CHAPTER 06

Project description

HELIDON TO CALVERT ENVIRONMENTAL IMPACT STATEMENT

INLAND RAIL

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

Contents

Figures

Tables

6. Project description

6.1 Purpose of this chapter

The purpose of this chapter is to describe the Helidon to Calvert (H2C) Project (the Project) to satisfy the EIS Terms of Reference (ToR) requirements and to provide a basis for the identification of impacts throughout the EIS. This chapter describes the key elements of the Project throughout its construction and operational phases. This chapter also discusses the major associated infrastructure requirements of the Project. Where relevant, design and construction mitigation measures have been identified and integrated into the Project design to minimise the environmental impact of the Project.

6.2 Project overview

ARTC proposes to construct and operate the Project, which consists of approximately 47 kilometres (km) of single-track, dual-gauge railway with four crossing loops to accommodate double-stack container freight trains up to 1,800 metres (m) long. It will also involve the construction of an approximately 850 m long tunnel through the Little Liverpool Range to facilitate the required gradient across the undulating topography. The initial construction allows for 1,800 m long double-stack freight trains. The design does not preclude future accommodation trains up to 3,600 metres (m) long, based on business needs and subject to separate approval applications. The Project is classed as both greenfield and brownfield development as approximately 50 per cent of the alignment runs parallel to existing rail corridors.

The design response to key environmental features has been developed in line with engineering constraints for the rail design. The rail design is aimed at minimising environmental and community impacts, minimising disturbance to existing infrastructure and meeting engineering and rail operations design criteria.

6.2.1 Capacity for future passenger rail services

The general alignment has been designed to include future-proofing for train length and axle load. Although not considered part of the design or part of the EIS, the alignment does not preclude either the duplication of the Inland Rail freight line and/or future passenger lines.

6.2.2 Relationship to the Inland Rail Program

The Project is one of 13 projects that complete the Inland Rail Program (Inland Rail) for the delivery of 1,700 km of rail line by 2026. It is also one of five Inland Rail projects in Queensland.

The Project connects directly into the eastern end of the Gowrie to Helidon (G2H) Inland Rail project, and the western end of the Calvert to Kagaru (C2K) Inland Rail project.

Further information is provided in Chapter 2: Project rationale.

6.2.3 Capital expenditure

Due to the Project's overall length, and the significant infrastructure elements, it is expected to represent an investment of up to $1 billion (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 a capital expenditure profile of approximately $565 million, based on 2019 dollars, generally consistent with the *Inland Rail Programme Business Case* (ARTC, 2015a). The assessment 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.

Further detail on the economic impact assessment is located in Chapter 17: Economics and Appendix R: Economics Technical Report.

6.2.4 Anticipated timing

The anticipated timing of phases for the Project is shown in Table 6.1. Early works are scheduled for commencement in late 2021, following detailed design and subject to required post-EIS activities.

With commencement in 2021, completion is targeted for 2026.

While construction is planned to start in late 2021, a number of factors could potentially impact the Project and delay the start of construction to 2022, such as successful procurement of a contractor.

The construction completion date is influenced by a number of variables, including outcomes of ongoing engagement and stakeholder consultation, and ongoing design and development work.

Commissioning will be completed prior to the Project becoming operational.

TABLE 6.1: ANTICIPATED TIMING OF PROJECT PHASES

Project phase	2021				2022				2023				2024				2025				2026			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Detailed design				■	■	■	■	■	■	■	■	■												
Pre-construction and early works				■	■	■	■	■																
Construction					■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		
Commissioning																				■	■	■		
Operation																							■	■

6.3 Project objectives

The objectives of the Project 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 and to connect to adjoining sections of Inland Rail
- Minimise the potential for adverse environmental and community impacts
- Maximise benefits at a national, State, regional and local level.

The objectives of Inland Rail are to:

- Provide a rail link between Melbourne and Brisbane that is interoperable with train operations to Perth, Adelaide, and other locations on the standard gauge rail network, to:
  - Serve future rail freight demand
  - Stimulate growth for inter-capital and regional/bulk rail freight
- Provide an increase in productivity that will benefit consumers through lower freight transport costs
- Provide a step-change improvement in rail service quality in the Melbourne to Brisbane corridor and deliver a freight rail service that is competitive with road
- Improve road safety, ease congestion, and reduce environmental impacts by moving freight from road to rail
- Bypass bottlenecks within the existing metropolitan rail networks, and free up train paths for other services along the coastal route
- Act as an enabler for regional economic development along the Inland Rail corridor.

6.4 Rationale

The Australian Government has committed to delivering a significant piece of national transport infrastructure by constructing a high-performance and direct interstate freight rail corridor between Melbourne and Brisbane, via central-west New South Wales (NSW) and Toowoomba in Queensland.

Inland Rail is a nationally significant transport initiative. Inland Rail will provide a high-capacity freight link between Melbourne and Brisbane through regional Australia to better connect cities, farms, and mines via ports to domestic and international markets.

The Project forms part of Inland Rail and enhances Australia's existing rail network and serves the interstate freight market by delivering a road-competitive service that will enable freight to be delivered from Melbourne to Brisbane in less than 24 hours with reliability, pricing and availability that is equal to or better than road.

A discussion of the Program and Project's rationale and justification is provided in Chapter 2: Project rationale.

Alternative alignments and locations of ancillary infrastructure were investigated, and this Project is the result of several iterations of option assessment and consultation with the Queensland Government.

6.5 Infrastructure alternatives

The design has been developed to include infrastructure components that can be feasibly, safely and efficiently constructed and operated. The design is optimised with consideration for the overarching principles of ecologically sustainable development, including:

- Precautionary principle
- Intergenerational equity
- Conservation of biological diversity and ecological integrity
- Improved valuation, pricing and incentive mechanisms.

Infrastructure alternatives will continue to be assessed for viability through the detailed design process and as construction approaches are refined.

Sustainability considerations, including defined preferences, in relation to sources of water, waste management and utility requirements are discussed in the following sections:

- Potential water sources—refer Section 6.9.3.1
- Provision of utilities—refer Section 6.9.3.2
- Management of waste and resource use—refer Section 6.9.3.5
- Management of waste water from the tunnel—refer Section 6.13.11.

Route and associated infrastructure alternatives considered for the Project are discussed in Chapter 2: Project rationale.

The four principles of ecologically sustainable development are further considered in Appendix J: Matters of National Environmental Significance Technical Report.

Chapter 11: Flora and fauna discusses how the precautionary principle and promotion of conservation of biological diversity and ecological integrity have been incorporated into both the assessment methodologies and the development of mitigation measure.

6.6 Ongoing activities, early works, and enabling works

Some activities are required before the start of construction. These activities have been classified as ongoing activities, early works, pre-construction activities and enabling works.

6.6.1 Ongoing activities

6.6.1.1 Corridor acquisition

The majority of land required for the rail corridor will be acquired by a Constructing Authority that has compulsory acquisition powers. Where compulsory acquisition of land is required, the process outlined in the *Acquisition of Land Act 1967* will be followed. Arrangements between ARTC and a constructing authority are yet to be finalised. Temporary and permanent access to State land tenures such as unallocated State land, reserves and roads will be undertaken in accordance with the *Land Act 1994* (Qld) (Land Act). The extent of property impacts will be refined and confirmed during detailed design in consultation with landowners.

6.6.1.2 Environmental and planning approvals

Following approval of the EIS under the *State Development and Public Works Organisation Act 1971* (Qld), the Project will require additional post-EIS approvals under State environmental and planning legislation. The majority of approvals will be required before the start of construction or any ground-disturbing activities.

Owners' consent will be required prior to the making of some planning applications, for example environmentally relevant activities (ERAs) and development approvals on any of the aforementioned land types during construction.

The Project may involve the following ERAs during construction, as defined in Schedule 2 of the Environmental Protection Regulation 2019 (EP Regulation):

- Chemical storage (ERA 8)—threshold to be determined following refinement of construction methodology
- Extractive and screening activities (ERA 16)—threshold to be determined following refinement of construction methodology
- Cement manufacturing (ERA 41)—manufacturing 200 tonnes or more of cement in a year
- Regulated waste transport (ERA 57)—transporting regulated waste in a vehicle
- Water treatment (ERA 64)—threshold to be determined following refinement of construction methodology.

The Project may involve the following development approvals:

- Operational work that is constructing or raising waterway barrier works unless the works comply with the requirements of the document *Accepted development requirements for operational work that is constructing or raising waterway barrier works* (DAF, 2018a)
- Operational work for clearing native vegetation (unless the clearing is accepted development or exempt clearing work under the Planning Regulation 2017
- Operational work that involves taking or interfering with water in a watercourse, lake or spring.

A summary of the potential post-EIS approvals is in Chapter 3: Project approvals. These approvals are subject to change during refinement of the construction approach and the detailed design process and will need to be reviewed further at that stage.

Unless determined by the contractor, all construction activities, including pre-construction and early works, will remain within the disturbance footprint. If works outside the disturbance footprint are required, the contractor will be responsible for undertaking further investigations of the disturbance area, obtaining relevant owners' consent and securing all necessary approvals or changes to approvals before scheduling any ground disturbance.

6.6.1.3 Survey and geotechnical investigations

The construction of Project infrastructure requires adherence to survey control plans and procedures to ensure spatial correctness and quality of construction. The Project will engage reputable and competent surveying teams who will, among other things, control and guide the following:

- All elements of survey and survey control
- Survey mark preservation and compliance with Queensland legislation
- Development and nomination of survey control points to feed into Inspection and Test Plans for delivery, including:
  - Topsoil stripping
  - Quantity measurement (usually before and after all materials are used)
  - Setting out of all alignment and structural elements.

The contractor will comply with ARTC survey requirements for the delivery of the Project.

6.6.2 Early works

Early works and pre-construction activities are required for construction mobilisation and to support the permanent infrastructure components. These activities are expected to include, but are not limited to:

- Establishment of access tracks
- Relocation or protection of QR assets (excluding those undertaken as enabling works)
- Utility or service relocations (excluding those undertaken as enabling works)
- Installation of temporary fencing
- Establishment of site compounds
- Delivery of materials to site.

Pre-construction activities may be scheduled before the main construction works or undertaken under a separate contract and be managed under a Construction Environmental Management Plan (CEMP).

6.6.3 Works that are not part of Project

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

- Overhead powerline relocations
- Telecommunications relocations
- Relocation or protection of existing QR assets.

6.7 Project location and land use

The Project is located within the Ipswich and Lockyer Valley local government areas (LGAs) in South East Queensland (SEQ). The Project is the third most-northern package of Inland Rail. The location of the Project and its regional context is shown in Figure 6.1.

The preferred alignment is generally consistent with the alignment of the Gowrie to Grandchester future State transport corridor protected under the *Transport Planning and Coordination Act 1994* (Qld) (TPC Act).

Land use within the preferred alignment is predominantly rural and rural residential interspersed between the townships of Helidon, Gatton, Forest Hill, Laidley, Grandchester and Calvert, and includes significant transport infrastructure of the Warrego Highway and West Moreton System rail corridor. Approximately 24 km of the alignment runs parallel to the existing West Moreton System rail corridor.

The preferred alignment commences at Helidon, deviating from the existing 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 corridor slightly north of Placid Hills.

The new track continues parallel to the north of the existing rail corridor, through Gatton and the northern side of the existing Gatton Station, through Forest Hill and then deviates from the existing rail corridor in a south-easterly direction just north of Laidley township across Laidley Plainlands Road. The preferred alignment then continues toward Little Liverpool escarpment and once again briefly runs parallel to the existing rail corridor before reaching a new 850 m tunnel section through the Little Liverpool Range.

The design includes space for a future, shared cycle path to be provided between Placid Hills and Laidley, with a dedicated shared path incorporated from Lockyer Creek to Forest Hill. The shared path generally runs parallel to the railway corridor and provides access for cyclist and pedestrians to The University of Queensland, Gatton Campus.

From the Little Liverpool Range eastern tunnel portal, the Project crosses under the existing Queensland Rail (QR) rail line, and over the Rosewood Laidley Road bypassing the existing Grandchester Station to the south, running parallel to the existing rail corridor, and then connecting into the proposed C2K rail line west of Calvert. The Project will connect to the Western Moreton System rail corridor at Calvert.

The intended land use for the Project is rail and associated infrastructure, including road realignments, grade separations and ancillary infrastructure.

The Project in its local context is shown in Figure 6.2. Existing land use of the Project alignment and adjoining areas is shown in Figure 6.3. Further discussion of the Project's land use is provided in Chapter 8: Land use and tenure.

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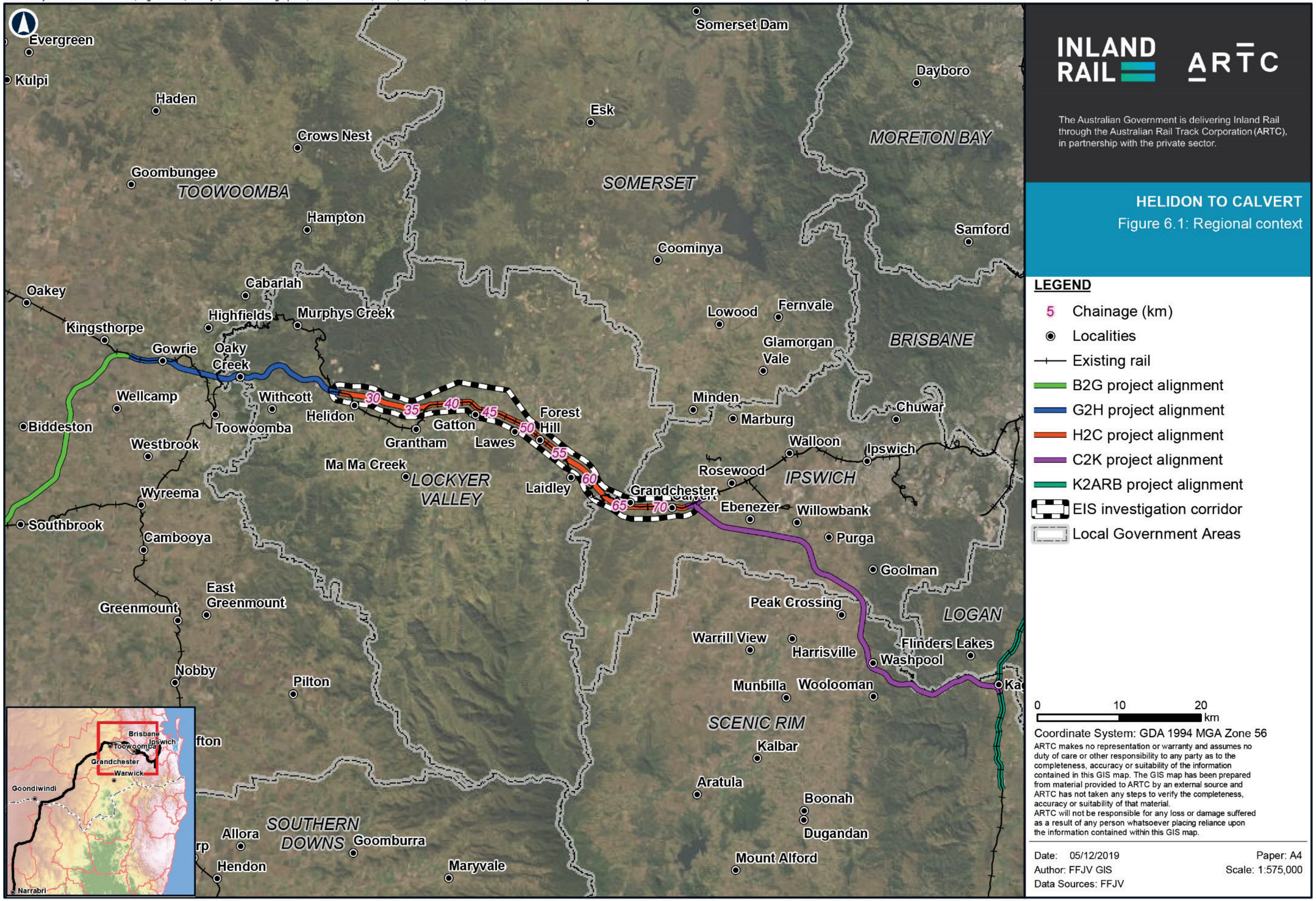

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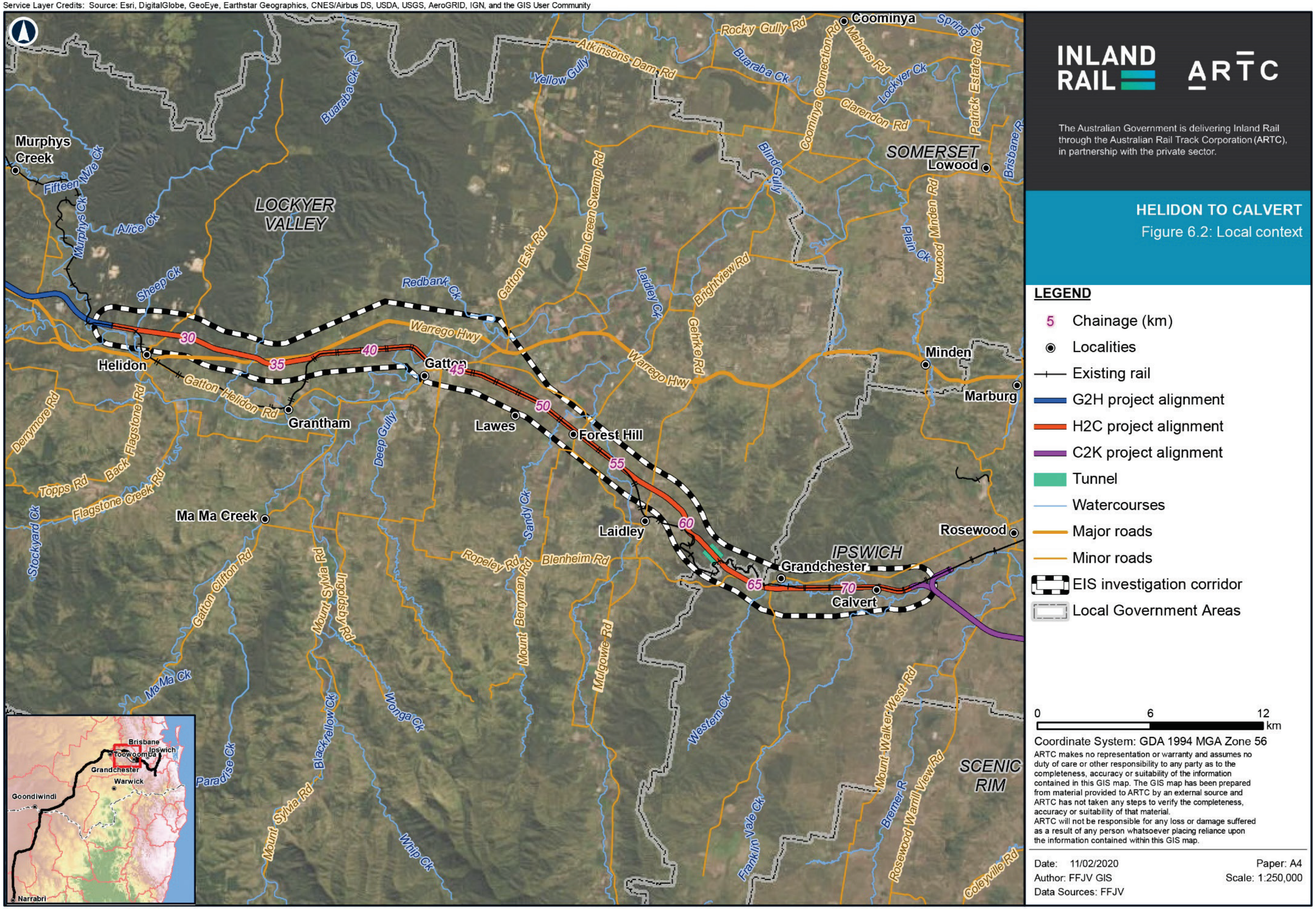

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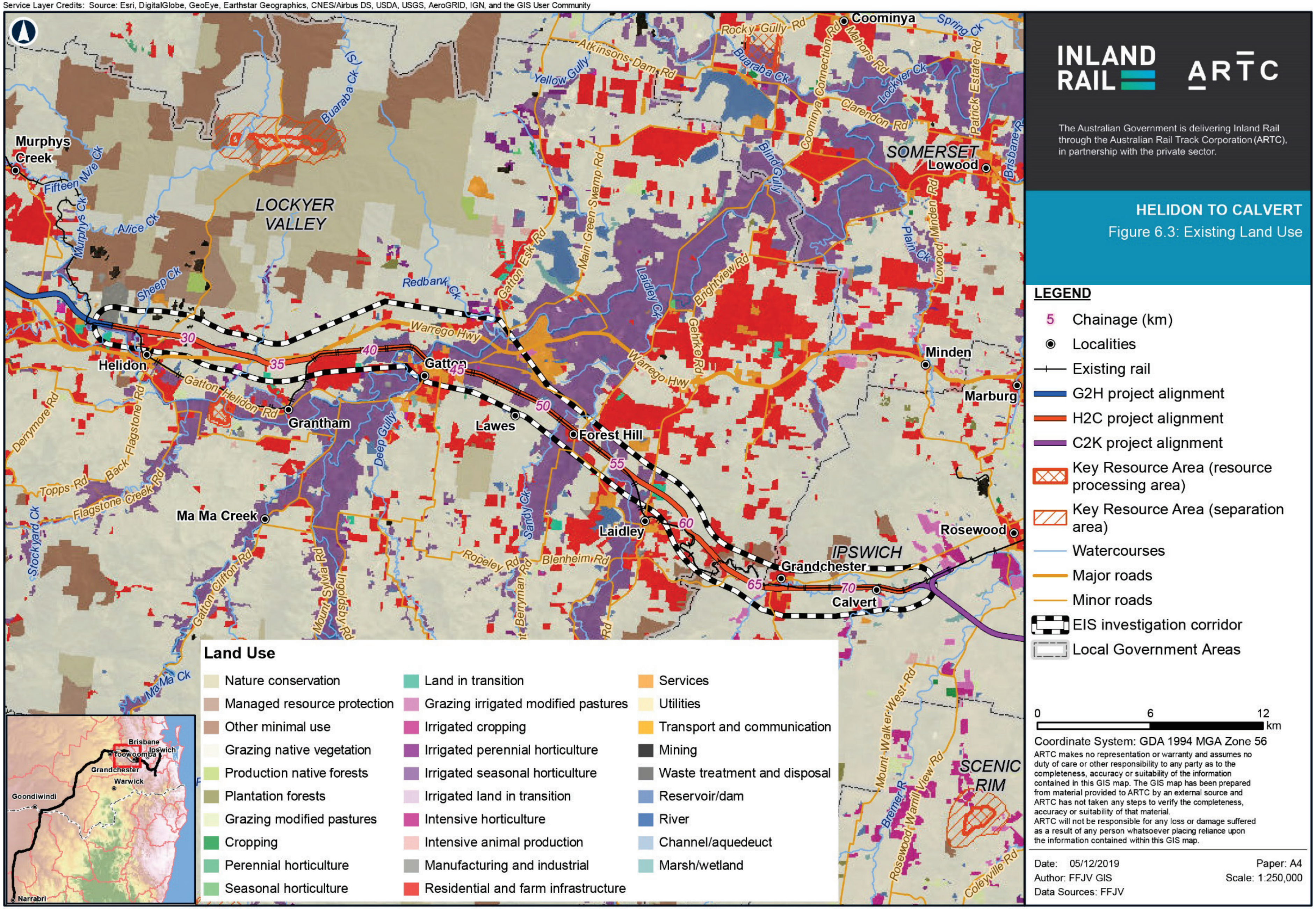

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6.8 Description of the Project

6.8.1 Design criteria

The key characteristics of the Inland Rail Program service offering are reliability, price, transit time and availability. To help achieve this service offering, ARTC have implemented a consistent set of design requirements and parameters to be applied across Inland Rail. Establishing consistent design criteria normalises designs, delivering an asset that meets the business and operational requirements and is consistent along its length, that will subsequently simplify asset maintenance.

The design criteria acts as a primary point of reference for the design of the Project, forming a baseline for design criteria and design standards.

The design criteria for Inland Rail and the Project are summarised in Table 6.2.

TABLE 6.2: INLAND RAIL PERFORMANCE SPECIFICATIONS

Attribute	Specification
Reference train	
Intermodal	21-tonne axle load (TAL), 115 kilometres per hour (km/h) maximum speed, 1,800 m length (initial) 2.7 horse power per tonne (hp/tonne) power:weight ratio
Coal/bulk	25 TAL (initial), 80 km/h maximum speed, length determined by customer requirements within maximum train length
Operational specification	
Freight train transit time (terminal to terminal)	Target driven by a range of customer preferences and less than 24 hours Melbourne–Brisbane for the intermodal reference train. Flexibility to provide for faster (higher power:weight ratio) and slower (lower power:weight ratio) services to meet market requirements
Gauge	Standard (1,435 millimetres (mm)) with dual standard/narrow (1,067 mm) gauge in appropriate Queensland sections
Maximum freight operating speed	115 km/h @ 21 TAL
Maximum axle loads (initial)	21 tonnes @ 115 km/h 23 tonnes @ 90 km/h 25 tonnes @ 80 km/h
Clearance (terminal to terminal)	As per ARTC Plate F for double stacking (7.1 m above rail)
Maximum train length (initial)	1,800 m
Minimum design standards	
General alignment	
Design speed	115 km/h
Maximum grade	1:100 target, 1:80 maximum (compensated) 1:200 maximum at arrival or departure points at loops
Curve radius	1,200 m target, 800 m minimum
Cant/cant deficiency	Set for intermodal reference train

Attribute	Specification
Medium-speed alignment (mountainous terrain)	
Design speed	80 km/h minimum
Maximum grade	1:100 target, 1:50 maximum (compensated) 1:200 maximum at arrival or departure points at loops
Curve radius	800 m target, 400 m minimum
Corridor width	40 m minimum
Rail	Minimum 53 kilogram per metre (kg/m) on existing track; 60 kg/m on new or upgraded track
Concrete sleepers	Rated @ 30 TAL
Sleeper spacing	667 mm spacing (1,500/km)—existing track 600 mm (1,666/km)—new corridors/track or re-sleepering existing track
Turnouts	Tangential, rated at track speed on the straight and 80 km/h entry/exit on the diverging track
Crossing loops (initial)	1,800 m (clearance point to clearance point) plus signalling overlap No level crossing across loops
Future proofing	
Train length	To provide for future extension of maximum train length to 3,600 m
New structures	Capable of 30 TAL @ 80 km/h minimum
Formation	Formation on new track suitable for 30 TAL @ 80 km/h
Crossing loops	Loops designed and located to allow future extension for 3,600 m trains
Reliability, availability, price and transit time	Competitive with road. Key characteristics of the Inland Rail service offering include: - Reliability: 98 %, defined as the percentage of goods delivered on time by road freight, or available to be picked up at the rail terminal or port when promised - Availability: services available with convenient departure and arrival times for customers, which depends on cut-off and transit times - Price: cheaper relative to road transportation, as a combined cost of access to the rail network, rail haulage and pick-up and delivery - Transit time: 24 hours or less Melbourne to Brisbane. Further information is contained in Chapter 2: Project rationale.

6.8.2 Summary of key components

Key components of the Project (refer Figure 6.4 and Volume 3: Drawings) are summarised in Table 6.3.

TABLE 6.3: KEY COMPONENTS OF THE PROJECT

Aspect	Description
Permanent features	
New track	- Approximately 47 km of new single-track, dual-gauge railway.
Rail corridor	- Approximately 47 km of rail corridor (including crossing loops) - Approximately 24 km of the Project will be co-located with existing rail corridor as brownfield.
Tunnel	- An approximately 850 m long tunnel through the Little Liverpool Range.

Aspect	Description
Crossing loops and turnouts	▸ Crossing loops are places on a single-line track where trains from opposing directions can pass each other. Four crossing loops, each a minimum of 2,200 m in length ▸ Crossing loops spaced at approximately 13 km intervals, located at Helidon, Gatton, Laidley and Calvert ▸ Turnouts are a combination of set of points, V crossing and guard rails that permit traffic to turnout from one track to another. Turnouts will be located at the tie-ins to the West Moreton System rail corridor and at the proposed crossing loops.

Bridges	▸ Bridges to accommodate topographical variation, crossings of waterways or other infrastructure such as roads
	▸ A total of 31 bridges, including:
	  ▸ 13 rail-over-waterway
	  ▸ 6 rail-over-waterway-and-road
	  ▸ 6 rail-over-road
	  ▸ 4 road-over-rail
	  ▸ 1 rail-over-rail
	  ▸ 1 pedestrian-over-rail.

Drainage	▸ Reinforced concrete pipe (RCP) culverts and reinforced concrete box culverts (RCBC) with scour protection measures installed to avoid erosion.
	▸ A total of 86 culverts including:
	  ▸ 51 RCP locations (multiple cells in places)
	  ▸ 35 reinforced concrete box culvert (RCBC) locations.

Rail crossings	▸ Rail crossings including level crossings, grade separations (rail, road or pedestrian overbridges), occupational/private crossings and fauna crossing structures
	▸ Preferred options for formed public road–rail interface treatments currently applied over the length of the Project include:
	  ▸ 7 active road level crossings, comprising
	  ▸ 4 new; 3 up-grade to existing; 1 consolidation (replaced with a pedestrian crossing)
	  ▸ 5 pedestrian crossings (including replacement of the existing pedestrian footbridge at Gatton Station)
	  ▸ grade-separate treatments, re-alignments and diversions
	▸ The Project interfaces with 50 private (occupational) accesses.

Ancillary works	▸ Associated rail infrastructure including maintenance sidings and signalling infrastructure to support the train control system
	▸ Ancillary works including road–rail interfaces (crossings and realignments):
	  ▸ 36 public road (formed) interfaces
	  ▸ 9 public road (unformed) interfaces.
	▸ Signalling and communications, signage and fencing, drainage works, and the installation or modification of services and utilities within the rail corridor (excluding those undertaken as enabling works).

Environmental treatments	▸ Fauna fencing and opportunities for screening ▸ Environmental design features including fauna sensitive design measures, landscaping and habitat rehabilitation and concept noise barriers ▸ Environmentally relevant activities including the potential establishment of a water treatment plant and concrete batching facilities. These elements are not part of the current design and are to be investigated more fully during Project detailed design.

Aspect	Description
Construction features	
Land	▸ The corridor required for the Project is expected to comprise a width of 40 m to 62.5 m and 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 ▸ Sufficient width has been considered not to preclude future crossing loop extensions to accommodate trains up to 3,600 m long , subject to separate approval applications based on business needs with land acquired as part of the initial acquisition process by the Constructing Authority ▸ Temporary tracks to access construction sites. Where required, these tracks may be retained to serve as rail maintenance access roads during operations ▸ Land requirements for construction will include temporary workspaces, site offices and laydown facilities ▸ Laydown areas located approximately every 5 km (avoiding 1 % Annual Exceedance Probability (AEP) floodplains where possible)—larger sites are approximately every 20 km ▸ Approximately 2,500 square metres (m^2) of laydown areas to support bridge construction (smaller in core habitat areas) ▸ Additional laydown areas for flash-butt welding and rail assembly with a typical size of 1,000 m x 200 m.
Embankments and cuttings	▸ Approximately 34 km of embankments (excluding structures) ▸ Embankments and cuttings will be required along the alignment, with a maximum height of 23 m ▸ The total length of cut for the Project will be in the range of 7.6 km with a maximum cut depth of 38.8 m (3,638,000 m^3 of cuttings).
Material sourcing	▸ Identification and lawful use of quarries for the sourcing of construction materials in the vicinity of the Project area.
Utilities	▸ Clashes with utilities flagged and treatment(s) identified for refinement during detailed design The (with utility relocations being subject to separate assessments, with all necessary approvals obtained prior to the relocation being undertaken) ▸ Major utility impacts and treatments have been confirmed with utility owners.

Construction activities for the Project will likely include temporary roads, upgrades and/or alterations to existing roads. The construction of the Project may also require relocation of some utilities, depending on their proximity to the construction zone. These aspects will be further examined during detailed design.

Figure 6.4 shows the location of the Project footprint, laydown areas, EIS investigation corridor, alignment and relevant infrastructure as known at this stage of the design. Further detail is provided Volume 3: Drawings.

The H2C project kilometrage decreased as the line moves, generally from west to east. Regarding chainages (Ch), the kilometrages and their directions adopted for the Project start at 100.02 km (latitude -27.49550707°; longitude 151.8529915°) and the end kilometrage is 52.56 km at the eastern extent (latitude -27.66380128°; longitude 152.5375911°).

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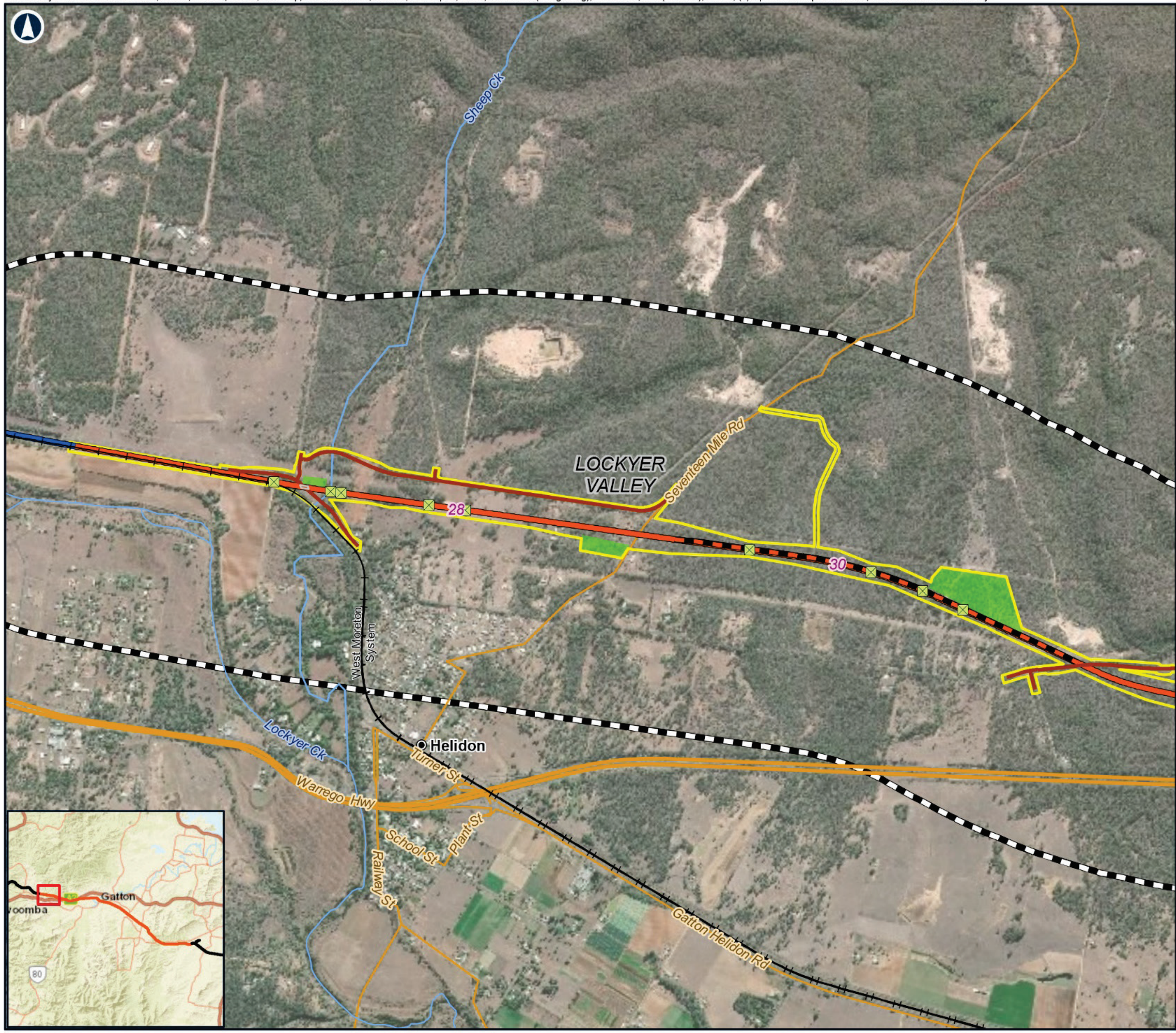

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HELIDON TO CALVERT

Figure 6.4a: Project components

LEGEND

- 5 Chainage (km)
- Localities
- Culverts
- Existing rail
- G2H project alignment
- 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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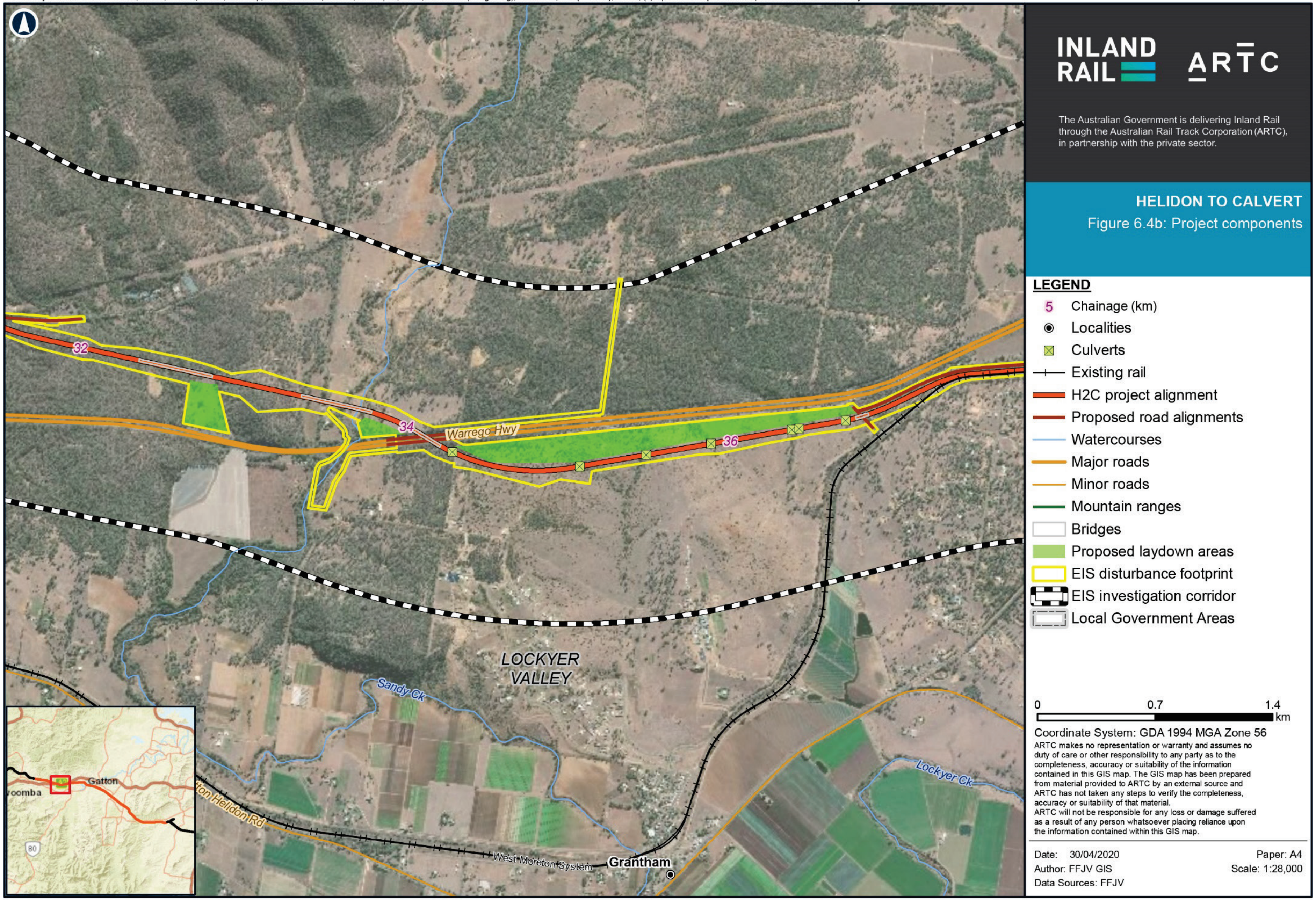

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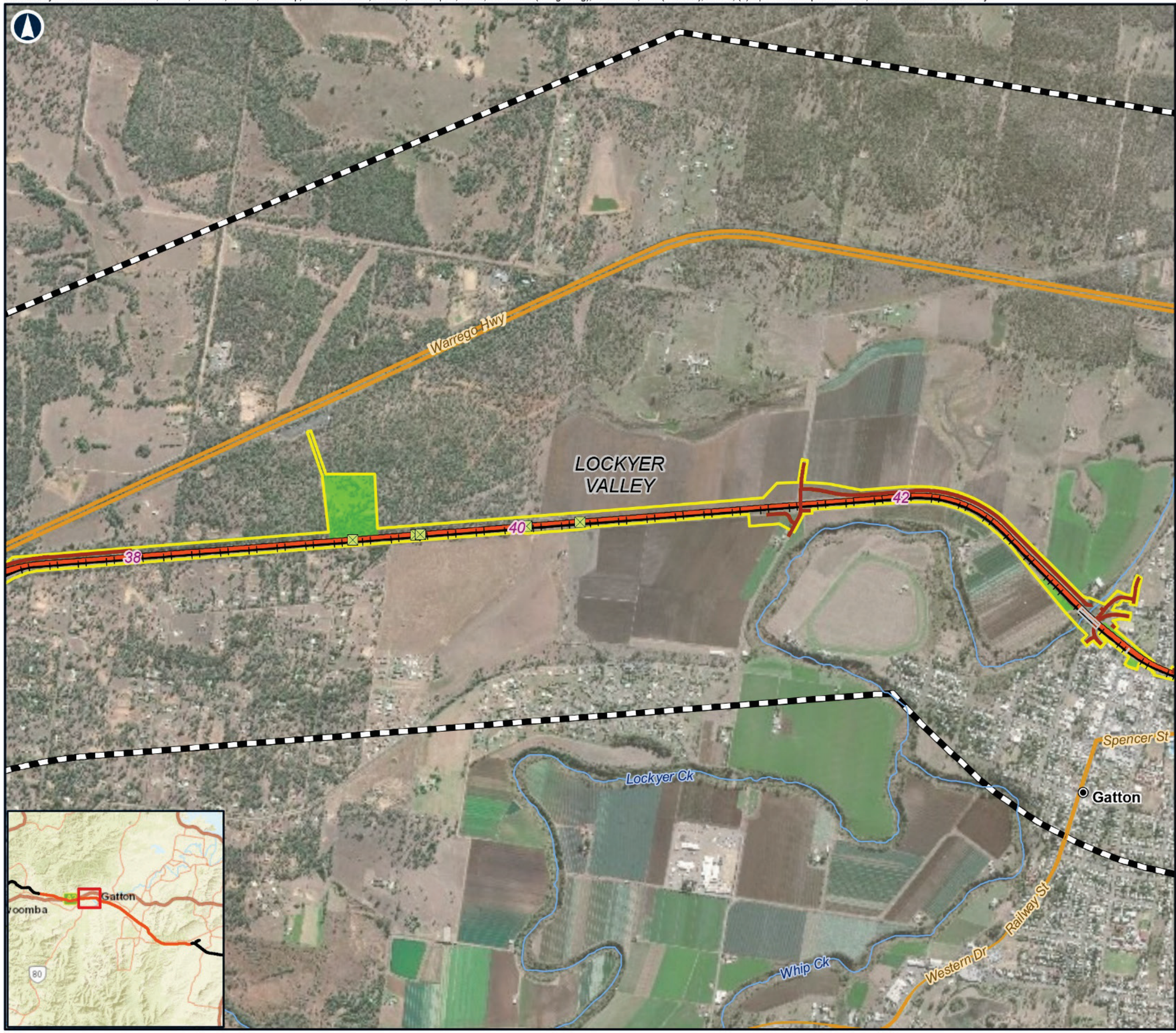

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HELIDON TO CALVERT

Figure 6.4c: Project components

LEGEND

- 5 Chainage (km)
- Localities
- Culverts
- Existing rail
- H2C project alignment
- 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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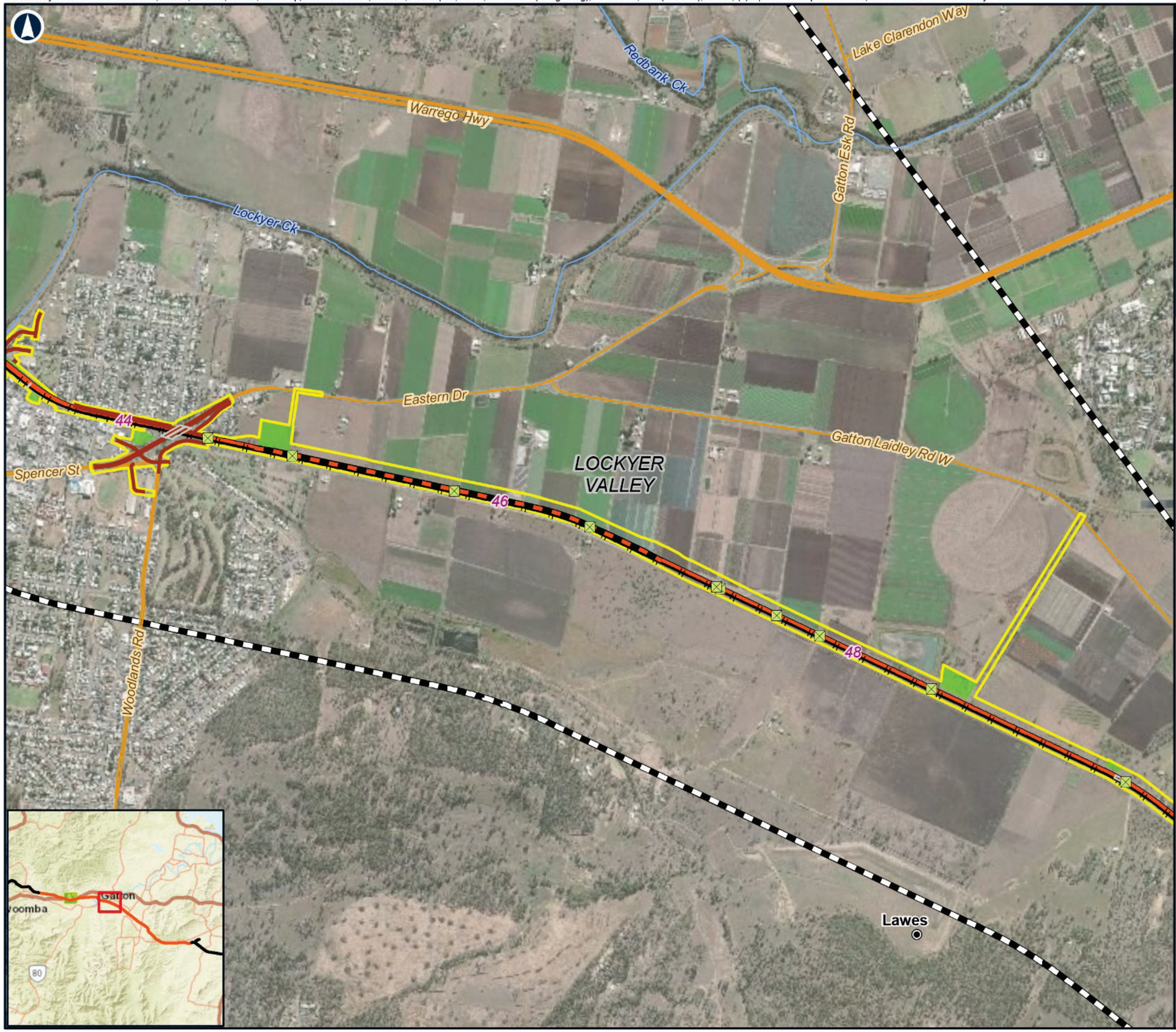

INLAND RAIL

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HELIDON TO CALVERT

Figure 6.4d: 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

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HELIDON TO CALVERT

Figure 6.4e: 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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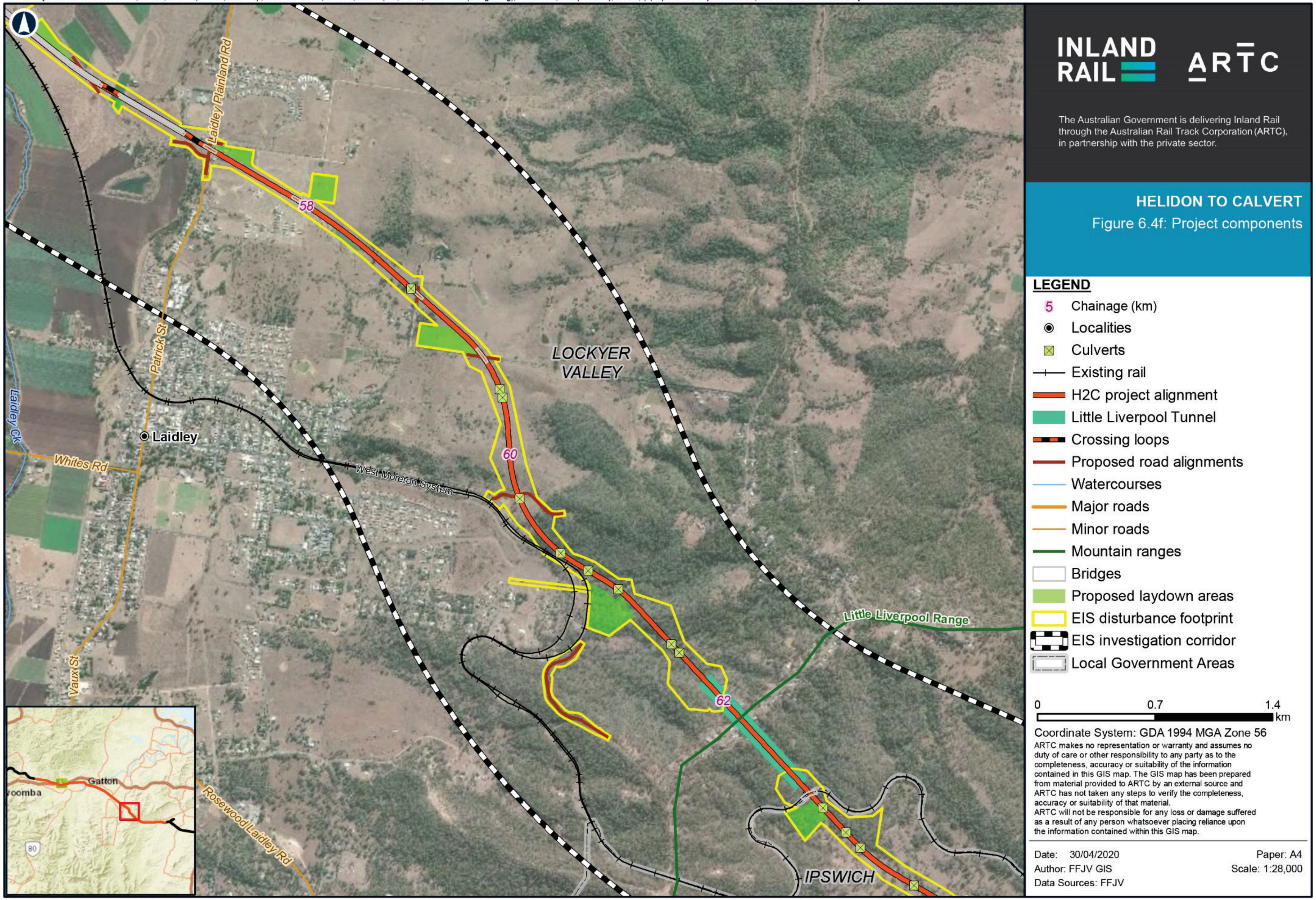

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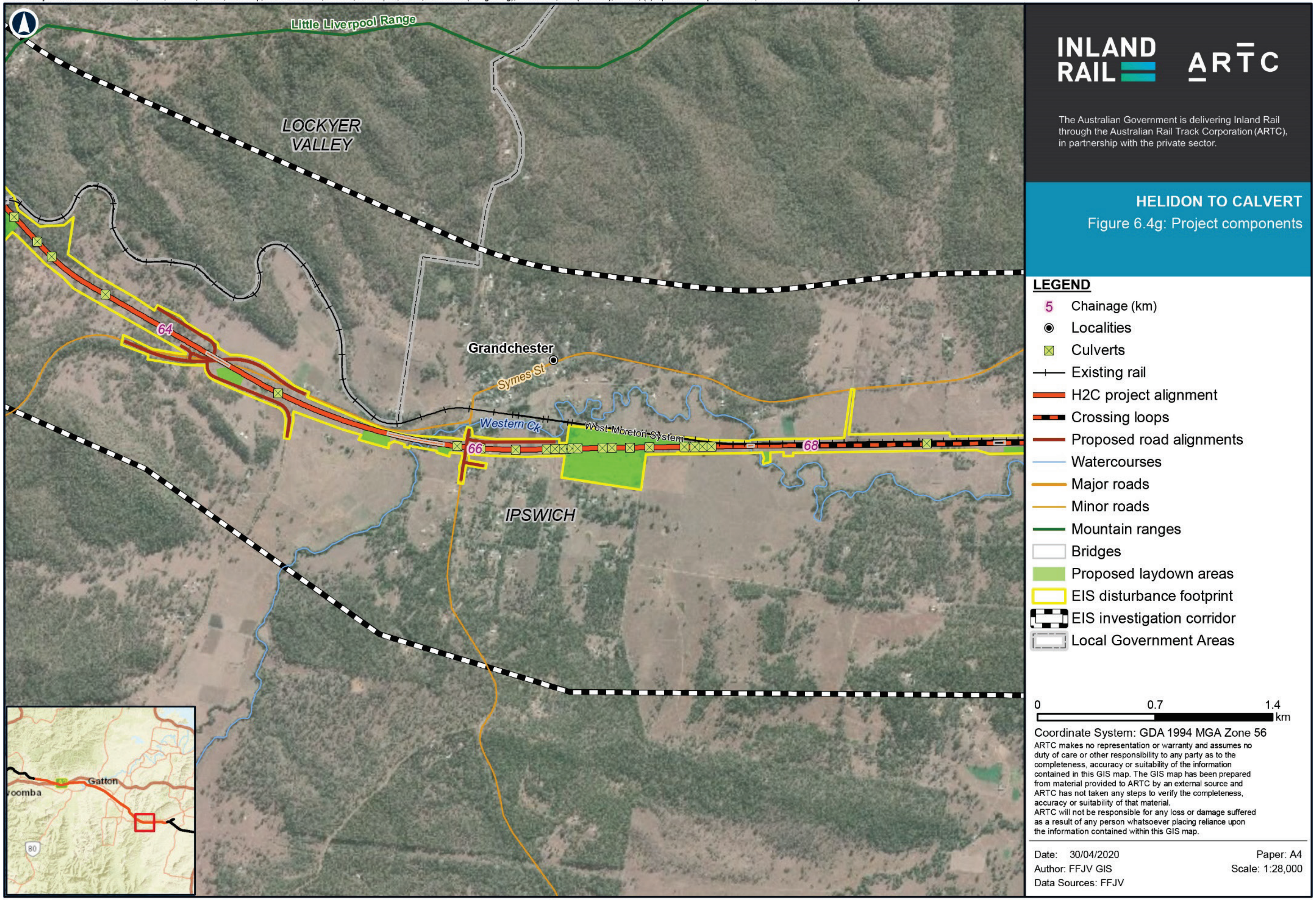

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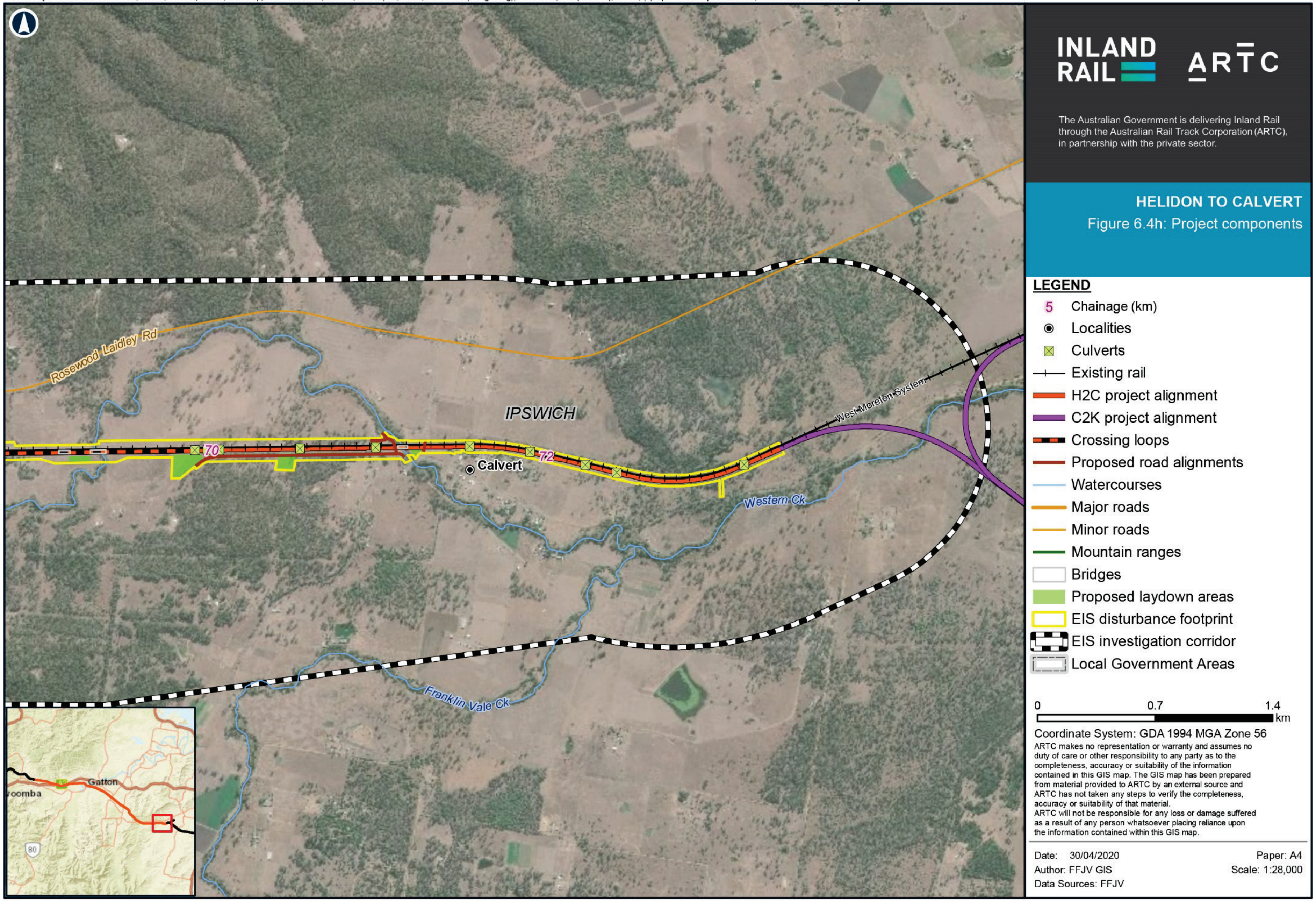

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6.8.3 Rail line

The Project is greenfield for approximately half (23 km) of the alignment, with a new, single line of dual-gauge track—standard gauge (1,435 mm) and narrow gauge (1,067 mm). The track structure consists of continuously welded 60 kilograms per metre (kg/m) rail, fasteners, rail pads and concrete dual-gauge, full-depth sleepers at a minimum of 600 millimetre (mm) centres. The design provides for 21-tonne axle load (tal) intermodal freight trains and 25 tal coal trains. The ballast depth below the rail is minimum 250 mm and not exceeding 500 mm, with a minimum 300 mm shoulder width for lateral restraint. Figure 6.5 shows a typical section for a dual-gauge ballasted track.

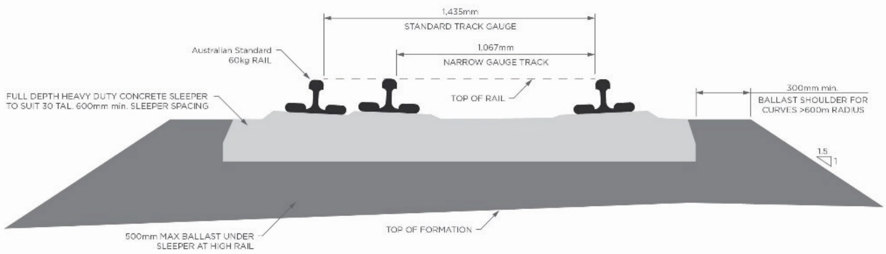

FIGURE 6.5: INDICATIVE DESIGN FOR NEW TRACK

Elements of the track are described in Table 6.4.

TABLE 6.4: ELEMENTS OF THE TRACK

Elements	Description and purpose
Rails	▸ Continuously welded 60 kg/m steel rails ▸ Due to there being fewer joints, trains can travel faster on continuously welded steel rails than on jointed rails. Continuously welded rails also require less maintenance.
Fasteners	▸ Fasteners are the method of fixing the rails to the sleepers.
Rail pads	▸ Rail pads are plastic or rubber mats that are inserted between the rails and the sleepers. Their purpose is to evenly distribute the load from passing trains onto the sleepers. ▸ Rail pads also act to reduce noise and vibration impacts from passing trains.
Sleeper	▸ Concrete, rectangular, sleepers, laid perpendicular to the rails ▸ Sleepers distribute the load from passing trains to the ballast and subgrade. They also function to hold the rails upright and keep them spaced to the correct gauge.

Ballast	▸ Ballast typically consists of crushed stone that is packed between, below and around the sleepers
	▸ The purpose of the ballast is to:
	  ▸ Bear the load from the sleepers
	  ▸ Hold the track structure in place as trains pass by
	  ▸ Facilitate the drainage of water
	▸ Keep down vegetation that might interfere with trains passing by.

Subgrade	▸ The subgrade consists of a capping layer (restricts the upward migration of wet clay and silt), a layer of structural fill, and a layer of general fill ▸ The subgrade is illustrated in Figure 6.6.

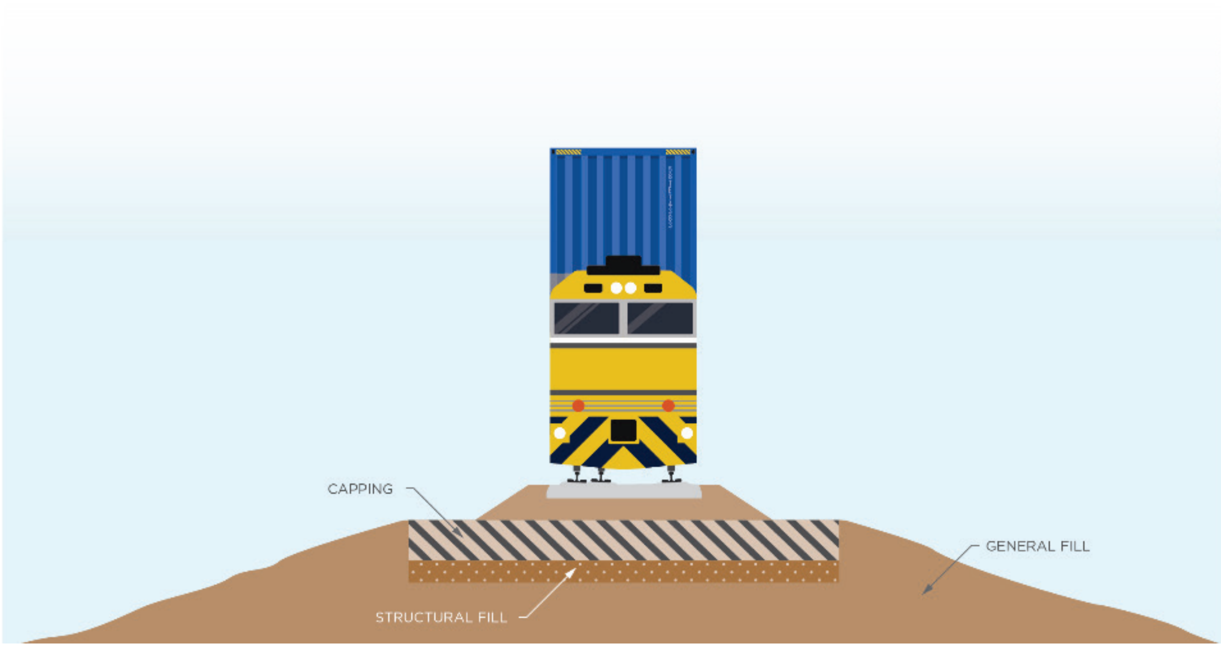

FIGURE 6.6: STRUCTURE OF THE SUBGRADE

6.8.4 Tunnel infrastructure

As shown in Figure 6.4f, the Project proposes an approximately 850 m long tunnel through the Little Liverpool Range.

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, which will be predominantly unmanned.

Stormwater runoff at the western portal area is drained out of the cutting by drains incorporated in the benches of the cutting. In addition, cut-off drains are designed to prevent stormwater entering the tunnel portal. Surface water will not be permitted to flow from the western portal through the tunnel to the eastern portal. Any water collected inside the tunnel (from groundwater seepage, carry-through, washdown, and/or firefighting-associated drainage) will be collected at the tunnel low-end sump at the eastern portal. If required, this water will be processed through a water treatment plant, which may include additional treatment such as hydrocarbon separation. The tunnel will have a ventilation building above each portal (approximate dimensions with height: 23 m; length: 61 m; and width: 22 m, fitted with attenuators and dampers) that will include large axial fans and air nozzles able 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. Also, 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.

The tunnel will likely only have minimal internal lighting, with only low-level lighting and emergency lighting expected.

6.8.5 Crossing loops

Four new crossing loops, spaced at approximately 13 km intervals, are proposed for the Project. The crossing loops are located at Helidon, Gatton, Laidley, and Calvert (refer Figure 6.4a and Figures 6.4d–6.4h). The loops would be constructed as new sections of track parallel with the new track. They will range in length to accommodate the surrounding area and topography and fit the design length of the train (1,800 m). The Project will be wide enough to accommodate the new crossing loops. A 1-in-16 dual-gauge turnout will be provided at each end of the four crossing loops. An additional turnout (1 in 10) will be required for provision of a maintenance siding at each crossing loop.

The disturbance footprint has made allowance for future extension of all loops to accommodate future 3,600 m trains, subject to separate approval applications. Crossing loop tracks have currently been assumed at 4.5 m spacing from the main track and incorporate a 250 m maintenance siding to enable maintenance of rolling stock without obstructing the track. It is proposed that the maintenance siding orientation is provided so that the maintenance vehicles would exit the siding on a falling grade. A typical layout of a crossing loop is shown in Figure 6.7.

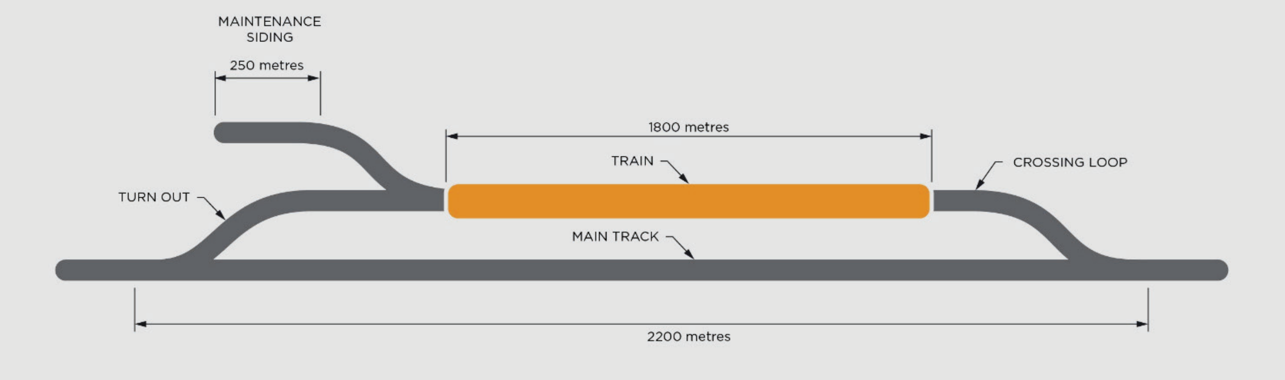

FIGURE 6.7: CROSSING LOOP AND MAINTENANCE SIDING

6.8.6 Crossovers

Crossovers (turnouts) are included in the design to provide connectivity between the Inland Rail and West Moreton System rail corridor. This is achieved by a combination of dual gauge and narrow-gauge turnouts to allow trains to be guided from one track to another. Four sets of crossovers are proposed at Helidon, Placid Hills, Forest Hill, and Calvert between Inland Rail and West Moreton System rail corridor. In addition, a set of crossovers are proposed between Inland Rail and the West Moreton System rail corridor at the Calvert end. Crossovers use 1:10.5 turnouts (both dual gauge and narrow gauge).

6.8.7 Bridges

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

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

The new bridge structures are typically founded on piles supporting in-situ reinforced concrete substructures. Bridge superstructures are typically 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 appropriate. The bridges are of various lengths and spans to suit the alignment and topography.

Typical section of piers with pre-stressed concrete Super-T girders are illustrated in Figure 6.8. Typical section of piers with pre-stressed concrete slab span are illustrated in Figure 6.9.

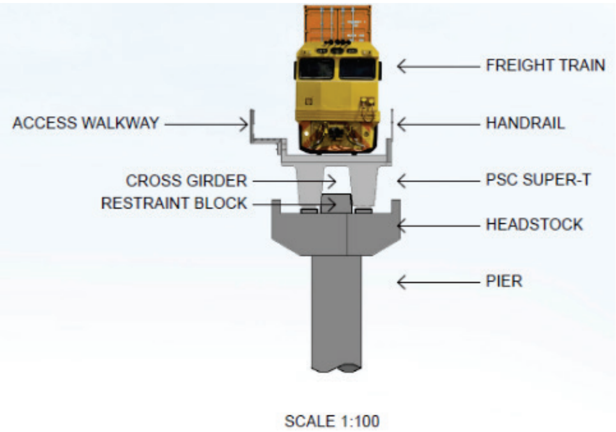

FIGURE 6.8: PIER WITH CONCRETE SUPER-T GIRDER

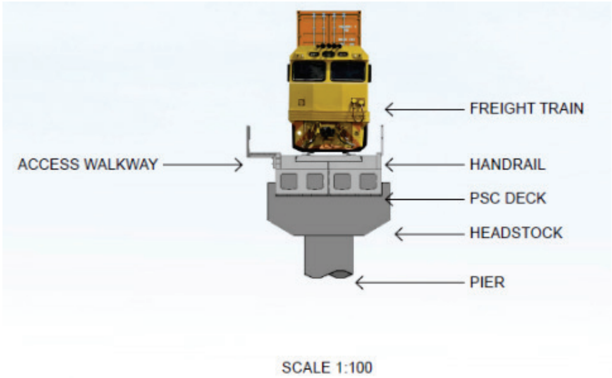

FIGURE 6.9: PIER WITH CONCRETE SLAB SPAN

There are two existing bridges that 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 replacing to provide the required clearance over the rail alignment. The existing rail bridge over Lockyer Creek requires replacing to accommodate the Old College Road and Beavan Street upgrade.

The Project requires 31 new bridge structures, including 13 rail-over-water, six rail-over-water-and-road, six rail-over-road, four road-over-rail, one rail-over-rail bridge and one pedestrian-over-rail bridge. The bridge locations are outlined in Table 6.5.

TABLE 6.5: NEW BRIDGE STRUCTURES AND LOCATIONS

Bridge No	Bridge name	Chainage (at Abutment)	Bridge type
330-BR27	Lagoon Creek 1 Loop	Ch 0.71 km	Rail bridge over waterway and road
330-BR29	Lagoon Creek 2 Loop	Ch 1.62 km	Rail bridge over waterway
330-BR30	Airforce Road	Ch 27.21 km	Road bridge over rail
330-BR02	UT1 Sandy Creek Bridge Rail Bridge	Ch 32.36 km	Rail bridge over waterway
330-BR03	Sandy Creek 1	Ch 33.35 km	Rail bridge over waterway and road
330-BR04	Warrego Highway	Ch 34.04 km	Rail bridge over road
330-BR05	Philps Road	Ch 36.76 km	Rail bridge over road
330-BR06	Lockyer Creek	Ch 43.15 km	Rail bridge over waterway and road
330-BR31	Lockyer Creek QR Rail Bridge	Ch 43.15 km	Rail bridge over waterway and road
330-BR08	Gatton Station Pedestrian Bridge	Ch 43.48 km	Pedestrian bridge over rail
330-BR09N	Eastern Drive Bridge Northbound	Ch 44.28 km	Road bridge over rail
330-BR09S	Eastern Drive Bridge Southbound	Ch 44.29 km	Road bridge over rail
330-BR10	UT1 Laidley Creek	Ch 49.51 km	Rail bridge over waterway
330-BR11	UT2 Laidley Creek	Ch 50.26 km	Rail bridge over waterway
330-BR12	Sandy Creek 2	Ch 51.37 km	Rail bridge over waterway
330-BR13	Sandy Creek 3	Ch 51.59 km	Rail bridge over waterway
330-BR14	Laidley Creek	Ch 54.74 km	Rail bridge over waterway
330-BR26	Lagoon Creek 1	Ch 55.82 km	Rail bridge over waterway and road
330-BR28	Lagoon Creek 2	Ch 56.72 km	Rail bridge over waterway
330-BR16	Laidley Plainlands Road	Ch 57.29 km	Rail bridge over road
330-BR32	Francis Road	Ch 57.91 km	Rail bridge over road
330-BR33	Luck Road	Ch 58.81 km	Rail bridge over road
330-BR17	Paroz Road	Ch 59.33 km	Rail bridge over road (waterway under road)
330-BR18A	QR Rail Bridge	Ch 62.75 km	Rail bridge over rail
330-BR18B	QR Access	Ch 62.76 km	Road bridge over rail
330-BR19	Rosewood Laidley Road	Ch 64.31 km	Rail bridge over road
330-BR20	Western Creek 1	Ch 65.29 km	Rail bridge over waterway
330-BR21	Western Creek 2	Ch 67.62 km	Rail bridge over waterway
330-BR25	UT Western Creek	Ch 69.09 km	Rail bridge over waterway
330-BR22	Western Creek 3	Ch 69.28 km	Rail bridge over waterway
330-BR23	Western Creek 4	Ch 71.11 km	Rail bridge over waterway

Table note: UT = Upper Tributary

The new bridge structures are typically founded on driven precast or bored in-situ piled foundations supporting in-situ reinforced concrete substructures. Bridge superstructures are typically formed from pre-stressed precast concrete girders with in-situ decks incorporating walkways, guardrails and barriers as appropriate. The bridges are of various lengths and spans to suit the alignment and topography. Rail-over-road bridges are expected to include protection screens (subject to further risk assessment during detailed design).

6.8.8 Drainage infrastructure

A number of waterway crossings span over *Queensland Waterways for Waterway Barrier Works* as identified by the Department of Agriculture and Fisheries (DAF) (DAF, 2018a). These waterways for waterway barrier works are classified along their length according to the risk of adverse impact from instream barriers on fish movement. There are 26 marked *Waterways for Waterway Barrier Works*, which are intersected 29 times by the Project.

These intersections include:

- 8 'major-risk' crossings
- 3 'high-risk' crossings
- 6 'moderate-risk' crossings
- 12 'low-risk' crossings.

As seen in Figure 6.4, culverts are proposed at various locations along the length of the alignment. The locations of the new culverts have been selected to maintain the existing flow paths and minimise the potential impacts to flood depths upstream and downstream of the rail infrastructure. The cross-drainage structures have been designed in accordance with the relevant industry standards.

The total number of cross drainage structures are as follows:

- 19 bridges
- 51 RCP locations (multiple cells in places)
- 35 RCBC 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); Grandchester Mount Mort Road; and Newman Road (Western Creek catchment).

6.8.8.1 Cross-drainage

Cross-drainage structures have been incorporated into the design where the alignment intercepts existing drainage lines and watercourses. The type of cross-drainage structure depends on various factors such as the natural topography, rail formation levels, design flow and soil type.

Bridges are proposed at selected waterway crossings to avoid disturbance to the existing riverine system.

Cross-drainage structures, including culverts, have been designed to meet the design criteria of 1% AEP event.

Culverts are structures that allow water (in a watercourse, drain or flood waters on a flood plain) to pass under the rail line.

Culverts associated with the proposal will be a mix of RCP and RCBC. 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 6.10.

The design of new culverts has been informed by a hydrological and hydraulic assessment of the Project, a geotechnical assessment, and a preliminary assessment of the existing structures. An assessment of flooding events has been undertaken for each structure. The design of new culverts for the Project is preliminary only. Detailed design will confirm the exact specifications of the culverts to be established for the Project.

The drainage features at cuttings have been designed in accordance with relevant industry standards. Existing drainage paths above cuttings have been diverted to the nearest cross-drainage structure through a catch drain, where practical, to minimise flow into cuttings and subsequent size of cutting drainage. This minimises the size of the cuttings and higher velocities to reduce the risk of scour on the cutting benches and batter chutes. Drainage channels are provided along the cutting benches, which connect to batter chutes, which flow to the base of the cutting. A larger cutting (cess) drain is provided in the base of each cut adjacent to the rail embankment.

Cess drains are surface drains located to the side of the tracks, which are used to remove water that percolates through the ballast and flows along the capping layer towards the outside of the track formation. Cess drains are used to protect the track formation by keeping it dry.

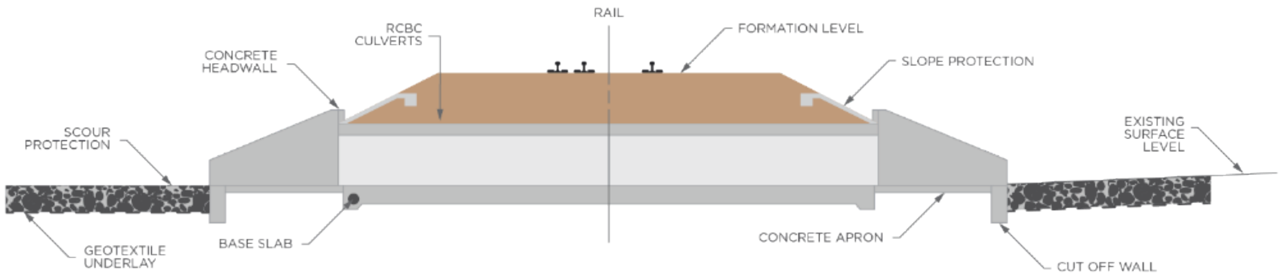

FIGURE 6.10: CROSS-DRAINAGE CULVERT (SECTION)

6.8.8.2 Longitudinal drainage

The purpose of longitudinal or track drainage is to remove water from the track ballast, and to divert surface runoff to the nearest bridge or culvert location before it reaches the subgrade.

Two types of track drainage are proposed:

- Embankment drains—longitudinal drains adjacent to the track in embankment conditions (refer Figure 6.11)
- Catch drains—longitudinal drains on the uphill side of cuttings (refer Figure 6.12).

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 detailed design to minimise potential impacts.

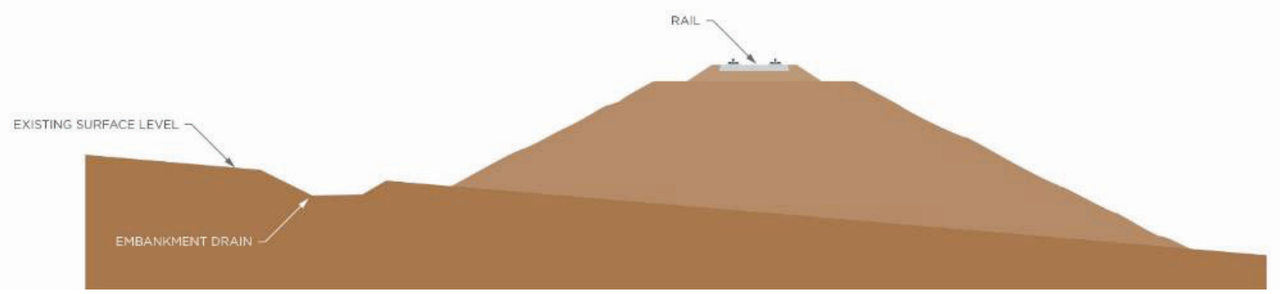

FIGURE 6.11: LONGITUDINAL DRAINAGE (EMBANKMENT)

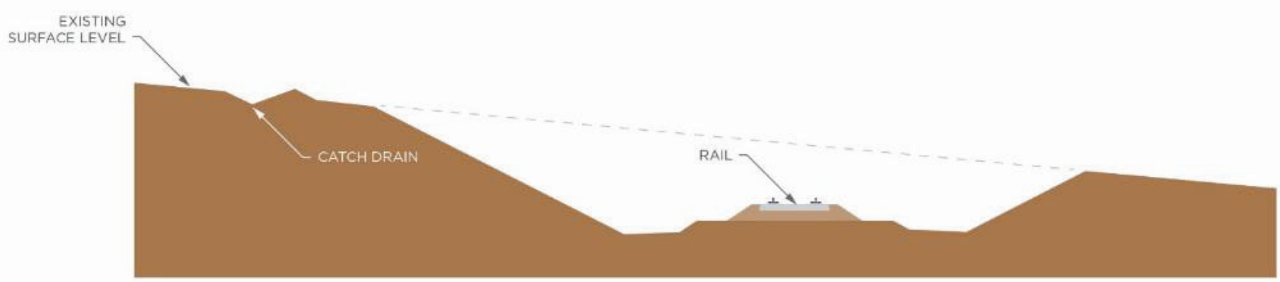

FIGURE 6.12: LONGITUDINAL DRAINAGE (CUT)

6.8.9 Level crossings

The Project includes seven active level crossings along the alignment, with the locations shown in Table 6.6 (and presented in Volume 3: Drawings). 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. In the development of the proposed treatments, consideration has also been given to State and national guidelines and strategies. Both the Office of the National Railways Safety Regulator (ONRSR) and Department of Transport and Main Roads (DTMR) have policies, such as the *Queensland Level Crossing Safety Strategy 2012–2021* (DTMR, 2012), which focus on avoiding building any new level crossings or minimising any proposal to construct a public level crossing on a new rail line.

For this Project, it was determined that the level crossings proposed at the locations shown in Table 6.6 would be necessary due to the need to retain legal and physical access to both properties and severed properties. Furthermore, the proposed level crossings will also influence potential traffic levels, land use, nearby interfaces, adjoined properties, and the vertical geometry of the rail alignment (in the context of the property and access or other local connectivity). Further discussion for the inclusion of these level crossings in the design of the Project is provided in Chapter 19: Traffic, transport and access.

Level crossings may have either passive or active controls to guide road users. Active level crossings implement additional infrastructure such as flashing lights and/or boom gates to alert motorists, and automated gates for pedestrians. Passive crossings have static warning signs (e.g. stop and give way signs) that are visible on approach. This signage is unchanging with no mechanical aspects or light devices. Passive level crossings may also include private and maintenance level crossings.

Regarding pedestrian road–rail interfaces, five crossings are proposed for: Gatton Station, Gaul Street, Dodt Road, Hunt Street and Grandchester Mount Mort Road. For Gatton Station, the existing pedestrian footbridge crossings will be replaced. This will be a grade separated crossing both QR lines and providing a link between the southern side and the northern side of Gatton.

Other considerations regarding road upgrades and temporary access tracks for the Project are outlined in Section 6.13.2.

TABLE 6.6: LOCATION OF PROPOSED LEVEL CROSSINGS

Location crossing ID	Road name	Level crossing type	Railway control line (approx. chainage)
330-2-P-5	Connors Road	Active	Ch 31.38 km
330-6-E-1	Jamiesons Road	Active	Ch 41.48 km
330-9-E-1	Dodt Road	Active	Ch 51.02 km
330-9-P-1	Glenore Grove Road	Active	Ch 52.47 km
330-14-P-2	Grand-chester Mount Mort Road	Active	Ch 65.95 km
330-15-E-3	Neumann Road	Active	Ch 71.09 km
330-15-E-4	Calvert Station Road	Active	Ch 71.27 km

6.8.10 Natural resource use efficiency

Waste generation and management have been considered for the Project during the construction, operation, and decommissioning phases. The application of the waste hierarchy to generate waste minimisation and management strategies underpins the Project's natural resource use efficiency, with reference to the Project's activities and land use. Sources, impacts, mitigation measures and management strategies (including efficiency of resource use) pertaining to Project wastes are discussed in Chapter 21: Waste and resource management, where the emphasis is placed on adhering to the waste management hierarchy.

Chapter 7: Sustainability provides an assessment of the Project against sustainability objectives and identifies opportunities to improve sustainable outcomes.

Efficient use of energy is a key component of implementing the Project in an economically and ecologically sustainable manner. In developing the Project alignment, consideration of energy efficiency was integral to determining options such as equipment selection, haul road length, location and grade, and general infrastructure construction and upgrades.

6.9 Construction phase

6.9.1 Construction schedule

The following broad milestone dates for construction are proposed at this stage:

- Construction commences: 2021
- Target completion of construction: 2026
- Six months testing and commissioning phase.

An indicative construction program for the Project is shown in Figure 6.13. This program is subject to change during the detailed design and construction phases as a result of: weather conditions; changes to construction methods and materials; and/or unexpected finds.

6.9.2 Construction stages, activities and equipment

The design and construction phases are discussed in detail in the following sections. Refer Section 6.10 for commissioning and construction decommissioning, Section 6.11 for reinstatement and rehabilitation and Section 6.12 for operational phase activities.

The construction program defines several stages and activities. These comprise:

- Pre-construction activities and early works, including detailed design, land acquisition, obtaining environmental planning approvals, surveys and geotechnical investigations, establishment of access tracks, and utility and service relocations
- Site preparation, including site clearance, establishment of construction site compounds and facilities, installation of temporary and permanent fencing, installation of drainage and water management controls and construction of site access, including temporary haul roads
- Civil works, including bulk earthworks, construction of cuts and embankments, construction of tunnel portals and tunnels, installation of permanent drainage controls, bridge and watercourse crossing construction
- Track works, including the installation of ballast, sleepers and rails
- Rail systems infrastructure and wayside equipment, including signals, turnouts and asset monitoring infrastructure

Commissioning, integration testing and handover process to achieve operational readiness.

Table 6.7 provides the indicative plant and equipment required for different stages of the construction phase. These will be refined and confirmed with the contractors prior to construction. The timing and details of construction works will also be discussed with relevant stakeholders prior to commencement.

6.9.3 Site preparation

The Project site clearing includes removal of vegetation and debris. Site clearing will occur before the main earthwork construction teams arriving.

Turf, topsoil and other organic and unsuitable material will be stripped from the temporary construction disturbance footprint. Wherever practical and appropriate, such material will be stockpiled and recycled within the disturbance footprint.

Access roads will be required along the alignment to allow drainage, earthworks and bridge structure crews to access work locations. The primary access roads to the alignment will be designed and constructed or upgraded with due consideration to minimising disruption to landowners and public infrastructure. The extent of directly impacted properties and areas is detailed in Chapter 8: Land use and tenure.

A direct construction access is proposed to be provided adjacent to all rail works within the disturbance footprint and will be sized to allow free flow and unhindered access for all construction and support traffic vehicles. These access points will also be used for the transport of water, personnel, fuel and materials for maintenance purposes during construction.

The access roads will also cater to the movement of:

- Construction equipment and vehicles
- Personnel transport for staff and labour to access the works
- Maintenance vehicles
- Water deliveries
- Deliveries of materials, including, but is not limited to, fill material, equipment, fuels and lubricants
- Servicing temporary construction facilities along the route.

A series of temporary construction site compounds and facilities will be established along the Project.

Both temporary and permanent fencing may be required, subject to land use for properties adjacent to the Project. Fencing standards will be confirmed on consultation with relevant landowners and in accordance with logistical requirements to facilitate fauna movement.

Temporary site drainage and water management controls will be installed to minimise any runoff and sedimentation from the proposed activities to existing waterways, and disturbance to the water quality of existing waterways.

During this phase, materials including rail, sleepers, ballast, culverts and structural fill will be delivered and stockpiled.

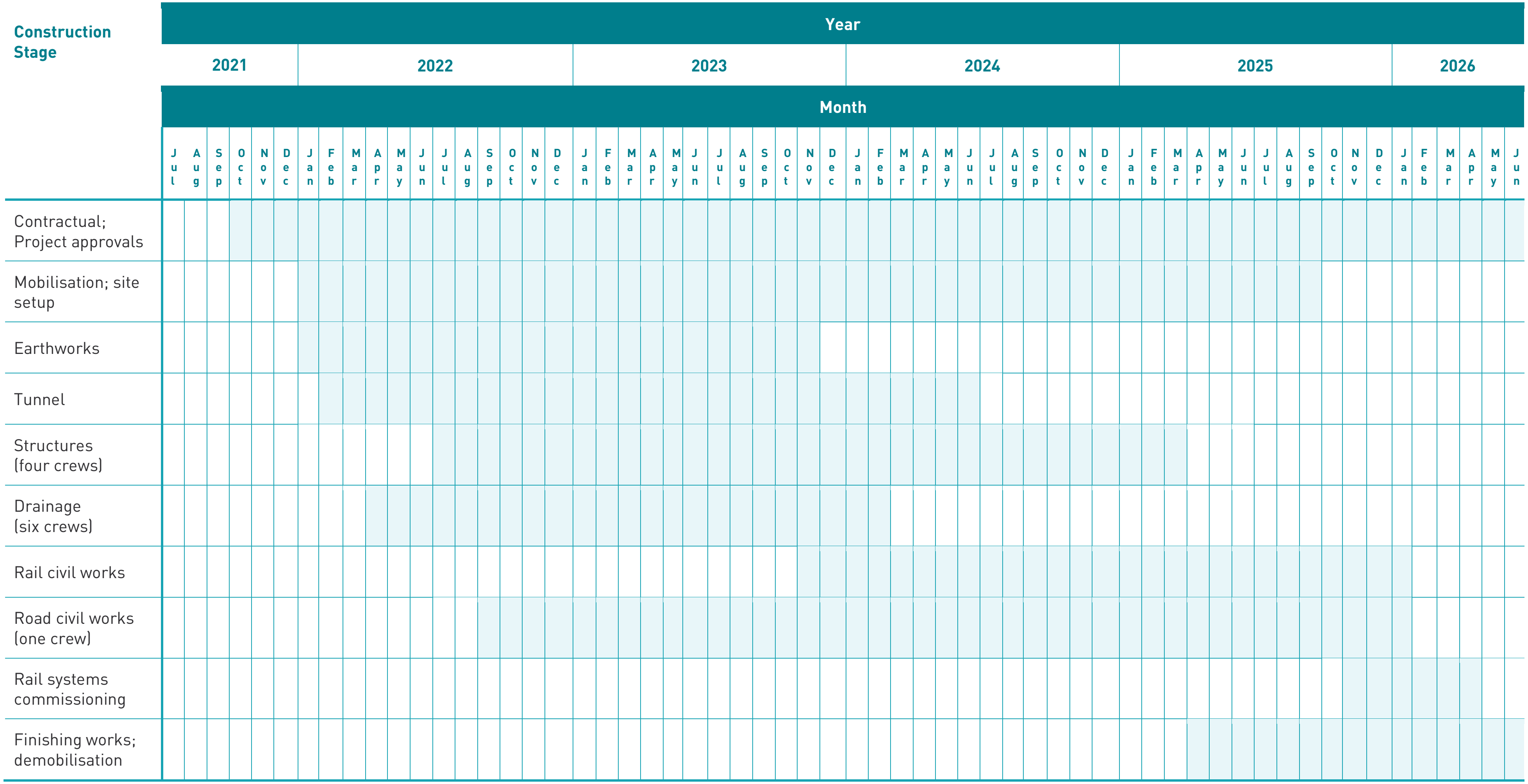

FIGURE 6.13: INDICATIVE CONSTRUCTION PROGRAM

TABLE 6.7: CONSTRUCTION PHASE PLANT/EQUIPMENT

Activity	Week From	Week To	Duration	Plant type	Indicative number
Mobilisation and site setup					
Establishment of site compounds, site facilities and camps	12	20	8	12G Grader	2
				Dump trucks—off-road (25 t Artic)	4
				Excavators—40 t	2
				Water carts—35 kL	2
Construction of concrete batch plant sites	21	26	6	12G Grader	1
				Dump trucks—off road (25 t Artic)	2
				Excavators—40 t	1
				Water carts—35 kL	1
Haul roads and access roads construction (two crews)	12	19	8	Grader 14H	2
				Excavators—40 t	1
				637 Scraper	2
				Dump trucks—off-road (25 t Artic)	2
				Water carts—35 kL	2
Haul road maintenance	20	187	168	Grader 14H	2
				615 Scraper	1
				Trucks—on-road tandem	2
				Water carts—35 kL	2
Earthworks					
Clearing and grubbing/ topsoil stripping	14	58	45	Dozer D7R	8
				Excavators 40 t	4
				Trucks 25 t Artic	8
				637 Scraper	4
				Watercarts	4
				Mulchers	4
Cut to fill—scraper crew	18	33	16	Dozer D11—pushing	1
				Dozer D10—Ripping	1
				Scrapers—5 (most likely for a 1.5–2 km cycle)	6
				Water cart 35 kL	2
Compaction crew— scraper matched	18	33	16	Dozer	1
				20 t Padfoot Roller	1
				825 Compactor	2
				Grader 14H	2
				Water cart—35 kL	2
Cut to fill—excavator and truck crew (peaking at four crews total)	20	100	81	Excavator 85 t	3
				Excavator 50 t	1
				Truck 50 t—to match excavator productivity, cycle time—average 6 trucks per 5 km haul	20+
				Water cart 35 kL	8
Drill and blast operations (1 crew)[1]	20	100	As required during cut operations and dictated by further geotechnical investigations [1, 2]	Top hole hammer drilling rig	1
				Down the hole hammer drilling rig	1
				Rotary drilling rig	1
				Mobile Processing Units (MPUs)—mixing trucks	1
				Shotfirer vehicles (4WDs/light trucks)	2
				Dewatering units (mobile pump and storage)	1
				Front-end loader	1

Activity	Week From	Week To	Duration	Plant type	Indicative number
				Explosives magazines (security of blasting materials and equipment)	1
Compaction crew—excavator matched	23	85	63	Dozer	4
				20 t padfoot roller	4
				825 compactor	8
				Grader 14H	8
				Water cart—35 kL	8
Import structural fill	37	103	67	Trucks—on-road tandem	10
				960 loader	1
				Dozer	1
				Excavators 40 t	1
				Water cart—35 kL	2
Place structural fill	37	103	67	Dozer	1
				15 t roller	1
				Compactor	1
				Grader 14H	2
				Water cart—35 kL	2
Tunnel construction					
Excavation and primary lining (including portal preparation)	19	62	44	Drill rig	1
				Excavator, fitted with rock breaker	1
				Front-end loader	1
				Fork lift	1
				Dump truck	2
				Shotcrete machine	1
				Roadheader	2
Secondary lining and internal structure	63	130	68	Shotcrete machine	1
				Concrete pump	1
Structures (four crews)					
Substructure/ foundations construction	38	159	122	Excavators 40 t	4
				Piling rig	4
				Concrete trucks	-
Pier construction	42	162	121	Excavators 40 t	4
				Crane	4
				Concrete trucks	-
Superstructure construction	53	164	112	Crane	4
Drainage (six crews)					
Install cross drainage	27	115	89	Backhoe (20 t equivalent)	6
				Excavator 30 t	6
				Work truck (hiab)	6
				Small compactor	6
				Concrete truck	6
				Concrete pump	6
				Franna crane	6
Rail civil works					
Capping material import	101	154	54	Trucks—on-road tandem	10
				Dozer—D7R	1
				Excavators—40 t	1
				Water cart—35 kL	1

Activity	Week From	To	Duration	Plant type	Indicative number
Capping material placement	101	154	54	Dozer D7R	1
				Roller 15 t	1
				Compactor	1
				Grader 14G	2
				Water cart 35 kL	2
Bottom ballast	168	184	17	Trucks—on-road tandem	6
				Dozer D7R or grader 14G	1
				FEL L110	1
				Excavators 20 t	1
				14 t smooth drum roller	1
Sleeper installation	176	186	11	Trucks—flat bed	2
				FEL—L110	3
				Excavators—20 t	3
Rail	187	189	3	Trucks—flat bed	2
				FEL L110	2
				Excavators 20 t	2
Top ballast	190	192	3	Trucks	6
				FEL—L110	1
				Excavators—20 t	1
				Ballast train	1
				Water cart	1
Track tamping and regulating	192	202	11	Tamper 4s	1
				Tamper 08-16 or 3x	1
				Regulator	1
				Excavator—20 t	1
				Water cart	1
Rail stressing	202	204	3	Trucks—flat bed	2
Road civil works (one crew)					
Road works	44	207	164	12G grader	1
				Excavator 30 t	1
				12 t compactors	2
				Water carts—15 kL	2
				Trucks—on-road tandems	5
				Bitumen seal sprayer/chip sealer	1

Table notes:
t = tonnes, kL = kilolitre, FEL = front-end loader
1 Based on the preliminary geotechnical information, it is anticipated that blasting may be required in the more significant cuttings. Further geotechnical investigation during detailed design will confirm blasting requirement. In this case, the detailed design will identify blasting locations and extent of the proposed activities.
2 Duration of blasting will be finite and during earthworks cut operations (currently anticipated between weeks 20 and 100). Dependent on blast extent and design, drilling is expected to be undertaken over approximately one week.

6.9.3.1 Construction water

Activities during the construction phase with the highest water demand are expected to be:

- Soil conditioning and compaction
- General dust suppression
- Dust suppression and maintenance of laydown areas and haul roads
- Construction offices and amenities.

Overall, an allowance in the range of 190 litres per cubic metre (L/m³) of fill earthworks has been made in building up the estimated water demand requirements (100 L/m³ for compaction of embankment, 50 L/m³ for dust suppression and 40 L/m³ for hail road maintenance).

This is a conservative estimate based on actual requirements to date recorded on the Toowoomba Second Range Crossing Project.

Further to the allowances for earthworks compliance, an additional 10 litres per track metre is expected to be required. For tunnel construction, 40 m³/day may be required. Bulk concrete batching has an expected allowance of 200 L/m³.

The main construction elements requiring water including quantity, quality and flow rate are detailed in Table 6.8. Any work on potential admixtures for water for earthworks or concrete production may impact the quantity and quality of water required.

TABLE 6.8: CONSTRUCTION WATER REQUIREMENTS

Construction activity/ process/ phase	Uses/requirement	Approximate volume (ML)	Quality	Flow rate	Potential sources
Earthworks	Material conditioning and general dust suppression	286 (conditioning) 143 (general dust suppression) 114 (haul road and laydown dust suppression)	Low	High	River, dam or bore
Concrete (by concrete supplier)	Bridge and culvert locations	Not yet quantified (medium quantity)	High	Low	Priority town mains
Concrete (Project-specific)	Bulk batching	Not yet quantified (medium quantity)	High	Low	Priority town mains
Trackwork	Ballast dust suppression during ballasting and regulating activities	0.48	Low	Low	River, dam or bore

Table note:
ML = megalitres
Potable water for human consumption will be supplied via bottled water or potable water tanks.
Non-potable water will be supplied using trailer-mounted storage tanks.
Portable toilet facilities will be used where existing infrastructure is unavailable and sewage pump-out services will be used to remove waste offsite.

It is estimated that approximately 560 ML may be required for the duration of construction. The estimated construction water allowance was calculated based on the current forecast for the earthworks (e.g. general fill, structural fill and capping), dust suppression, haul road works and maintenance, track works and the concrete batch plant. Further detail on water use is included in Appendix L: Surface Water Quality Technical Report. The estimated construction water volumes are based on the Project's current design and subject to future updates as the Project design progresses. Figure 6.14 provides a representation of the water use proposed for the Project over time.

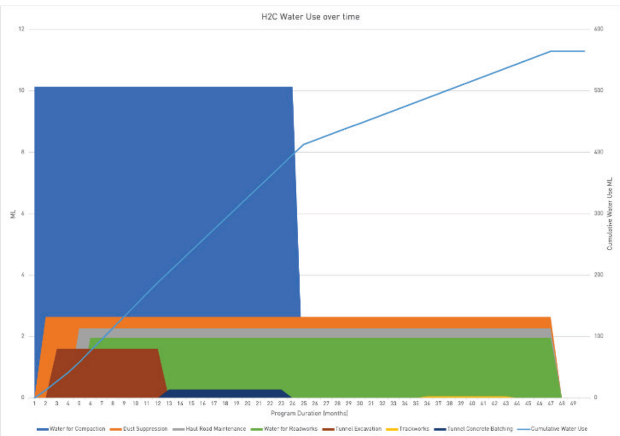

FIGURE 6.14: PROJECT WATER USE (CUMULATIVE, BY MONTH)

6.9.3.2 Utility relocations

Site preparation also includes modification, diversion or realignment of any utilities and associated infrastructure. The Project impacts on several existing utilities. The number of interactions with utilities within the Project alignment is presented in Table 6.9.

There are 662 identified impacted utilities or potential clashes, 56 per cent and 16 per cent of which involve Telstra and Energex assets respectively. Out of the 662 impacted utilities, 11 per cent were rated high risk, 32 per cent were rated medium risk and 57 per cent were rated low risk. Risk ratings were allocated based on the cost associated with the impact, the time required to relocate, rehabilitate, or protect the asset and any operational requirements (access, serviceability, specific tools/equipment) relating to the utility.

The high-risk utilities comprise: gas pipelines owned by APA; oil pipelines owned by Santos; overhead powerlines owned by Energex, pipes owned by Queensland Urban Utilities and optic fibre lines owned by Nextgen, Telstra and TPG. These types of utilities are known to involve considerable time to treat. The Project pay potentially clash with high-risk utilities in up to 20 instances, and represents about 3 per cent of the total number of utility interfaces (clashes) along the preferred Project alignment.

Utility owners have different requirements and drivers related to treating 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 and gas and petroleum pipeline owners about their requirements for relocation or protection of the utilities impacted by the Project to ensure there is no restricted access. Consultation with utility and service owners will continue through the detailed design phase of the Project.

TABLE 6.9: UTILITIES IMPACTED

Utility owners	Impacted utilities		
	Number	High risk	Proposed treatment
Energex	107	3	Relocation (2); Remain in place (1)
NBN Co	46	-	
Nextgen	7	3	Relocation (2); Remain in place (1)
Optus/UECOMM	7	-	
Powerlink	5	-	
Queensland Urban Utilities	88	6	Relocation (2); Protection (3); Remain in place (1)
Telstra	373	2	Protection (1); Relocation (1)
TPG/Powertel/AAPT	24	1	Relocation (1)
APA	3	3	Protection (3)
Santos	2	2	Protection (3)
Total	**662**	**20**	-

The utility relocations, including water, sewer and electricity, will be required prior to construction of relevant project works. Where undertaken as enabling works (refer Section 6.6.3), these utility relocations will be undertaken by the utility provider, and are not assessed as part of the Project. The utility relocations will be subject to separate assessments, with all necessary approvals obtained prior to the relocation being undertaken.

6.9.3.3 Corridor acquisition and access

The permanent operational footprint traverses approximately 193 land parcels. The acquisition and resumption of land and interests will be undertaken by the nominated construction authority (with ARTC continuing to work closely with landowners, stakeholders and relevant State Government agencies) prior to construction.

Appendix G: Directly Impacted Properties details the real property descriptions of land parcels along the preferred alignment.

Partial-or full-parcel acquisition of a property and/or acquisitions for easements and licences will be determined on a case-by-case basis prior to construction and will consider factors such as parcel size, alignment effect, land use and operability following construction.

To reduce severance of land parcels, the alignment of the Project has been chosen to align with roads and property boundaries where possible, to reduce potential property impacts. Furthermore, the alignment has been deliberately designed to use the existing West Moreton System rail corridor for approximately 50 per cent of the length of the alignment. Of the total 488.4 hectares (ha) of land required for the permanent operational disturbance footprint, 86.7 ha or approximately 18 per cent, is within the existing rail corridor.

Where the Project deviates from the existing West Moreton System rail corridor, the Project predominately follows the protected Gowrie to Grandchester future State transport corridor, a greenfield corridor protected for future railway land under the TPC Act. Approximately 80 ha, or 16 per cent, of the total area of the permanent operational disturbance footprint is located within the Gowrie to Grandchester future State transport corridor.

The Project was deliberately designed to use these existing and protected rail corridors, minimising the extent of 'new' properties to be acquired. Of the 193 properties within the permanent operational disturbance footprint, 23 are within the existing West Moreton System rail corridor and 57 properties within the Gowrie to Grandchester future State transport corridor. These properties include six that are required for volumetric acquisition where the Project passes beneath a property within the proposed Little Liverpool Range tunnel.

Based on the design to date, initial projection of directly impacted properties within the permanent operational and temporary construction disturbance footprints, where some form of land resumption is expected to be required, is detailed in Chapter 8: Land use and tenure with a consolidated list provided in Appendix G: Directly Impacted Properties. The extent of property impacts will be refined and confirmed prior to detailed design in consultation with property owners and access to all properties will be maintained.

6.9.3.4 Construction traffic

During the construction phase, transporting materials, equipment and personnel will mainly occur via existing State-controlled roads and local government roads. Further information is provided below on:

- Laydown area delivery points

  It is currently assumed that most construction material deliveries will be made to the key laydown area delivery points along the Project. These delivery points will be centralised locations for further construction laydown areas. From these locations, construction material will be distributed by road to the surrounding construction laydown areas.

- Quarry routes

  It is currently assumed that the existing quarries in the vicinity of the Project (discussed in Section 6.13.6) will be used to provide the necessary fill materials. Haul routes to and from quarries have been based on the location of the quarries and routes most likely to be used for the transportation of material to construction access points.

- Ready mix and pre-cast concrete traffic routes

  Routes have been based on the location of existing concrete suppliers. For the transportation of some of the larger precast concrete girders, it is expected that police escort will be required.

- Sleeper routes

  It is currently assumed that concrete sleepers will originate from Grafton in NSW and be distributed via the road network to various laydown area delivery points. Sleepers may originate from alternative locations. However, an existing production facility for the sleeper configurations required is operational in Grafton. Two overarching sleeper routes have thus far been identified for the Project:

  - North using the Pacific Highway
  - South using Summerland Way and the Mount Lindesay Highway.

- Rail segments routes

  It is assumed rail will be supplied by a single source and will be distributed from the closest existing QR and ARTC rail network to various points along the alignment, where possible. Police escorts are anticipated to be required for transporting the rail via the road network.

- Parking facilities

  Parking requirements will be defined during detailed design with consideration to labour requirements and community expectations. Temporary parking facilities for construction labour force will be located predominantly within the designated construction laydown areas. The temporary carparks will be proportional to the size and use of the facility.

  Parking requirements will include emergency service access considerations.

For additional detail regarding construction traffic volumes and proposed routes refer Chapter 19: Traffic, transport and access.

For more information on the traffic impact assessment refer to Appendix U: Traffic Impact Assessment.

Expected spoil transport and handling requirements are provided in Appendix T: Soil Management Strategy.

6.9.3.5 Waste disposal

Waste generation and management have been considered for the Project during the construction, operation, and decommissioning phases. The application of the waste hierarchy to generate waste minimisation and management strategies underpins the Project's natural resource use efficiency, with reference to the Project's activities and land use. Sources, impacts, mitigation measures and management strategies (including efficiency of resource use) pertaining to project wastes are discussed in Chapter 21: Waste and resource management, where the emphasis is placed on adhering to the waste management hierarchy. Chapter 7: Sustainability provides an assessment of the Project against sustainability objectives and identifies opportunities to improve sustainable outcomes.

In the area surrounding the Project, wastes are generated from domestic, commercial and agricultural sources. Regional councils provide waste collection, recycling and disposal facilities and services for residential properties. However, it is likely that waste disposal from the Project will predominantly occur at commercial facilities. Appropriately licensed contractors will also provide additional options for collection, treatment and disposal of wastes.

The proximity of existing waste management facilities to the Project has been considered based on the industry accepted haul route distance of 50 km for bulk waste and 15 km for municipal waste.

Confirmation of waste acceptance criteria and available/permissible annual disposal rates will be undertaken in consultation with the relevant operator once the timing for construction of the Project is determined. The capacity of the existing waste management facilities will then be investigated following detailed design (post-EIS), in consideration of landfill airspace, the volume of waste generated by the Project requiring disposal, and other needs within the region.

6.9.4 Civil works

Activities be undertaken during civil works include:

- Bulk earthworks (cuts and embankments)
- Trackworks and permanent way
- Bridge and watercourse crossings
- Installation of permanent drainage controls
- Construction of temporary haul roads
- Tunnel, portal and ancillary structures.

Key civil work activities are outlined in the following sections.

6.9.5 Track works

The proposed method of track construction will be tailored to maintain maximum flexibility, to not be confined to the use of dedicated plant or equipment. The focus will be to prioritise the use of readily available plant and equipment that is easy to maintain and has a low establishment and operating costs.

Track work construction could be undertaken using two different methods: track laying machine or excavators with octopus attachments. The preferred option for the construction of the Project is excavators with octopus attachments; however, either construction method may be used. For construction using excavators with octopus attachments, the bottom ballast layer would be installed followed by sleepers positioned and spaced to their designed alignment by a tracked excavator using an octopus attachment. This would be closely followed by placement/threading of the rail in 27.5 m shorts or up to 400 m strings. The rail will then be clipped up followed by top ballasting prior to commencing tamping activities.

6.9.5.1 Bottom ballast

Several options exist for the delivery and installation of bottom ballast. The preferred option would be potentially selected through the direction of track construction i.e. if using a track laying machine (TLM).

Bottom ballast may be delivered and installed by one of the following approaches:

- Delivered by road or rail to designated stockpile locations situated along the length of the corridor. Deliveries would be staged to suit the construction program and minimise disruption on roads and to the travelling public
- Directly discharged onto the formation via truck and trailer or stockpiled and locally moved via 18-tonne dumper trucks
- Installed along with the top ballast via a works train. This means skeleton track will be constructed directly on the formation.

6.9.5.2 Sleepers

Two options exist for the delivery and installation of sleepers. The preferred option would be potentially selected through the direction of track construction i.e. if using a TLM.

Sleepers may be delivered and installed by one of the following approaches:

- Delivered by road or rail to designated stockpile locations situated along the length of the rail corridor. Deliveries will be staged to suit the construction program and minimise disruption on roads and to the travelling public. Sleepers would be installed by an excavator, which will place the sleepers using an Octopus sleeper grab, picking up to six sleepers at a time and spread them to the correct spacing. Labourers will assist this activity by placing spacers over the last couple of sleepers that have been laid and the first couple that are being placed by the Octopus sleeper grab, to ensure that the correct spacing is maintained between the packs of sleepers.
- Delivered to the construction depot to be loaded onto the material train for direct discharge onto the formation by the TLM.

6.9.5.3 Rail

Two options exist for the delivery and installation of rail. The preferred option would be potentially selected through the direction of track construction i.e. if using TLM.

Rails may be delivered and installed by one of the following approaches:

- Installed in 27.5 m lengths and flash-butt welding in-situ or lineside and thimble into the sleeper housing in long welded rail
- Delivered in short lengths (<30 m) to the flash-butt welding facility situated within the construction depot. This will allow the short rail to be welded into long welded rail and then loaded onto the material train in strings of approximately 400 m. The long welded rail can then be positioned into the alignment along with the sleepers through the TLM.

A temporary rail handling yard will be required adjacent to the rail alignment.

6.9.5.4 Top ballast

The most efficient method of unloading ballast for track construction will be through a train consist using ballast hopper wagons. Additional land will be required to facilitate the loading of ballast onto a train consisting of ballast hopper wagons along the alignment.

After establishing a ballast-handling facility, ballast can be delivered along the alignment using a train consist. This train consist has the opportunity not only to distribute top ballast but also the option to distribute bottom ballast if installing skeleton track straight onto the formation is the desired method of track construction.

The key drivers of this method are the productivity of the key rail-bound equipment and matching this to the earthworks delivery program. Productivity depends on the number of ballast wagons used and the cycle time of the ballast train against the various ballast loading locations, as well as the productivity of the following rail surfacing fleet.

6.9.5.5 Tamping

To make the rail track more durable, a machine will be used to pack (tamping) the ballast. The process will set the geometry and re-arrange the ballast under the sleeper to keep the track in position and provide it with a homogenous ballast bed.

Plain line tamping will be undertaken by a high-output tamper fitted with guidance software to implement the correct target geometry. Turnout tampers will be used for tamping turnouts.

Depending on the required track construction tolerances and quality of constructed track, tamping operations could take anywhere from three to six passes. Correctly installed bottom ballast levels, adequately compacted bottom ballast and high-quality track installation dramatically reduces tamping operations and follow up tamp requirements.

6.9.5.6 Welding and stressing

To ensure quality of welds, the majority of welding will be undertaken by flash-butt welding method. Stressing welds and welds located close to turnouts may be undertaken by approved Alumino Thermic Welding processes. All stressing welds will use rollers (side and under).

Flash-butt welding facility

Flash-butt welding is an electrical resistance welding process used for joining components, where the energy transfer is provided primarily by the resistance heat from the parts themselves (The Welding Institute, 2020). The components are positioned end-to-end across the full joint area. This process is used for joining a range of section sizes and complex shapes such as railway rims (The Welding Institute, 2020). This produces a weld with no melted metal remaining in the joint.

Flash welding is used to join sections of mainline rail together to create continuous welded rail (CWR), which is much smoother than mechanically joined rail because there are no gaps between the sections of rail (Tawfik et al., 2008). This smoother rail reduces the wear on the rails themselves, effectively reducing the frequency of inspections and maintenance (Tawfik et al., 2008). There are two locations within the proposed rail corridor where allowance has been made for the positioning of temporary flash-butt welding facilities (refer Table 6.15). It is assumed that rail will be delivered via the closest rail network.

The delivery of the rail via an external rail network will require further investigation and consultation with relevant asset owners during detailed design.

6.9.5.7 Turnouts

Turnouts connecting to existing operational infrastructure will likely be pre-built and panelled in, if the possession window does not adequately grant the required time to construct in situ. The pre-building and panelling in method will provide the least risk to the rail possession windows, ensures turnout componentry is complete and allows some welding to happen prior to the possession.

All crossing loop turnouts and maintenance sidings can be constructed in situ to reduce lifting of switch and crossing panels. All turnout construction should be undertaken early enough in the program to ensure that any issues caused by incorrect or missing components can be rectified prior to the commissioning of the turnout.

6.9.6 Tunnel construction

The tunnel is expected to pass through the Koukandowie Formation (part of the Marburg Subgroup), which is a sedimentary rock comprising cross-bedded sandstone and shale layers of weak to medium strength. The rocks are typically moderately to highly weathered, and shale bands weather to clays, and commonly undercut the sandstone beds.

The tunnel drive length through the Little Liverpool Range is approximately 850 m and has a maximum cover of approximately 90 m. The tunnel excavated cross section is approximately 142 m^2, and the internal space requirements are driven by ventilation needs.

The expected typical cross section for the Little Liverpool Range tunnel is shown in Figure 6.15.

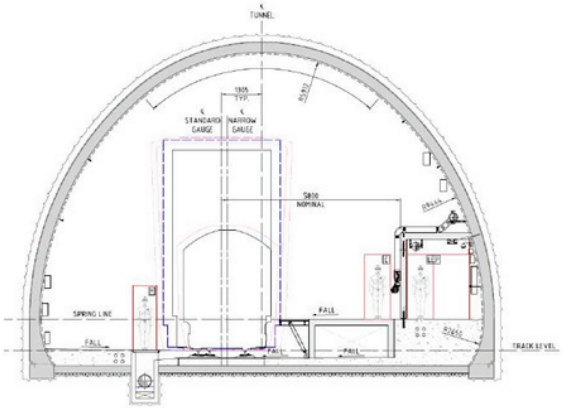

FIGURE 6.15: TYPICAL PROJECT TUNNEL CROSS SECTION

A preliminary hydrogeological investigation has been undertaken for the Little Liverpool Range tunnel and associated portals. There is likely to be little risk of consolidation settlement impacting on existing infrastructure in this environment; however, other groundwater drawdown issues such as potential adverse impacts on vegetation, groundwater quality, and any groundwater bores in the area have been investigated as part of the EIS (refer Chapter 11: Flora and fauna, and Chapter 14: Groundwater).

Two tunnel construction methods could be considered for the tunnel:

- Roadheader excavation
- Drill and blast method.

A roadheader is a track-mounted machine with a cutting head mounted on a boom. The cutting head uses tungsten carbide picks to cut the rock; these have limitations in terms of the rock strength and abrasivity. Roadheader excavation offers considerable versatility and flexibility as a tunnelling technique in suitable conditions and is used to excavate tunnels of various shapes and sizes. While power supplies would need to be investigated, temporary power arrangements using generators are possible for roadheader machines. It is envisaged that multiple roadheaders would be used, one from each portal.

The drill and blast method of excavation may also be suitable; however, the risk of excessive over-break would need to be mitigated because of the inferred blocky nature of the rock material, with potential difficulties in the portal area due to weathering. Construction by drill and blast method could also be undertaken from both ends of the tunnel.

6.9.6.1 Tunnel liner

Regardless of the construction methodology, it is likely a flexible sheet type membrane would be used to waterproof the tunnel. For a drained tunnel, the purpose of this waterproof membrane is to control groundwater inflows over the crown and walls of the driven tunnel down to invert level, where the water would be collected in an appropriate groundwater drainage system. The other purpose of the waterproof membrane is to assist with the long-term durability of the concrete secondary lining, including all fixings installed into the concrete.

6.9.6.2 Tunnel support

Generally, a two-staged support construction sequence is adopted for driven tunnels that use sheet waterproof membranes, consisting of temporary support (primary) and permanent support (secondary). The temporary support is required to facilitate construction of the excavation and provide stability and safety appropriate to the temporary condition. Once the temporary support is constructed, a waterproof membrane can be installed.

The temporary tunnel support is envisaged to generally consist of temporary rockbolts and sprayed concrete that may be reinforced with fibres or steel mesh. In poor ground conditions, steel sets, forward rock reinforcement and canopy tubes can be used.

Steel sets, forward rock reinforcement and canopy tubes would be used in poor ground conditions for tunnel stability and/or low cover environments to control elastic ground deformations.

Permanent support would generally consist of a cast in-situ unreinforced concrete lining. When the concrete is cast, the lining will 'shrink' and an appropriate low-shrink concrete mix is anticipated to reduce the degree and severity of shrinkage cracking in the concrete lining. The annulus is typically grouted after construction of the permanent lining. In drained tunnels, the waterproof membrane acts as a barrier to prevent blockage.

6.9.6.3 Water treatment

The tunnel construction is expected to produce a constant volume of waste water that will either be treated or disposed of according to further testing.

Provision has been made for the collection and treatment of water from the tunnel.

6.9.7 Signalling installation

The design and installation of the safe-working or signalling system will be completed in parallel with the design and construction of the track and civil structures of the Project. The construction, procurement and testing program will be integrated into the track and civil programs to ensure both activities are carried out so commissioning activities can be undertaken at the same time.

6.9.8 Construction workforce and hours

6.9.8.1 Construction workforce

The Initial Advice Statement (ARTC, 2017b) for the Project estimated the workforce to be 1,800 FTEs, which was a proportional figure based on the overall capital cost for a 10-year program wide delivery period.

As a result of further detailed assessment and design advancement, the Project currently estimates that an onsite construction workforce will peak at 410 FTEs (expected between weeks 56–57). An annual average of 190 FTEs may be required onsite across the full construction period. Over the estimated construction period of 200–205 weeks, this equates to approximately 730–750 FTEs. The Project construction workforce estimate excludes Project planning delivery personnel, Inland Rail support function, pre-construction design personnel, technical support services and review/verification labour effort.

A preliminary estimate of the workforce required to undertake Project works to the nominated program is shown in Figure 6.16.

The size and composition of the construction workforce will vary depending on the construction activities being undertaken and the staging strategy adopted.

As part of the procurement and contracting process, primary contractors will be required to document their proposed construction-phase training strategies. These strategies will form a key input to the tender evaluation process. During the construction period, construction managers will be required to report to ARTC on the delivery and outcomes.

Actions undertaken during the construction phase will also address development of capacity of the local and regional workforce for employment in the operational phase. Management of the Project's operational workforce will be in accordance with ARTC's established training, recruitment and employment strategies

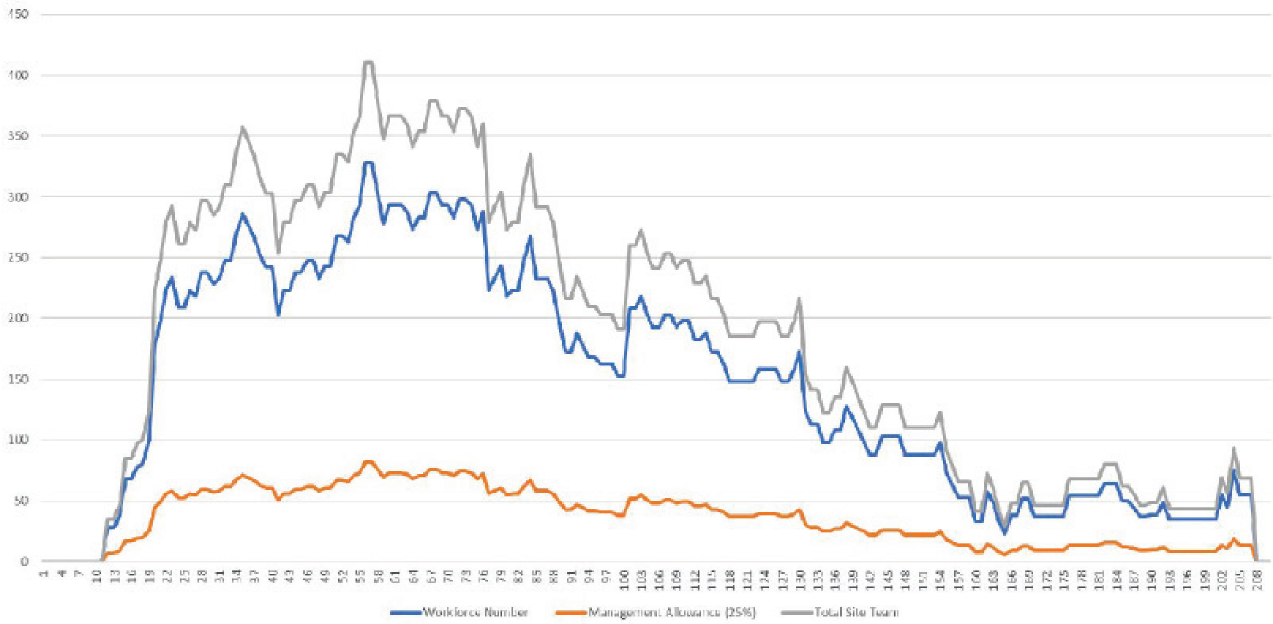

FIGURE 6.16: ESTIMATED CONSTRUCTION WORKFORCE (BY WEEK)

6.9.8.2 Construction hours

Construction work would be undertaken during the following standard Project construction hours:

- Monday to Friday: 6.30 am to 6.00 pm (and up to 10.00 pm if the construction works comply with the performance requirements in approved environmental management plans)
- Saturday: 6.30 am to 1.00 pm (and up to 5.00 pm if the construction works comply with the performance requirements in approved environmental management plans)
- No work on Sundays or public holidays
- Tunnelling activities: 7 days per week, 24 hours per day, with all activities underground or within the acoustic sheds
- Spoil haulage: 7 days per week, 24 hours per day.

Track possessions may potentially occur on a 7-day/24-hours per day (in accordance with the hours of work prescribed by the rail infrastructure manager). Track possessions will generally be allocated over weekend periods, with extended track possessions occurring over holiday or non-seasonal periods.

Works outside of standard construction hours will occur throughout the duration of the construction program and will involve:

- Delivery of concrete, steel, and other construction materials delivered to site by heavy vehicles
- Movements of heavy plant and materials
- Transport, assembly or decommissioning of oversized plant, equipment, components or structures
- Delivery of 'in time' materials such as concrete, hazardous materials, large components and machinery
- Arrival and departure of construction staff during shift changeovers
- Roadworks to arterial roads
- 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.

Works that require continuous construction support, such as continuous concrete pours, pipe-jacking or other forms of ground support necessary to avoid a failure or construction incident will also be expected to occur outside of standard construction hours.

Activities carried out in an emergency to avoid the loss of life, damage to property or to prevent environmental harm may be undertaken at any time.

All works will be undertaken in a manner that is compliant with relevant guidelines and requirements (as defined in the draft Outline Environmental Management Plan (draft Outline EMP), refer Chapter 23: Draft Outline Environmental Management Plan).

6.10 Commissioning and construction decommissioning

6.10.1 Commissioning

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

Testing and commissioning (checking) of the rail line and communication/signalling systems will be undertaken to ensure that all systems and infrastructure are designed, installed, and are operating according to ARTC's operational requirement.

For the connections to the existing QR and ARTC networks, the Testing and Commissioning Plan will address the existing QR and ARTC signalling system and also be approved by ARTC and QR.

Commissioning of the trackworks will require completed Inspection and Test Plans, Clearance Reports, weld certification, rail stressing records, as built documentation and track Geometry reports. The commissioning period will also be used for driver training and test trains.

6.10.2 Construction decommissioning

All construction sites, compounds and access routes will be returned to no worse than the existing condition, unless otherwise agreed with the relevant landowner. Site reinstatement and rehabilitation will be undertaken progressively in accordance with the draft Outline EMP (and relevant sub-plans) as sites become available. This phase will include the following activities:

- Demobilise site compounds and facilities
- Remove all materials, waste and redundant structures from the works sites
- Form and stabilise spoil mounds
- Decommission all temporary work site signs
- Establish permanent fencing
- Remove temporary fencing
- Decommission site access roads that are no longer required
- Restore disturbed areas, including revegetation as/where required.

Construction decommissioning will be undertaken progressively. The surface of all rehabilitated areas will be relieved of compaction prior to rehabilitation. De-compaction (ripping) or aeration will be undertaken in accordance with the draft Outline EMP (refer Chapter 23: Draft Outline Environmental Management Plan).

6.11 Reinstatement and rehabilitation

During construction, laydown and temporary construction areas will be progressively decommissioned and rehabilitated.

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

A Landscape and Rehabilitation Management Plan will be developed to define:

- Progressive and post construction installation of the Project landscape design
- Establishment and ongoing maintenance and monitoring requirements
- Construction contract completion criteria for areas defined in the landscape design and/or identified in the Reinstatement and Rehabilitation Plan.

All construction sites, compounds and access routes will be reinstated or rehabilitated progressively once available and would include the following activities:

- Demobilising temporary site compounds and facilities
- Removing all materials, waste and redundant structures from the works sites
- Forming and stabilising of spoil mounds, where required
- Decommissioning of all temporary work-site signs
- Removal of temporary fencing
- Progressive establishment of permanent fencing in coordination with rehabilitation and landscaping activities
- Decommissioning of site access roads that are no longer required
- Restoration of disturbed areas as required, including revegetation where required.

On removal of construction site offices, laydowns and stockpiles areas, retained topsoil and, where available, retained mulch will be used as part of the rehabilitation activities in addition to other appropriate treatments in accordance with the Reinstatement and Rehabilitation Plan.

Where possible, previously excavated material stockpiled onsite will be used to reinstate the ground form (where spoil is applicable) to ensure that it is returned to its pre-existing profile and contour.

Some erosion and sediment control measures will be left in place until completion of the rehabilitation of the area. On removal of construction facilities (e.g. offices, laydown areas, stockpiles), topsoil and mulched vegetation will be spread over the area and seeding undertaken according to the land resources, landscape and visual amenity and flora and fauna sub-plans of the draft Outline EMP.

Permanent erosion and sediment control measures (e.g. drainage and berms) will be installed as appropriate prior to re-spreading of topsoil and maintained until rehabilitation goals are achieved.

Some construction office facilities may remain until the end of the Project commissioning phase.

Access roads and tracks that will no longer be used will be decommissioned. Decommissioning of the temporary road/accesses will achieve complete stabilisation and restoration to a condition generally consistent with the pre-existing area characteristics.

Treatments will be designed and implemented to eliminate the road/access track by restoring natural contours, hydrology, and vegetation through mechanical and/or natural means. Chapter 10: Landscape and visual amenity discusses the proposed landscaping for the Project.

6.12 Operational phase

6.12.1 Land use and workforce

Operational processes include the use of the railway for freight purposes, operation and maintenance of tunnel ventilation and safety systems, signalling, and general track and infrastructure maintenance.

It is anticipated that the operational phase workforce will be partially locally sourced or be provided accommodation in the Lockyer/Ipswich/Toowoomba regions. It is estimated that the average number of full-time equivalent workforce on site during the operational phase of the Project will be 15 to 20 people. Operational occupation groups required will include:

- Train drivers
- Maintenance staff, including for the track, associated infrastructure, and maintenance of the tunnel ventilation and safety system
- Signallers and track controllers.

The hours of operation are anticipated to be 24 hours a day.

6.12.2 Train operations

The Project will form part of the rail network managed and maintained by ARTC. Train services will be provided by a variety of operators. Trains will be a mix of grain, coal, bulk freight and other general transport trains.

Inland Rail will be operational once all 13 sections are complete, which is estimated to be in 2026. It is expected that construction will conclude in 2026 with commissioning to continue during 2026 until all Inland Rail projects become operational.

The Project will involve operation of a single rail track with crossing loops, to accommodate double-stacked freight trains up to 1,800 m long and 6.5 m high. Train design speeds will vary according to axle loads and track geometry and range from 80 km to a maximum of 115 km per hour (km/hr). It is estimated that the operation of the Project will involve an annual average of about 33 train services per day, which will travel in both directions, in 2026. This is likely to increase to up to 47 train services per day in both directions in 2040 with current proposed infrastructure.

During the operational phase, tunnel operations will require power and water supplies for ventilation and fire safety. Electricity supply will also be needed for points, signalling and other infrastructure. It is anticipated that the supply of these services will be delivered by relevant providers under the terms of their respective approvals and/or assessment exemptions.

6.12.3 Operational maintenance

Standard ARTC maintenance activities will be undertaken during operations. Typically, these activities include minor maintenance works, such as bridge and culvert inspections, sleeper replacement, rail welding, rail grinding, ballast dropping and track tamping, through to major periodic maintenance, such as ballast cleaning and reconditioning of track.

6.13 Supporting infrastructure

The following sections outline the supporting infrastructure that will be used across phases of the Project during construction, operation, and/or decommissioning phases.

6.13.1 Workforce accommodation

No construction camps are proposed for the Project. All construction accommodation will be supplied by the surrounding towns particularly in the Logan and Ipswich areas.

6.13.2 Access tracks and haul routes

Rail maintenance access roads are required to facilitate maintenance for critical infrastructure, such as turnouts, and to provide access for emergency recovery. Figure 6.17 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

Rail maintenance access roads will be provided for access to the tracks at strategic locations to facilitate maintenance for critical infrastructure (e.g. turnouts), and to provide access for emergency recovery.

Where public roads can provide access to required specific locations and allow suitable access to the track for emergency vehicles, they will be used in the access plan rather than providing dedicated access roads directly adjacent to the formation.

Where access roads are required to be provided, they will be located dependent on the design and terrain, at surface level, formation level or on intermediate benching. The locations of proposed access tracks are shown in Figure 6.17 and outlined in Table 6.10.

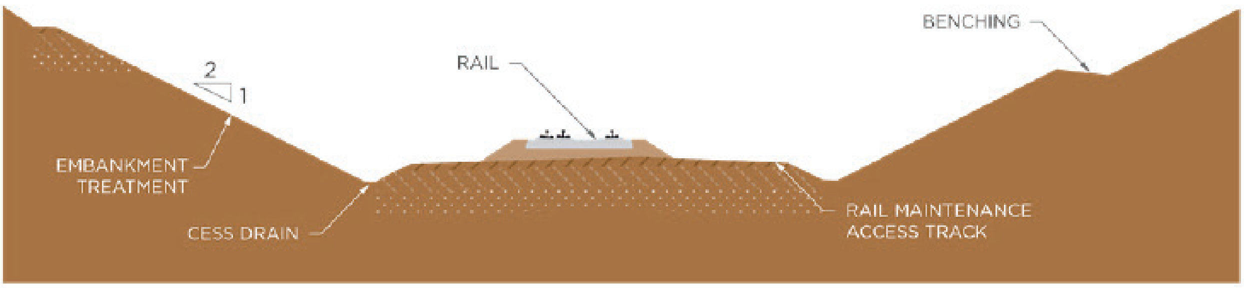

FIGURE 6.17: TYPICAL RAIL FORMATION CROSS SECTION

TABLE 6.10: PROJECT TEMPORARY ACCESS TRACKS

ID	Adjoining road	Chainage	Length (m)
H2C-TRK029.9	Seventeen Mile Road (access track)	Ch 29.88 km	1,100
H2C-TRK031.0	Connors Road (north access track)	Ch 31.00 km	390
H2C-TRK031.4	Connors Road (south access track)	Ch 31.40 km	930
H2C-TRK032.8	Connors Road (south access track)	Ch 32.80 km	770
H2C-TRK033.5	Sandy Creek Road	Ch 33.50 km	980
H2C-TRK036.8	Philps Road	Ch 36.80 km	2,500
H2C-TRK039.1	Warrego Highway Truck Stop (access track)	Ch 39.10 km	320
H2C-TRK044.9	Eastern Drive	Ch 44.90 km	360
H2C-TRK049.5	Gatton Laidley Road	Ch 49.50 km	850
H2C-TRK050.2	Greyfriars Road	Ch 50.20 km	950
H2C-TRK052.0	Railway Street	Ch 52.00 km	630
H2C-TRK054.5	Railway Street	Ch 54.50 km	840
H2C-TRK061.0	Tunnel Portal access track	Ch 61.00 km	1,000
H2C-TRK063.0	Tunnel Portal access track	Ch 63.00 km	1,500
H2C-TRK065.0	Doonans Road	Ch 65.00 km	430
H2C-TRK065.8	Grandchester Mount Mort Road	Ch 65.80 km	110
H2C-TRK067.0	Rafters Road	Ch 67.00 km	410
H2C-TRK067.8	H2C-TRK068.8	Ch 67.80 km	1,000
H2C-TRK068.8	Rosewood Laidley Road	Ch 68.80 km	1,000
H2C-TRK070.0	Neumann's Road	Ch 70.00 km	550
H2C-TRK071.3	Hiddenvale Road	Ch 71.30 km	85
H2C-TRK073.1	Waters Road	Ch 73.10 km	150

6.13.3 Fencing

Fencing will be provided for the extent of the rail corridor (except where noted otherwise) and its primary purpose is to limit access to the railway during operations. It is anticipated that construction of fencing will occur concurrent to the construction of the alignment. Fencing is to extend between the corridor and lands of owners or occupiers adjoining the railway, with any specific requirements to be designed in consultation with the adjoining landowner.

The Project alignment will be fenced with three- or four-strand barbed-wire fencing where the alignment occurs within the existing rail corridor. The barbed-wire fencing is reflective of the largely agricultural land use of this section of the alignment and seeks to ensure that stock and people do not enter the rail corridor. The barbed-wire fencing will maintain the current barriers of the existing landscape will also allow animals to move along the alignment, maintaining current movement opportunities across the existing corridor. Most of the Project alignment will maintain this style of fencing, except where fauna fencing or potential concept noise barriers are specified.

Fencing returns are required to bridge abutments and drainage or fauna crossing culverts. Fencing across waterways will be designed to avoid storm damage and to retain effective stock control.

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

Further information about fencing for fauna and fish passage can be found in Section 6.13.7.

6.13.4 Laydown, stockpile and storage areas

Material resulting from the excavation of track formation and cess drains will be stockpiled along the Project. The stockpiles will be located as close as practical to the source of the excavated material and will be formed into permanent spoil mounds, spread out to minimise height.

The Project incorporates several laydown areas along the alignment, details of which are provided in Table 6.11 and shown in Figure 6.4.

TABLE 6.11: LAYDOWN AREAS AND UTILISATION

ID	Location	Chainage	Size (approx., m^2)	Comments
H2C-LDN027.3	Airforce Road	Ch 27.30 km	5,000	Bridge construction site, rail laydown, aggregate stockpiles, ballast stockpile
H2C-LDN028.8	Seventeen Mile Road	Ch 28.80 km	19,000	Rail laydown, aggregate stockpiles, ballast stockpiles
H2C-LDN030.7	Connors Road (North)	Ch 30.70 km	83,000	Rails, ballast, fuel storage, roadworks site, site offices
H2C-LDN032.8	Connors Road (South)	Ch 32.80 km	60,000	Major bridge construction site, rails, ballast
H2C-LDN033.9	Warrego Highway (North)	Ch 33.90 km	41,000	Major bridge construction site
H2C-LDN035.4	Warrego Highway (South)	Ch 35.40 km	264,000	Ballast, fuel storage, Philps Road Bridge Construction, road realignment site, site offices
H2C-LDN043.0	Smithfield Road	Ch 43.00 km	7,000	General construction site, limited clearance bridge
H2C-LDN043.4	Gatton Station (North)	Ch 43.40 km	7,000	Bridge construction site
H2C-LDN043.5	Gatton Station (North)	Ch 43.50 km	3,000	Removal/relocation of pedestrian footbridge
H2C-LDN043.6	Gatton Station (South)	Ch 43.60 km	3,000	Removal/relocation of pedestrian footbridge
H2C-LDN044.1	Crescent Street	Ch 44.10 km	3,000	Bridge construction side
H2C-LDN048.5	Gatton Laidley Road	Ch 48.50 km	19,000	Ballast, road realignment site
H2C-LDN049.5	Greyfriars Road	Ch 49.50 km	3,000	Bridge construction site
H2C-LDN050.2	Greyfriars Road	Ch 50.20 km	3,000	Bridge construction site
H2C-LDN051.4	Railway Street	Ch 51.40 km	6,000	Bridge construction site
H2C-LDN054.6	Hall Road	Ch 54.60 km	37,000	General construction laydown including bridge construction site
H2C-LDN056.1	Old Laidley Forest Hill Road	Ch 56.10 km	21,000	Rail laydown, road realignment laydown
H2C-LDN056.7	Old Laidley Forest Hill Road	Ch 56.70 km	4,000	Bridge construction site
H2C-LDN057.4	Laidley Plainlands Road	Ch 57.40 km	29,000	Bridge construction site, road realignment site
H2C-LDN058.0	Off Boundary Road	Ch 58.00 km	24,000	Main construction compound/hub, fuel storage, bridge construction site
H2C-LDN059.2	Paroz Road	Ch 59.20 km	55,000	Bridge construction site, ballast

ID	Location	Chainage	Size (approx., m^2)	Comments
H2C-LDN061.2	Tunnel portal (west)	Ch 61.20 km	31,000	Tunnel construction site, potential concrete batch plant, fuel storage
H2C-LDN062.8	Tunnel portal (east)	Ch 32.80 km	30,000	Tunnel construction site
H2C-LDN064.0	Rosewood Laidley Road	Ch 64.00 km	15,000	General construction laydown, including bridge construction site, fuel storage, road realignment site, site offices
H2C-LDN065.3	Doonans Road	Ch 65.30 km	13,000	Bridge construction site
H2C-LDN065.8	Grandchester Mount Mort Road	Ch 65.80 km	4,000	Bridge construction site
H2C-LDN066.8	Grandchester Station	Ch 66.80 km	160,000	General construction laydown
H2C-LDN067.8	Rosewood Laidley Road	Ch 67.80 km	3,000	Bridge construction site
H2C-LDN069.2	Rosewood Laidley Road	Ch 69.20 km	6,000	Bridge construction site
H2C-LDN069.8	Neumann Road	Ch 69.80 km	18,000	Bridge construction site
H2C-LDN070.4	Neumann Road	Ch 70.40 km	11,000	General construction laydown
H2C-LDN071.2	Hiddenvale Road	Ch 71.20 km	3,000	Bridge construction site

Additional laydown areas (including stockpile and storage) may be identified during Project detailed design in consultation with the contractor. Any additional areas will not result in clearing additional Matters of National Environmental Significance (MNES) or habitat for MNES.

6.13.5 Fuel and hazardous materials

Fuel is to be stored at laydown areas along the Project alignment. The proposed locations are outlined in Table 6.11 and these locations will be confirmed during the detailed design and construction phase (post-EIS). Specification and requirements on the storage of diesel will be in accordance with *AS 1940 The storage and handling of flammable and combustible liquids* (Standards Australia, 2017) and any further approval conditions.

During the construction phase, each laydown area is expected to be used for storage and distribution of construction chemicals. Likely chemical requirements have been determined based on usage on similar rail projects. While the chemical quantities may vary due to refinement of requirements during detailed design, the types and indicative quantities identified in Table 6.12 are considered to represent the usage requirements.

TABLE 6.12: DANGEROUS GOODS/HAZARDOUS SUBSTANCES LIST

Chemical type	Typical chemicals	Design lifecycle stage	Purpose/ use	DG class	Packing Group	Indicative rate of use	Expected storage method
Fuel oil	Diesel	Construction Operation	Fuel for mobile equipment	(C1)*	III	40 kL/2 weeks per depot	40 kL bulk storage (fuel depots)
Grease	Rocol rail-curve grease	Construction Operation	Lubricate plant and equipment	(C2)**	N/A	Limited	Package storage
	Caltex 904 grease	Construction Operation	Lubricate plant and equipment	(C2)**	N/A	Limited	Package storage
	Shell GADUS gauge face-curve grease	Construction Operation	Lubricate plant and equipment	(C2)**	N/A	Limited	Package storage
	RS Claretech biodegradable grease	Construction Operation	Lubricate plant and equipment	(C2)**	N/A	Limited	Package storage
Explosives	Ammonium nitrate	Construction Decommissioning	Tunnel construction	5.1***	III	Limited	Not stored
	Blasting explosives	Construction Decommissioning	Tunnel construction	1		Limited	Not stored
Concreting	Concrete and concrete residue	Construction	Concreting for slab construction	N/A	N/A	As required by the local construction team	Truck deliveries
	Concrete curing compound	Construction	Concreting for slab construction	N/A	N/A	As required by the local construction team	Truck deliveries
Welding gases	Oxygen	Construction	Welding	2.2/5.1	N/A	Cylinders and/or manifold packs as required by the local construction team	Cylinder storage
	Acetylene	Construction	Welding	2.1	N/A	Cylinders and/or manifold packs as required by the local construction team	Cylinder storage
Pesticides	Australian Pesticides and Veterinary Medicines Authority approved pesticides	Construction Operation	Pests and weeds control	6.1 or 9	I, II or III	As required, in accordance with ENV-PR-003	Not stored in alignment

Table notes:
*Class C1—a combustible liquid that has a flashpoint of 150 °C or less.
**Class C2—a combustible liquid that has a flashpoint exceeding 150 °C.
***Security Sensitive Ammonium Nitrate (SSAN) is classified as an explosive under the *Explosives Act 1999*.

6.13.6 Sourcing material

Potential quarries to be used by the Project have been identified and investigated with a focus on:

- The required properties of the construction material
- The haul distances from the quarries to the work fronts.

Potential quarry sources include:

- Quarry Products Harlaxton—Harlaxton
- Mt. Sylvia Basalt Quarry—Junction View
- Mount Marrow Blue Metal Quarry—Mount Marrow
- Boral Quarry Purga—Purga.

There are currently no borrow pits proposed within the EIS investigation corridor.

6.13.7 Environmental design requirements

6.13.7.1 Concept noise barriers

Concept noise barrier options have been determined through the noise and vibration analysis (refer Chapter 15: Noise and vibration, and Appendix P: Operational Railway Noise and Vibration Technical Report). Based on reasonable and practicable noise mitigation options for the Project, concept rail noise barriers have been investigated at Gatton and Forest Hill (brownfield) and Laidley (greenfield). Concept noise barrier options, along with other options such as acoustic treatments and property solutions, were investigated in these locations to determine the height and extent at which noise barriers may need to be constructed to reduce potential operational noise impacts.

Final noise barrier design details will be determined during Project detailed design.

6.13.7.2 Fauna fencing

Fauna fencing is constructed to facilitate safe and effective movement of fauna (to maintain existing movement corridors and animal behaviours) where it is deemed that there is a risk of population fragmentation. Fencing and tie-ins with fauna crossings are designed to deter or effectively prevent animals entering the operating rail environment, and is an important aspect aimed at guiding animals towards the preferred fauna-crossing structure or passage.

The elevation of standard fencing to fauna exclusion fencing is proposed where the alignment represents a moderate to high risk of fauna entering the corridor and becoming trapped within the active track area.

An appropriate clearance buffer will be maintained between adjacent vegetation and fauna fences to minimise opportunity for fauna to climb onto the exclusion fencing. Vegetation within the alignment will also be removed in these areas identified as moderate to high risk to ensure that fauna is not encouraged into the active track area.

The specifics on the design of this fencing will be undertaken during detailed design and will be consistent with current accepted practices.

6.13.7.3 Fauna crossings

The approach to fauna crossings focuses on areas of greenfield development where existing fauna movement may be impacted by the Project.

All proposed fauna crossings are within areas of greenfield development for the Project.

Three fauna crossings are proposed for the Project. This includes three proposed concept fauna crossings at:

- Ch 29.7 km—over track at natural level (cut/fill interface)
- Ch 32.6 km—associated with the proposed rail bridge
- Ch 65.7 km—associated with the proposed rail bridge.

Further design development will consider the potential requirements for fencing to guide species away from operational environments and provide a tie-in to safe movement areas.

6.13.7.4 Fish passage

Fish passage is an essential requirement for the survival and productivity of many species of Queensland fish. Due to the construction of instream structures (such as dams and culverts) on waterways, the loss of access to habitat has caused the decline in distribution of native fish populations.

The *Fisheries Act 1994* (Qld) and the *Planning Act 2016* (Qld) legislate that works within waterways that are considered to be the development of new, or raising of existing waterway barriers, in addition to maintenance of existing structures, must be designed, constructed, maintained and operated to provide adequate fish passage.

Confirmation of the design of culverts, bridges (under both rail and road) and any other cross drainage structures and how they meet fish passage requirements is to be undertaken for the detailed design.

A review of the DAF Queensland Waterways for Waterway Barrier Works mapping is included in Appendix I: Terrestrial and Aquatic Ecology Technical Report. The rail alignment crosses a total of 26 waterways for waterway barrier works, which are intersected 29 times by the Project (refer Section 6.8.8).

6.13.8 Erosion and sediment control basins

Temporary site drainage and water management controls will be installed to minimise the impacts of runoff and sedimentation from construction activities on adjacent receptors.

Temporary site drainage and water runoff management will be in line with the International Erosion Control Association's (IECA) *Best Practice Erosion and Sediment Control Document* (IECA, 2008) and will minimise:

- any runoff and sedimentation from Project activities to existing waterways
- disturbance to the water quality of existing waterways along the alignment.

Table 6.13 lists the size and location of the expected erosion and sediment control basins for the Project. The locations are also presented in Volume 3: Drawings.

TABLE 6.13: POTENTIAL SEDIMENT CONTROL BASINS

Name	Type*	Catchment size (m^2)	Total volume (m^3)	Surface area (m^2)
Sediment Basin 1 (Ch 37.00 km)	Passive	26,980	470	501
Sediment Basin 2 (Ch 43.00 km)	Passive	10,970	191	256
Sediment Basin 3 (Ch 57.00 km)	Passive	26,159	456	547
Sediment Basin 4 (Ch 57.50 km)	Passive	67,787	1,182	1204
Sediment Basin 5 (Ch 64.20 km)	Passive	63,331	1,104	1192
Sediment Basin 6 (Ch 65.60 km)	Passive	23,421	408	491

Table note:
*Type: Passive overland flow to sediment basin without pumping.

6.13.9 External infrastructure requirements

6.13.9.1 Parking facilities

Temporary parking facilities for construction workers will be located predominately within the Project construction laydown areas, typically incorporated into the approximate size of the laydown areas, with the number of carparks at each laydown area being proportional to the size and use of the facility (refer Section 6.13.4 and Figure 6.4).

6.13.9.2 New utilities and services

Requirements for power supply to the tunnel during construction and operation are unlikely to be met by the current utilities available in the area (refer Figure 6.18a–e). For this reason, two alternative utility installations have been considered to provide power for the tunnel. These options included:

- Two permanent 11 or 33 kilovolt (kV) primary and secondary supplies from Laidley Energex Substation and an alternative Energex Substation, each rated to supply 100 per cent of the required operational load
- One permanent 11 or 33 kV primary supply from Laidley Energex Substation and a secondary on-site ARTC owned 11 kV diesel powered generator supply; each rated to supply 100 per cent of the required.

The choice of utility installation to be implemented for the tunnel will be decided (including route selection and connection points) during Project detailed design, once further discussions with energy providers and contractors have been held.

The only other utilities required for construction outside of the tunnel are assumed to be temporary in nature and have not been subject to the utilities assessment. When the final locations of site offices and batch plants are locked down, the contractor will engage with the utility owners to connect to mains power, water, communications and sewerage.

Temporary requirements will be provided by portable water tanks and gen-sets, where required. The need for mains connections to facilitate construction activities, while beneficial, will not hold up construction.

6.13.9.3 Water supply and storage

Water will be required for dust control, site compaction and reinstatement during construction and for tunnelling works. Several potential water sources have been investigated, including extraction of groundwater and/or surface water, private bores and watercourses. Initial consultation with Seqwater has been undertaken to understand potential supply options from Seqwater sources. This will be further explored prior to construction in consultation with relevant stakeholders including regulatory agencies, local councils and landowners. Where water is not available, it will be transported to the site via tanker truck and stored in temporary storage tanks.

Potable water for human consumption will be supplied via bottled water or potable water tanks. Non-potable wash water will be supplied using trailer-mounted storage tanks. Portable toilet facilities will be used where existing infrastructure is unavailable and sewage pump-out services will be used to remove waste offsite. Development Guidelines and Land Use Risk Tool (available on Seqwater website) will be used to appropriately locate these potable facilities or pump out systems.

Further information regarding water supply and storage for the Project is included in Appendix L: Surface Water Quality Technical Report.

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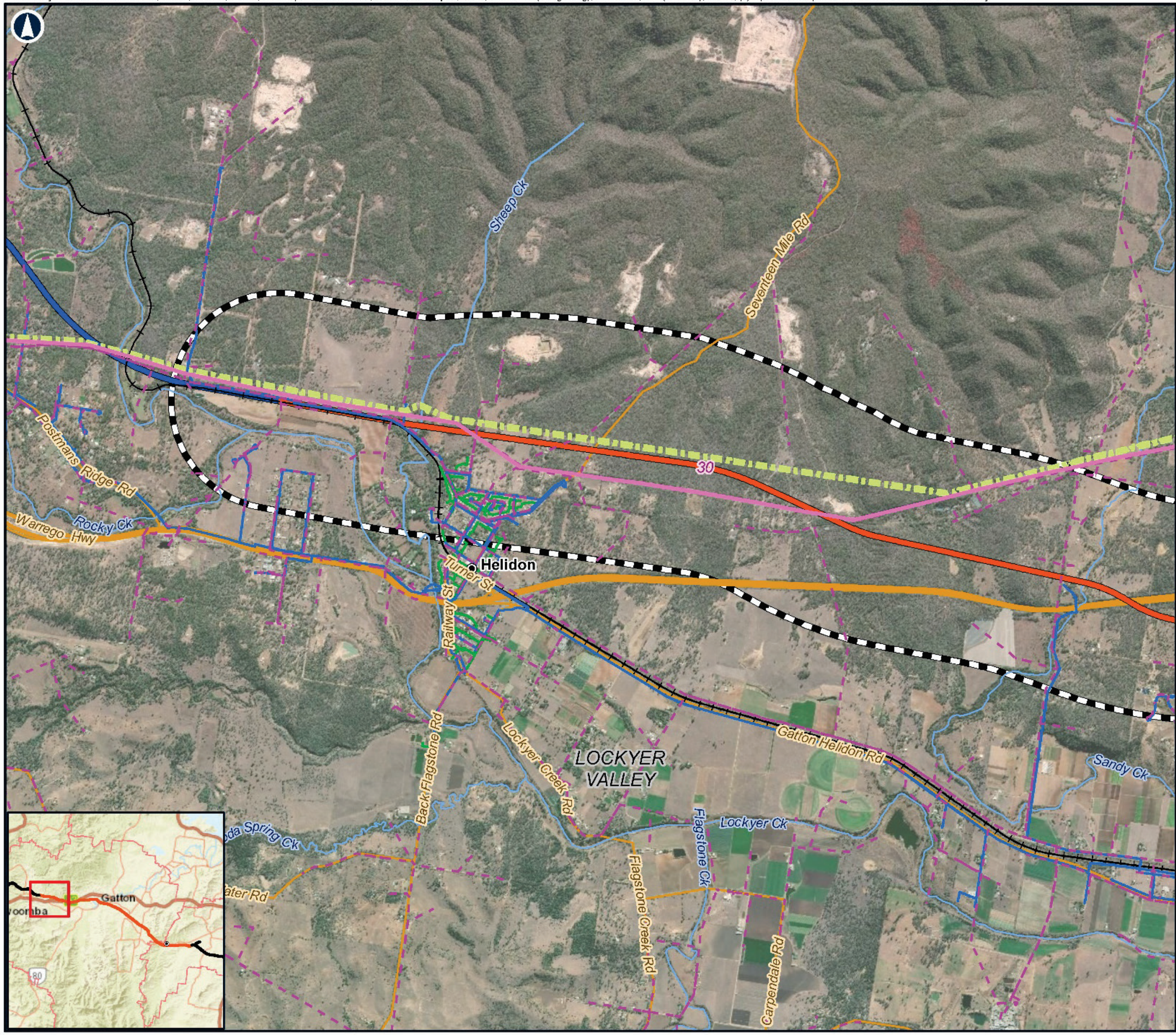

INLAND RAIL

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HELIDON TO CALVERT

Figure 6.18a: Existing local services and utilities

LEGEND

- Electrical infrastructure
- High voltage transmission line
- Roma to Brisbane gas pipeline
- Water infrastructure
- Sewer infrastructure
- 5 Chainage (km)
- Localities
- Existing rail
- G2H project alignment
- H2C project alignment
- Watercourses
- Major roads
- Minor roads
- EIS investigation corridor
- Local Government Areas

0 1 2 km

Coordinate System: GDA 1994 MGA Zone 56

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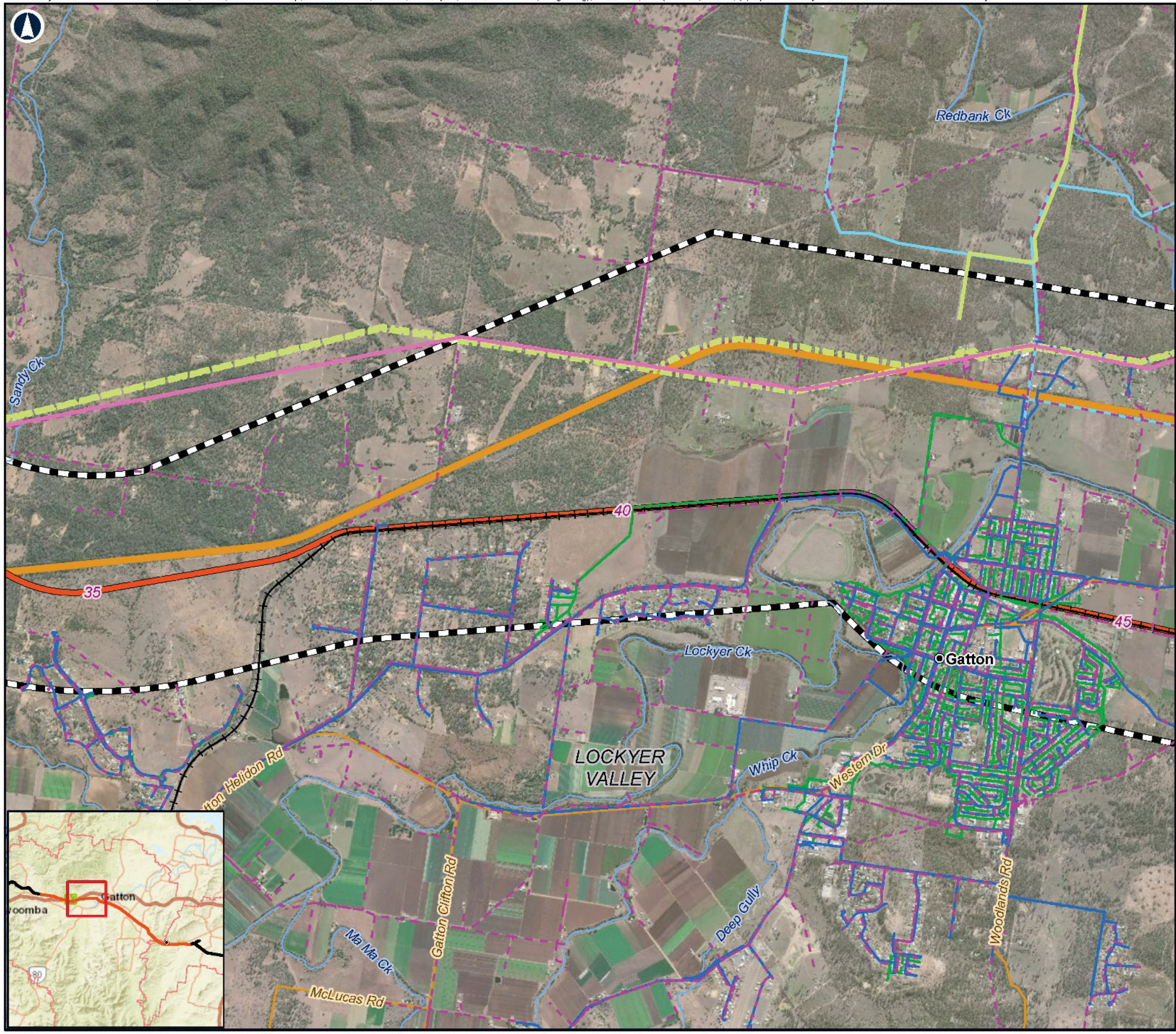

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HELIDON TO CALVERT

Figure 6.18b: Existing local services and utilities

LEGEND

- Electrical infrastructure
- High voltage transmission line
- Gatton to Gympie gas pipeline
- Roma to Brisbane gas pipeline
- Water infrastructure
- Sewer infrastructure
- Recycled water infrastructure
- 5 Chainage (km)
- Localities
- Existing rail
- H2C project alignment
- Watercourses
- Major roads
- Minor roads
- EIS investigation corridor
- Local Government Areas

0 1 2 km

Coordinate System: GDA 1994 MGA Zone 56

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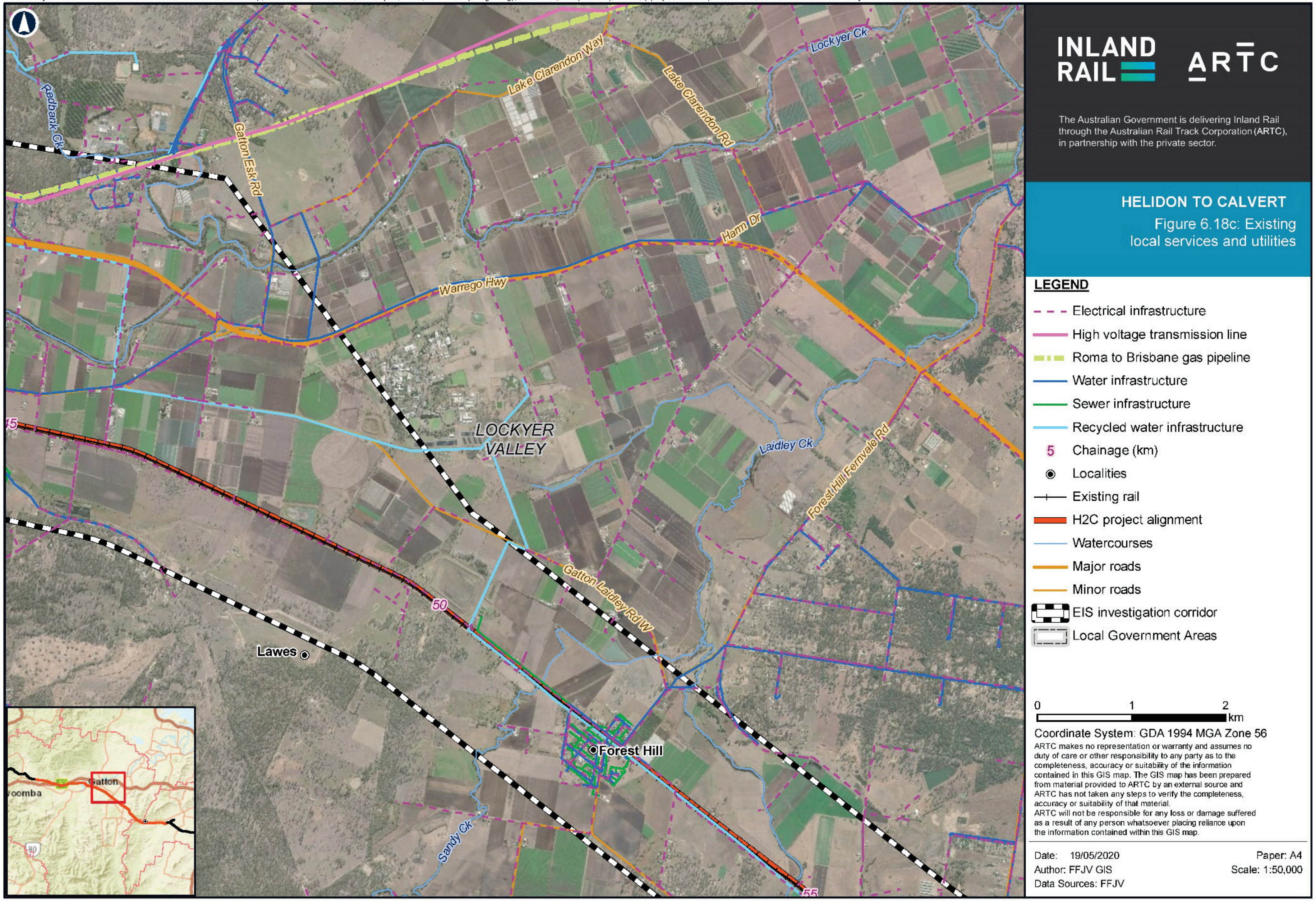

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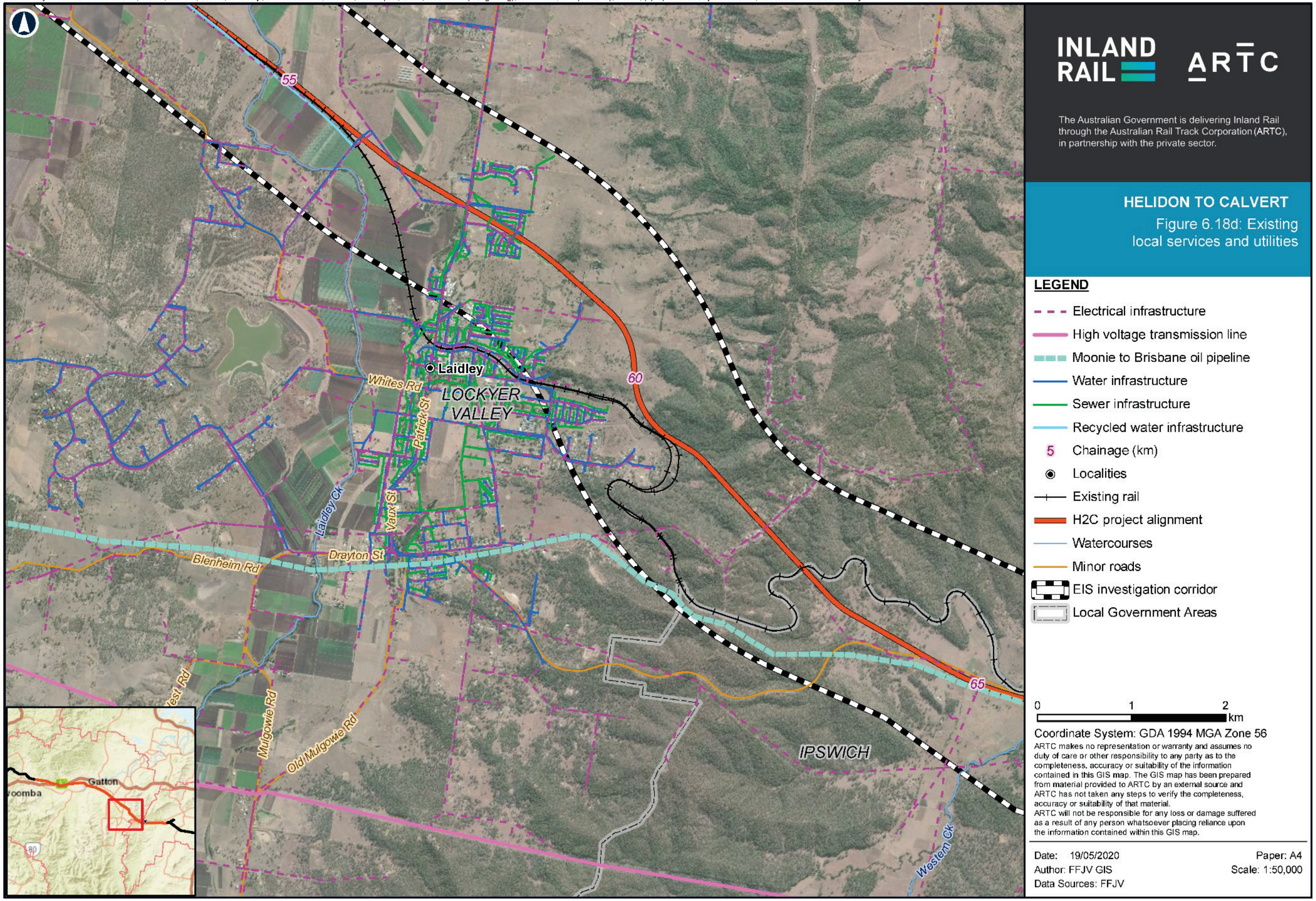

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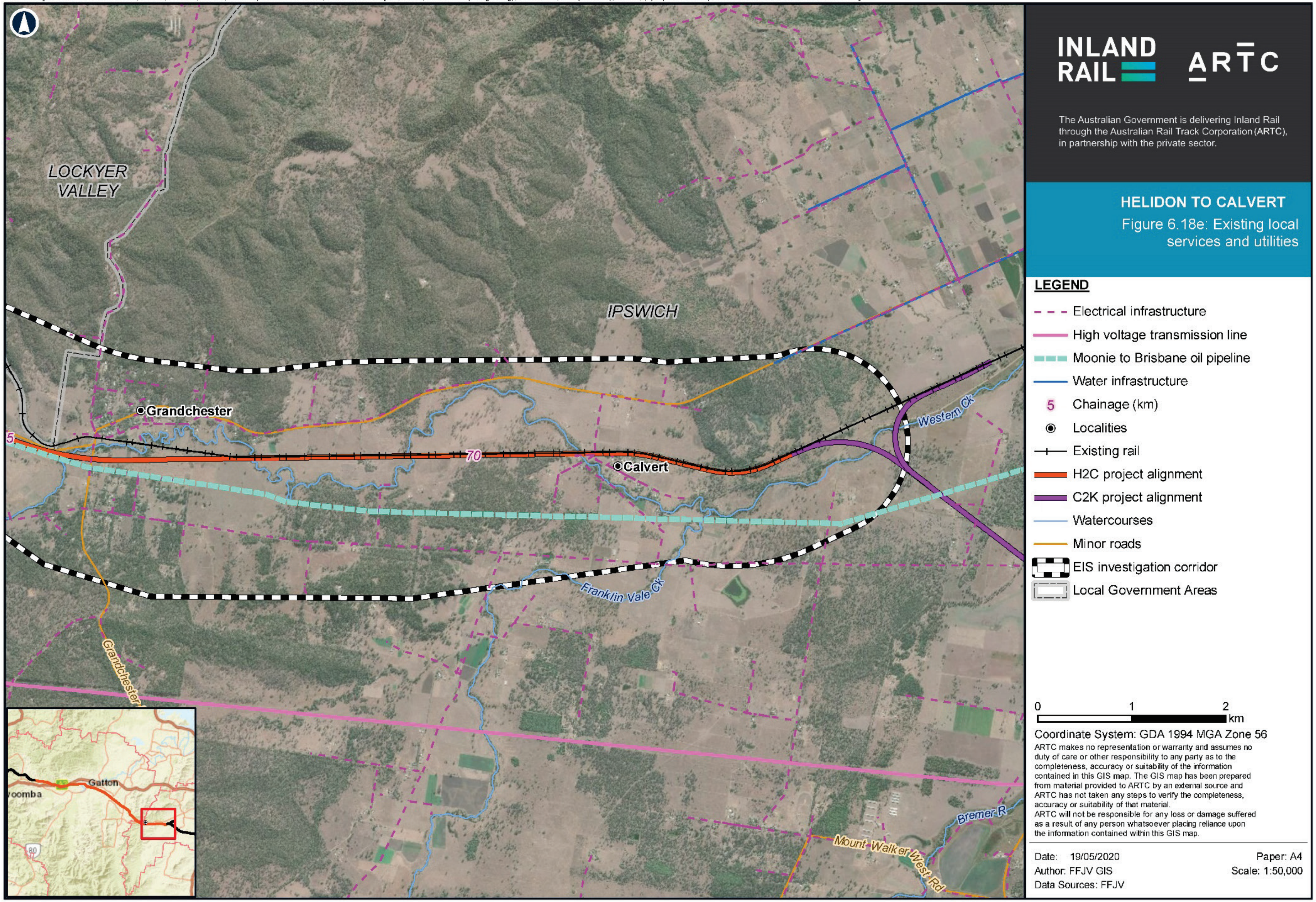

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6.13.10 Spoil management

From preliminary constructability assessments, several options have been identified to reuse and/or spoil excess cut material within the Project. A mass haul assessment will be carried out in the detailed design stage to assess different methods of spoil management. Depending on the assessment, one of the following options may be employed, depending on the suitability of the method and the assessment that occurs during Project detailed design:

- Use excess rock material for scour protection at bridge and culverts, if suitable
- Use excess for temporary works construction, such as access roads and laydown areas
- Construct rail maintenance access roads at rail formation
- Stockpile and use for the possible extensions to the rail formation for future crossing loops
- Stockpile and use for other projects near the Project, including G2H
- Acquire land adjacent (or already planned for acquisition) and use for spoil management, subject to appropriate flora, fauna and hydrology constraints
- Rehabilitate existing quarries and mines around Helidon
- Investigate opportunities to provide fill to surrounding land uses, e.g. for Gatton West Industrial Zone
- Transport excess fill to designated spoil sites.

The current data suggests excess cut of approximately 1,349,000 cubic metres (m^3) will require management during construction using one or a combination of these options. Detailed design will confirm the management plans that will be sed for the management of spoil during all phases of the Project.

Further detail in provided in Appendix T: Soil Management Strategy.

6.13.11 Waste water

The water collected inside the tunnel (groundwater, storm water carry-in, wash-down, firefighting) will be directed through a common tunnel drain and stored in a sump at the eastern portal.

Water quality will be monitored, and it is likely that this water will be processed through a water treatment plant that will include hydrocarbon and first flush separation.

6.13.12 Sewage treatment

Portable toilet facilities will be located along the alignment during construction for workers. A suitably qualified contractor will be engaged for the removal and transport of the sewage to an approved treatment site.

Sewage produced from the tunnel control centre will be drained to a sewage holding tank as there are no conventional nearby sewage catchments nor enough waste to justify on-site sewage treatment. The sewage holding tank will provide a means of temporarily storing sewage for subsequent removal and transport to an approved treatment site.

6.13.13 Power supply

Where power utilities are located close to the work sites, opportunities to connect to existing sources will be explored with relevant electricity providers. Where connections are not available, power will be provided by generators. Further information regarding power supply for the Project is discussed in Chapter 7: Sustainability.

6.13.14 Communications and signalling

The Project involves new telecommunications and signalling infrastructure, including construction communications and a train control system. The train control system will provide significantly upgraded capabilities to the rail industry of Australia. It is designed to support ARTC's objectives of improving rail network capacity, operational flexibility, train service availability, transit times, rail safety and system reliability.

6.13.15 Fixed operations infrastructure

The following sections describe the fixed operations infrastructure for the Project. The locations of the infrastructure is indicative only and for the purposes of this assessment. Specific locations are to be determined during Project design phase.

6.13.15.1 Concrete batch plants

Two locations have been identified as potential concrete batch plant sites for the Project. These are shown in Table 6.14. The tunnel portal west location is specifically to provide concrete products for tunnel construction and the potential site adjacent to the Warrego Highway provides good access to a central location of the alignment.

TABLE 6.14: PROJECT POTENTIAL CONCRETE BATCH PLANTS

ID	Adjoining road	Chainage	Description
H2C-LDN035.4	Warrego Highway	Ch 35.4 km	Good access to proposed site
H2C- LDN061.2	Dedicated access to tunnel site	Ch 61.2 km	Support tunnel construction activities

6.13.15.2 Flash-butt welding facility

The Project footprint has made allowances for the positioning of temporary flash-butt welding facilities at two locations along the corridor. These are shown in Table 6.15. It is envisaged that the Project will not require a significantly sized flash-butt welding facility to support the requirements of delivery equipment such as a track laying machine. It is assumed that rail will be delivered via the closest rail network (QR network).

TABLE 6.15: POTENTIAL FLASH-BUTT WELDING SITES

ID	Adjoining road	Chainage	Description
H2C-FBW039.1	Warrego Highway Truck stop	Ch 39.1 km	Access to rail supply via QR network
H2C-FBW044.6	Eastern Drive	Ch 44.6 km	Access to rail supply via QR network

6.14 Decommissioning

The Project is expected to be operational for in excess of 100 years. The design life of structures is 100 years to support this operational objective. The decommissioning of the Project cannot be foreseen at the date of preparing the Project EIS. If the Project, or elements of it, were subject to plans for decommissioning it is envisaged that the works would be undertaken in accordance with a decommissioning plan, which would be developed in consultation with relevant stakeholders and regulatory authorities.