste streams will be further refined during detailed design to more accurately assess the receiving waste management facilities and waste disposal options for the Project.

The Project will not be applying for any waste-related Environmentally Relevant Activities (ERAs); however, the Project will ensure that any Contractors managing waste will be appropriately licensed.

Cumulative impacts

When a number of projects are being undertaken at the same time in a similar location, they can cause 'cumulative impacts'. The cumulative impact assessment for the Project considered eight projects that have the potential to contribute to cumulative impacts. The cumulative impact assessment relies on publicly available information, and depending on the level of information available, conservative assumptions about a project's impact have been adopted (e.g. area of vegetation to be cleared).

Potential cumulative impacts on environmental aspects are considered to be of low significance, except the potential cumulative impacts on the following environmental aspects:

- Land resources due to the potential cumulative impacts on soil resources (losses), changes to landform and topography, erosion, and weed management
- Landscape and visual amenity due to the operational impacts associated with views of combined, successive, and sequential adjoining projects
- Flora and fauna due to the impacts of habitat loss from vegetation clearing/removal and potential cumulative issues from edge/barrier effects, habitat fragmentation and the associated reduction in connectivity to existing biodiversity corridors
- Surface water and hydrology due to the potential clearing and removal of existing riparian vegetation during construction
- Social impacts due to the combined effects of adjoining projects on social values including the labour demands, traffic volumes, traffic safety, and amenity for landowners
- Economics due to potential increased demand on both the labour market and physical inputs (materials, goods and services)
- Traffic, transport and access due to the impacts of construction traffic on local traffic volumes and the extent to which adjoining projects may intensify these effects
- Potential cumulative impacts associated with the loss of biodiversity and cultural heritage aspects within the respective areas of interest are common to all projects in the cumulative impact assessment; therefore, these impacts are cumulative by nature. Similarly, projects in the landscape and visual amenity cumulative impact assessment are likely to exacerbate impacts from the Project through combined, successive and sequential views of adjoining projects
- The potential cumulative impacts associated with spoil disposal when considering the Inland Rail projects in isolation is recognised as being of greater than low significance. It is, however, expected that in detailed design and execution phases, the adjacent Inland Rail projects will coordinate spoil management and reduce the volumes required to be disposed outside project areas
- All projects included in the cumulative impact assessment have overlapping construction schedules—this is likely to increase traffic and congestion on certain roads within the traffic area of impact, as well as decrease the availability of skilled labour over the short term
- Each of projects considered by the cumulative impact assessment will be required to mitigate and manage potential cumulative impacts to acceptable levels
- The proposed combined delivery approach for the Gowrie to Helidon, Helidon to Calvert and Calvert to Kagaru Projects provides opportunities to coordinate the management of cumulative impacts generated as a result of construction traffic movements, workforce requirements, spoil management and reuse, and identification and protection of environmental offsets.

Approach to environmental protection and management

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

- Provide an environmental management framework—to identify outcomes to be achieved for the detailed design, pre-construction, construction and commissioning
- Establish the process for preparation and implementation—of the Outline EMP, Construction EMP and relevant sub-plans.

The draft Outline EMP includes discipline-specific sub-plans, drawing on the outcomes of the environmental assessments documented in the EIS. The draft Outline EMP sub-plans establish a framework that will be prepared as components of the Construction EMP during the next phase of the Project. Each draft Outline EMP Sub-plan identifies:

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

The sub-plans 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 will be addressed under the SIMP.

Any conditions imposed by the Coordinator-General in the EIS evaluation report or by the Australian Government Minister for the Environment will be incorporated into future versions of the draft Outline EMP, the sub-plans and the Construction EMP to ensure that all works are authorised and consistent with those conditions.

Conclusion

The Project, from Helidon to Calvert, and Inland Rail as a whole, provides a 'step change' for freight transport in Australia. Inland Rail offers a safe and sustainable solution to existing freight bottlenecks and provides opportunities for complementary development.

As part of Inland Rail, 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, identified as one of the 'missing links' for Inland Rail, will maximise economic growth opportunities for the region.

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

The Project is consistent with the objectives of the *Environment Protection and Biodiversity Conservation Act (1999)* (Cth), including providing for the protection of matters of national environmental significance. 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 and assessing potential impacts of the Project. Where environmental impacts have been identified, efforts have been made, in the first instance and where practical, to avoid or minimise those impacts through design development. Where required, further mitigation and management measures have been proposed for future Project phases. Proposed measures will be implemented through the development of detail design and environmental management framework as the Project proceeds to construction and into operation.

Key considerations for this Project include the interaction of the alignment through rural, agricultural and residential areas.

Interactions with stakeholders helped to shape the Project design and proposed mitigation measures for future stages of design, construction, commissioning and operation.

Information captured from consultation processes has informed the preparation of the EIS. The Project responded to, and specifically addressed, issues raised—key areas with targeted Project responses included: land use and tenure (including property); noise and vibration; traffic, transport and access; flooding and water management and socio-economic concerns.

Regarding intergenerational equity, as part of the wider Inland Rail works, 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 EIS demonstrates that Project-related residual impacts and benefits can be appropriately managed.

The delivery of the Project is an integral part of Inland Rail. The Project will provide opportunities to deliver long-term and substantial economic benefits. The Project will connect regional and urban markets to buyers and increase the capacity of the existing passenger and road network.

The Project will provide a safe and sustainable solution to Australia's freight challenge.