CHAPTER 13

Surface Water

BORDER TO GOWRIE REVISED DRAFT ENVIRONMENTAL IMPACT STATEMENT

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13.1 Scope of chapter

The purpose of this chapter is to provide a description of the surface water quality impact assessment for the Inland Rail—Border to Gowrie project (the Project). This chapter has been prepared to address items 11.36 to 11.63 of the *Terms of reference for an environmental impact statement: Inland Rail—Border to Gowrie project (November 2018)* (ToR) and the additional requests for information by the Office of the Coordinator-General following the public notification stage. A cross reference of the ToR against the relevant components of the revised draft Environmental Impact Statement (EIS) is documented in Appendix A2: Terms of Reference Cross-reference Table. The 'Flood Management' sections of the ToR including hydrology and geomorphology components are presented in Chapter 14: Flooding and Geomorphology.

The Project consists of approximately 217.48 kilometres (km) of single-track railway extending from the New South Wales (NSW)/Queensland border, approximately 18 km to the south-east of Goondiwindi near Kurumbul, to a tie-in with the Gowrie to Helidon section of the Inland Rail Program. The new railway will be positioned within approximately 149.48 km of new rail corridor (greenfield) and approximately 68.00 km of existing open-access rail corridor (brownfield).

This chapter describes the existing environment and provides an assessment of the potential surface water quality impacts from the Project. Potential short and long-term impacts on local and regional surface waterways have been assessed based on a review of the Project's construction works and operations stages. The results of the impact assessment and recommended mitigation measures have been outlined along with potential cumulative impacts.

Further details of the surface water quality assessment are provided in Appendix S: Surface Water Quality Technical Report.

13.2 Regulatory environment

This section describes the legislative, policy and management framework relevant to surface water quality and water resources for the Project (Table 13-1). Relevant legislation and approvals are discussed further in Chapter 3: Legislation and Project Approvals Process.

TABLE 13-1 REGULATORY CONTEXT

Legislation, policy, or guideline	Relevance to the Project
Commonwealth	
Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act)	The EPBC Act provides that any action that has, will have or is likely to have, a significant impact—on a matter of national environmental significance (MNES), requires assessment and approval from the Commonwealth Environment Minister. The Project has been determined to be a controlled action under the EPBC Act (EPBC 2018/8165) as a result of the Project's potential impacts on listed threatened species and communities.
Water Act 2007 (Cth)	The *Water Act 2007* (Cth) provides the legislative framework for ensuring that the Murray–Darling Basin is managed in accordance with Australia's national interests. The *Water Act 2007* recognises that Australian states manage water resources within their jurisdictions that occur within the Murray–Darling Basin. The Project traverses the Murray-Darling Basin Plan, the Basin Plan and the Queensland Water Plan, as described below: - The Murray-Darling Basin Plan (Basin Plan) is prepared under the *Water Act 2007* (Cth) subparagraph 44(3)(b)(i) and is the overarching plan to manage the Basin as a connected system. - The Basin Plan was agreed to in 2012 by all the Basin jurisdictions, including the Queensland Government. Under the Basin Plan, each basin state and territory government is required to prepare a water resource plan for each catchment identified in the Basin Plan. - The *Queensland Water Plan (Condamine and Balonne) 2019* and *Water Plan (Border Rivers and Moonie) 2019* have each been accredited by the Australian Government minister as being consistent with the Basin Plan.

Legislation, policy, or guideline	Relevance to the Project
State	
Environmental Protection Act 1994 (Qld) (EP Act)	The objective of the EP Act is to achieve ecologically sustainable development by protecting Queensland's environment while allowing for development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends. Under the EP Act, environmental protection policies are developed to cover specific aspects of the environment. It is an offence under Section 440ZG of the EP Act to unlawfully deposit or release a prescribed water contaminant in Queensland waters; however, under Section 493A of the EP Act, releasing contaminants to waters is lawful if provided for by an Environmental Authority (EA) or compliance with Section 319 can be demonstrated. Under the EP Act, all persons have a general environmental duty to not carry out any activity that causes, or is likely to cause, environmental harm, unless the person takes all reasonable and practicable measures to prevent or minimise the harm. An environmental authority (EA) is required to undertake any Environmentally Relevant Activities (ERA), this is applicable to temporary works including: ERA 16 Extractive and screening activities and ERA 63 Sewage treatment. Construction water for the Project will be guided by these policies, EAs and ERAs to ensure all reasonable and practicable measures to prevent or minimise harm to waters is accounted for during Project activities.
Environmental Protection (Water) Policy 2019 (EPP (Water and Wetland Biodiversity))	The purpose of the EPP (Water and Wetland Biodiversity) is to achieve the object of the EP Act in relation to waters and wetlands. That is, protecting Queensland's water environment while allowing for development that is ecologically sustainable. The EPP (Water and Wetland Biodiversity) lists the Environmental Values (EVs) and water quality objectives (WQOs) that need to be considered by planners and managers when making decisions about waters and/or water quality. The Project has assessed the water quality within the area against the EPP (Water and Wetland Biodiversity), EVs and WQOs.
Fisheries Act 1994 (Qld) (Fisheries Act)	Under the provisions of the Fisheries Act and the *Planning Act 2016* (Qld) (Planning Act), a development permit is required for operations work that is constructing or raising waterway barrier works unless the work is accepted development. Acceptable development requirements are defined in the Department of Agriculture and Fisheries (DAF) guideline: *Accepted development requirements for operational work that is constructing or raising waterway barrier works* (2018) and, at a minimum, include standards such as: ▸ Development work minimises impacts to waterways and fish habitat areas ▸ Where works are for the replacement of an existing waterway barrier work, the defunct waterway barrier work is to be completely removed as soon as possible and within four weeks of the completion of the replacement works ▸ For any part of the waterway bed or banks adjacent to the works that has been altered by the waterway barrier works, the site is restored and/or rehabilitated, including fish habitat elements. Inland Rail commits to ongoing consultation during detailed design with DAF, including about the acceptable development requirements regarding timing and construction timing for waterway barrier works. The Project is likely to require applications for waterway barrier works or demonstrate compliance with acceptable development requirements. This will be further described in detailed design and early works and pre-construction stages of the Project.
Planning Act 2016 (Qld) (Planning Act)	The Planning Act sets out a planning system for development assessment, plan making and dispute resolution. Under the Planning Act, development is either accepted, assessable or prohibited. Assessment is carried out through the development assessment rules. The Project may trigger the requirement to obtain development permits for aspects of the Project such as operational work that involves taking or interfering with water (dust suppression, earthworks and rehabilitation), or waterway barrier works. These aspects are assessable under Schedule 10 of the Planning Regulation 2017.

Legislation, policy, or guideline	Relevance to the Project
Water Act 2000 (Qld) (Water Act)	The Water Act provides a framework under which catchment-based water plans are developed for sharing water between human consumptive needs and EVs (including environmental protection, irrigation, and stock watering). Water plans relevant to the study area are the *Water Plan (Condamine and Balonne) 2019* and *Water Plan (Border Rivers and Moonie) 2019*. Both plans include performance indicators and objectives such as: - Environmental flow objectives - Water allocation security objectives. The following approvals under the Water Act, may be relevant to the Project: The Project will require a riverine protection permit for undertaking works in a watercourse, lake or spring, unless an exemption applies. There will be an exemption where Australian Rail Track Corporation (ARTC) (as an approved entity) carry out the works in accordance with the Riverine protection permit exemption requirements Additionally, the taking of or interfering with the flow of water for water required during construction processes requires a water authorisation (permit or licence). (Department of Regional Development, Manufacturing and Water (DRDMW), 2023). A water permit or water license may be required for work that involves the taking of or interfering with water. Development permit for operations works for levees unless the modification to levees complies with the accepted development requirements. ARTC is listed as an entity under Schedule 2 of the *Riverine protection permit exemption requirements* (WSS/2013/726) (DRDMW, 2023a). Subject to detailed design, modification of the existing levee at Yelarbon may be required for Project works.
Water—EIS information guideline (DES, 2016)	This guideline, published by the Queensland Government, advises proponents about the information and assessment requirements in relation to water resources, water quality, and associated EVs when preparing an EIS.
State Planning Policy (SPP) (Department of Infrastructure, Local Government and Planning (DILGP, 2017) (including State Planning Policy—state interest guideline, Water quality)) (DILGP, 2016)	The SPP is a key component of the Queensland land use planning system, which expresses the State's interest (as defined under the Planning Act) in land use planning and development. The SPP defined the Queensland Government's State interests in land use planning and development, which notably includes State transport infrastructure. The SPP includes a State interest policy relating to water quality that provides performance outcomes to ensure development is planned, designed, constructed and operated to manage stormwater and wastewater in ways that support the protection of EVs identified in the EPP (Water and Wetland Biodiversity). While no components of the Project are assessable under the provisions of a local government planning scheme (Chapter 3: Legislation and Project Approvals Process), State approval requirements will trigger the Chief Executive of the Department of State Development and Infrastructure as a referral agency for a number of applications, involving State interests. As such, relevant provisions of the SPP will be required to be addressed as part of the supporting application materials to be submitted, and will be considered in the assessment process.
Monitoring and Sampling Manual: Environmental Protection (Water) Policy 2009 (Department of Environment and Science (DES), 2018b)	The *Monitoring and Sampling Manual* provides an overview of common techniques, methods and standards for the collection, handling, quality assurance and control, custodianship and data management in relation to water quality samples. The manual helps to ensure that monitoring data is collected in a consistent and scientifically accurate manner.
ShapingSEQ South East Queensland Regional Plan 2023 (ShapingSEQ 2023) (Department of State Development, Infrastructure, Local Government and Planning (DSDILGP), 2023a)	*ShapingSEQ* 2023 is the Queensland Government's plan to guide the future of the South East Queensland region. *ShapingSEQ* 2023 is based on the understanding that the region relies on its environmental assets to support our communities and lifestyles. *ShapingSEQ* 2023 provides strategies to protect and sustainably manage the region's catchments to ensure that the quality and quantity of water in waterways, aquifers, wetlands, estuaries, Moreton Bay and oceans meets the needs of the environment, industry and community. The *ShapingSEQ* 2023 update has been released for public consultation by the Queensland Government and amends the *ShapingSEQ* 2017. The Project has been identified as a key priority in the region and is considered to be consistent with *ShapingSEQ* 2023.

Legislation, policy, or guideline	Relevance to the Project
Healthy Waters Management Plan Guideline (DES, 2020c)	Under the *Healthy Waters Management Plan Guideline*, the Healthy Waters Management Plans (HWMPs) are a key planning mechanism to improve the quality of Queensland waters under the EPP (Water and Wetland Biodiversity). HWMPs provide an ecosystem-based approach to integrated water management. The HWMPs provide: ▸ Identification and mapping of EVs, desired levels of aquatic ecosystem protection and management goals for Queensland waters ▸ WQOs under the *National Water Quality Management Strategy* (Australian Government, 2018b) to protect the EVs. The relevant HWMPs for the Project include: ▸ Chainage (Ch) 30.6 km (North Star to NSW/QLD Border (NS2B)) to Ch 117.0 km: within the boundaries of the Border Rivers basin. The relevant EVs for the impact assessment area are described in the *Healthy Waters Management Plan: Queensland Border Rivers and Moonie River Basins* (DES, 2019a). ▸ Ch 117.0 km to Ch 210.6 km: within the boundaries of the Condamine–Balonne River basin. The relevant EVs for the impact assessment area are described in the *Healthy Waters Management Plan: Condamine River Basin* (DES, 2019a). ▸ As the Queensland Border Rivers and the Condamine River basins are located within the Murray–Darling Basin, these healthy water management plans also contribute to the requirements of a Water Quality Management Plan under the *Water Act 2007* (Cth)*—Basin Plan 2012*.
Darling Downs Regional Plan 2013 (Department of State Development, Infrastructure and Planning, 2013b)	The *Darling Downs Regional Plan 2013* identifies priority outcomes for the region's transport network, which include prioritisation of transport programs to improve freight movement and reduce conflicts in urban areas with other network users. The plan also identifies opportunities for protecting the quality of the surface and groundwater quality of the region. The Project is considered to be consistent with the *Darling Downs Regional Plan 2013* via the adoption of WQOs under Schedule 1 of EPP (Water and Wetland Biodiversity) as a basis of existing environment conditions.

13.2.1 Water quality guidelines

Various water quality guidelines were used to assess the quality of surface waters within the impact assessment area (see Section 13.3.1) against defined reference conditions, which enabled the quantification of WQOs. Applicable guidelines are briefly described below.

13.2.1.1 Australian and New Zealand Guidelines for Fresh and Marine Water Quality

The *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (Australian and New Zealand Governments (ANZG), 2018) provide a method for assessing water quality through comparison with guidelines derived from local reference values.

The guideline values were developed based on the following criteria:

- Level of environmental disturbance of surface waters (i.e. highly or slightly/moderately disturbed waters)
- Freshwater or saline surface water
- Waterbody elevation (i.e. upland or lowland aquatic environments)
- Biogeographic region (i.e. southeast or tropical Australia).

Where local guideline values are not available, the ANZG (2018) values can be regarded as guideline trigger values that can be modified into regional, local, or site-specific guidelines, with consideration to the variability of the subject environment, soil type, rainfall, and contaminant exposure. Exceedances of the guideline trigger values indicate a potential environmental issue and trigger an environmental management response.

13.2.1.2 Queensland Water Quality Guidelines 2009

The *Queensland Water Quality Guidelines 2009* published by the Department of Environment and Heritage Protection (DEHP), now the Department of Environment, Science and Innovation (DEHP, 2009), provide a framework for assessing water quality in Queensland via the setting of WQOs. The *Queensland Water Quality Guidelines 2009* are intended to address the need identified in the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZG, 2018) by:

- Providing guideline values (numbers) that are tailored to Queensland region and water types
- Providing a process/framework for deriving and applying more locally specific guidelines for waters in Queensland.

13.2.1.3 Healthy Waters Management Plans

HWMPs are a key planning mechanism to improve the quality of Queensland waters under the EPP (Water and Wetland Biodiversity). HWMPs provide an ecosystem-based approach to integrated water management.

The HWMPs provide:

- Identification and mapping of EVs, desired levels of aquatic ecosystem protection and management goals for Queensland waters
- WQOs under the *National Water Quality Management Strategy* (Australian Government, 2018b) to protect the EVs.

The relevant HWMPs for the Project include:

- Ch 30.6 km (North Star to NSW/QLD Border (NS2B)) to Ch 117.0 km: within the boundaries of the Border Rivers basin. The relevant EVs for the impact assessment area are described in the *Healthy Waters Management Plan: Queensland Border Rivers and Moonie River Basins* (DES, 2019b) Ch 117.0 km to Ch 210.6 km: within the boundaries of the Condamine–Balonne River basin. The relevant EVs for the impact assessment area are described in the *Healthy Waters Management Plan: Condamine River Basin* (DES, 2019b).

As the Queensland Border Rivers and the Condamine River basins are located within the Murray–Darling Basin, these Healthy Water Management Plans also contribute to the requirements of a Water Quality Management Plan under the *Water Act 2007* (Cth)—Basin Plan 2012.

13.2.2 Water quality objectives and environmental values

The Project footprint traverses through the Border Rivers basin (Ch 30.6 km (NS2B) to Ch 117.0 km) and the Condamine River basin (Ch 117.0 km to Ch 210.6 km), as recognised under the EPP (Water and Wetland Biodiversity).

WQOs have been developed under the provisions of the EPP (Water and Wetland Biodiversity), under the EP Act, to support and protect different EVs identified for waters within both the Condamine River and Border Rivers basin areas. Under the EVs, it is expected that each WQO is achieved in order to maintain existing water quality standards, or aspirational water quality standards, where present. Typically, median data is assessed against the WQOs of the existing environment; however, for this assessment, grab samples were assessed against the WQO with reference to prevailing conditions and trending data in regard to seasonal conditions.

13.2.2.1 Environmental values

The Project footprint crosses through eight sub-catchments of the Condamine River basin and the Border Rivers basin, each of which are recognised for their own unique EVs, as outlined in Table 13-2.

TABLE 13-2 ENVIRONMENTAL VALUES FOR SUB-CATCHMENTS THAT THE PROJECT FOOTPRINT INTERSECTS

Environmental values	Aquatic ecosystems	Irrigation	Farm supply	Stock water	Aquaculture	Human consumer	Primary recreation	Secondary recreation	Visual recreation	Drinking water	Industrial use	Cultural, spiritual and ceremonial values
Sub-catchments of the Condamine River basin												
Upper Oakey	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Hodgson Creek	✓	✓	✓	✓	-	✓	-	-	✓	-	-	✓
Ashall Creek	✓	✓	✓	✓	-	-	-	-	✓	-	✓	✓
Condamine River North Branch	✓	✓	✓		-	-	-	-	✓	✓	✓	✓
Condamine River South Branch	✓	✓	✓	✓	-	✓	-	✓	✓	✓	✓	✓
Sub-catchments of the Border Rivers basin												
Canning Creek	✓	✓	-	✓	-	-	-	-	✓	-	-	✓
Lower Macintyre Brook	✓	✓	✓	✓	-	✓	✓	-	✓	✓	-	✓
Macintyre Barwon Floodplain	✓	✓	✓	✓	-	✓	✓	✓	✓	✓	-	✓

Source: DES (2019b)

13.2.2.2 Water quality objectives

The Project footprint extends through the following water type zones within the Border Rivers and Condamine basins, as published in the relevant HWMP:

- Condamine River basin (DES, 2019b):
  - Oakey Creek
  - Central Condamine
  - Southern Condamine.
- Border Rivers basin (DES, 2019b):
  - Canning Creek
  - Lower Macintyre Brook
  - Macintyre Barwon floodplain.

WQOs for each of these water type zones are presented in Table 13-3 and Table 13-4.

The WQOs in Table 13-3 are for physico-chemical parameters and are consistent with the accreditable water quality target values published in the relevant HWMP. WQOs in Table 13-3 are presented for low-flow and high-flow conditions for moderately disturbed waterways. The moderately disturbed classification is applicable to the use of physico-chemical parameters for Queensland WQOs.

The WQOs in Table 13-4 are for heavy metals and other toxic contaminants and are consistent with the toxicant default guideline values published in the ANZG (2018). The ANZG does not have a classification for moderately disturbed waterways; hence, the slightly to moderately disturbed classification is applicable to the use of metals and other toxicants under the ANZG.

TABLE 13-3 WATER QUALITY OBJECTIVES FOR MODERATELY DISTURBED WATER INTERSECTED BY THE PROJECT

Water type zone	Water flow	Turbidity (NTU)	Total P (µg/L)	Chlorophyll a (µg/L)	Total nitrogen (µg/L)	Oxidised nitrogen (µg/L)	Ammonium N (µg/L)	Dissolved oxygen		pH	Electrical Conductivity µS/cm	Salinity mg/L	TSS mg/L
								mg/L	%sat				
Condamine River basin[1]													
Oakey Creek (Sites 34 to 43)	Low flow	13	110	5	1,000	5	10	ID	60 to 110	7.7 to 8.3	510	N/A	14
	High flow	55	340	ID	1,280	ID	ID			7.4 to 8.1	380		65
Central Condamine (Sites 27 to 33)	Low flow	25	170	9	860	4	4			7.4 to 8.3	890		25
	High flow	220	950	4	2,200	480	ID			7.0 to 7.6	290		130
Southern Condamine (Sites 21 to 26)	Low flow	9	45	5	595	3	6			7.2 to 7.9	170		8
	High flow	25	60	ID	830	ID	ID			7.0 to 7.6	160		17
Border Rivers basin[2]													
Canning Creek (Sites 9 to 20)	Low flow	35	30	ID	520	6	10	>5	60 to 110	7.2 to 7.8	200	N/A	25
	High flow	50	40	ID	600	ID	ID			6.9 to 7.9	165		60
Lower Macintyre Brook (Sites 3 to 8)	Low flow	11	55	ID	710	18	8			7.4 to 8.0	370		10
	High flow	25	70	ID	910	ID	ID			7.2 to 8.0	250		25
Macintyre Barwon Floodplain (Sites 1 to 2)	Low flow	30	70	3	575	10	20			7.4 to 8.0	240		25
	High flow	110	150	ID	900	195	ID			7.0 to 7.5	180		70

Source: 1. Healthy Waters Management Plan: Condamine River Basin (DES, 2019a); 2. Healthy Waters Management Plan: Queensland Border Rivers and Moonie River Basins (DES, 2019a)

Table notes:
P = phosphorus
NTU = Nephelometric Turbidity Units
mg/L = milligrams per litre
TSS = total suspended solids
ID = Insufficient data for determination of water quality objective
µS/cm = microsiemens per centimetre
µg/L = micrograms per litre
N/A = not applicable

TABLE 13-4 WATER QUALITY OBJECTIVES FOR PROTECTION OF SLIGHTLY TO MODERATELY DISTURBED WATERS: HEAVY METALS AND POTENTIALLY TOXIC CONTAMINANTS

Water type zone	Arsenic (mg/L)	Cadmium (mg/L)	Chromium (mg/L)	Copper (mg/L)	Lead (mg/L)	Mercury (mg/L)	Nickel (mg/L)	Zinc (mg/L)	Naphthalene (mg/L)
Condamine River basin									
Oakey Creek	0.024	0.0002	.0033	0.0014	0.0034	0.0006	0.011	0.008	0.016
Central Condamine	0.024	0.0002	0.0033	0.0014	0.0034	0.0006	0.011	0.008	0.016
Southern Condamine	0.024	0.0002	0.0033	0.0014	0.0034	0.0006	0.011	0.008	0.016
Border Rivers basin									
Canning Creek	0.024	0.0002	0.0033	0.0014	0.0034	0.0006	0.011	0.008	0.016
Lower Macintyre Brook	0.024	0.0002	0.0033	0.0014	0.0034	0.0006	0.011	0.008	0.016
Macintyre Barwon floodplain	0.024	0.0002	0.0033	0.0014	0.0034	0.0006	0.011	0.008	0.016

Source: ANZG (2018)

13.3 Methodology

The methodology adopted for the assessment of surface water has been established to provide sufficient information to determine:

- Existing receiving surface water conditions
- Potential impacts to surface water quality and resources that may arise as a result of the Project
- Mitigation measures that can practicably be implemented throughout the Project stages to avoid or reduce the potential impacts to surface water
- Cumulative impacts to surface waters, as a result of Project activities occurring in parallel to activities of other projects in the region. Outcomes of these are presented and discussed in Chapter 23: Cumulative Impacts.

The existing condition of surface waters within the impact assessment area was established through assessment of publicly available datasets, in combination with water quality data collected across 18 sampling events with seasonal variation (see Section 13.3.3).

In combination, these datasets were used to determine the quality of receiving waters within the impact assessment area and were subsequently used to assess the potential for impacts to surface waters to arise as a result of Project activities.

The assessment of potential impacts to surface water quality and resources was undertaken using a significance-based impact assessment framework, as described in Chapter 4: Assessment Methodology. The significance-based impact assessment is appropriate to matters where impacts cannot be quantified and is considered appropriate for surface water.

In the context of surface water, the significance-based impact assessment method requires consideration of the likely sensitivity of a receptor (e.g. the quality or resource value of surface waters) and the magnitude (e.g. intensity, duration and spatial extent) of potential impact on that receptor. In combination, the sensitivity of a receptor and the magnitude of potential impact enable the significance of a risk to be established.

Further information on the adopted impact assessment methodology is provided in Chapter 4: Assessment Methodology and Appendix S: Surface Water Quality Technical Report.

13.3.1 Impact assessment area

The impact assessment area for the assessment of surface water is approximately 1 km either side of the Project alignment and includes Project activities for the Yelarbon non-resident workforce accommodation and Turallin facility, which are outside of the 1 km buffer. In addition, as a conservative measure, in recognition that hydraulic connectivity between a source aquifer and spring may be expansive, the groundwater impact assessment area was expanded significantly to a 20 km distance from the Project alignment to assess potential groundwater related springs.

The 1 km buffer either side of the Project alignment includes:

- The permanent footprint: comprises the area required to accommodate all rail and road infrastructure components and other miscellaneous infrastructure. It includes new rail track, crossing loops, signalling, bridges and drainage structures, level crossings, road realignments, road–rail interfaces, stock route treatments, rail maintenance access roads, fencing, signage and other permanent infrastructure.
- The temporary footprint: includes land required on a temporary basis to enable safe construction of the Project, including construction laydown and work areas, stockpile and storage areas, facilities (such as Whetstone Material Distribution Centre (MDC) located at Ch 45 km, temporary erosion control structures, areas for concrete batching, movement of construction traffic and borrow pits.

The Project footprint crosses eight sub-catchments of the Condamine River basin and the Border Rivers basin, each of which are recognised for their own unique EVs as outlined in Table 13-2. The impact assessment area is shown on Figure 13-1 in relation to the Project alignment and surrounding hydrological features.

13.3.2 Desktop review

The desktop study included reviews of relevant climate and water quality databases, existing literature, and previous study reports. The desktop review undertook a gap analysis to inform the field sampling program. Details of the relevant database sources, search dates, search area parameters and type of information considered for the desktop study are summarised in Appendix S: Surface Water Quality Technical Report. Several concurrent studies were being undertaken for the Project, and the outcomes of these studies were used in the assessment, where appropriate. Those studies included the assessment of land resources in Chapter 9: Land Resources, Appendix U: Groundwater Technical Report, Appendix T: Hydrology and Flooding Technical Report, Appendix H: Geomorphology Report, and Appendix L: Terrestrial and Aquatic Ecology Technical Report.

13.3.3 Field sampling program

Water quality sampling was conducted at selected locations along the Project footprint for the purpose of establishing baseline conditions and enabling site-specific WQOs to be derived. This section provides a summary of the locations, methodology and timing of monitoring.

13.3.3.1 Sampling locations

There were 43 sites along the Project footprint initially selected as potentially suitable sampling sites. This allowed for removal of sites when land access proved to be problematic or if sites were unable to be accessed in the field. Additionally, the inclusion of a large number of potential sampling sites provided greater certainty that sufficient water would be present at a representative selection of sites in the event that dry conditions were experienced.

Sampling was undertaken at 20 out of these nominated 43 monitoring locations as presented in Table 13-5 and Figure 13-1.

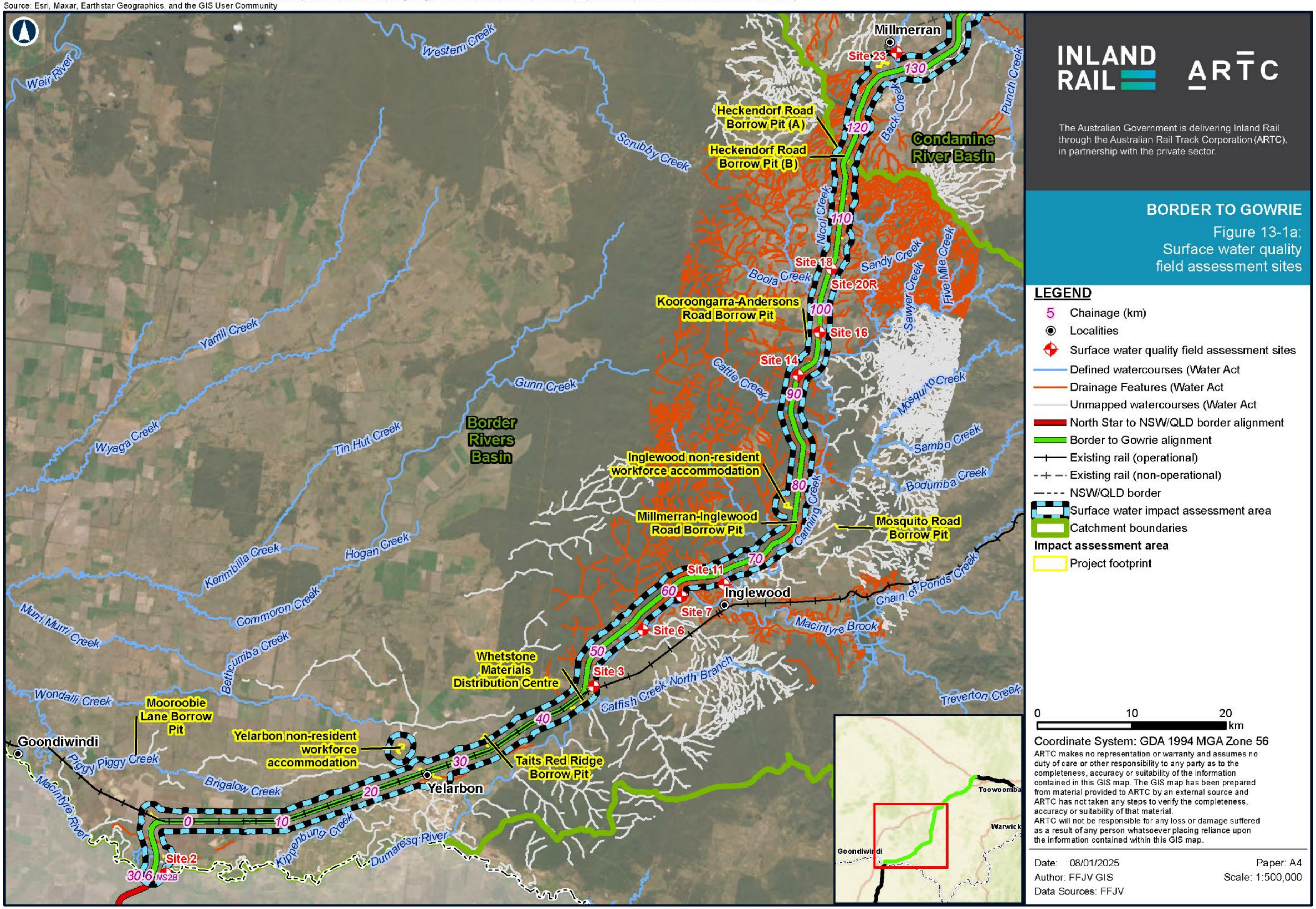
Sites were positioned as close as possible to locations where the revised reference design rail footprint traversed watercourses, waterways or other drainage features and were nominally assigned into one of the following categories:

- Aquatic ecology and surface water quality sites — where an assessment of aquatic ecology habitat values and surface water quality was to be undertaken
- Surface water quality sites — where assessment of surface water quality only was to be undertaken.

A range of factors were taken into consideration when determining the location of sampling sites. These include the following:

- Mapping and aerial photography that provided information on aquatic habitat features, including DAF waterway barriers and DESI aquatic habitat mapping
- Inclusion of waterways with a variety of stream orders within the Project footprint, ensuring water features of varying size and complexity were sampled
- Representation of a variety of aquatic habitat types and surrounding land uses (e.g. areas where remnant riparian vegetation was intact, and areas that had been subject to disturbance from existing infrastructure or agricultural land uses)
- A relatively even spread of survey sites along the Project footprint, to determine spatial variability in aquatic and water quality values
- Practicality of access to the site and the safety of field teams.

Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community
Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community



Map by: DTH/NCW/KG/AWS/CM Z:\GIS\GIS_310_B2G\Tasks\310-EAP-201910101214_SurfaceWaterQuality\310-EAP-201910101214_ARTC_Fig13-1_AssessmentSites_v9.mxd Date: 8/01/2025 14:54

Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community
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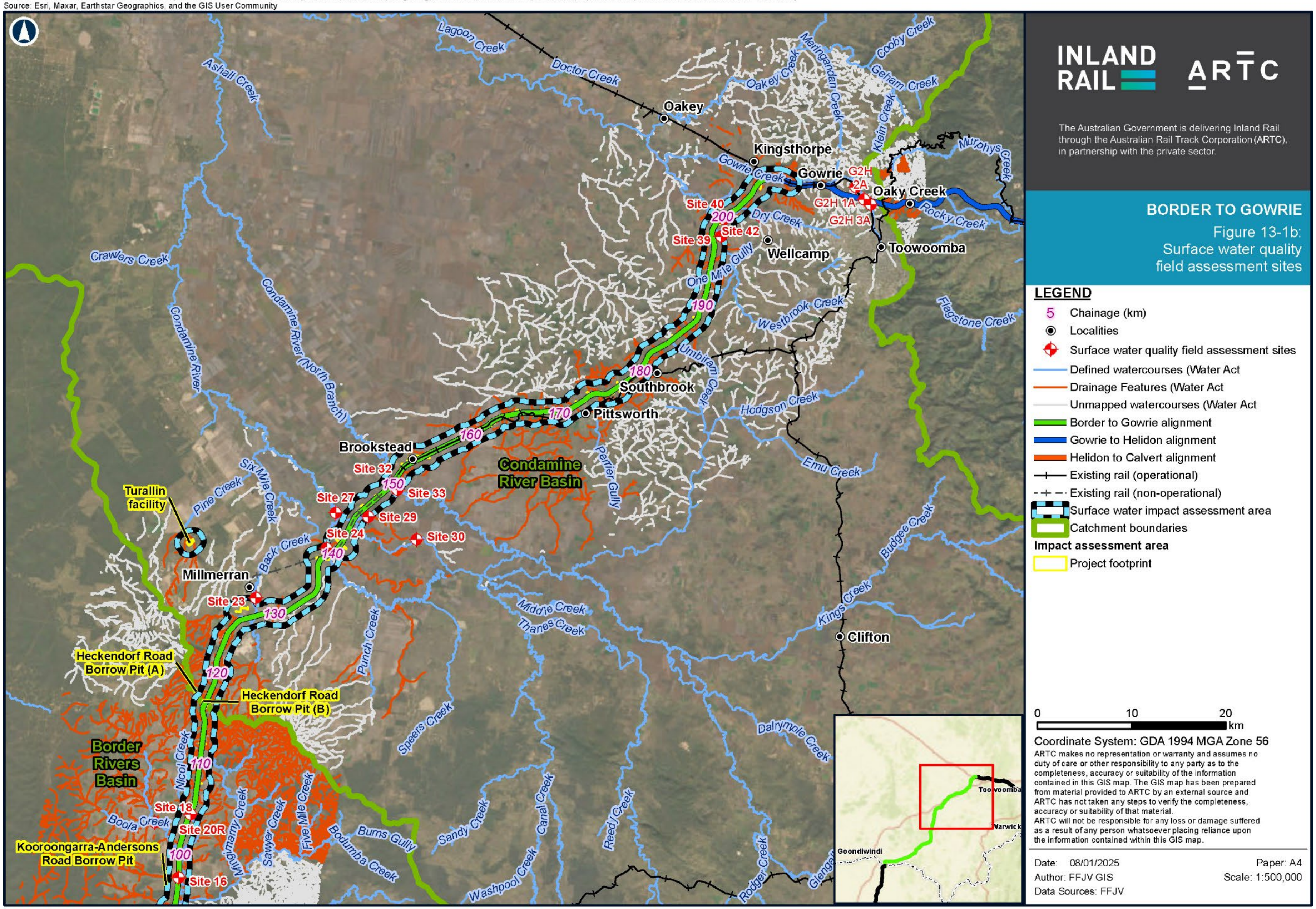

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Where practical, and if access was possible, surface water quality sites were located upstream and downstream of the revised reference design. This positioning of sampling sites ensured that the collected data retained value for assessment purposes, in the event that localised alignment shifts occurred during the design development process.

The 20 surface water monitoring sites consisted of three sites (Sites 2/2R, 16 and 32) where aquatic ecology assessment and surface water quality sampling was conducted, and 17 sites where only surface water quality sampling was conducted.

Sites were assigned a number in approximate numerical order from south-west to north-east. On some occasions, when a site could not be accessed, an alternative site was identified on public land nearby and labelled with the site number and the letter 'R' (e.g. Site 20R). This allowed the assessment of water quality information from areas adjacent to the original site.

TABLE 13-5 SAMPLING SITES TARGETED DURING THE FIELD SAMPLING EVENTS AND ASSOCIATED BASIN AND WATER TYPE ZONE

Site	Site ID	Assessment type	Watercourse/waterway	Tenure
Border Rivers basin				
Macintyre Barwon Floodplain water type zone				
2	B2GSW01.2	Aquatic ecology and surface water	Macintyre River	Private land
2R	B2GSW01.2R	Aquatic ecology and surface water	Macintyre River	Public land
Lower Macintyre Brook water type zone				
3	B2GSW01.3	Surface water	Macintyre Brook	Public land
6	B2GSW01.6	Surface water	Macintyre Brook	Private land
7	B2GSW01.7	Surface water	Macintyre Brook	Public land
Canning Creek water type zone				
11	B2GSW01.11	Surface water	Canning Creek	Private land
14	B2GSW01.14	Surface water	Unnamed	Private land
16	B2GSW01.16	Aquatic ecology and surface water	Unnamed	Private land
18	B2GSW01.18	Surface water	Unnamed	Public land
20R	B2GSW01.20R	Surface water	Nicol Creek	Public land
Condamine River basin				
Southern Condamine water type zone				
23	B2GSW01.23	Surface water	Unnamed	Public land
24	B2GSW01.24	Surface water	Grasstree Creek	Public land
Central Condamine water type zone				
27	B2GSW01.27	Surface water	Condamine River	Public land
29	B2GSW01.29	Surface water	Unnamed	Public land
30	B2GSW01.30	Surface water	Condamine River	Public land
32	B2GSW01.32	Aquatic ecology and surface water	Condamine River (North Branch)	Public land
33	B2GSW01.33	Surface water	Condamine River (North Branch)	Public land
Oakey Creek water type zone				
39	B2GSW01.39	Surface water	Westbrook Creek	Public land
40	B2GSW01.40	Surface water	Dry Creek	Public land
42	B2GSW01.42	Surface water	Dry Creek	Public land

Table note:
R indicates original site could not be accessed, and an alternative site was identified and sampled on public land nearby

13.3.3.2 Sampling methodology

Surface water quality data was collected at accessible sites in accordance with the *Monitoring and Sampling Manual* (DES, 2018b). Information about site characteristics was recorded using the *Water Quality Sampling Field Sheet* (Department of Natural Resources and Mines, 2002). Field personnel undertaking the surveys were experienced in the collection and analysis of water quality samples.

The following values were recorded at each surface water sampling site:

- Site ID and name
- Date and time
- Sampling location (latitude, longitude and reach orientation looking downstream)
- Weather (rain in the past week, cloud cover, wind)
- Observations at water sampling site (within 2 metres (m) of sampling point or on closest bank), including:
  - shading (per cent)
  - water odour
  - water surface condition
  - algae (per cent) (on substrate, in water column)
  - macrophytes (per cent) (emergent, submerged, floating, fringing)
  - impact (per cent) (human, pastoral animals, non-pastoral animals).

A multi-probed, battery-operated water quality meter (YSI Professional Plus) was used to measure physico-chemical parameters. The device was calibrated in the field prior to the collection of data and used to take measurements of the following parameters:

- Dissolved oxygen (DO) (mg/L) and saturation (per cent)
- pH
- Electrical conductivity (EC) (µs/cm)
- Temperature (°C)
- Turbidity (NTU)
- Oxidation reduction potential (ORP) (mV).

Water quality samples were collected using sampling containers prepared and provided by the National Association of Testing Authorities' accredited laboratory Australian Laboratory Services. Nitrile gloves were worn during sampling and field teams maintained best-practice protocols to assist in prevention of onsite contamination.

Water samples collected for the purpose of analysis for dissolved metals were filtered in the field through a 0.45 µm filter using a sterile syringe. Once collected, samples were immediately placed in a refrigerator or on ice, in an esky, and delivered with Chain of Custody forms to Australian Laboratory Services for analysis of the following analytes:

- Conductivity and salinity
- Total suspended solids (TSS)
- Total hardness as $CaCO_3$ (Alkalinity)
- Nutrient suite (ammonia, nitrite, nitrate, total nitrogen, total Kjeldahl nitrogen (TKN), nitrogen oxides (NO_x), reactive phosphorus (P) and total phosphorous (TP))
- Organic nitrogen
- Dissolved metals (eight metals suite: arsenic, cadmium, chromium, copper, nickel, lead, zinc and mercury)
- Polycyclic aromatic hydrocarbons (PAHs)
- Chlorophyll a.

Quality assurance and quality control measures adopted during the water quality sampling events are described in Appendix S: Surface Water Quality Technical Report.

The parameters listed above were analysed to establish a baseline of the existing water quality within the impact assessment area, against general WQOs to protect aquatic ecosystems, as indicated by EPP (Water and Wetland Biodiversity).

Field and laboratory results were compared against the WQOs presented in Table 13-3 and Table 13-4.

13.3.3.3 Timing of sampling

Eighteen surface water quality sampling events were conducted over two periods, as follows:

- Five sampling events between June 2018 and May 2019
- Thirteen sampling events between December 2020 and November 2021.

The first period of sampling was undertaken to inform the Project's draft EIS. The second period of sampling was conducted to supplement the data previously collected, with the objective of enabling interim site-specific WQOs to be derived.

The EPP (Water and Wetland Biodiversity) presents different water quality guideline values for baseflow/low-flow and high-flow conditions for some water quality parameters. Routine surface water quality monitoring events were selected in order to efficiently incorporate varying environmental conditions (expected seasonal variation) with regards to low/base-flow surface water conditions, with the expectation this will be the typical environmental conditions encountered during construction and operational works related to the Project. Additional sampling during high-flow (flood) events was conducted to determine water quality parameters under high-flow conditions and compare these to the relevant guideline level values.

The timing of field surveys for the surface water quality monitoring is provided in Table 13-6.

The *Queensland Water Quality Guidelines 2009* specify that percentile estimates for interim guidelines can be derived from eight or more samples across representative environments; as such, the eighteen data points collected over 40 months are appropriate for reliably deriving interim site-specific WQOs. Additional water quality sampling will be conducted before commencement of construction to enable full calculation of site-specific WQOs, as a revision to the interim site-specific WQOs.

TABLE 13-6 COMPLETED BASELINE WATER QUALITY MONITORING

Field survey task	Timing
Routine surface water quality field monitoring (base flow/low flow)	11 to 20 June 2018[1]
	26 November to 3 December 2018[1]
	11 to 19 February 2019
	29 April to 2 May 2019
	15 to 19 May 2019
	14 to 17 December 2020
	19 to 21 January 2021
	23 to 25 February 2021
	13 to 15 April 2021
	5 to 7 May 2021
	26 to 28 May 2021
	22 to 24 June 2021
	21 to 23 July 2021
	24 to 26 August 2021
	21 to 23 September 2021
	18 to 20 October 2021
	17 to 19 November 2021
High-flow (flood) event surface water quality field monitoring	23 to 25 March 2021

Table note:
1. Survey coupled with aquatic ecology survey

13.3.3.4 Assessment of results

Field and laboratory results were compared against relevant WQOs as presented in Section 13.2.1.

The data obtained in the field was assessed against the data obtained during the desktop assessments to supplement identified data gaps, and provide a contemporary assessment of the physical and chemical status of aquatic systems to be intersected by the Project footprint, against current WQOs.

WQOs and assessment of surface water quality monitoring results against the relevant WQOs are discussed in further detail in Section 13.4.5.

13.3.4 Modelling

As a means of verifying discharge of stormwater quality from the rail corridor, a Model for Urban Stormwater Improvement Conceptualisation (MUSIC) was undertaken. This modelling was used to compare the existing discharge conditions within the impact assessment area with the discharge conditions due to longitudinal drainage infrastructure included revised reference design.

Hydraulic modelling has been undertaken to assess potential changes to overland flow, and to identify potential impacts to adjacent environmental and land use receptors. Changes to overland flow were assessed by comparing pre- and post-development peak flows and flow hydrographs at appropriate locations (e.g. directly downstream of the footprint), and by comparing pre- and post-development flood inundation footprints. Full details are provided in Appendix T: Hydrology and Flooding Technical Report.

13.3.5 Significance impact assessment methodology

The surface water quality assessment for the Project uses a significance-based impact assessment framework to identify and assess Project-related impacts in relation to water quality receptors. The significance-based impact assessment framework is appropriate to matters where impacts cannot be quantified, and is considered appropriate for surface water.

For the purposes of the assessment, a significant impact depends on the sensitivity of the surface water value, the quality of the environment that is impacted, and upon the intensity, duration, magnitude and potential spatial extent of the potential impacts. Determination of the sensitivity or vulnerability of the surface water quality receptor and the magnitude of the potential impacts facilitate the assessment of the significance of potential impacts.
The following sections discuss and define impact magnitudes, receptor sensitivity and impact significance.

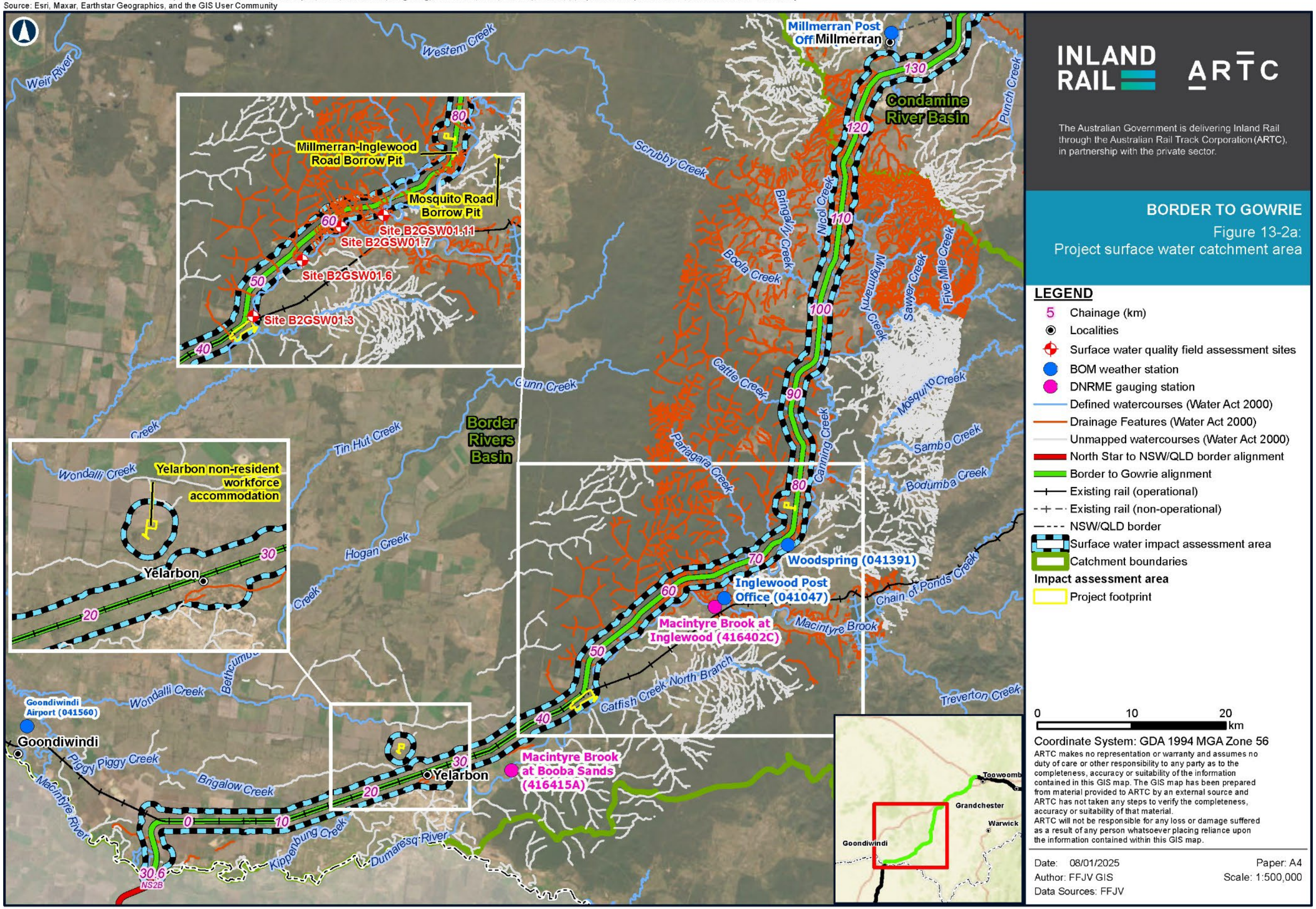
13.4 Existing environment

13.4.1 Catchment overview

The Project is located across two surface water catchment areas, the Condamine River basin and the Border Rivers basin (Figure 13-2). The Project footprint extends through the Borders Rivers basin from the NSW/QLD Border to approximately 15 km southwest of Millmerran (Ch 117.0 km). From this point, the Project footprint is located in the Condamine River basin until its northern end point at Ch 208.2 km. Agriculture is the dominant land use in both basins—specifically irrigated cropping, dryland cropping and open grazing.

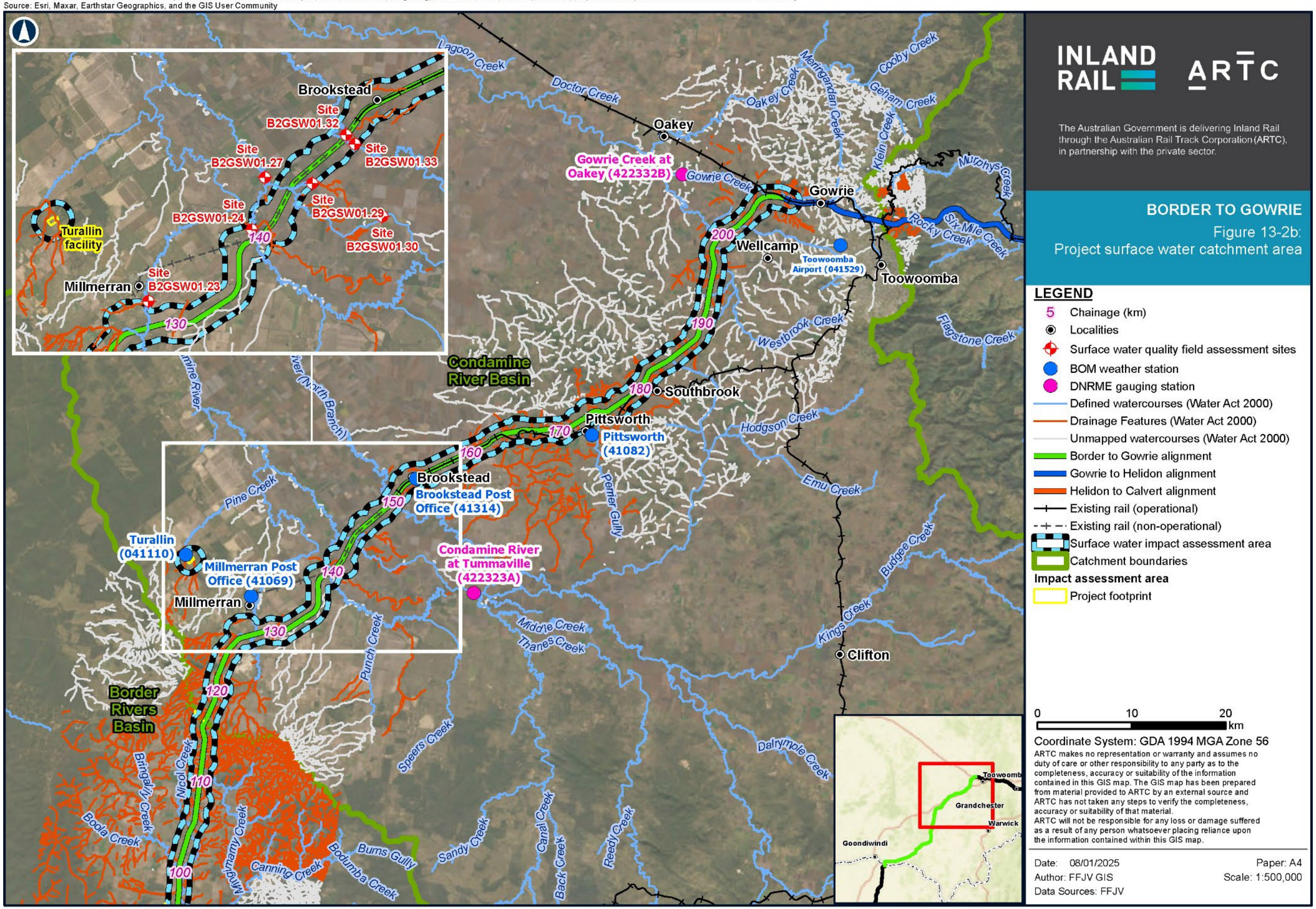
The impact assessment area features two distinct areas of high elevation along flat-to-undulating terrain, as the Project footprint passes through the floodplains of the Border Rivers and Condamine River basins (Bureau of Meteorology (BoM), 2017. The Project's lowest point of elevation occurs at the southern end of the Project footprint at the Macintyre River, with an approximate elevation of 227 m. From this point, elevation along the Project alignment increases steadily in a northward direction towards Mount Domville and Commodore Peak, south of Millmerran. The Project alignment peaks at 482 m at Ch 122.2 km as it passes through the Clontarf and Millmerran area before dropping into the Condamine River floodplain—a shallow topographical parabola between Millmerran and Yarranlea, with a low point of 377 m. From Yarranlea, the Project alignment increases in elevation until Ch 178.5 km near Southbrook, where a maximum elevation of 595 m is reached. From this high point, elevation of the Project alignment decreases to an end point, at Ch 208.2 km, of 458 m.

Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community
Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community



Map by: DTH/NCW/AWS/TM/CM Z:\GIS\GIS_310_B2G\Tasks\310-EAP-201910101214_SurfaceWaterQuality\310-EAP-201910101214_ARTC_Figure_13-2a_CatchmentArea_v9.mxd Date: 21/01/2025 07:22

Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community
Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community



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The Border Rivers basin covers approximately 23,800 square kilometres (km^2) and, in combination with the Moonie River basin, comprises approximately 12 per cent of the Queensland portion of the Murray–Darling Basin (DES, 2020). This basin resides predominantly in Queensland with a portion extending into NSW.

The Border Rivers are a network of perennial streams that rise in the western slopes of the Great Dividing Range on the Granite Belt and New England Tablelands; together, they form the headwaters of the Darling River (DES, 2020d). In Queensland, the Macintyre Brook, Severn River, Mole River and Beardy River drain from the Inglewood, Granite Belt, Tenterfield and Deep Water districts, respectively. The confluence of the Severn River and the Mole River becomes the Dumaresq River, which forms part of the border between Queensland and NSW. The Dumaresq River enters the Macintyre River above Goondiwindi and continues to form the border between the two States.

The Macintyre River flows west before reaching its confluence with the Weir River, west of Goondiwindi. The Weir River headwaters are located in the Dunmore State Forest, south-west of Cecil Plains. It is fed by a number of tributaries that drain to an area west of Millmerran and Inglewood and north of Goondiwindi. The Weir River flows in a southwest direction and combines with the Macintyre River, north of Mungindi, where it becomes the Barwon River (DES, 2020e).

The Condamine River basin covers approximately 25,440 km^2 and comprises approximately 9 per cent of the Queensland Murray–Darling Basin (DES, 2019a). The Condamine River basin forms part of the headwaters of the Murray–Darling Basin river system that flows through the southern states.

The main channel in this basin begins in the headwaters of the Condamine River, near Warwick. This is within the Main Range National Park. The Condamine River flows northwest until around Brigalow, where the river turns west and crosses into the Maranoa and Balonne River basin. It then becomes the Balonne River between the town of Condamine and Surat, and eventually discharges into the NSW intersecting streams. Tributaries of the Condamine River include Emu Creek, Glengallan Creek, Hodgson Creek, Oakey Creek, Wilkie Creek and Charleys Creek.

The major water storages in the Queensland Border River basin are Glenlyon Dam (capacity 254 gigalitres) and Coolmunda Dam (capacity 69 gigalitres), which are approximately 68 km and 10 km from the Project footprint, respectively (direct linear distance). The major water storage in the Condamine River basin is Leslie Dam, with a capacity of 106 gigalitres, which is located approximately 72 km east of the Project footprint (direct linear distance). Additionally, smaller water storages are present for the management of supplemented and non-supplemented (regulated or natural) flow for irrigation, stock and domestic uses throughout the catchment (DES, 2019b).

13.4.1.1 Climate

The Köppen climate classification system indicates that the impact assessment area falls within the Cfa—Humid Subtropical Climate region, which is characterised by hot and humid summers, and mild winters. A review of BoM climate data of relevance to surface water conditions within the impact assessment area was undertaken to validate this classification and to establish an appreciation of location-specific conditions. This climatic data was sourced from several representative BoM monitoring stations within or closest to the impact assessment area, as identified in Table 13-7.

Table 13-7 summarises the recorded rainfall data for eight BoM weather stations closest to the impact assessment area. The data shows that the region receives its heaviest rainfall in summer, with the highest recorded single rainfall event occurring in January 2010, with 433.6 millimetres (mm). During the winter months, the area predominantly receives low-to-no rainfall (BoM, 2022a).

TABLE 13-7 WEATHER STATIONS WITHIN THE IMPACT ASSESSMENT AREA AND ASSOCIATED RAINFALL DATA

Station number	Name	Locality (distance (km) from footprint)	Operation date	Annual rainfall average (mm)	Month of highest average rainfall/ amount (mm)	Month of lowest average rainfall/ amount (mm)
041391	Woodspring	Woodspring (~5)	1954 to 2022	631.6	Dec (91.1)	Jun (29.1)
041047	Inglewood Post Office	Inglewood (~2)	1883 to 2022	652.7	Jan (83.8)	Aug (32.4)
41069	Millmerran Post Office	Millmerran (~2)	1900 to 2014	662.6	Jan (88.8)	Aug (30.9)
041110	Turallin	Turallin (~10)	1909 to 2015	648.5	Jan (91.1)	Sep (31.5)
41314	Brookstead Post Office	Brookstead (<1)	1958 to 2022	643.3	Dec (101.7)	Jun (28.2)
41082	Pittsworth	Pittsworth (~1)	1886 to 2022	692.9	Dec (97.8)	Aug (30.3)
041529	Toowoomba Airport	Toowoomba (~8)	1996 to 2022	709.0	Feb (111.3)	Apr (26.7)
041560[a]	Goondiwindi Airport	Goondiwindi	2020 to 2022	943.8	Nov (228.0)	Sep (3.6)

Source: BoM (2022)

Table note:

a Goondiwindi Airport weather station has only recorded 18 months of data to June 2022.

Other key climatic characteristics of the impact assessment area are as follows:

- Annual rainfall across the Border Rivers basin decreases along an east–west gradient from over 1,000 mm in the eastern ranges around the Great Dividing Range to around 500 mm in the west (BoM, 2019)
- The Condamine River basin is characterised by high annual rainfall of around 600 to 800 mm in the upper reaches in the east, and low annual rainfall of around 300 to 500 mm in the lower reaches on the floodplains of the Darling Downs in the west (BoM, 2022a)
- Tropical cyclones can impact on the impact assessment area, especially the headwaters of the Condamine River basin. The most recent tropical cyclone to have impacted the impact assessment area was the resulting sub-tropical system from tropical cyclone Seth, which produced extreme rainfall in Southern Queensland.
- Long-term average rainfall varies from around 702 mm/annum in the north-eastern part of the impact assessment area, in Toowoomba, to around 652 mm/annum in the southwestern part, in Inglewood (BoM, 2022a)
- Rates of evaporation are typically higher in the summer months, where the mean average evaporation rate was 7.8 mm compared to the winter months, where the mean evaporation rate was 2.7 mm
- Mean maximum monthly temperatures range from 33.9°C in the summer to 3.8°C in the winter (BoM, 2022a).

13.4.1.2 Defined watercourses, waterways and waterbodies

Watercourses

Watercourses are defined under Section 5 of the Water Act for the purposes of administering that Act, as a river, creek or other stream, which includes a stream in the form of an anabranch or a tributary where water flows either permanently or intermittently, regardless of flow frequency; however, a watercourse does not include a drainage feature, or any section of a feature that has a tidal influence or is upstream or downstream from a defined limit between potential estuarine and fresh water (Queensland Government, 2014).

There are 18 defined watercourses within the impact assessment area that are listed below and shown on Figure 13-3. Where the watercourse is intersected by the Project footprint, the approximate chainage is given:

- Macintyre River — at Ch 30.6 km NS2B
- Macintyre Brook
- Canning Creek
- Pariagara Creek — at Ch 67.3 km
- Cattle Creek — at Ch 88.2 km
- Bringalily Creek — at Ch 100.6 km
- Nicol Creek — at Ch 104.4 km
- Back Creek un-named tributary — at Ch 126.9 km
- Back Creek — Ch 128.0 km
- Grasstree Creek — at Ch 139.9 km
- Condamine River (Main Branch) — at Ch 144.2 km
- Condamine River (North Branch) — at Ch 149.9 km
- Umbiram Creek unnamed tributary — at Ch 184.89 km
- Half Mile Gully — Ch 190.0 km
- One Mile Gully — Ch 193.1 km
- Westbrook Creek — at Ch 198.5 km
- Dry Creek — at Ch 199.3 km
- Gowrie Creek.

Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community
Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

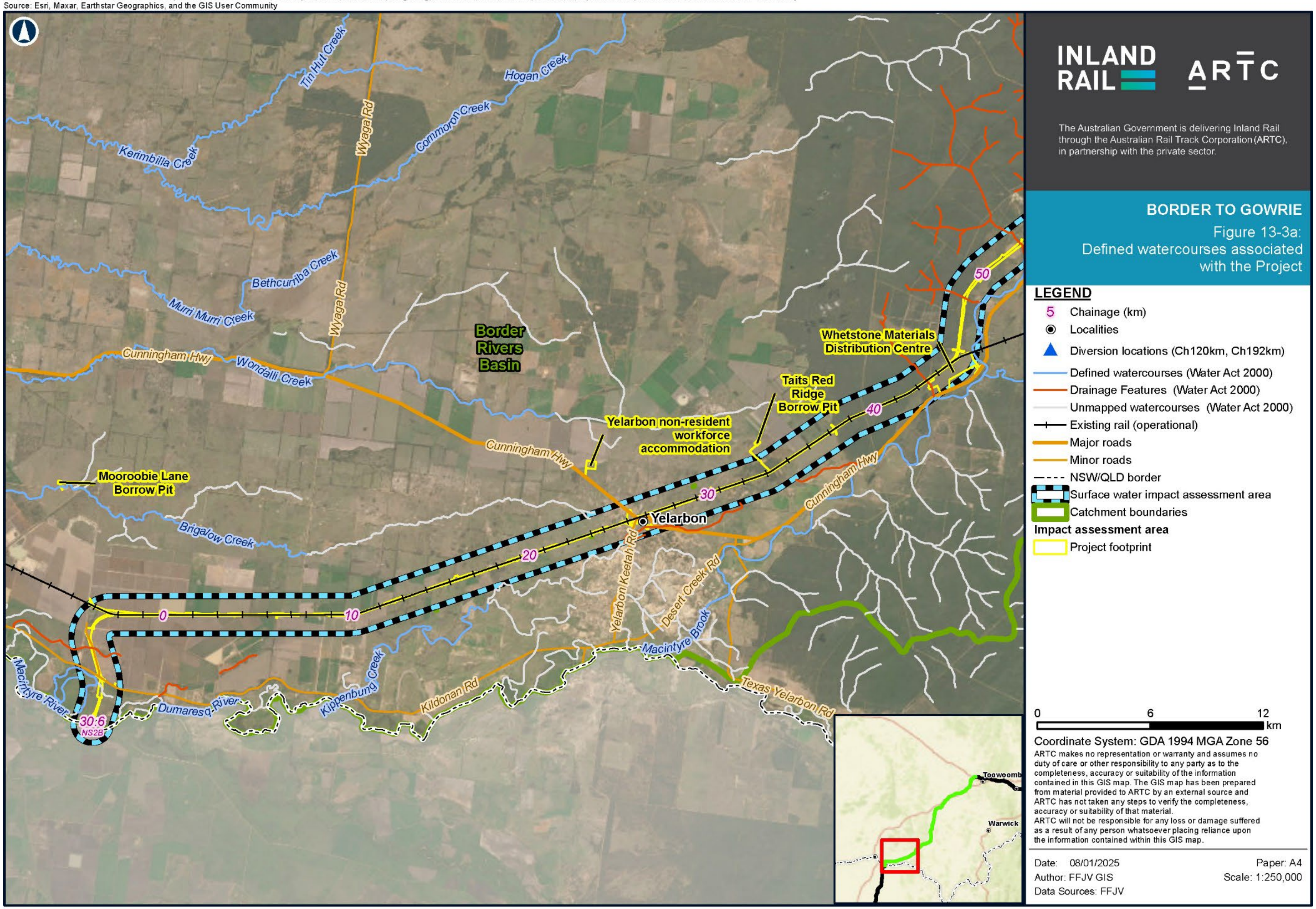

Figure 13-3a: Defined watercourses associated with the Project

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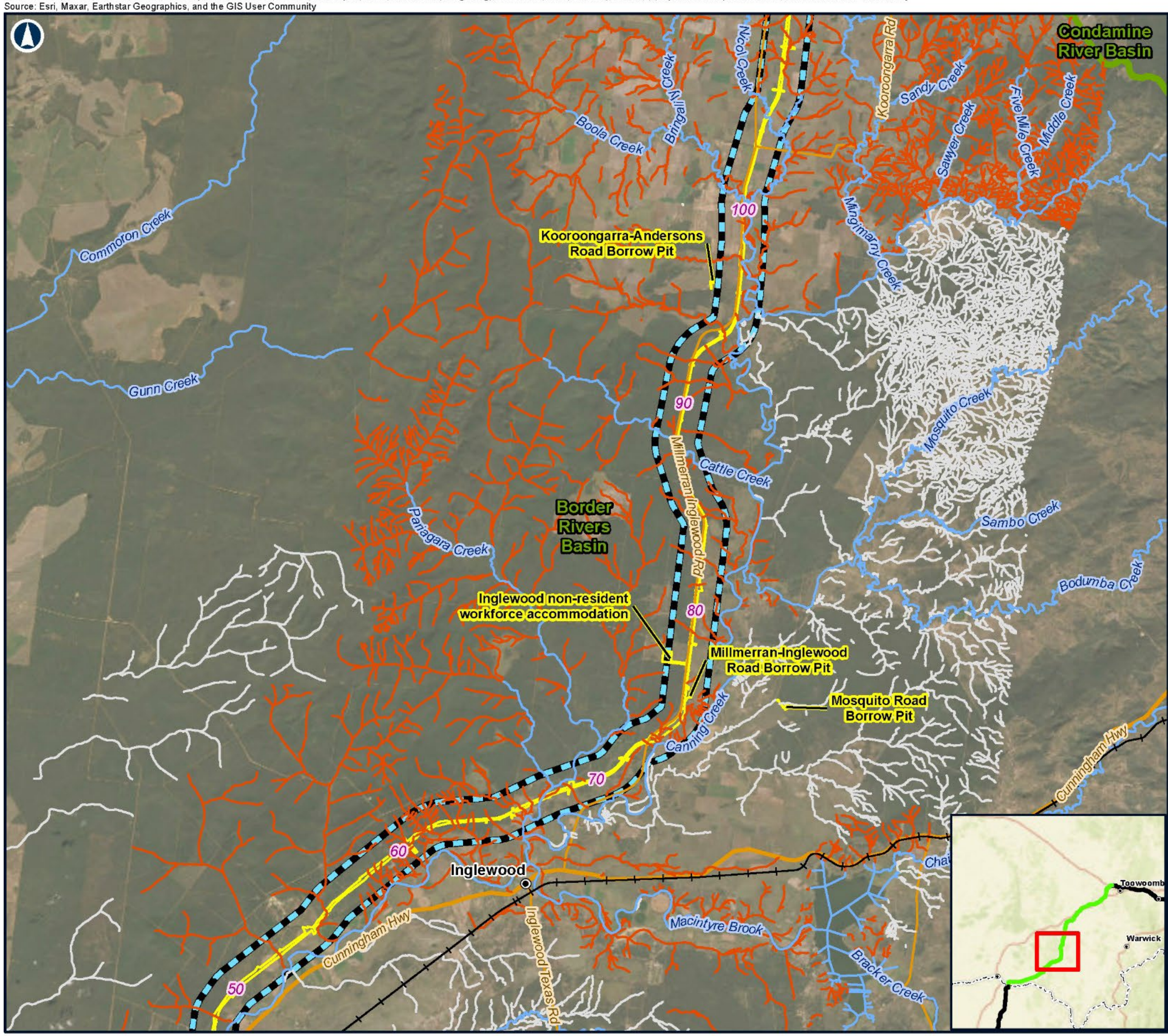
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community
Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community



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BORDER TO GOWRIE

Figure 13-3b: Defined watercourses associated with the Project

LEGEND

- 5 Chainage (km)
- Localities
- Diversion locations (Ch120km, Ch192km)
- Defined watercourses (Water Act 2000)
- Drainage Features (Water Act 2000)
- Unmapped watercourses (Water Act 2000)
- Existing rail (operational)
- Major roads
- Minor roads
- Surface water impact assessment area
- Catchment boundaries

Impact assessment area

- Project footprint

0 6 12 km

Coordinate System: GDA 1994 MGA Zone 56

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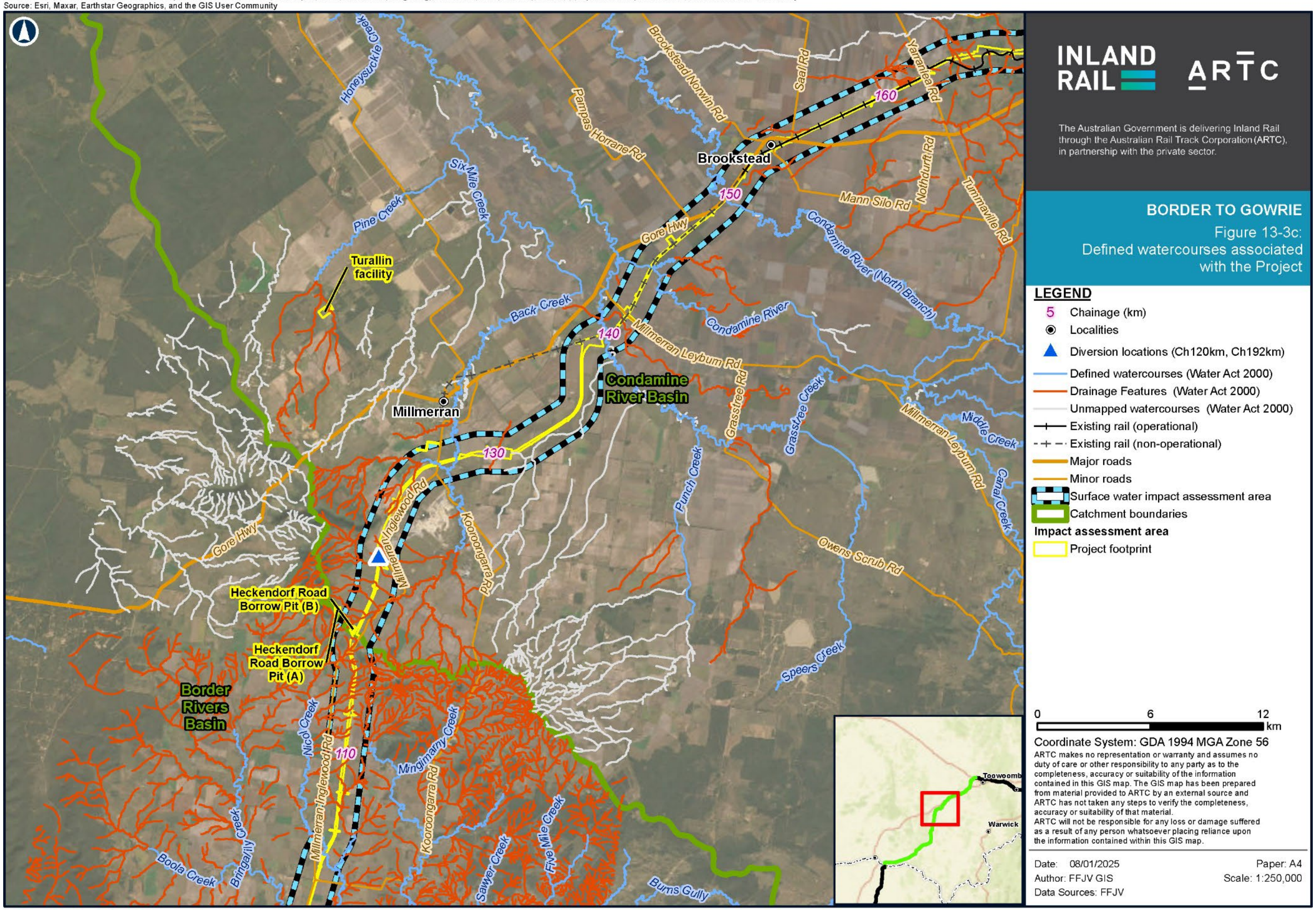

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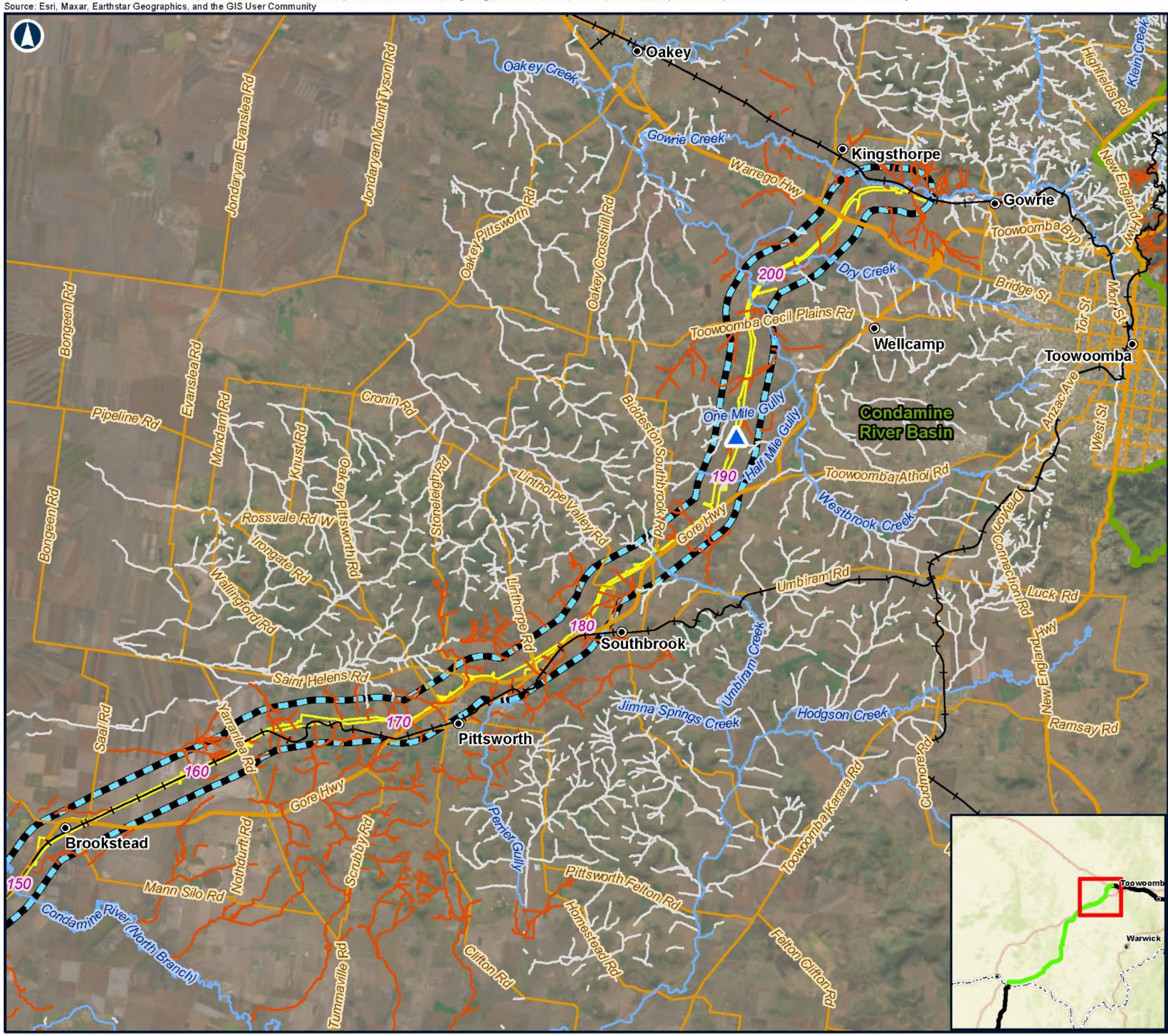

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BORDER TO GOWRIE

Figure 13-3d:
Defined watercourses associated with the Project

LEGEND

- 5 Chainage (km)
- Localities
- Diversion locations (Ch120km, Ch192km)
- Defined watercourses (Water Act 2000)
- Drainage Features (Water Act 2000)
- Unmapped watercourses (Water Act 2000)
- Existing rail (operational)
- Existing rail (non-operational)
- Major roads
- Minor roads
- Surface water impact assessment area
- Catchment boundaries

Impact assessment area

- Project footprint

0 6 12 km

Coordinate System: GDA 1994 MGA Zone 56

Date: 08/01/2025
Author: FFJV GIS
Data Sources: FFJV
Paper: A4
Scale: 1:250,000

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Defined watercourses within the impact assessment area have been identified in reference to the Department of Regional Development, Manufacturing and Water's (DRDMW) *Water identification map—watercourses Queensland,* last published 2 April 2022 (DRDMW). One unmapped water feature was noted from the current impact area. The feature was an upstream reach of Pine Creek, a section of which occurred within the Turallin facility footprint. Determination by DRDMW (in August 2023) confirmed this reach of Pine Creek as a drainage feature under the Water Act.

Waterways for waterway barrier works

Waterways are defined under the Fisheries Act for the purposes of administering that act, and include a river, creek, stream, watercourse or inlet of the sea. The definition includes freshwater and tidal waters, both permanent and ephemeral waterways, and includes drainage features. It also includes channels along which fish are expected to move if they connect isolated waterbodies to defined waterways during times of flow; however, it does not include isolated waterbodies where no connectivity is available.

A review of the DAF *Queensland Waterways For Waterway Barrier Works* (2021) mapping was undertaken, identifying a total of 100 intersections of waterways for waterway barrier works with the Project footprint, in multiple locations.

Under the Fisheries Act, waterways can be classed as one of five different colours that represent the level of risk waterway barrier works impact on fish passage. The Project does not impact any tidal waterways (grey colour). The levels of risk are as follows:

- Purple — major impact
- Red — high impact
- Amber — moderate impact
- Green — low impact
- Grey — tidal waterways, major impact.

The revised reference design includes full-width crossings of 19 major waterways (stream order ≥ 3) and 81 minor waterways (stream order < 3).

Waterways for waterway barrier works are regulated under the Fisheries Act and the Planning Act when barriers to fish movement, including partial barriers, are installed across waterways. Barrier works include construction, raising, replacement and some maintenance works on structures such as culverts, crossings, bed-level and low-level crossings, weirs and dams, both permanent and temporary. In addition to affecting connectivity for aquatic fauna, water quality risk to species is considered with waterway barrier works due to the potential impact it may have on water passage. Barrier works applicable to the Project include the construction of culverts, crossings both temporary and permanent, as well as works that interfere with waterway banks and beds.

Appendix S: Surface Water Quality Technical Report provides more detail on the water quality and condition of some of these waterways.

Waterways for waterway barrier works are intersected by the Project footprint at 100 locations. These locations and corresponding chainages are presented in Table 13-8.

TABLE 13-8 WATERWAYS FOR WATERWAY BARRIER WORKS THAT ARE INTERSECTED BY THE PROJECT FOOTPRINT

Waterway impact risk (DAF)	Waterway and approximate chainage of intersection (km)
Purple	▸ Un-named tributary of Macintyre Brook (Ch 55.6 km) ▸ Pariagara Creek (Ch 67.3 km) ▸ Unnamed tributary of Pariagara Creek (Ch 67.3 km) ▸ Bringalily Creek (Ch 100.6 km) ▸ Nicol Creek (Ch 104.4 km) ▸ Back Creek (Ch 128.0 km) ▸ Grasstree Creek (Ch 139.9 km) ▸ Condamine River (Ch 144.2 km) ▸ Condamine River (North Branch) (Ch 150.0 km) ▸ Westbrook Creek drainage feature (Ch 198.5 km)

Waterway impact risk (DAF)	Waterway and approximate chainage of intersection (km)
Red	▸ Un-named tributary of Macintyre Brook (Ch 52.6 km) ▸ Cattle Creek (Ch 88.2 km) ▸ Native Dog Creek (Ch 93.9 km) ▸ Back Creek (Ch 97.6 km) ▸ Un-named tributary of Back Creek (Ch 120.3 km) ▸ Un-named tributary of Back Creek (Ch 127.0 km) ▸ One Mile Gully (tributary of Westbrook Creek) (Ch 193.1 km) ▸ Four Mile Gully (tributary of Westbrook Creek) (Ch 197.4 km) ▸ Dry Creek drainage feature (Ch 199. km)
Amber	▸ Un-named tributary of Macintyre Brook (Ch 48.4 km, Ch 60.5 km, Ch 61.9 km Ch 63.1 km) ▸ Un-named tributary of Pariagara Creek (Ch 66.2 km) ▸ Un-named tributary of Canning Creek (Ch 91.0 km) ▸ Un-named tributary of Nicol Creek (Ch 109.4 km Ch 114.4 km) ▸ Un-named tributary of Grasstree Creek (Ch 141.0 km) ▸ Un-named drainage feature (Ch 160.0 km) ▸ Un-named tributary of Umbiram Creek (Ch 184.9 km, Ch 187.2 km) ▸ Half Mile Creek (Ch 190.0 km) ▸ Un-named tributary of Westbrook Creek (Ch 194.7 km) ▸ Un-named tributary of Pine Creek near Turallin Facility
Green	▸ Un-named tributary of Macintyre Brook (Ch 43.2 km (Also crosses Whetstone Material Distribution Centre), Ch 58.2 km, Ch 59.0 km, Ch 59.6 km, Ch 61.6 km, Ch 62.9 km, Ch 63.9 km) ▸ Un-named tributary of Pariagara Creek (Ch 64.7 km, Ch 66.8 km, Ch 67.55 km, Ch 67.56 km, Ch 68.0 km, Ch 68.7 km) ▸ Un-named tributary of Canning Creek (Ch 73.7 km, Ch 78.9 km, Ch 80.0 km, Ch 81.1 km, Ch 82.3 km, Ch 84.4 km, Ch 85.4 km) ▸ Un-named tributary of Cattle Creek (Ch 87.4 km) ▸ Un-named tributary of Canning Creek (Ch 92.1 km, Ch 92.9 km) ▸ Un-named tributary of Nicol Creek (Ch 107.2 km, Ch 108.5 km Ch 110.9 km, Ch 111.3 km, Ch 111.9 km) ▸ Un-named drainage feature (Ch 112.3 km, Ch 113.0 km) ▸ Un-named tributary of Nicol Creek (Ch 113.3 km, Ch 114.9 km, Ch 115.5 km, Ch 115.6 km, Ch 116.2 km) ▸ Un-named tributary of Leonard (Back Creek) Gully (Ch 117.4 km) ▸ Back Creek (Ch 117.6 km) ▸ Un-named tributary of Back Creek (Ch 118.4 km, 119.4 km, Ch 120.8 km, Ch 121.4 km, Ch 124.3 km, Ch 124.4 km, Ch 125.5 km) ▸ Un-named drainage feature (Ch 130.2 km) ▸ Un-named drainage feature (Ch 162.2 km, Ch 162.8 km) ▸ Un-named tributary of Fourteen Mile Creek (Ch 164.2 km, Ch 164.4 km, Ch 165.1 km, Ch 168.6 km, Ch 169.9 km, Ch 170.6 km, Ch 171.9 km, Ch 172.2 km, Ch 173.6 km) ▸ Un-named tributary of Perrier Gully (Ch 176.9 km, Ch 177.7 km, Ch 178.7 km) ▸ Un-named tributary of Umbiram Creek (Ch 181.1 km, Ch 181.8 km, Ch 182.9 km) ▸ Umbiram Creek (Ch 186.2 km) ▸ Un-named tributary of One Mile Gully (Ch 191.9 km) ▸ Un-named tributary of Four Mile Gully (Ch 197.9 km) ▸ Un-named tributary of Dry Creek (Ch 202.8 km).

Artificial/constructed waterbodies

In addition to the naturally occurring water sources, there are a number of smaller artificial/constructed waterbodies located within the impact assessment area that are intersected by the Project footprint. These artificial/constructed waterbodies are predominantly private farm dams used for agricultural purposes, and typically occur along unnamed drainage features. Table 13-9 identifies artificial waterbodies that are intersected by the Project footprint.

TABLE 13-9 ARTIFICIAL WATERBODIES INTERSECTED BY THE PROJECT FOOTPRINT

Artificial waterbody (approximate chainage)	Associated waterway
Ch 9.70 km	Un-named drainage feature of Dumaresq River
Ch 16.85 km	Un-named drainage feature of Dumaresq River
Ch 17.30 km	Un-named drainage feature of Dumaresq River
Ch 21.05 km	Un-named drainage feature of Dumaresq River
Ch 25.85 km	Un-named drainage feature of Dumaresq River
Ch 54.4 km	Un-named drainage feature of Macintyre Brook
Ch 54.80 km	Un-named drainage feature of Macintyre Brook
Ch 55.50 km	Un-named drainage feature of Macintyre Brook
Ch 60.60 km	Un-named drainage feature of Macintyre Brook
Ch 66.85 km	Pariagara Creek
Ch 72.90 km	Un-named drainage feature of Canning Creek
Ch 74.05 km	Un-named drainage feature of Canning Creek
Ch 75.45 km	Un-named drainage feature of Canning Creek
Ch 75.60 km	Un-named drainage feature of Canning Creek
Ch 76.45 km	Un-named drainage feature of Canning Creek
Ch 77.20 km	Un-named drainage feature of Canning Creek
Ch 77.80 km	Un-named drainage feature of Canning Creek
Ch 79.50 km	Un-named drainage feature of Canning Creek
Ch 81.20 km	Un-named drainage feature of Canning Creek
Ch 81.65 km	Un-named drainage feature of Canning Creek
Ch 82.20 km	Un-named drainage feature of Canning Creek
Ch 82.40 km	Un-named drainage feature of Canning Creek
Ch 83.20 km	Un-named drainage feature of Canning Creek
Ch 83.60 km	Un-named drainage feature of Canning Creek
Ch 84.00 km	Un-named drainage feature of Canning Creek
Ch 85.00 km	Un-named drainage feature of Canning Creek
Ch 86.40 km	Un-named drainage feature of Canning Creek
Ch 88.20 km	Cattle Creek
Ch 92.10 km	Native Dog Creek
Ch 98.20 km	Back Creek
Ch 99.80 km	Named drainage feature of Canning Creek
Ch 100.00 km	Named drainage feature of Canning Creek
Ch 101.20 km	Bringalily Creek
Ch 104.40 km	Nicol Creek
Ch 106.80 km	Named drainage feature of Canning Creek
Ch 117.40 km	Back Creek
Ch 121.40 km	Back Creek
Ch 123.30 km	Back Creek
Ch 124.00 km	Un-named drainage feature of Back Creek
Ch 126.80 km	Back Creek drainage feature
Ch 133.50 km	Un-named drainage feature of Grasstree Creek
Ch 135.40 km	Un-named drainage feature of Grasstree Creek
Ch 135.60 km	Un-named drainage feature of Grasstree Creek
Ch 139.70 km	Un-named drainage feature of Grasstree Creek
Ch 141.0 km	Un-named tributary to Grasstree Creek
Ch 160.40 km	Un-named drainage feature of Condamine River (North Branch)

Artificial waterbody (approximate chainage)	Associated waterway
Ch 163.20 km	Un-named drainage feature of Condamine River (North Branch)
Ch 168.90 km	Named drainage feature of Condamine River (North Branch)
Ch 169.90 km	Named drainage feature of Condamine River (North Branch)
Ch 170.90 km	Named drainage feature of Condamine River (North Branch)
Ch 174.10 km	Named drainage feature of Condamine River (North Branch)
Ch 174.30 km	Un-named drainage feature of Spring Creek
Ch 175.90 km	Un-named drainage feature of Spring Creek
Ch 177.20 km	Un-named drainage feature of Spring Creek
Ch 179.40 km	Un-named drainage feature of Spring Creek
Ch 180.60 km	Un-named drainage feature of Umbiram Creek
Ch 183.30 km	Un-named drainage feature of Umbiram Creek
Ch 188.60 km	Un-named drainage feature of Westbrook Creek
Ch 188.80 km	Un-named drainage feature of Westbrook Creek
Ch 193.70 km	Un-named drainage feature of Westbrook Creek
Ch 195.00 km	Un-named drainage feature of Westbrook Creek

The aquatic conservation assessment using the Aquatic Biodiversity Assessment Mapping Method (AquaBAMM) assesses the conservation and ecological value of wetland systems based on a series of national and international criteria, including naturalness (aquatic and catchment), diversity and richness, threatened species/ecosystems, priority species/ecosystems, special features, connectivity and representativeness (Clayton et al., 2006).

AquaBAMM provides an overall conservation value (Aquascore), ranging from very low to very high, for each spatial unit (e.g. wetland), which is based on eight separate criteria. Each criterion value is formed through a mathematical combination of measures and indicators. This scoring was used to provide a verification of management intentions for aquatic environments within the Project footprint, specifically in relation to surface water features that intersected the impact assessment area.

The results of an Aquascore riverine assessment against each water quality monitoring site are presented Table 13-10. The majority of water quality monitoring sites scored a moderate or above, indicating a moderate environmental condition.

TABLE 13-10 AQUASCORE FOR ALL WATER QUALITY MONITORING SITES

Aquascore	Monitoring site
Very low	-
Low	16, 27
Medium	18, 20R, 23, 24, 32, 33, 39, 40, 42
High	14
Very high	2, 2R, 3, 6, 7, 11, 29, 30

Source: State of Queensland (2020)

13.4.1.3 Licenced water users

Within the impact assessment area, licenced water usage is comprised of recreational, commercial and domestic uses (Table 13-11). The catchments provide hydrological flow into the Murray–Darling Basin, contributing to the availability of water for water harvesting practices (DES, 2019b; 2020c). The review of water allocation licence data was obtained for 2023 water access and are relevant only to properties whose licences intersect the impact assessment area. The search for water allocations is limited to this area as identified impacts to water quality would be expected to primarily impact these users.

Within the impact assessment area, water allocation licence data indicates that there are few allocations of surface water, and limited surface water is used for irrigation; however, groundwater is the predominant water supply for irrigation and stock watering. Many of the surface water licences are associated with channel diversions or impoundments. Data from DRDMW (2023) showing water licences is presented in Table 13-11.

TABLE 13-11 SUMMARY OF 2018–2019 WATER LICENCE DATA FOR MAJOR WATERCOURSES

Water source	No. of water licences issued and current	Water made available (ML/year)
Canning Creek (surface water source)	11	(4 ha of irrigation*)
Canning Creek (alluvial aquifer)	3	75
Condamine River (surface water source)	1	N/A
Condamine River (alluvial aquifer)	1	74
Condamine River – North Branch (surface water source)	1	N/A
Condamine River – North Branch (alluvial aquifer)	3	19,690
Dry Creek (alluvial aquifer)	5	252
Macintyre Brook (surface water source)	3	N/A
Macintyre Brook (alluvial aquifer)	2	193
Macintyre River (surface water source)	2	N/A
Macintyre River (alluvial aquifer)	1	10
Westbrook Creek (surface water source)	1	N/A
Westbrook Creek (alluvial aquifer)	17	1,560
Other surface water sources	10	(12 ha of irrigation*)
Other alluvial aquifers	27	6,531

Source: DRDMW (2023c)

Table note:
*** Older water licences were based on irrigable area**
ML/year = megalitres per year
N/A = Not Applicable

Consultation with potential water suppliers to gauge in-principle interest in providing water for the Project has occurred. ARTC is committed to ongoing consultation with all potential suppliers (e.g. DRDMW, Sunwater) to confirm the ability to source water from any identified (and agreeable) licensed private water sources (e.g. in the instance the allocation type requires modification).

DRDMW maintains *Exemption requirements for construction authorities for the take of water without a water entitlement* (DNRME, 2021). These exemption requirements may only be used by a constructing authority defined under Schedule 2 of the *Acquisition of Land Act 1967* (Qld), and includes state government departments and local governments.

If an exemption does not apply to ARTC, a Temporary Water permit would be required before taking any water for construction purposes. Given the range of construction activities, the water quality requirements will range from potable to non-potable water sources. Opportunities may exist for construction water to be sourced from recycled water. Construction water will only be obtained from existing licensed sources, within the limits of applicable allocations or entitlements. Additionally, no water will be sourced from potable networks or surface water storages that are managed by Toowoomba Regional Council (TRC) or Goondiwindi Regional Council (GRC). ARTC will not interfere with any existing commercial arrangements for the access to and/or sale of water between water entitlement holders and other end users. Consultation with potential water suppliers and/or water entitlement holders for construction water purposes will continue during the detailed design process.

13.4.1.4 Sensitive environmental areas

This section provides a summary of sensitive environmental areas that occur within the impact assessment area. These sensitive environmental areas are wetland areas, identified fish habitat and groundwater-dependent ecosystems within receiving waters. Additionally, the endangered aquatic ecological community, Lowland Darling River Aquatic Ecological Community, is known to occur within the NSW Border Rivers basin. This basin includes the Macintyre River, which is recognised as a high sensitivity receptor due to the presence of the Lowland Darling River Aquatic Ecological Community.

Wetlands

There are no wetlands of international importance (Ramsar wetlands) within 10 km of the impact assessment area.

The *Map of Queensland wetland environmental values* (DES, 2020f) identifies multiple palustrine (non-riverine) wetlands along the Project footprint, which are also recognised as high ecological significance (HES) under the EPP (Water and Wetland Biodiversity). The HES wetlands within the impact assessment area are associated with Brigalow Creek, Canning Creek and the Condamine River, and were classified as high sensitivity water quality receptors (Section 13.4.4). Potential impacts and mitigation measures for wetlands and other receptors are described in Sections 13.5 and 13.6. The HES wetlands are considered a matter of state environmental significance (MSES) under the Planning Act. Further assessment of wetland values identified as MSES is provided in Chapter 11: Flora and Fauna and Appendix L: Terrestrial and Aquatic Ecology Technical Report.

Fish habitat

There are no declared fish habitat areas mapped within the impact assessment area.

Groundwater dependent ecosystems

Groundwater dependent ecosystems (GDEs) are ecosystems that require access to groundwater on a permanent or periodic basis to meet all or some of their water requirements, to maintain their communities of plants and animals, ecological processes and ecosystem services (DES, 2014).

Aquatic groundwater dependent ecosystems

A review of Chapter 15: Groundwater and Appendix L: Terrestrial and Aquatic Ecology Technical Report indicates no high potential aquatic GDEs were located within 5 km of the Project footprint. Areas where potential aquatic GDEs are identified within 5 km include:

- Between NS2B Ch 30.6 km and Ch 20.0 km the Project passes numerous low potential aquatic GDEs associated with the Macintyre River and associated tributaries
- Between Ch 40.0 km and Ch 95.0 km, the Project crosses numerous un-named tributaries associated with Macintyre Brook and Canning Creek. These drainage features have been assigned a moderate aquatic GDE potential
- Un-named creeks and tributaries between Ch 115.0 km to Ch 125.0 km (south-west of Millmerran) inferred to be associated with Bora Creek, located east of the groundwater impact assessment area, and have been assigned a moderate potential for aquatic GDEs
- The Condamine River, which the Project footprint crosses near Ch 139.5 km, is considered to have a low potential for aquatic GDEs. The Condamine River North branch is not considered to support aquatic GDEs
- Low-to-moderate potential for aquatic GDEs are mapped between Ch 165.0 km to Ch 185.0 km
- Low-to-moderate potential for aquatic GDEs are mapped between Ch 197.0 km and Ch 200.0 km associated with Gowrie Creek.

Terrestrial groundwater dependent ecosystems

Areas where terrestrial GDEs are identified by BoM’s GDE Atlas within 5 km of the Project footprint include:

- One high potential terrestrial GDE is crossed by the Project footprint between Ch 24.4 km and Ch 26.8 km, near Yelarbon. This GDE is associated with the alkaline landscape of the Yelarbon Desert sandy plains (Department of Science, Information Technology and Innovation, 2017). This GDE is recognised under *Water Plan (Great Artesian Basin and Other Regional Aquifers) 2017* as a GDE Area. The Yelarbon Desert GDE has not yet been attributed a source aquifer.
- Broad areas of moderate potential for terrestrial GDEs occur between Ch 33.0 km and Ch 95.0 km. These areas are characterised to have intermittent connection to brackish aquifers associated with sandy plains and shallow alluvium (Department of Science, Information Technology and Innovation, (DSITI), 2017).
- Irregular areas of moderate potential for terrestrial GDEs are crossed by and surround the Project footprint between Ch 165.0 km to Ch 196.0 km. These GDEs are associated with fractured-rock aquifers of the Main Range Volcanics (MRV) geotechnical unit, which may provide an intermittent connection to these ecosystems.

Springs

A spring is a hydrogeological feature that occurs due to natural groundwater discharge and may be classed as having a permanent or non-permanent (ephemeral) saturation regime. GDEs may in turn be associated with the expression of groundwater in a spring. A total of nine springs are identified within a 20 km distance from the Project footprint (Table 13-12). The groundwater impact assessment area for springs was expanded significantly, as a conservative measure, as it is recognised that hydraulic connectivity between a source aquifer and spring may be expansive.

TABLE 13-12 SUMMARY OF SPRINGS WITHIN 20 KM OF THE PROJECT FOOTPRINT

Spring name/site #	Distance from footprint (km)	Direction from footprint	Spring type	Source aquifer
Stone Spring/1145	2.1	NW of Ch 173.7 km	Active and non-permanent	MRV
Jimna Springs/1147	5.0	SE of Ch 179.5 km		MRV
Springside/1146	5.5	N of Ch 166.9km		MRV
Wellcamp Spring/1150	7.2	E of Ch 201.9 km		MRV
Leigh Spring/1144	8.7	NW of Ch 174.0 km		MRV
Eustondale Spring/1154	10.4	E of Ch 208.2 km		MRV
Lockyer Creek Spring/1382	23.7	E of Ch 208.2 km		MRV
Helidon Spring/1504	26.7	E of Ch 208.2 km		MRV
Kearneys Spring/1139	14.8	E of Ch 208.2 km	Active—Permanent	MRV

Source: Department of Science, Information Technology and Innovation (2020)

13.4.1.5 Salinity hazard and risk

Existing salinity expressions within the impact assessment area and the potential for new expressions of salinity have been assessed in Chapter 9: Land Resources, in reference to published literature and the results of soil sample analysis as part of geotechnical investigations for the Project.

A targeted salinity hazard assessment (Chapter 9: Land Resources) has been undertaken in accordance with Part B of the *Salinity Management Handbook* (Department of Environment and Resource Management, 2011). In undertaking the salinity hazard assessment, potential impacts of the Project on hydrology were considered on a sub-catchment level. The assessment concluded that sub-catchments within the impact assessment area have either a moderate or high mean salinity hazard rating. Salinity hazard ratings for areas associated with the Project footprint are presented in Figure 13-4.

Two salinity risk assessments have previously been undertaken within the impact assessment area. The *Salinity Risk Assessment for the Queensland Murray–Darling Region* (Biggs et al., 2010b) provides coverage of the impact assessment area between the Macintyre River and east of Millmerran State Forest, and the *Strategic Salinity Risk Assessment in the Condamine Catchment* (Searle et al., 2007) provides coverage of the impact assessment area from east of Millmerran State Forest to Gowrie.

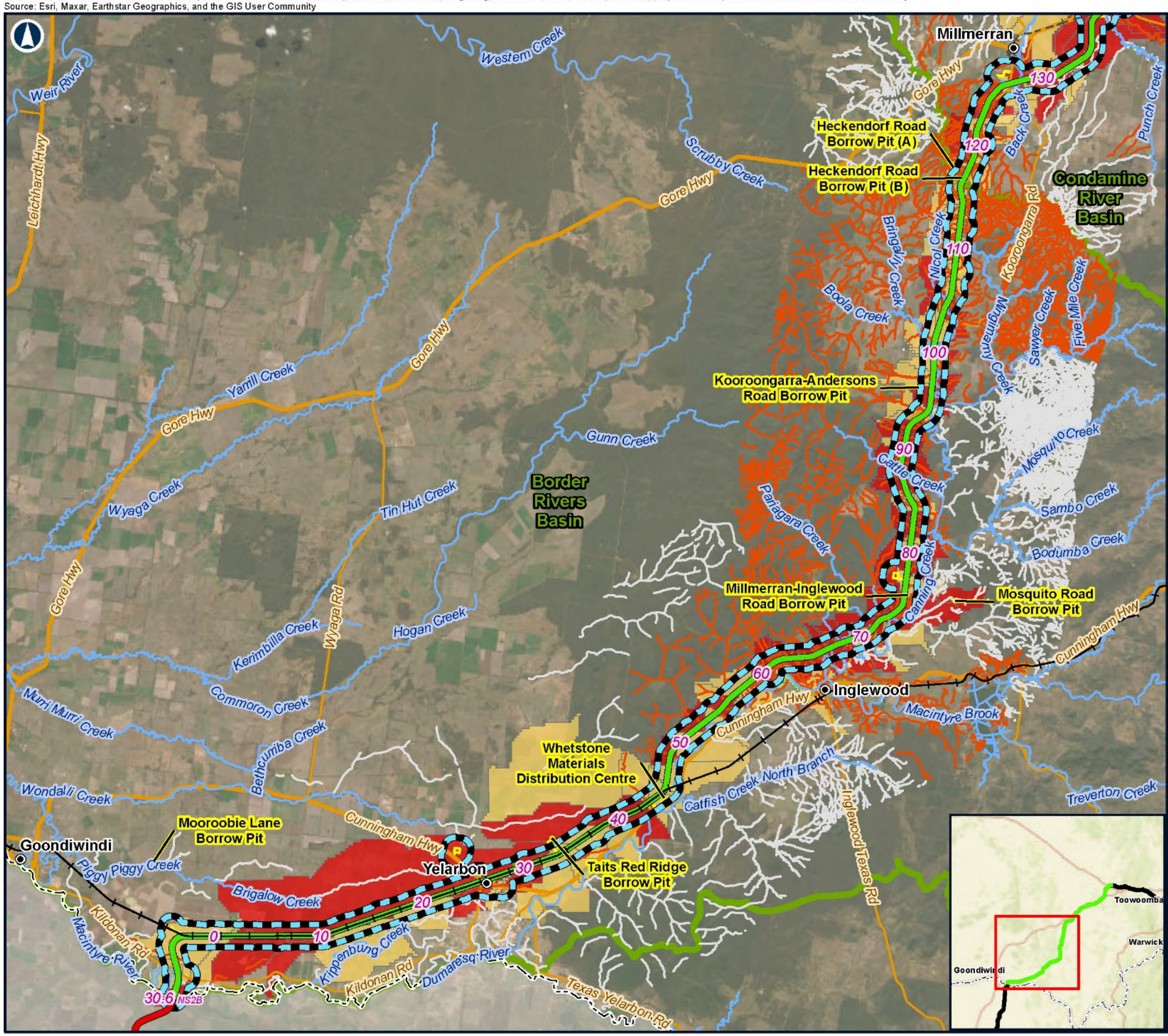
The *Salinity Risk Assessment for the Queensland Murray–Darling Region* identified 58 known salinity expression areas affected by secondary salinity, including the Yelarbon Desert in the Border Rivers basin. The Yelarbon area is known for its extremely alkaline, sodic sodosol soils, strongly attributed to upwelling of sodium-bicarbonate rich groundwater (Biggs et al., 2010a).

The salinity risk assessment identified the use of saline groundwater, leaking dams and dissolution of salts as the most common salinity types within the Border Rivers basin. The risk assessment concluded that salinity in the region will have a low risk to rail infrastructure, although it acknowledged that more research is required regarding secondary salinity formation and the impact of salinity on infrastructure assets (Biggs et al., 2010b).

The *Strategic Salinity Risk Assessment in the Condamine Catchment* (Searle et al., 2007) identified more than 170 salinity expression sites, with most influenced by climatic conditions. The strategic salinity risk assessment identified that a return to typical long-term weather patterns will likely increase the size and number of dryland salinity expressions in the region and increase salt load exported from the catchment. The impact assessment area intersects areas that are considered by the strategic salinity risk assessment to contain a very low, to high, overall salinity risk. The Millmerran area is considered to have a very low, to low, risk of secondary salinity, while the Pittsworth and Gowrie area are considered to have a moderate risk. An area of high salinity risk occurs within the impact assessment area near Southbrook and presents a 'current' threat to infrastructure assets in the area (Searle et al., 2007).

Further detail is provided in Chapter 9: Land Resources.

Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community
Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community



INLAND RAIL

ARTC

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

BORDER TO GOWRIE

Figure 13-4a: Salinity hazard rating for areas associated with the Project alignment

LEGEND

- 5 Chainage (km)
- Localities
- Defined watercourses (Water Act 2000)
- Drainage Features (Water Act 2000)
- Unmapped watercourses (Water Act 2000)
- North Star to NSW/QLD border alignment
- Border to Gowrie alignment
- Existing rail (operational)
- Existing rail (non-operational)
- Major roads
- Minor roads
- NSW/QLD border
- Surface water impact assessment area
- Catchment boundaries

Mean salinity hazard rating

- Low
- Moderate
- High

Impact assessment area

- Project footprint

0 10 20 km

Coordinate System: GDA 1994 MGA Zone 56

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Data Sources: FFJV

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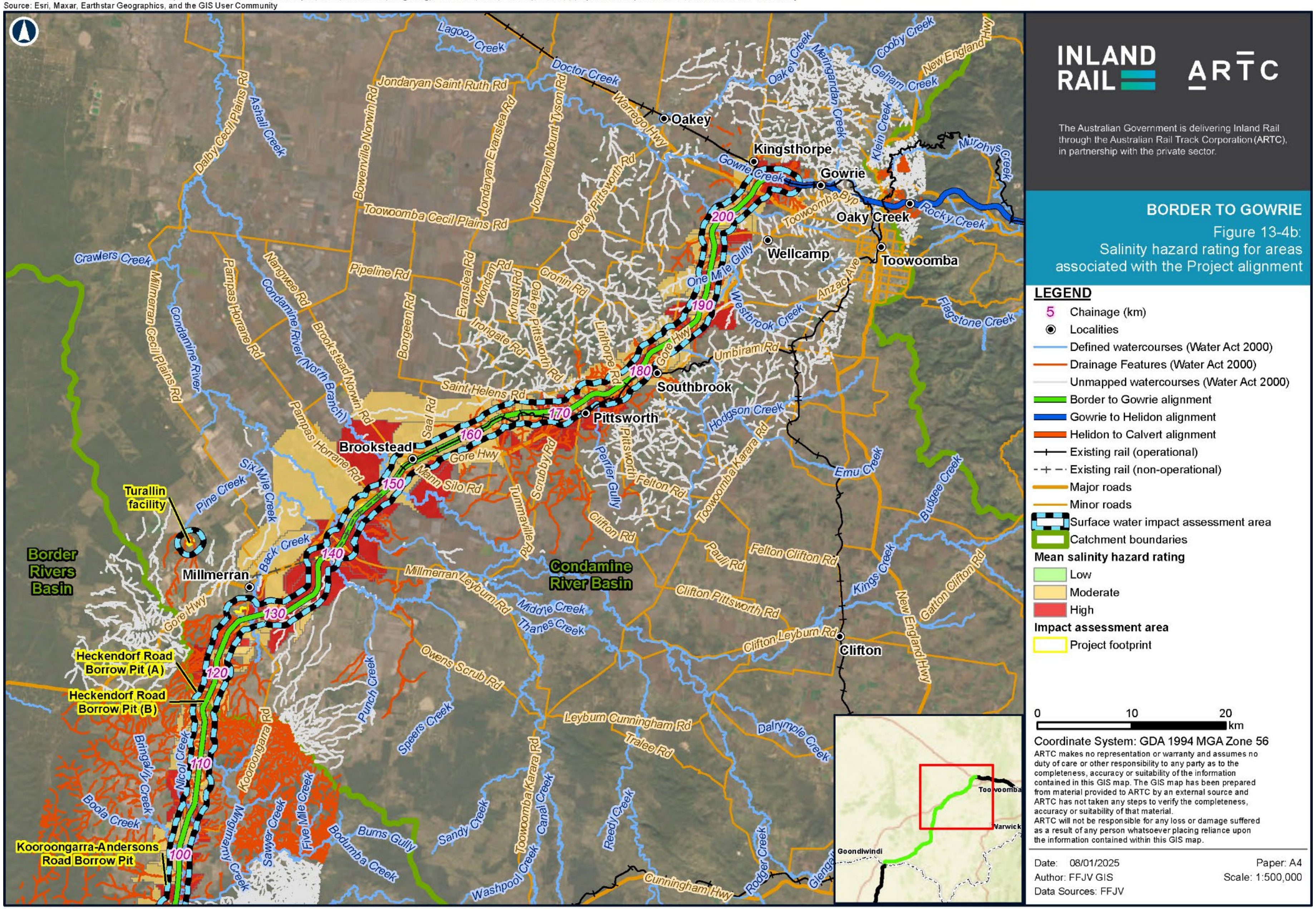
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community
Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community



Map by: DTH/NCW Z:\GIS\GIS_310_B2G\Tasks\310-EAP-201910101214_SurfaceWaterQuality\310-EAP-201910101214_ARTC_Fig13-4b_SalinityHazard_v10.mxd Date: 8/01/2025 14:54

13.4.2 Surface water quality sampling and analysis

This section provides a summary of the results of field sampling and laboratory analysis of water quality. The locations of water quality monitoring sites are summarised in Table 13-5 and shown in Figure 13-1.

Water quality results are presented in the following sections and are grouped to facilitate assessment of sites consistent with the six water-type zones (sub-catchments) identified below:

- Border Rivers basin (DES, 2019a):
  - Canning Creek
  - Lower Macintyre Brook
  - Macintyre Barwon Floodplain.
- Condamine River basin (DES, 2019b):
  - Oakey Creek
  - Central Condamine
  - Southern Condamine.

Further details regarding the water-type zones, associated WQOs, tables of collected data, description of each sampling site and laboratory certificates of analysis are provided in Appendix S: Surface Water Quality Technical Report.

13.4.2.1 Border Rivers basin

Macintyre Barwon floodplain (sites 1 and 2)

Water quality results for the Macintyre Barwon floodplain reflect a catchment with elevated pH, salinity and organic nutrient levels, most likely due to a combination of saline soils, poor riparian vegetation and adjacent grazing land use.

Physico-chemical parameters presented WQO exceedances of pH in most cases, EC exceedances in half of the samples and several elevated levels for dissolved oxygen, turbidity and total suspended solids.

Nutrient parameters show WQO exceedances for the majority of samples for the parameters total N, total P and reactive P. NOx parameters exceeded WQOs approximately 50 per cent of the time, and chlorophyll a and Ammonia occasionally exceeded WQOs.

Dissolved metal concentrations were below laboratory detection limits for cadmium, lead, zinc and mercury. Several exceedances for copper were noted, potentially due to applications of herbicides or fertilisers containing copper sulphates. No other exceedances of WQOs were recorded.

The concentration of PAHs was below the laboratory level of detection at all sites for all sampling events.

Lower Macintyre Brook (sites 3 to 8)

Water quality at sites in the Lower Macintyre Brook water type zone was characterised by low dissolved oxygen saturation, high salinity, low pH, and simultaneously elevated turbidity and total suspended solids. In contrast to the Macintyre Barwon floodplain sites, the Lower Macintyre Brook water sites demonstrated higher impact from the reduced flow environmental conditions throughout the impact assessment area.

Physico-chemical parameters presented WQO exceedances of pH, DO, turbidity and TSS in most cases, and EC exceedances in half of the samples.

Nutrient data also demonstrated exceedances of ammonia NOx, total N, through the majority of samples. Total P concentrations were above WQOs in about 50 per cent of the samples and Reactive P exceedance levels were recorded several times. This may reflect low flow conditions.

Dissolved metal concentrations were below laboratory detection limits for cadmium, zinc and mercury. Several exceedances for copper were noted, potentially due to applications of herbicides or fertilisers containing copper sulphates. No other exceedances of WQOs were recorded.

The concentration of PAHs was below the laboratory level of detection at all sites for all sampling events.

Canning Creek (sites 9 to 20)

Water quality at sites in the Canning Creek catchment was characterised by elevated electrical conductivity, turbid waters and instances of alkaline pH observations exceeding local WQO guidelines. Results present a catchment most likely exposed to saline soils, poor riparian vegetation and adjacent grazing land use.

Physico-chemical parameters presented WQO exceedances of EC and turbidity in most cases, pH and DO exceedances in about 50 per cent of the samples and several elevated levels for Total Suspended Solids.

Nutrient parameters exhibited WQO exceedances for the majority of samples for the parameters total N, total P and ammonia. Reactive P, NOx parameters exceeded WQOs approximately 50 per cent of the time and NOx presented several elevations.

Dissolved metal concentrations were below laboratory detection limits for cadmium and mercury. Several exceedances for copper were noted, potentially due to applications of herbicides or fertilisers containing copper sulphates.

The concentration of PAHs was below the laboratory level of detection at all sites for all sampling events.

13.4.2.2 Condamine River basin

Southern Condamine (sites 21 to 26)

Water quality at sites in the Southern Condamine River catchment was characterised by turbid, saline waters low in oxygen and instances of alkaline pH levels. General WQO exceedances for most physico-chemical and nutrient parameters present poor water quality for Southern Condamine sites. Potential impacts through the combined factors of reduced flow, sparse riparian vegetation, adjacent land use and soils likely contribute to the poor WQ.

Physico-chemical parameters presented WQO exceedances for all parameters with an established WQO (pH, EC, DO, turbidity and TSS) in most cases.

Nutrient data also demonstrated exceedances of ammonia, total P and reactive P through the majority of samples. NOx, total N and chlorophyll a concentrations were above WQOs in approximately 50 per cent of the samples.

Dissolved metal concentrations were below laboratory detection limits for cadmium and mercury. Copper concentrations were exceeding WQOs in the majority of the samples, potentially due to applications of herbicides or fertilisers containing copper sulphates. One lead exceedance was recorded at site 24.

The concentration of PAHs was below the laboratory level of detection at all sites for all sampling events.

Central Condamine (sites 27 to 33)

Water quality at sites in the Central Condamine River catchment was characterised by turbid waters and instances of alkaline waters. Significant oversaturation of dissolved oxygen and an increase in chlorophyll a concentration was noted from Sites 27 and 28 during February 2019 indicating potential diurnal fluxes in surface water dissolved oxygen concentrations due to algal growth. Exceedances in chlorophyll a across most of the sampled sites aligns with the majority of exceedances noted in ammonia, total nitrogen and total phosphorus.

Physico-chemical parameters presented WQO exceedances for turbidity in most cases. TSS concentrations were above WQOs approximately 50 per cent of the time, and several exceedances were recorded for pH, DO and EC.

Nutrient parameters exhibited WQO exceedances for ammonia, total N, total P and reactive P. Chlorophyll a concentration exceeded WQOs approximately 50 per cent of the time and NOx levels presented several elevations.

Dissolved metal concentrations were below laboratory detection limits for cadmium, chromium, lead and mercury. Copper concentrations were exceeding WQOs in the majority of samples, potentially due to applications of herbicides or fertilisers containing copper sulphates. Lead exceedances were recorded at sites 28, 29 and 32. Zinc exceedances were recorded at sites 27, 30, 32 and 33. Nickel exceedances were documented at sites 28, 29 and 32.

The concentration of PAHs was below the laboratory level of detection at all sites for all sampling events.

Oakey Creek (sites 34 to 43)

Water quality at sites in the Oakey Creek catchment was characterised by waters high in salinity and with alkaline pH. Significantly elevated chlorophyll a levels during 2021 for site 40 suggest eutrophication. Samples depict the catchment as relatively high in organic nutrients, while most of the physico-chemical parameter levels were within WQOs (apart from site 39).

Physico-chemical parameters presented WQO exceedances for EC. Approximately 50 per cent of pH and DO concentrations exceeded WQOs, and turbidity and TSS presented several exceedances.

Nutrient data also demonstrated low flow conditions, with exceedances of ammonia and NOx through the majority of samples. Total N concentrations were above WQOs in about 50 per cent of the samples. Total P, reactive P and chlorophyll a presented several WQO exceedances.

Dissolved metal concentrations were below laboratory detection limits for arsenic, cadmium, chromium, lead and mercury. Copper concentrations were exceeding WQOs in approximately 50 per cent of the samples, potentially due to applications of herbicides or fertilisers containing copper sulphates. Several zinc exceedances were recorded at site 42.

The concentration of PAHs was below the laboratory level of detection at all sites for all sampling events.

13.4.3 Interim water quality objectives

The interim site-specific WQOs were developed as a tool for identifying potential impacts arising from construction activities. While each stream crossing location was not assessed for water quality values, it was considered that the values presented within this report provide a proxy indication of water quality across key stream crossing locations along the proposed footprint.

These are not intended as assessment triggers for compliance (nor are the EPP regional WQOs) but indicators for the adequacy of impact management measures. The interim WQOs will be supplemented by additional water quality sampling before commencement of construction to allow for full calculation of WQOs.

Across all water types, interim physico-chemical, site-specific WQOs were elevated in relation to EPP WQOs, specifically for chlorophyll a, TSS and turbidity. Additionally, interim nutrient site-specific WQOs were elevated in relation to EPP WQOs. Interim toxicant site-specific WQOs varied (in terms of above and below) in relation to EPP WQOs.

Further details are provided in Appendix S: Surface Water Quality Technical Report.

13.4.4 Surface water quality receptors

A receptor is a feature (including utilisation by human and ecological components), area or structure that may be affected by direct or indirect changes to the environment. The water quality receptors were assessed against relevant legislation (Section 13.2) and the overarching values used to identify potential impacts which included:

- Queensland’s natural environment (including utilisation by native flora and fauna)
- Finite natural resources, with specific regard to wetlands
- Watercourses conducive to the maintenance of existing landforms, ecological health and biodiversity.

Due to the interconnected nature of the watercourses and waterbodies intersecting the Project disturbance, Project footprint and residing within the study area, the water quality receptors for the existing environment (as a whole of package) were assigned a moderate sensitivity due to several factors:

- Protected by state legislation
- Important for biodiversity
- Existing sensitivity (under threatening process) and/or high exposure to impacts.

To maintain a conservative approach to assessment, all waterways and waterbodies within the Project footprint, study area and downstream receiving environments, were nominated as moderate-sensitivity water quality receptors for identification of potential impacts, associated mitigation measures and identification of residual impact after implementation of mitigation.

High-sensitivity water quality receptors were identified where a waterway was known to support another matter identified and protected under legislation; for example, MNES species (fringing rush (*Fimbristylis vagans*), Murray cod (*Maccullochella peelii*), and Agassiz’s glassfish (*Ambassis agassizii*), and MSES wetlands (Chapter 11: Flora and Fauna). The Macintyre River, Macintyre Brook, Canning Creek and the Condamine River were all identified as being high-sensitivity water quality receptors for the purpose of this assessment.

Therefore, all receiving waterways were considered as either moderate or high-sensitivity water quality receptors. Further information on the assessment of existing conditions and the assessment of receptor sensitivity is provided in Appendix S: Surface Water Quality Technical Report.

13.4.5 Summary of existing water quality condition

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

Historic water quality was typically outside of WQOs with TSS exceeding WQOs both historically and within the current assessment. Total nitrogen and phosphorus as typical anthropogenic contaminants were also consistent with historical data, with WQO exceedances recorded across all sampling events. Water quality across the impact assessment area was typically considered average to poor, with typical patterns of alkaline pH, high electrical conductivity, elevated concentrations of suspended sediment, nutrients and instances of diminished dissolved oxygen concentrations.

Data from the gauging stations showed that the majority of water quality parameters (i.e. TSS, ammonia, TN and TP) did not meet WQOs. The gauging station data indicates that discharge within Macintyre Brook and Gowrie Creek was variable. Similarly, the Condamine River exhibited no flow conditions for much of the sampling period from 2017 to 2019. More flow was present in the streams in 2021.

Low, medium and high Aquascore riverine wetlands are modelled along the Project footprint (Appendix S: Surface Water Quality Technical Report). Alongside the poor condition noted under the sustainable rivers audit (Murray-Darling Basin Authority, 2012), the scores suggest that lack of connectivity remains the degrading factor for the health of both basins. The water quality monitoring sites with low Aquascores were those associated with sections of the Canning Creek and the Central Condamine water type zones. Those with medium Aquascores were on sections of the Canning Creek, Southern Condamine, Central Condamine and Oakey Creek water type zones. Those with high and very high Aquascores were on sections of the Canning Creek, Macintyre Barwon Floodplain, Lower Macintyre Brook, Canning Creek, Central Condamine and Oakey Creek.

In summary, the poor water quality conditions observed within the impact assessment area are likely to be the result of the extensive agricultural and rural land uses in the catchment, and the disturbed status of the waterways.

13.5 Potential impacts

This section identifies and discusses the potential Project-related impacts associated with surface water.

13.5.1 Impacts to surface water quality

Potential impacts to surface water quality have been identified with reference to the existing EVs for surface waters within the impact assessment area (Section 13.2.2.1), including existing water quality and condition (Section 13.1.1) and the sensitivity of water quality receptors (Section 13.4.3 and Section 13.4.5).

The assessment of surface water quality impacts has also included consideration of the assimilative capacity of the receiving environment through historic and existing compliance with existing WQOs. Currently, the existing water quality conditions do not meet all the WQO values for each water type zone; therefore, the qualitative risk of degradation of water quality (against WQOs) from potential Project impacts has been assessed while considering the assimilative capacity of waterways in order to identify the magnitude of potential impact.

It is considered likely that the assimilative capacity of waterways within the impact assessment area will be greater during higher flow conditions (Appendix S: Surface Water Quality Technical Report). In contrast, the lowest assimilative capacity and highest realisation of impact would occur during periods of extended low flow (such as from 2017 to 2019). Potential impacts from the Project are expected to have the highest risk during periods of higher flow conditions, due to increased potential of transportation of contaminants to waterways; however, this aligns with the highest assimilative capacity of the waterway, reducing overall impact magnitude.

The following sections provide a summarised discussion of the potential direct and indirect impacts to surface water quality as a result of Project activities. Further information is available in Appendix S: Surface Water Quality Technical Report.

13.5.1.1 Construction impacts

Potential direct and indirect impacts to surface water quality that may arise due to construction activities for the Project are discussed in Table 13-13. Impacts include those to the water feature itself, in addition to receptors that may be indirectly impacted due to alterations in water quality, such as fish species and riparian vegetation.

TABLE 13-13 POTENTIAL CONSTRUCTION IMPACTS TO WATER QUALITY AND IMPACTING PROCESSES

Potential impact	Impacting process
Increased debris load in waterways, thereby reducing the aesthetic quality of downstream waterway systems. Debris may also impact on the health of aquatic and terrestrial fauna, particularly if ingested	Potential for rubbish and debris from construction sites to be blown off or washed away from a construction area into nearby waterways, due to poor housekeeping or loss of containment
Increased water turbidity and sedimentation load. Potential changes to overland flow pathways and diversions are considered to have a high risk of impacting surface water quality receptors associated with: - Flowing watercourses and unmapped waterways - Static waterbodies occurring downstream of the Project works	Increased sediment loading of waterways may arise due to: - Construction activities that involve the clearance of vegetation and disturbance of topsoil, thereby leaving subsoils exposed to erosional processes. In turn, this may result in elevated sediment concentrations in surface runoff - Construction works involving disturbance to the riparian corridor (e.g. removal of riparian vegetation and alterations to the profile of banks) may indirectly result in erosion and scouring of streambanks - Physical disturbance of stream beds and banks during the establishment of culverts and bridges, leading to a reduction in stability during construction of creek crossings

Potential impact	Impacting process
	▸ Dewatering associated with the decommissioning of artificial waterbodies that intersect the Project footprint may cause an increase in erosion and sedimentation of waterways if the discharge of that water is not adequately managed ▸ Catch-drains to re-direct the drainage ▸ Potential erosion risk associated with soils exposed during topsoil stripping, earthworks, stockpiles, excavation and trenching activities required for infrastructure and material borrow pits, or from inadequate rehabilitation processes.
Alterations to water chemistry may impact on downstream aquatic ecosystem conditions, as well as the useability of downstream waters for purposes such as irrigation, farm supply, stock use and recreation Potential impact to proximal wetlands within high-sensitivity receptor areas	Water chemistry may be altered due to the following processes: ▸ Clearing and construction activities ▸ Accidental spills and leaks of chemicals or fuels from construction equipment or fuel storages ▸ Flow diversions ▸ Subsoil exposure within excavations and borrow pits, which have the potential to result in the leachate of acid rock drainage from the soil into overland flow ▸ The erosion of stockpiled materials, which could lead to increased nutrient concentrations in overland flow. Salinity in runoff could arise from: ▸ Disturbance and exposure of saline soils during construction, which could increase salinity in overland flows. The Project footprint directly intersects moderate to high salinity hazard rating areas (Figure 13-4) ▸ Stockpiling of sediment and earthworks within high salinity hazard areas ▸ Removal of vegetation, alteration of water resources, application of water (e.g. for material compaction) and general land use changes. Leakage from longitudinal drainage channels. If ponding were to occur, this may also contribute to rising water tables and the vertical movement of salts in the soil profile. Nutrient loading: ▸ Nutrients may migrate into waterways with sediment lost from cleared areas and from stockpiles Contaminants and toxicants may impact water quality as a result of: ▸ Accidental spills and leaks of chemicals or fuels from construction equipment or fuel storages ▸ Residual heavy metals from rail grinding and welding ▸ Compounds adhered to ballast materials ▸ Dewatering activities leading to liberation of toxicants from potentially contaminated land ▸ Contaminated land disturbance — if any nearby contaminated lands are disturbed near waterways, there is the potential for contamination from runoff on these waterways.

Domestic wastewater

Sources of domestic wastewater generation during construction will be restricted to the following:

- Kitchenette facilities provided in site office locations along the Project footprint
- Portaloos established at work fronts
- Two non-resident workforce accommodation sites that will be used during the construction works stage.

It is expected that each of these potential sources of domestic wastewater will be self-contained and will not require direct discharge of wastewater to sewer or to waterways. Wastewater generated through the use of, for example, kitchenette facilities, in office sites and work fronts will be captured and containerised. It is expected that this wastewater will be collected by a licenced waste contractor and taken offsite for disposal at an appropriately licenced wastewater facility.

Volumes of wastewater generated are expected to be similar to water demands for the workforce accommodation sites. ARTC received advice from a non-resident workforce accommodation service provider to determine the typical daily water requirement for a non-resident workforce accommodation. From this advice it was concluded that an average daily volume of 250 L/person/day should be adopted to estimate the water usage for non-resident workforce accommodation.

Each non-resident workforce accommodation facility has a 300-bed design capacity, with occupancy expected to vary from 150 to 300 persons depending on the construction schedule. The daily water usage for a single non-resident workforce accommodation facility will fluctuate with occupancy throughout the construction period. Based on a usage rate of L/person/day, a 300-bed facility will operate between 50 and 100 per cent capacity (300 occupants), requiring 37.5 to 75.0 kilolitres (kL) of water per day. Actual water usage will fluctuate around this average as accommodation demands change with the progression of construction works.

Onsite package wastewater treatment plants are proposed for the non-resident workforce accommodation facilities. Water for reuse will be treated in accordance with the National Water Quality Management Strategy: Australian Guidelines for Sewerage Systems – Effluent Management to a standard appropriate for the intended use, so that the treated water has the potential to be used for irrigation or dust suppression. Wastewater will be used onsite for these water demands, to minimise the volumes of water that must be imported and to minimise the volumes of wastewater requiring disposal. This will maximise rates of wastewater capture, treatment and reuse within non-resident workforce accommodation.

Any wastewater not re-used onsite and/or by-products of treatment not suitable for reuse will be taken offsite for lawful disposal by a licenced waste contractor. Depending on the technologies that are adopted, water can be recycled for immediate use as non-potable water. A key objective of the Inland Rail Sustainability Strategy is to maximise onsite reuse of wastewater generated by non-resident workforce accommodation, to avoid water being carted offsite for treatment and discharged.

Industrial or trade waste

Sources of industrial or trade waste during construction works may include:

- Concrete batch plants
- Vehicle and plant washdown facilities, located in laydown areas, non-resident workforce accommodation or Whetstone MDC.

Two locations have been identified for the temporary siting of a precast concrete facility and concrete batch plant for the Project (Table 13-14). The proposed locations are immediately north and south of the Condamine River floodplain outside the 1% Annual Exceedance Probability (AEP) flood line.

TABLE 13-14 PRECAST CONCRETE FACILITY AND CONCRETE BATCH PLANT LOCATIONS

ID[1]	Location	Chainage	Description
B2G-LDN150.5	Gore Highway and Dieckmann Road	Ch 152.1 km	Precast concrete facility and concrete batch plant—north
B2G–LDN138.5	Gore Highway and Hall Road	Ch 138.6 km	Precast concrete facility and concrete batch plant—south

Table note:
1. Drawings are provided in EIS Appendix B1: Design Drawings.

Where industrial or trade waste may be generated by construction activities, the resultant wastewater will be captured in a bunded facility or tank and, where possible, recycled. Where recycling is not feasible, the captured wastewater will be collected by a licenced contractor and taken offsite for disposal at an appropriately licenced wastewater facility.

Stormwater and seepage

Sources of stormwater and seepage during construction works may include:

- Stormwater runoff from construction sites
- Water that is discharged from dewatered excavations and trenches
- Water that accumulates in cuts due to groundwater seepage.

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 *Best Practice Erosion and Sediment Control* (International Erosion Control Association, 2008) and will:

- Minimise runoff and sedimentation from Project activities to watercourses and drainage features
- Minimise disturbance to the water quality of watercourses and drainage features along the Project footprint
- Mitigate secondary salinisation through preventing downward leakage of water, with the use of lining or similar
- Establish surface profiling to prevent inadvertent ponding of water
- Ensure that water usage for vegetation establishment, landscaping, dust suppression and rehabilitation be consistent with the quality requirements specified for irrigation and general water use in the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZG, 2018)
- Ensure efficient water application, to avoid prolonged oversaturation of soils within and adjoining the Project footprint.

The design includes 20 sediment basins associated with the construction works stage (Table 13-15). All the proposed sediment basins are passive, which allows surface runoff from a catchment to flow into the sediment basin without the need for pumping. The locations of sediment basins are shown in working plans and longitudinal sections presented in Appendix B1: Design Drawings.

TABLE 13-15 SEDIMENT BASINS FOR THE PROJECT

Sediment basin ID and chainage[1]	Catchment size (m^2)	Settling volume (m^3)	Total volume (m^3)
Sediment basin 1 (Ch 48.4 km)	50,000	581	871
Sediment basin 2 (Ch 55.5 km)	60,000	697	1,046
Sediment basin 3 (Ch 60.4 km)	48,000	558	837
Sediment basin 4 (Ch 61.6 km)	30,000	349	523
Sediment basin 5 (Ch 63.2 km)	20,000	232	349
Sediment basin 6 (Ch 97.8 km)	40,000	465	697
Sediment basin 7 (Ch 125.5 km)	55,000	639	959
Sediment basin 8 (Ch 164.3 km)	20,000	232	349
Sediment basin 9 (Ch 171.8 km)	25,000	290	436
Sediment basin 10 (Ch 173.8 km)	83,000	964	1,447
Sediment basin 11 (Ch 181.2 km)	60,000	697	1,046
Sediment basin 12 (Ch 184.7 km)	40,000	465	697
Sediment basin 13 (Ch 187.2 km)	20,000	232	349
Sediment basin 14 (Ch 190.1 km)	45,000	523	784
Sediment basin 15 (Ch 192.1 km)	27,000	314	417
Sediment basin 16 (Ch 193.1 km)	60,000	697	1,046
Sediment basin 17 (Ch 196.9 km)	45,000	523	784
Sediment basin 18 (Ch 199.3 km)	62,000	720	1,081
Sediment basin 19 (Ch 205.7 km)	63,000	732	1,098
Sediment basin 20 (Ch 206.0 km)	60,000	697	1,046

Table notes:
m^2 = square metres
m^3 = cubic metres
1 = Drawings are provided in Appendix B1: Design Drawings.

In addition to sediment basins, construction sites will be set out, through a combination of landform and use of temporary erosion and sediment control measures, in a manner to minimise the volume of surface runoff that flows across the cleared areas within the temporary footprint. Construction sites will also be established so that potential sources of contamination (e.g. fuels and other hazardous materials) are appropriately stored and bunded.

In the first instance, stormwater and water that is dewatered from excavations (i.e. trenches and pits), or private storages within the Project footprint that are being decommissioned, will be directed to a temporary retention structure where the water will be retained to allow suspended solids to settle out of suspension, and for evaporation to occur. If waters are to be discharged from site, either directly or indirectly, it will be done in a manner that ensures the discharged water is compliant with the relevant WQOs for the receiving waterway (Section 13.2.1).

Water collected in sediment basins may be used for dust suppression or earthworks purposes on the condition that the water is proven to be of a quality that is:

- Non-deleterious to earth fill properties
- Consistent with the quality requirements specified for irrigation and general water use in the *Australia and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZ, 2018) and in accordance with any other required licences or conditions.

If waters are to be discharged from site, either directly or indirectly, it will be done in a manner that ensures the discharged water is compliant with the relevant WQOs for the receiving waterway, ANZG (2018), and in accordance with relevant licences and conditions (Section 13.2.1).

Predictive modelling for groundwater seepage has determined that seepage may occur from the face of deep cuts (>10 m) where groundwater is intersected; however, the assessment has concluded that seepage water will typically evaporate due to local climate conditions and relatively small volumes when considered with the length of the cuts. Further details are provided in Chapter 15: Groundwater.

13.5.1.2 Operation and maintenance impacts

Potential direct and indirect impacts to surface water quality during the Project's operation and maintenance activities include those to the water feature itself, in addition to receptors that may be indirectly impacted due to alterations in water quality, such as fish species and riparian vegetation. Many of the potential impacts and impacting processes are consistent with those that may occur during construction (Table 13-13) and full duplication of details has not been provided.

Operation and maintenance impacts to surface water quality may include:

- Increased rubbish and debris from operations blown off or washed away from the rail corridor into proximal watercourses
- Introduction of contaminants from a variety of sources during operation and maintenance due to:
  - oil and grease spills—there is the potential for spillage of oil and grease from the general operation of rollingstock and for this spillage to enter the waterways after heavy rainfall events
  - residual heavy metals from maintenance rail grinding and welding
  - accidental spills of fuels, oil and chemicals during routine operations or maintenance.
- Maintenance—maintenance of the rail line or machinery near waterways (such as the crossing loops proximal to Macintyre Brook at approximate Ch 50.20 km to Ch 52.40 km) has the potential to mobilise sediments from areas disturbed by maintenance activities into adjacent waterways. Furthermore, oils and greases and other contaminants, such as metals, have the potential to enter waterways from spills, and for impact from the use of environmental toxicants (such as biocides) to maintain operating infrastructure areas. These activities have the potential to impact nearby waterways through discharge points, without appropriate mitigation
- Increase in rates of erosion and resultant sedimentation of waterways, where soils are exposed as a result of unsuccessful site rehabilitation.

Operations stage wastewater volumes cannot be established at this time, as the frequency and nature of maintenance activities, and rate of wastewater generation, will vary between Project components, and be in response to asset age and condition. In any event, wastewater generated during operation and maintenance will be infrequent and small in volume.

Point source discharge of stormwater for the Project is anticipated only to occur where longitudinal drainage connects to locations of cross-drainage. The purpose of longitudinal or track drainage is to remove water that has percolated through 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 that run parallel to the railway and are located within the rail corridor, at the foot of the railway embankment
- Catch drains — longitudinal drains that run parallel to the railway and are located within the rail corridor, on the up-slope side of cuttings.

Track drainage is proposed at specific locations along the Project footprint where the gradient is steep enough to divert surface runoff to the nearest bridge or culvert location. The design and location of track drainage will be refined, if required, during the detailed design stage.

Discharges of stormwater from the rail corridor are only likely to occur during weather events that contribute to inputs to the local waterway system from other sources at the same time, e.g. agricultural lots and road surfaces; therefore, the impact of stormwater discharges into the local water system during such events is likely to be negligible.

The assessment of stormwater quality using MUSIC modelling compared TSS, TP and TN levels in existing discharge conditions against stormwater discharged from longitudinal drains, which were applied with 3.5 m buffer strips within 100 m swales before the point of discharge. Swales are grassed or vegetated broad, shallow channels used to collect and convey stormwater flows, promote infiltration, reduce stormwater peak flow rates and discharge volumes, and remove sediments. Swales use a combination of physical and biochemical processes to treat stormwater. Buffer strips are vegetated areas that reduce sediment loads from water flowing through them. Buffer strips are aligned perpendicular to the water flow. They are commonly used in conjunction with swales.

The modelling indicated that impacts to rural areas associated with potential stormwater discharges are expected to be negligible, with buffering from swales producing discharge of a better quality (reduced concentrations) than typical for rural areas; therefore, with proposed treatment measures in place, water quality leaving the rail corridor is expected to be similar to, or better than, runoff from the existing condition of the rural environments. The proposed Project treatment requirements are considered adequate for water quality receptors, provided sufficient buffer strips and swales are provided.

Modelled operational discharge along the Project footprint is predicted to contain suspended solids and nutrients in concentrations higher than forested conditions; however, these pollutant loads would be expected to be discharged from a comparable area of nearby rural catchment. It is expected that these will be contained within the areas of targeted rehabilitation zones and be limited in impact. Although impacts to water quality are theoretically possible, these will be mitigated with the provision of grassed rehabilitation strips along the length of the rail formation. Any impacts are likely to be minor and associated with highly constrained sites where buffer strips and swales cannot be provided.

13.5.2 Impacts to waterway morphology

Impacts to water quality could arise from changes to waterway geomorphology through changes to the stability of streams, and the potential for scour and sediment transport. The assessment of the potential for change to the fluvial geomorphic environment due to the Project recognises that existing-case geomorphological processes must continue to function into the future. The geomorphological assessment is presented in Appendix H: Geomorphology Report and described in Chapter 14: Flooding and Geomorphology.

The revised reference design does not require permanent diversion of any watercourses as defined under the Water Act. Diversions of two waterways as mapped under the Fisheries Act 1994 is required however at Ch 120.77km to Ch 121.43km, and Ch 192km. Two trapezoidal diversion drains are expected to be required for the permanent diversion of mapped waterways under the Fisheries Act based on the revised reference design:

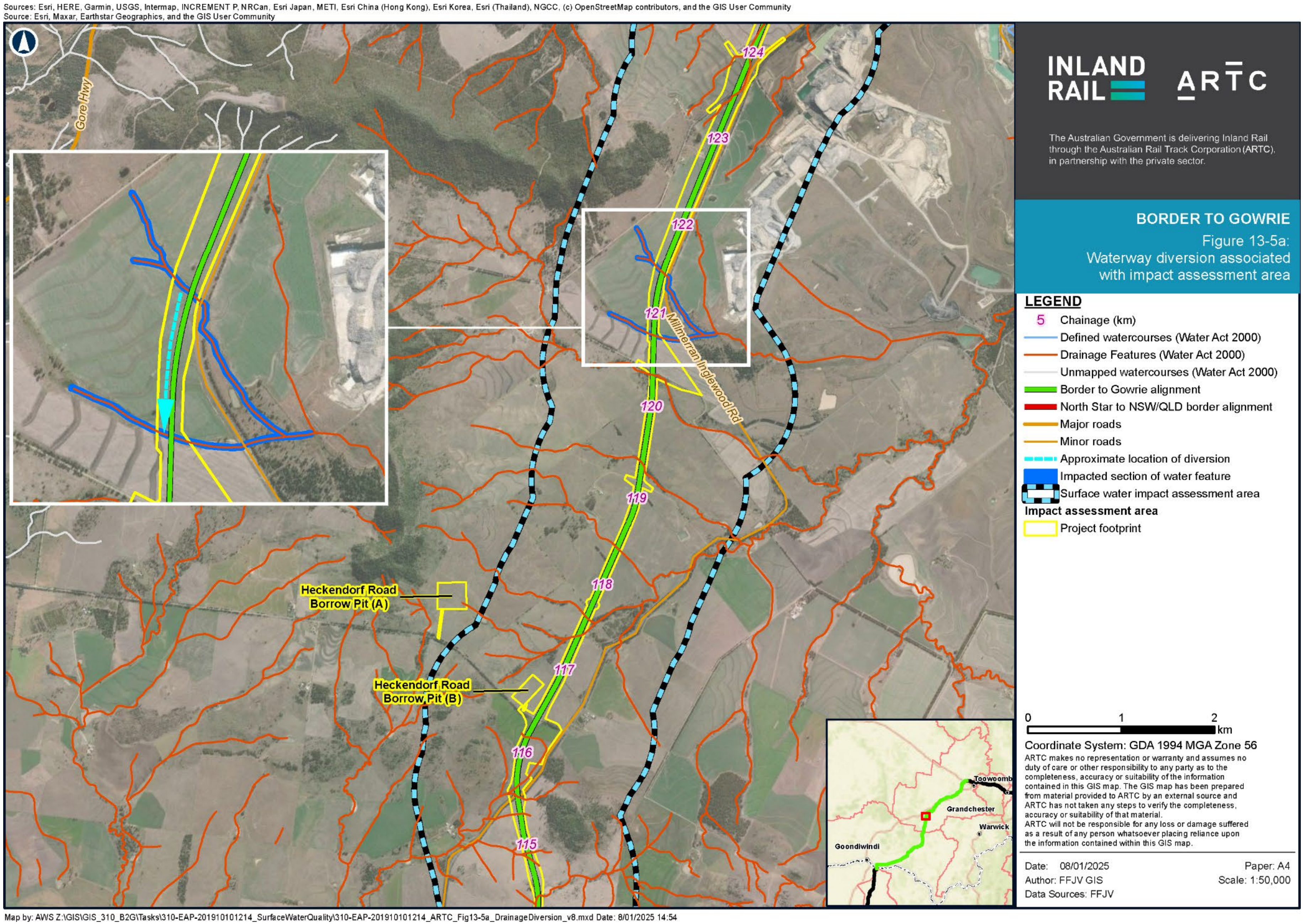
- One trapezoidal diversion drain is required from Ch 120.77 km to Ch 121.43 km to divert runoff from the west, away from the rail in cut at a small unnamed tributary of Back Creek, and will be part of a rail alignment longitudinal drainage. The rail in cut intersects a waterway flow path at Ch 121.43 km. The diverted flow path length is about 750 m and returns to the original flow path downstream of the rail at Ch 120.77 km, to a 2,400 x 1,800 reinforced concrete culvert. The diversion from Ch 121.43 km to 120.77 km will be part of a rail alignment longitudinal drainage and is identified as green (low-risk) of impact waterway under the Department of Agriculture and Fisheries Queensland Waterways for Waterway Barrier Works spatial mapping (Figure 13-5a).
- At Ch 192 km a trapezoidal diversion drain is proposed where the rail embankment overlays an existing flow path at an unnamed tributary of One Mile Gully. This affected flow path runs for 200 m at Ch 192.2 km before crossing the alignment obliquely. The flow path will be slightly altered to accommodate the rail embankment. The diversion pathway is identified as a green (low risk) impact waterway under the Department of Agriculture and Fisheries Queensland Waterways for Waterway Barrier Works spatial mapping. The diversion is expected to consist of a realignment of the existing drainage feature to run parallel to the alignment before meeting a cross-drainage 1,800 mm reinforced concrete culvert and adjoining the downstream existing flow path (Figure 13-5b).

Design considerations for waterway barriers will include provision of an equivalent channel capacity to the existing channel, and use of a similar bed and bank material. As such, these design considerations are not expected to impact fish passage requirements.

At the Whetstone MDC, a drainage feature of Macintyre Brook flows through the western extent of the MDC site. Existing flow paths for this drainage feature will be maintained. Where practicable a 10 m setback distance from the top bank of waterways will be implemented for activities within the temporary footprint. Any plant maintenance, chemical storage and refuelling will be carried out a minimum of 30 m from riparian vegetation and waterways where practical, with appropriate interception measures in place to avoid impacts to waterways, aquatic habitats and groundwater.

In-stream works are proposed to be undertaken in accordance with *Accepted Development Requirements for Operational Work that is Constructing or Raising Waterway Barrier Works* (DAF, 2018a) for lower-risk waterways (low and moderate). In-stream works for lower-risk waterways that cannot meet the accepted development requirements and within higher-risk waterways will be planned and undertaken in accordance with applicable assessment benchmarks for assessable development. Where in-stream works are developed in accordance with applicable accepted development requirements or acceptable outcomes within relevant codes, works are expected, at a minimum, to reduce increases in barriers for water movement during construction. Design considerations for waterway barriers will include provision of an equivalent channel capacity to the existing channel and use of a similar bed and bank material. As such, these design considerations are not expected to impact fish passage requirements.

In-stream works will be undertaken in accordance with the *Riverine protection permit exemption requirements* (DRDMW, 2023a). ARTC is an ‘approved entity’ for exemption from the requirement for riverine protection permit applications. As such, activities associated with in-stream disturbance works will be exempt from requiring approval, if the exemption requirements are adhered to. If exemption requirements are unable to be met, the local DRDMW business centre will be contacted to discuss the need to apply for a riverine protection permit.


Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community
Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community
Gore Hwy
Millmerran Inglewood Rd
124
123
122
121
120
119
118
117
116
115
Heckendorf Road Borrow Pit (A)
Heckendorf Road Borrow Pit (B)
INLAND RAIL
ARTC
The Australian Government is delivering Inland Rail through the Australian Rail Track Corporation (ARTC), in partnership with the private sector.
BORDER TO GOWRIE
Figure 13-5a: Waterway diversion associated with impact assessment area
LEGEND
5 Chainage (km)
Defined watercourses (Water Act 2000)
Drainage Features (Water Act 2000)
Unmapped watercourses (Water Act 2000)
Border to Gowrie alignment
North Star to NSW/QLD border alignment
Major roads
Minor roads
Approximate location of diversion
Impacted section of water feature
Surface water impact assessment area
Impact assessment area
Project footprint
Toowoomba
Grandchester
Warwick
Goondiwindi
0 1 2 km
Coordinate System: GDA 1994 MGA Zone 56
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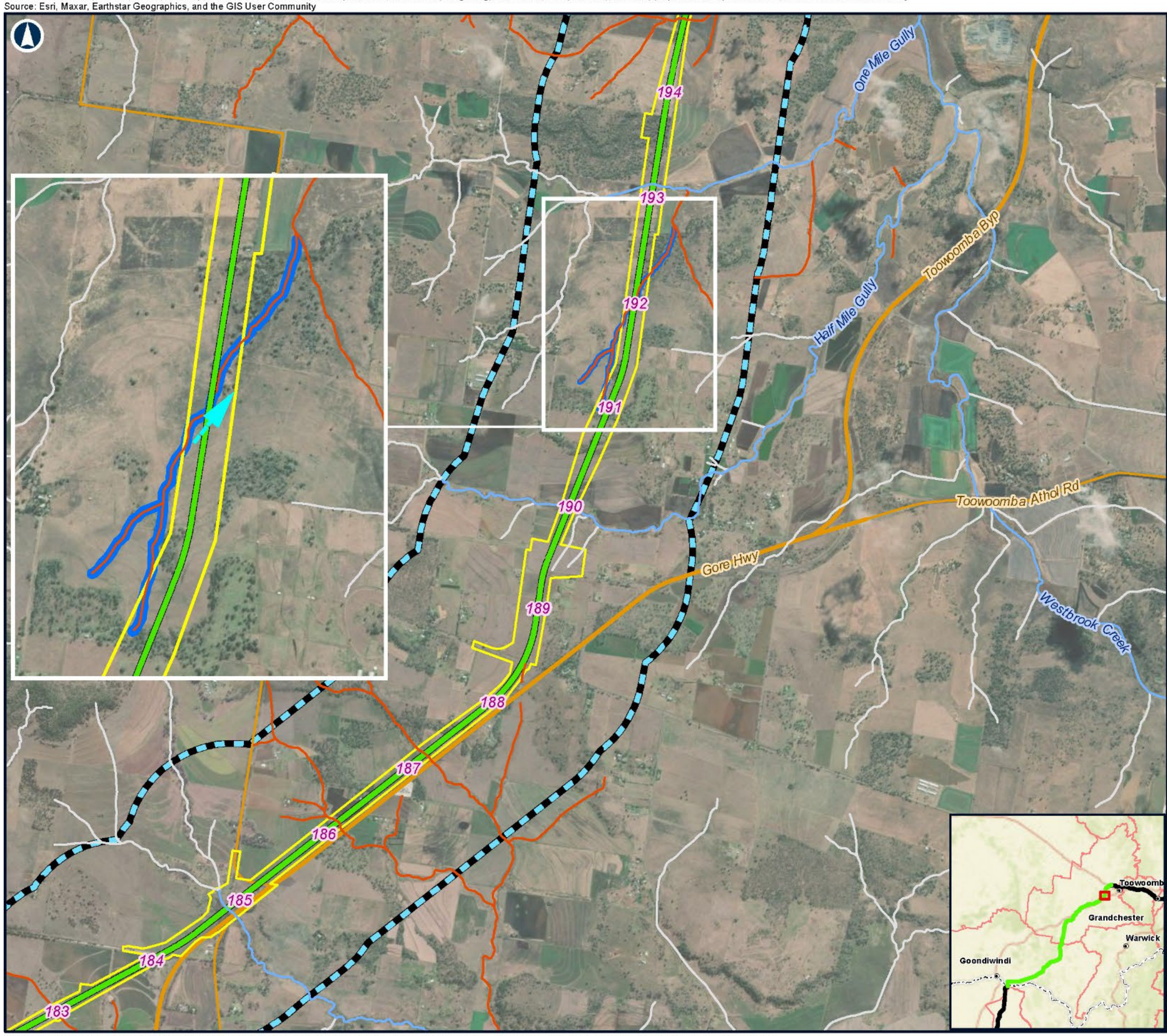
Paper: A4
Author: FFJV GIS
Scale: 1:50,000
Data Sources: FFJV
Map by: AWS Z:\GIS\GIS_310_B2G\Tasks\310-EAP-201910101214_SurfaceWaterQuality\310-EAP-201910101214_ARTC_Fig13-5a_DrainageDiversion_v8.mxd Date: 8/01/2025 14:54

Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community
Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community



INLAND RAIL

ARTC

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

BORDER TO GOWRIE

Figure 13.5b: Waterway diversion associated with impact assessment area

LEGEND

- 5 Chainage (km)
- Defined watercourses (Water Act 2000)
- Drainage Features (Water Act 2000)
- Unmapped watercourses (Water Act 2000)
- Border to Gowrie alignment
- North Star to NSW/QLD border alignment
- Major roads
- Minor roads
- Approximate location of diversion
- Impacted section of water feature
- Surface water impact assessment area

Impact assessment area

- Project footprint

0 1 2 km

Coordinate System: GDA 1994 MGA Zone 56

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13.5.3 Impacts to surface water availability and users

13.5.3.1 Construction water requirements

Water will be required for various activities associated with construction of the Project, including for earthworks, concrete production, track works and the operation of non-resident accommodation. Details of the estimated construction water demand, including the estimated construction water usage over time for the Project and the estimated water demand along the length of the Project footprint are presented in Chapter 5: Project Description. Further details are provided in Appendix B5: Construction Water.

13.5.3.2 Construction water sources

ARTC recognises that water sourcing and availability is critical to supporting the construction program for the Project. Sources of construction water will be finalised as the construction approach is refined during the detailed design stage of the Project (post-EIS). Through this process, refined water demand planning will be undertaken, including detailed contingency options, if protracted dry seasonal conditions prevail and water supply options become unavailable.

The ultimate water sourcing strategy for the Project will be documented in a Construction Water Plan as detailed in Appendix AC: Proponent Commitments.

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

- Available volume from identified source
- Legal access
- Volumetric requirement for the activity
- Water quality requirement for the activity
- Source location relative to the location of need.

Potential sources that are discussed in this section are those that are considered to meet the following assessment criteria:

- Source is located within 25 km of the Project
- Water will, subject to availability, be available for access/purchase for the Project.

Water source types are grouped into the following classifications:

- Potable
- Non-potable:
  - supplemented sources: refers to water delivered from infrastructure, e.g. dams. Supplemented supplies are managed by water supply scheme operators
  - un-supplemented sources: surface water or groundwater that is not reliant on infrastructure to store or distribute water
  - recycled sources: in Queensland, recycled water is regulated differently depending on how the recycled water is used. For example, irrigation and dust suppression are regarded as low exposure uses, while uses, such as outdoor irrigation, and for augmenting a supply of drinking water, are all considered high-exposure uses of recycled water.

A summary of the considerations for accessing water from each potential surface water source is presented in Appendix B5: Construction Water. ARTC has consulted with each of the potential water suppliers and consultation suppliers. Consultation details are provided in Appendix E: Consultation Report.

13.5.3.3 Licenced water users

Construction water will only be obtained from existing licenced and/or lawful sources, within the limits of applicable allocations or entitlements. No water will be sourced from potable networks or supplemented surface water sources that are managed by TRC or GRC. ARTC will not interfere with any existing commercial arrangements for the access to and/or sale of water between water entitlement holders and other end users.

Prior to taking water from existing licenced source points, ARTC will be responsible for obtaining all necessary permits and licences, and will seek to enter into an agreement with the water entitlement holder to purchase water at a negotiated rate. In all such instances, the take of water will be metered and/or recorded to ensure that volumes taken for the Project are within the allocated annual limits for each source. The take of water from a source will cease once the allocated annual limit has been reached.

Based on these limitations and management measures, the take of water for construction of the Project is expected to be no greater than that which is already licenced to be extracted and used within catchment areas proximal to the Project. Consequently, no impacts to existing licenced water users are foreseen.

Construction water supply consultation

Consultation with potential water suppliers to gauge interest in providing water for the Project has occurred and is outlined in Appendix E: Consultation Report. ARTC is committed to ongoing consultation with all potential suppliers to confirm the ability to source water from any identified (and agreeable) licenced private water sources (e.g. in the instance the allocation type requires modification).

DRDMW maintains *Exemption requirements for construction authorities for the take of water without a water entitlement (OSW/2020/5467)* (DRDMW, 2021). These exemption requirements may only be used by a constructing authority defined under Schedule 2 of the *Acquisition of Land Act 1967* (Qld) and includes state government departments and local governments. apply to ARTC.

If an exemption does not apply, then a Temporary Water Permit would be required before taking any water for construction purposes (Chapter 3: Legislation and Project Approvals Process).

Further detail regarding consultation for water supply is detailed in Appendix E: Consultation Report and Appendix S: Surface Water Quality Technical Report.

13.6 Mitigation measures

This section provides discussion of the mitigation measures and controls that have been incorporated into the revised reference design (see Section 13.6.1). Additionally, this section provides measures that are proposed to be implemented into future stages of Project delivery (see Section 13.6.2).

13.6.1 Mitigation through the revised reference design stage

Development of the revised reference design for the Project has progressed in parallel with the impact assessment process. As a result, design solutions for avoiding, minimising or mitigating impacts have been incorporated into the revised reference design as appropriate and where possible.

Mitigation measures and controls that have been factored into the design, or otherwise implemented during the revised reference design stage for impacts to surface water quality and resources, are as follows:

- The Project uses the existing Queensland Rail South Western Line and Millmerran Branch Line rail corridors as much as possible, to avoid introducing a new linear infrastructure corridor across watercourses and floodplains, where possible
- The revised reference design has been developed to minimise impacts to watercourses, riparian vegetation and in-stream flora and habitats by adopting a crossing structure hierarchy where bridges are preferred to culverts
- Watercourse crossing structures (including culverts and bridges) are designed to minimise the need for ongoing maintenance and inspection to maintain aquatic fauna passage (e.g. fish and turtles), and minimise the risk of blockages in reference to the *Accepted development requirements for operational work that is constructing or raising waterway barrier works* (DAF, 2018a)
- Bridges and waterway crossings are designed to minimise impacts to bed, banks and environmental flows, in accordance with relevant regulatory requirements (as per requirements of DAF and the Fisheries Act)
- Bridge structures are provided in the revised reference design over the following watercourses, to minimise disturbance of aquatic habitats:
  - Macintyre River
  - Macintyre Brook
  - Pariagara Creek
  - Cattle Tree Creek
  - Native Dog Creek
  - Bringalily Creek
  - Nicol Creek
  - Back Creek
  - Grasstree Creek
  - Condamine River
  - Condamine River North Branch
  - Westbrook Creek
  - Dry Creek.

- Site-specific risk assessments for each waterway crossing will be performed once construction timing and methods are established. The proponent will develop an assessment procedure that considers site-specific attributes (topography, soil conditions, WQ, in-stream habitat and aquatic ecology, ephemeral nature, fish passage, sediment loading type and intensity of construction works) to minimise risks and impacts on the watercourse and its ecology. For instance, it is suggested to utilise the ephemeral nature of streams by performing construction works during dry season to reduce potential impacts. Construction procedures will strictly follow the provided Soil Management Plan (Chapter 9: Land Resources and Appendix AB: Earthworks Strategy and Draft Soil Management Plan) and activities will be avoided during wet weather. In addition, the following information should be provided for each crossing.
    - topographical contours
    - direction of surface water runoff and drainage
    - existing or proposed water bores or monitoring wells on the site or adjacent land
    - location of waste storage and disposal locations
    - hydrogeological features
    - identification of environmental values
    - monitoring and reporting requirements
- The revised reference design has been developed to avoid the need to permanently divert watercourses, as defined and mapped under the Water Act. Two drainage features (not mapped watercourses under the Water Act) defined as waterways under the Fisheries Act are expected to require diversion.
- Scour protection measures have been selectively included around culvert entrances and exits, on disturbed stream banks and on land bound by a watercourse, to avoid erosion. Scour protection or energy dissipation measures have been specifically designed and sized for culvert locations, in accordance with the *Guide to Road Design Part 5B: Drainage—Open Channels, Culverts and Floodways* (AGRD) (Austroads, 2013) with consideration for flow velocity, soil type and vegetation cover. Scour protection measures incorporated into the revised reference design for culverts include:
    - concrete apron
    - concrete wingwalls
    - rock mattress scour protection, with geotextile underlay.
- Scour protection measures for culvert outlets have been designed to ensure that the maximum allowable flow velocities in a 1% AEP event, as specified in Table 3.1 of AGRD, are not exceeded. Maximum allowable flow velocities in Table 3.1 of AGRD are specific to the soil type at each culvert location, as follows:
    - stable rock — 4.5 m/s
    - stones 150 mm diameter or larger — 3.5 m/s
    - gravel 100 mm or grass cover — 2.5 m/s
    - firm loam or stiff clay — 1.2 to 2 m/s
    - sandy or silty clay — 1.0 to 1.5 m/s.
- Where areas immediately downstream of culvert outlets experience velocity changes above the Flood Impact Objectives at the Project boundary, additional scour protection allowed for within the revised reference design.
- The scour protection length and minimum rock size diameter (d50) have been determined from Figure 3.15 and Figure 3.17 in AGRD. All required scour lengths are predicted to fit within the rail corridor.
- The revised reference design includes 20 sediment basins. All sediment basins are passive, which allows surface runoff from a catchment to flow into the sediment basin without the need for pumping.
- Longitudinal drains have been designed to include 3.5 m buffer strips within 100 m swales before the point of discharge into the local waterway system. Longitudinal drains are included in the rail formation design, including for crossing loops.

13.6.2 Proposed mitigation measures

In order to manage and mitigate potential impacts associated with the Project, several mitigation measures have been proposed for implementation to address Project-specific risks to surface water quality in future stages of Project delivery.

Table 13-16 identifies the relevant Project stage, the aspect to be managed and the proposed mitigation measure. The mitigation measures presented in Table 13-16 have then been factored into the assessment of residual impact significance, as documented in Table 13-17.

A Surface Water Management Plan will be developed as a component of the Construction Environmental Management Plan (CEMP) in consultation with relevant agencies.

TABLE 13-16 PROPOSED SURFACE WATER MITIGATION MEASURES

Delivery stage	Aspect	Mitigation and management measures
Detailed design	Erosion and sediment control	▸ Finalise the draft Soil Management Plan that includes the following procedures and protocols relevant to potential impacts on water quality and watercourses: ▸ management of problem soils, such as: – acid sulfate soils, which may occur in proximity to wetland features and water storages – erosive or dispersive soils, such as sodosols that are expected to be encountered between the Macintyre River and Yelarbon as well as along the fertile lands north of Inglewood to the west of Kooroongarra – cracking clays (vertosols) that are expected to be encountered between Kooroongarra and Millmerran and from Yandilla to Gowrie – saline soils, particularly in high salinity hazard areas such as between Kurumbul and Yelarbon. ▸ specification of the type and location of erosion and sediment controls. The erosion and sediment control measures will be developed by a Certified Professional in Erosion and Sediment Control and be in accordance with the International Erosion Control Association *Best Practice Erosion and Sediment Control* (2008). The controls will include: – locations for specific temporary/permanent erosion and sediment control measures, such as: ▸ sediment retention basins ▸ scour protection (included in the revised reference design) ▸ sediment fencing ▸ berms and other surface flow diversions – nomination of location-specific erosion controls will include consideration of site conditions, proximity to environmental receptors, adjoining land uses, climatic and seasonal factors, and will be based on an erosion risk assessment – minimise the area of disturbance during each stage to that required to enable the safe construction, operation and maintenance of the rail corridor: ▸ scheduling of works with consideration to periods of higher rainfall (summer months) ▸ establish and specify the monitoring and performance objectives for handover on completion of construction ▸ stockpiling and management/segregation of topsoil where it contains native plants seedbank or weed material. ▸ requirements for training, inspections, corrective actions, notification and classification of environmental incidents, record keeping, monitoring and performance objectives for handover on completion of construction. ▸ Wherever a potential salinity risk is identified, the following design management measures should be implemented: ▸ temporary earthworks and permanent landform for the Project are designed to avoid unwanted water ponding. This objective will be achieved through surface levelling and use of cross-drainage and longitudinal drains within the rail corridor ▸ design water retention structures, such as sediment basins, to prevent downward leakage of water, with the use of lining or similar ▸ where possible, avoiding the need for diversions or alterations to water resources

Delivery stage	Aspect	Mitigation and management measures
Detailed design *continued*	Interference with existing surface water	▸ The revised reference design will be further developed during detailed design to: ▸ minimise the potential for diversion of watercourses, (as defined under the Water Act), and waterways (as defined under the Fisheries Act). ▸ minimise the extent of impacts to waterways, riparian vegetation and in-stream flora and habitats, in accordance with the intent of: – *Riverine protection permit exemption requirements (WSS/2013/726)* (DRDMW, 2023a) – *Accepted development requirements for operational work that is constructing or raising waterway barrier works* (DAF, 2018a) – *State code 18: Constructing or raising waterway barrier works in fish habitats* (DSDILGP, 2022b). ▸ Where the Project is unable to comply with the *accepted development requirements for operational work that is constructing or raising waterway barrier works* (DAF, 2018), a development approval for operational work that is constructing or raising waterway barrier works will be sought, and works would be done in accordance with approval conditions. ▸ Where the Project is unable to comply with the exemption requirements, a riverine protection permit will be required for works within a watercourse, and future construction works would be done in accordance with approval conditions ▸ An in-stream monitoring program will be developed during the detailed design stage, to inform design and management measures to be used at proposed waterway crossing activities during construction.
	Water quality	▸ The surface water monitoring framework will consider, where appropriate, aligning with the in-stream monitoring program. The in-stream monitoring program is to be developed for the purposes of monitoring impacts to riparian vegetation, aquatic fauna and habitats. It will be developed through the detailed design process to inform engineering design and management measures to be used at proposed waterway crossing activities.
	Availability of water to users	▸ The revised reference design will be further developed during detailed design to avoid, where practicable, impacts to private water storages so that affected landowners retain access to existing natural resources ▸ If impacts to access to existing natural resources cannot be avoided through design, appropriate compensation arrangements will be discussed and agreed with the relevant impacted landowner ▸ Where the Project will result in disturbance to private surface water storages (e.g. dams), ARTC will consult with the owners of relevant legal storage structures, prior to works commencing, to agree an approach to decommissioning or relocation of the structure. This may also include the usage or relocation of stored water and compensation (if applicable).
	Construction water	▸ The construction water requirements (volumes, quality, demand curves, approvals requirements and lead times) will be confirmed through review of the detailed design and the construction approach refinement process and will be documented in a draft Construction Water Plan. ▸ the refinement process will assess the suitability of each potential source, based on the following considerations: – available volume from identified source – legal access – volumetric requirement for the activity – water quality requirement for the activity – source location relative to the location of need. ▸ licences, approvals and agreements to access water from sources identified in the finalised Construction Water Plan will be obtained. These may include seasonal water assignments and/or water licences under the Water Act, or access agreements with bulk water suppliers or private landowners ▸ ARTC will consult with the relevant stakeholders including local governments where relevant, regarding the management of wastewater including options for treatment, reuse, and disposal

Delivery stage	Aspect	Mitigation and management measures
Detailed design *continued*	Rehabilitation	▸ A Rehabilitation and Landscaping Management Plan will be developed for the Project, during the detailed design stage of the Project. This plan will be based on the Inland Rail Landscape and Rehabilitation Strategy, in addition to location- and property-specific reinstatement commitments. ▸ Where temporary construction facilities/borrow pits are required, the design will include that the land is to be returned to a stable condition that complies with the conditions of applicable landowner agreements and regulatory approvals (e.g. development approval and/or EA).

	Registered water users	▸ Confirm with the owners of water infrastructure on impacted lots, the intended purpose of the water and any associated water authorisations. Ensure that the landowner is made aware that:
		  ▸ if a water licence attaches to land and the licensee ceases to be an owner of the land, on the day the licensee ceases to be the owner—(a) the licensee ceases to be the holder of the water licence; and (b) the registered owner of the land becomes the new licensee.
		  ▸ when ownership of part of a property is transferred, the water licence for the property may then be associated with multiple lots, and the water licence may need to be amended before the transfer of the land or it will be held jointly by the buyer and seller after the transfer.
		▸ Identify landowners willing to provide construction water to the Project, including briefing the landowner on potential amendments required to the existing authorisations
		▸ Where applicable, engage with any downstream landowners deemed at risk from the Project (e.g. where the Project may impact on in-stream or overland flow)
		▸ Inform the contractor of existing water infrastructure and authorisations attached to a lot.

Pre-construction and early works	Erosion and sediment control	▸ Install initial erosion and sediment controls in support of pre-construction minor civil works, e.g. establishing laydown areas.
Construction works	Erosion and sediment control	▸ Implement erosion and sediment controls ▸ Install permanent longitudinal drains and erosion-control measures, such as sediment retention basins and scour protection, in accordance with revised erosion and sediment control plans, developed during detailed design. ▸ Monitor the effectiveness of erosion controls installed as part of the environmental inspection schedule for the Project, as prescribed in the Construction Environmental Management Plan (CEMP) ▸ Controls that are found to be failing or not performing as intended will either be modified or replaced, as required ▸ Clearing extents are limited to the Project footprint, and clearing is scheduled to minimise the exposure time of unprotected earth to prevent sedimentation of receiving waterways ▸ Where practical, vegetation clearing and ground-disturbing works will be staged sequentially across the Project to minimise areas exposed to erosion and sediment risk of receiving waterways ▸ As part of the Rehabilitation and Landscaping Management Plan, where required, surfaces will be consolidated through either landscape, drainage and/or pavement designs to reduce risks of operation and maintenance erosion and sediment control ▸ Surface profiling of the site will occur, to prevent inadvertent ponding of water.
	Dewatering	▸ Where the dewatering of excavations (e.g. trenches and pier holes) is required, water will need to meet the established WQOs for receiving waterways before being released/discharged into local waterways ▸ If dewatering of existing storages is required, dewatering strategies will be required to comply with the *Biosecurity Act 2014* (Qld) to take reasonable measures to avoid the spread of pest species, e.g. screening of pump intake.
	Construction water	▸ The extraction of water will occur in accordance with licences, approvals and/or agreements ▸ Volume monitoring during extraction will be required for each source point, with extraction logs maintained ▸ Extraction reporting will occur, as required, in accordance with requirements of relevant licences, approvals and/or agreements obtained to cover this activity ▸ Ensure efficient water application, so as to avoid prolonged oversaturation of soils within and adjoining the Project footprint.

Delivery stage	Aspect	Mitigation and management measures

	Water quality	- A Surface Water Management Plan will be developed as a component of the CEMP. The plan will provide a surface water monitoring framework, as discussed in Section 13.6.3. The Surface Water Reporting will be prepared in accordance with the requirements for the Receiving Environment Monitoring Program as per the DESI guideline (2024). The proposed Receiving Environment Monitoring Program to be established for the Project during detailed design will be included in the Surface Water Management Plan.
		- Scheduling construction works in defined watercourses and drainage features for drier months where logistically possible
		- Water will need to meet the established WQOs for receiving waterways before being released/discharged into local waterways. Water that does not comply with relevant WQOs will either be:
		  - treated onsite to enable discharge
		  - removed from site for disposal at an appropriately licenced facility
		  - water that is dispersed for vegetation establishment, landscaping and rehabilitation will be consistent with the quality requirements specified for irrigation and general water use in the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZG, 2018)
		- Bulk storage areas for dangerous goods and hazardous materials will be located away from areas of social and environmental receptors such that offsite impacts or risks from any foreseeable hazard scenario will not exceed the dangerous dose for the defined land-use zone, i.e. either sensitive, commercial/community, or industrial, in accordance with the intent of *State Code 21: Hazardous chemical facilities* (DSDILGP, 2022c), or the SPP.
		- Licenced transporters operating in compliance with the *Australian Code for the Transport of Dangerous Goods by Road & Rail* (National Transport Commission, 2024) will be used for the transportation of dangerous goods
		- Chemicals stored and handled as part of construction activities will be managed in accordance with:
		  - the *Work Health Safety Act 2011* (Qld) and Regulation
		  - *AS 2187.1:1998 Explosives—Storage, transport and use:* Part 1: *Storage* (Standards Australia, 1998a)
		  - *AS 2187.2:2006 Explosives—Storage, transport and use:* Part 2: *Use of explosives* (Standards Australia, 2006b)
		  - *AS 1940:2017 The storage and handling of flammable and combustible liquids* (Standards Australia, 2017a)
		  - *AS 3780:2008 The storage and handling of corrosive substances* (Standards Australia, 2008a)
		  - the requirements of chemical safety data sheets
		- Procedures will be established for safe and effective fuel, oil and chemical storage and handling. This includes storing these materials within roofed, bunded areas. The bunding will have floors and walls that are lined with an impermeable material, to prevent leaching and spills
		- The Surface Water Management Plan will include spill prevention measures, as well as spill response procedures (should an accidental discharge take place) as follows:
		  - report the incident to relevant supervisor, and if warranted, evacuate the area and follow emergency procedures i.e. calling ‘000’
		  - control the source of the spill to stop continued loss of the chemical/material
		  - contain the chemical/material that has been spilled to prevent further spread
		  - clean up the spilled chemical/material, for disposal to a licenced waste management facility

Delivery stage	Aspect	Mitigation and management measures
Construction works *continued*	Water quality *continued*	‣ the Surface Water Management Plan will include development of a spill management and discharge permitting system to reduce the risk of accidental discharge from site ‣ Construction tasks will be scheduled to avoid, where possible, bulk earthwork activities within the 1% AEP extent during periods of elevated flood risk. Where works cannot be scheduled outside of this time period, activity-specific flood readiness and response planning will be required. This planning will be developed in consultation with the relevant local government and Queensland Fire and Emergency Service ‣ Laydown areas and other construction facilities that are located within the 1% AEP extent will be temporary. Their planning and function in supporting construction will reflect the local flood risk, e.g. hazardous goods will not be bulk stored in these locations ‣ Mobile plant will not be stored in the 1% AEP extent when not scheduled to be in use for construction purposes ‣ Plant maintenance and refuelling will be carried out a minimum of 50 m from riparian vegetation and waterways, with appropriate interception measures in place to avoid impacts to waterways, aquatic habitats and groundwater. Appropriate spill-control materials, including booms and absorbent materials, will be onsite at refuelling facilities at all times ‣ Appropriate waste bins will be located in laydown areas to facilitate segregation and appropriate containment of waste materials. ‣ Where practicable, implementation of a 10 m exclusion area will be implemented from Top of Bank associated with any waterways within the temporary footprint.
	Rehabilitation	‣ Reinstatement, stabilisation and rehabilitation of disturbed areas will be undertaken progressively, consistent with the Rehabilitation and Landscaping Management Plan.

Operations	Water quality	‣ Drainage structures will be inspected to assess physical condition, performance and structural integrity, with corrective measures implemented, as required. Maintenance of surface and subsurface drains will be required to ensure continued effectiveness, and to minimise risk of impact to surrounding and downstream environments and structures
		‣ Maintenance of plant, rollingstock and railway infrastructure will be carried out with appropriate interception measures in place to avoid impacts to waterways, aquatic habitats and groundwater. Appropriate spill-control materials, including booms and absorbent materials, will be onsite at all times during maintenance activities
		‣ Spill response procedures (should an accidental discharge take place) will be implemented, as follows:
		  ‣ report the incident to the relevant supervisor. If warranted, evacuate the area and follow emergency procedures, i.e. calling '000'
		  ‣ control the source of the spill to stop continued loss of the chemical/material
		  ‣ contain the chemical/material that has been spilled to prevent further spread
		  ‣ clean up the spilled chemical/material, for disposal to a licenced waste management facility.
		‣ Mass discharge events (e.g. train derailment) will be responded to in a coordinated manner, with ARTC adopting the role of lead coordinator, with involvement of rollingstock operators, emergency service providers, local council representatives and state agency representatives, as relevant and necessary.

	Erosion and sediment control	‣ The effectiveness of permanent erosion controls (e.g. scour protection or vegetated swales) will be monitored as part of the maintenance inspection schedule for the Project, to be included within the Operations Environmental Management Plan ‣ Controls that are found to be failing or not performing as intended will either be modified or replaced, as required ‣ The integrity of rail embankments will be maintained to prevent slope face scour and degradation.

13.6.3 Surface water monitoring program

The surface water monitoring program will provide for an ongoing assessment of the potential for surface water impacts discussed in Section 13.5. This section provides an overview of the additional baseline and construction works stage surface water monitoring that will be conducted for the Project. To provide a robust water quality monitoring strategy, targeted real-time monitoring surveys will be performed in addition to regular baseline monitoring.

ARTC commits to provide a detailed monitoring strategy for each water crossing during construction once exact locations and time frames of Project works are established. Site-specific mitigation measures for each crossing location will be developed to allow for individual site characteristics and impact level of construction activities. Considerations for the site-specific monitoring strategy will include but are not limited to the below points and will be documented in the Surface Water Management Plan supporting the CEMP.

- Water Quality Objectives
- Aquatic fauna and flora
- Environmental values including aesthetic quality of downstream waterbodies
- Soil salinity
- Flow regime
- Sediment loading
- Elevated exposure to nutrients and toxicants
- All work will be in accordance with the *Accepted development requirements for operational work that is constructing or raising waterway barrier works* (DAF, 2018a).

13.6.3.1 Baseline surface water monitoring

A program of baseline surface water monitoring has been undertaken to enable interim site-specific WQOs to be derived. Additional water quality sampling will be required prior to construction to enable full calculation of site-specific WQOs. The *Queensland Water Quality Guidelines 2009* specifies that 18 data points over a two-year period should be used to derive site-specific WQOs.

The locations of sampling will endeavour to be consistent with those adopted for the previous baseline sampling, as identified in Table 13-5. If, following detailed design, previous sites are no longer considered to be representative of surface water conditions in the Project footprint, such locations will be changed for alternative locations that are closer to the Project footprint.

Surface water quality data will be collected at accessible sites in accordance with the DES *Monitoring and Sampling Manual* (2018a). Field personnel undertaking the surveys will be experienced in the collection and analysis of water quality samples.

The proponent is committing to perform monthly baseline water quality monitoring until construction activities for the Project are completed.

At each sampling location, the same site characteristics will be recorded, and in-field measurements will be collected as have been collected for the previous baseline sampling (Appendix S: Surface Water Quality Technical Report). Additionally, samples will be collected for laboratory analysis, to be subject to the same suite of analysis the previous baseline sampling (Appendix S: Surface Water Quality Technical Report).

Reporting will be done in accordance with the requirements for *Receiving Environment Monitoring Program guideline* (DES, 2014).

13.6.3.2 Construction surface water monitoring

The locations, frequency and parameters of interest for water quality sampling during construction will be subject to confirmation as part of the Surface Water Management Plan, to be reviewed and accepted by the Environmental Monitor.

The frequency and location of surface water sampling during construction of the Project will be established with consideration for:

- Construction activities with potential to impact water quality
- Seasonality
- Sensitivity of receiving watercourse
- Flow characteristics.

Water quality sampling will be limited to in-situ field parameters in the first instance (i.e. DO, pH, EC, temperature, turbidity, EC and ORP) to provide instant results and evaluation of potential impacts from construction activities. Where exceedances of WQOs are recorded that cannot be attributed to natural background conditions, i.e. water quality values downstream of the construction site vary by +/- 20 per cent from upstream water quality values, then corrective mitigation measures and additional sampling may be warranted.

Corrective action procedures for patterns of WQO exceedance that can be attributed to the Project will be agreed with the Environmental Monitor prior to commencement of construction and documented in the CEMP. Quality assurance/quality control, data control and reporting requirements will also be agreed and included in the CEMP.

13.7 Impact assessment summary

Potential impacts on surface water in the construction works and operations stages of the Project are outlined in Table 13-17. These impacts have been subjected to significance assessment as per the methodology introduced in Chapter 4: Assessment Methodology and discussed in Appendix S: Surface Water Quality Technical Report.

The initial impact assessment assumes that the design considerations (or initial mitigation measures) factored into the revised reference design stage (Section 13.6.1) have been implemented.

Additional mitigation and management measures (Table 13-16) were then applied to future stages of the Project to further reduce the level of potential impact and derive a residual significance of impact.

The initial and residual significance of potential impacts are presented in Table 13-17 to demonstrate the effectiveness of mitigation measures. Each potential impact is assessed for moderate and high sensitivity receptors. High sensitivity receptors are waterways with habitat values that support MNES and MSES, i.e. sections of Macintyre River, Macintyre Brook, Canning Creek and the Condamine River that intersect with the Project footprint. All other waterways are regarded as moderate sensitivity receptors.

Impacts on water quality are based on a model of expected occurrences regarding projected impacts (potential and specific) from Project activities. As such, critical failure of infrastructure is not considered a viable impact for impact significance assessment.

TABLE 13-17 INITIAL AND RESIDUAL IMPACT SIGNIFICANCE ASSESSMENT FOR SURFACE WATER

Aspect	Potential impact	Specific impact	Stage	Sensitivity	Initial impact significance[1]		Residual impact significance of risk[2]	
					Magnitude	Significance	Magnitude	Significance
Erosion and sediment control	Increased debris	Contamination of waterway from debris from the Project to be blown or washed into waterway	Pre-construction and early works & construction works Operations	Moderate	Low	Low	Negligible	Low
			Pre-construction and early works & construction works Operations	High[3]	Low	Moderate	Negligible	Low
		Restriction of flow within the waterways if too much debris is introduced to waterway or is stuck in culverts or creek crossings	Pre-construction and early works & construction works Operations	Moderate	Moderate	Moderate	Negligible	Low
			Pre-construction and early works & construction works Operations	High[3]	Moderate	High	Negligible	Low
Water quality Waterways	Changes to receiving water quality and hydrology	Changes to receiving water quality from dewatering of artificial waterbodies	Pre-construction and early works & construction works	Moderate	Low	Low	Low	Low
Erosion and sediment control Water quality	Increase in salinity	Increased salinity in proximal watercourses from land disturbance	Pre-construction and early works & construction works	Moderate	Moderate	Moderate	Negligible	Low
				High[3]	Moderate	High	Negligible	Low
Erosion and sediment control Water quality Waterways	Increase in contaminants	Contamination of waterway from inadequate storage of fuels, oils and contaminants	Pre-construction and early works & construction works Operations	Moderate	Low	Low	Negligible	Low
			Pre-construction and early works & construction works Operations	High[3]	Low	Moderate	Negligible	Low
		Runoff from areas of disturbed contaminated lands near waterways	Pre-construction and early works & construction works	Moderate	Low	Low	Negligible	Low
			Pre-construction and early works & construction works	High[3]	Low	Moderate	Negligible	Low

Aspect	Potential impact	Specific impact	Stage	Sensitivity	Initial impact significance[1]		Residual impact significance of risk[2]	
					Magnitude	Significance	Magnitude	Significance
		Introduction of contaminants from stockpiled areas	Pre-construction and early works & construction works	Moderate	Low	Low	Negligible	Low
			Pre-construction and early works & construction works	High[3]	Low	Moderate	Negligible	Low
		Contaminants can enter waterways after rainfall events from rollingstock or after weed control activities	Operations	Moderate	Moderate	Moderate	Negligible	Low
			Operations	High[3]	Moderate	High	Negligible	Low
		Potential contamination of waterways from failed equipment or from failed infrastructure	Pre-construction and early works & construction works	Moderate	Moderate	Moderate	Negligible	Low
			Operations					
			Pre-construction and early works & construction works	High[3]	Moderate	High	Negligible	Low
			Operations					
Erosion and sediment control General interference with existing surface water	Increases in erosion and sedimentation	Disturbance of the bed, banks and riparian zone of waterways	Pre-construction and early works & construction works	Moderate	High	High	Negligible	Low
			Operations		Moderate	Moderate	Negligible	Low
			Pre-construction and early works & construction works	High[3]	Moderate	High	Negligible	Low
			Operations		Moderate	High	Negligible	Low
		Increased turbidity and sedimentation; and potential mobilisation of contaminants through erosion from disturbance activities near waterways	Pre-construction and early works & construction works	Moderate	High	High	Negligible	Low
			Operations		Moderate	Moderate	Negligible	Low
			Pre-construction and early works & construction works	High[3]	Moderate	High	Negligible	Low
			Operations		Moderate	High	Negligible	Low
		Increased turbidity and potential mobilisation of contaminants from stockpiled areas	Pre-construction and early works & construction works	Moderate	Moderate	Moderate	Negligible	Low
			Pre-construction and early works & construction works	High[3]	Moderate	High	Negligible	Low

Aspect	Potential impact	Specific impact	Stage	Sensitivity	Initial impact significance[1]		Residual impact significance of risk[2]	
					Magnitude	Significance	Magnitude	Significance
		Soils exposed through construction activities, leading to increased scour and erosion risk through overland flow (dispersive sodic soils main type along footprint)	Pre-construction and early works & construction works	Moderate	Moderate	Moderate	Negligible	Low
			Operations	Moderate	Moderate	Moderate	Negligible	Low
			Pre-construction and early works & construction works	High[3]	Moderate	High	Negligible	Low
		Increased turbidity and potential mobilisation of contaminants from dewatering activities near excavations	Pre-construction and early works & construction works	Moderate	Moderate	Moderate	Negligible	Low
			Pre-construction and early works & construction works	High[3]	Moderate	High	Negligible	Low
		Increased sedimentation can impact the function of culverts/creek crossing and impede flow of the waterway	Pre-construction and early works & construction works	Moderate	Moderate	Moderate	Negligible	Low
			Operations		Low	Low	Negligible	Low
			Pre-construction and early works & construction works	High[3]	Moderate	High	Negligible	Low
			Operations		Low	Moderate	Negligible	Low
Erosion and sediment control	Exacerbation of listed impacts above, from inadequate rehabilitation processes	Potential for sedimentation and increased turbidity within waterways if areas are either not rehabilitated or inadequate rehabilitation occurs	Pre-construction and early works & construction works	Moderate	Moderate	Moderate	Negligible	Low
			Operations					
			Pre-construction and early works & construction works	High[3]	Moderate	High	Negligible	Low
			Operations					
		Inadequate rehabilitation increasing erosion and sedimentation within waterways impacting the function of culverts/creek crossing and impeding flow of the waterway	Pre-construction and early works & construction works	Moderate	Moderate	Moderate	Negligible	Low
			Operations					
			Pre-construction and early works & construction works	High[3]	Moderate	High	Negligible	Low
			Operations					

Aspect	Potential impact	Specific impact	Stage	Sensitivity	Initial impact significance[1]		Residual impact significance of risk[2]	
					Magnitude	Significance	Magnitude	Significance
Waterway morphology	Alteration to the structure and function of waterways	Alteration to the structure of waterways, through diversions or introduction of infrastructure elements into the bank full width, has potential to impact the physical characteristic of a waterway	Pre-construction and early works & construction works	Moderate and High[3]	Moderate	High	Negligible	Low
		Alterations to stream bed and banks through potential scour downstream of scour treatments at bridge and culvert locations	Pre-construction and early works & construction works		Moderate	High	Negligible	Low
Water availability	Extraction of water for construction	Extraction of water, from multiple surface water sources, for the purpose of supporting construction activities has the potential to reduce the availability of water for other users within the relevant basins, if not planned and managed appropriately	Pre-construction and early works & construction works	Moderate and High[3]	Moderate	High	Negligible	Low
			Operations		N/A	N/A	N/A	N/A

Table notes:

1. Includes implementation of design mitigation specified in Section 13.5.1
2. Includes proposed mitigation measures specified in Table 13-16
3. Macintyre River, Macintyre Brook, Canning Creek and the Condamine River.

13.8 Conclusion

A review of historic and field data for water quality identified that surface waters within the Project footprint do not currently achieve all WQOs for the protection of aquatic ecosystems within each basin.

All waterways within the Project footprint have been identified as sensitive receptors. Several high–sensitivity, water quality receptors with associated EVs were identified within the Project footprint. Associated EVs included MNES species and MSES wetlands. High-sensitivity water quality receptors include the Macintyre River, Macintyre Brook, Canning Creek and the Condamine River.

Pre-construction, early works, construction works and operations stages of the Project have the potential to impact on surface water quality through:

- Change to water quality and hydrology
- Alteration to the structure and function of waterways
- Extraction of water for construction
- Increase in salinity
- Increase in contaminants
- Increases in erosion and sedimentation
- Increased debris
- Exacerbation of impacts from inadequate rehabilitation processes.

Additionally, the Project has potential to impact waterway morphology and the availability of surface waters for existing users.

A significance assessment has concluded that with mitigation measures in place, the significance of residual impacts is low. It is not expected that significant residual impact on surface water quality will occur as a result of the Project works as proposed.