CHAPTER 21

Cumulative Impacts

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

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21. Cumulative impacts

21.1 Overview

It is a requirement of the Terms of Reference (ToR) for the Inland Rail—Border to Gowrie Project (the Project) that the potential for cumulative impacts be considered. Section 7.3 of the ToR states:

'Cumulative impacts should be assessed over time and in combination with impacts created by the activities of other local, upstream and downstream land uses, major projects under construction, and proposed significant development progressing through the statutory assessment processes for which information is publicly available. The EIS should also propose means to suitably address predicted cumulative impacts. Outline ways in which the cumulative impact assessment and management could subsequently be progressed further on a collective basis.'.

This chapter provides a summary of the cumulative impact assessment undertaken for the Project. Projects with spatial and/or temporal overlap can result in cumulative impacts.

Cumulative impacts may:

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

The assessment draws on the findings of Chapters 7 to 20, as well as impact assessments of projects within the areas of influence of the assessed specific matters. Specific matters are components of the natural, built and social environment that have been assessed for the Project, in accordance with the requirements of the ToR. The cumulative impact assessment was carried out for each specific matter using the methodology outlined in Section 21.2.

21.2 Methodology

21.2.1 Scope and assessment approach

The scope of the cumulative impact assessment is to present clear and concise information on the cumulative impacts on specific matters that could occur as a result of the Project's development in conjunction with other identified existing or proposed developments. Specific matters include:

- Land use and tenure
- Land resources
- Landscape and visual amenity
- Flora and fauna
- Air quality
- Surface water and hydrology
- Groundwater
- Noise and vibration
- Social
- Economics
- Cultural heritage
- Traffic, transport and access
- Hazard and risk
- Waste and resource management.

The approach used to identify and assess potential cumulative impacts is summarised below:

- A review of the potential impacts identified through assessment of specific matters, as presented in Chapter 7 to Chapter 20 of the draft EIS. The status of the natural, built and social environment at the time of the ToR being issued is considered to be the baseline.
- A preliminary list of projects for consideration in the cumulative impact assessment has been collated, with timelines to demonstrate the temporal relationship between projects (refer Table 21.6). This preliminary list of projects was compiled through consideration of the following:
  - Projects subject to assessment under the *Environmental Protection Act 1994* (Qld) (EP Act) or the *State Development and Public Works Organisation Act 1971* (Qld) (SDPWO Act) with an Initial Advice Statement (IAS) published by the Department of Environment and Science (DES) or the Department of State Development, Tourism and Innovation (DSDTI)
  - Projects listed in Goondiwindi Regional Council (GRC) and Toowoomba Regional Council (TRC) development application databases
  - Development within Priority Development Areas and State Development Areas
  - Economic Development Queensland (EDQ) development projects
  - Community infrastructure designation projects
  - Projects within the public register of environmental authorities
  - Department of Transport and Main Roads (DTMR) infrastructure projects
  - Private infrastructure facilities
  - Development in accordance with regional planning interests
  - The Inland Rail projects immediately adjacent to the Project—the North Star to NSW/Queensland Border and Gowrie to Helidon projects.
- The preliminary list of projects was assessed to identify those that meet one of the following criteria:
  - Projects that have been approved but where construction has not commenced
  - Projects that have commenced construction, subsequent to issuance of the ToR for the Project, but have potential for overlap in construction activities with the Border to Gowrie Project
  - Projects that have been completed, subsequent to issuance of the ToR for the Project
  - Are operational developments that have future plans for expansion.
  - Projects that were excluded from further assessment were:
  - Existing projects with no known plans for expansion. Such projects are typically considered part of the 'existing environment' and have been accounted for in the impact assessment of each specific matter. Exceptions to this, where they occur, have been noted in Section 21.3 (e.g. flora and fauna).
  - Proposed projects that have not been developed to the point that details of their scale, size, location and core activities would be publicly available.
- Where there is a potential overlap in impacts (either spatially or temporally), a cumulative impact assessment has been undertaken to determine the nature of the cumulative impact. Where possible, the assessment method has been quantitative in nature; however, qualitative assessment has also been undertaken for some specific matters. Where quantitative assessment has been possible, the significance of impact has been assessed in comparison to the same criteria or guidelines as adopted by the relevant specific matter assessments. Where impacts are expressed qualitatively, the probability, duration, and magnitude/intensity of the impacts have been considered, as well as the sensitivity and value of the receiving environmental conditions.
- An assessment matrix (further detailed in Section 21.2.2) was used to determine the significance of cumulative impacts with respect to beneficial or detrimental effects.
- Where cumulative impacts are deemed to be of 'medium' or 'high' significance, additional mitigation measures were proposed, beyond those already proposed by the relevant specific matter assessments.

A summary of the assessment approach adopted by each discipline in assessing cumulative impacts for the Project is presented in Table 21.1.

TABLE 21.1 DISCIPLINE APPROACH TO CUMULATIVE IMPACT ASSESSMENT

Discipline	Section	Assessment approach	Assessment matrix
Land use and tenure	Section 21.3.1	Qualitative	Inland Rail (refer Section 21.2.2)
Land resources	Section 21.3.2	Qualitative	Inland Rail (refer Section 21.2.2)
Landscape and visual amenity	Section 21.3.3	Qualitative	Inland Rail (refer Section 21.2.2)
Flora and fauna	Section 21.3.4	Quantitative	Inland Rail (refer Section 21.2.2)
Air quality (construction only)[1]	Section 21.3.5	Qualitative	Inland Rail (refer Section 21.2.2)
Surface water	Section 21.3.6	Qualitative	Inland Rail (refer Section 21.2.2)
Hydrology	Section 21.3.7	Quantitative	N/A – included in assessment of Project impacts
Noise and vibration	Section 21.3.9	Qualitative	Inland Rail (refer Section 21.2.2)
Groundwater	Section 21.3.8	Qualitative	Inland Rail (refer Section 21.2.2)
Non-Indigenous heritage	Section 21.3.9	Qualitative	Inland Rail (refer Section 21.2.2)
Traffic, transport and access	Section 21.3.11	Qualitative	Inland Rail (refer Section 21.2.2)
Hazard and risk	Section 21.3.12	Qualitative	Inland Rail (refer Section 21.2.2)
Waste management	Section 21.3.13	Qualitative	Inland Rail (refer Section 21.2.2)
Social	Section 21.3.14	Qualitative	*Social Impact Assessment Guideline for State significant mining, petroleum production and extractive industry development and SIA Scoping Tool* (Department of Planning and Environment (DP&E), 2017) (refer Section 21.2.3)
Economics	Section 21.3.15	Qualitative	N/A—assessed via qualitative discussion due to the potential fluidity of future economic scenarios

Table note:
1. Operation air quality cumulative impacts included in assessment of Project impacts (Refer to Chapter 11: Air Quality)

21.2.2 Inland Rail assessment matrix

Following the identification of potential cumulative impacts, a relevance factor score of low, medium or high was determined for each potential impact in accordance with the assessment matrix given in Table 21.2.

Relevance factors account for:

- Probability of impact—what is the likelihood of impact occurring? For example, low = unlikely, medium = possible, high = likely/certain.
- Duration of impact—how long will the impact occur for? For example, low = event based or an otherwise short timeframe, high = permanent or a long duration of impact.
- Magnitude/intensity of impact—how big will the impact be on the sensitive receptor being considered? This is unique to each specific matter being considered.
- Sensitivity of receiving environment—how sensitive is the receptor being impacted? This is unique to each specific matter being considered.

Relevance factors for each potential cumulative impact were determined qualitatively, through the professional judgement of appropriately qualified persons.

TABLE 21.2 RELEVANCE FACTORS FOR CHARACTERISTICS OF POTENTIAL CUMULATIVE IMPACTS

	Relevance factor		
Impact characteristic	**Low**	**Medium**	**High**
Probability of impact	1	2	3
Duration of impact	1	2	3
Magnitude/Intensity of impact	1	2	3
Sensitivity of receiving environment	1	2	3

The sum of the relevance factors was then used to determine the impact significance and corresponding consequence of the impact as summarised in Table 21.3. For example, if a potential impact was considered to have a probability of impact of 1, duration of impact of 2, magnitude/intensity of impact of 1 and a sensitivity of receiving environment of 2, the significance of impact would be 6 (1+2+1+2 = 6) and the impact would be considered to be of low significance.

TABLE 21.3 IMPACT SIGNIFICANCE OF POTENTIAL CUMULATIVE IMPACTS

Impact significance	Sum of relevance factors	Consequence
Low	1–6	Negative impacts need to be managed by standard environmental management practices. Monitoring to be part of general Project monitoring program.
Medium	7–9	Mitigation measures likely to be necessary and specific management practices to be applied. Targeted monitoring program required, where appropriate.
High	10–12	Alternative actions should be considered and/or mitigation measures applied to demonstrate improvement. Targeted monitoring program necessary, where appropriate.

21.2.3 NSW Social Impact Assessment Guidelines assessment matrix

The *Queensland Social Impact Assessment Guideline* (Department of State Development, Manufacturing, Infrastructure and Planning (DSDMIP), 2018a) does not include a significance or risk-assessment matrix; therefore, the social risk matrix from the NSW *Social Impact Assessment Guideline* (DP&E, 2017), as shown in Table 21.4, has been applied in the assessment of Project impacts (refer Chapter 15: Social). Having been adopted for the assessment of Project risks, this same social risk matrix has then been adopted for the assessment of cumulative social impacts that are presented in Section 21.3.14.

The likelihood of social impacts and opportunities occurring has been assessed with reference to the social baseline (e.g. findings regarding community vulnerabilities), stakeholder inputs and technical findings of the draft EIS.

'Consequence', as defined in Table 21.5, has been assessed based on how the social impact may be experienced by the relevant stakeholders, considering the:

- Duration of impacts and benefits, being either short term (during construction) or long term (during operation)
- Sensitivity, including specific vulnerabilities and resilience to impacts
- Severity of potential effects on stakeholders and magnitude of potential benefits.

TABLE 21.4 RISK ASSESSMENT RATINGS, NSW SOCIAL IMPACT ASSESSMENT GUIDELINES

		Consequence level				
Likelihood		**1 Minimal**	**2 Minor**	**3 Moderate**	**4 Major**	**5 Catastrophic**
A	Almost certain	A1 (High)	A2 (High)	A3 (Extreme)	A4 (Extreme)	A5 (Extreme)
B	Likely	B1 (Moderate)	B2 (High)	B3 (High)	B4 (Extreme)	B5 (Extreme)
C	Possible	C1 (Low)	C2 (Moderate)	C3 (High)	C4 (Extreme)	C5 (Extreme)
D	Unlikely	D1 (Low)	D2 (Low)	D3 (Moderate)	D4 (High)	D5 (High)
E	Rare	E1 (Low)	E2 (Low)	E3 (Moderate)	E4 (High)	E5 (High)
		Project benefits and opportunities				

Source: *Social Impact Assessment Guideline for State significant mining, petroleum production and extractive industry development and SIA Scoping Tool* (DP&E, 2017)

TABLE 21.5 CONSEQUENCE DEFINITIONS

Rating	Impact (-)	Benefit (+)
Minimal	Local, small-scale, easily reversible change on social characteristics, or the values of the community, or communities, of interest can easily adapt or cope with change	Local small-scale opportunities emanating from the Project that the community can readily pursue and capitalise on
Minor	Short-term recoverable changes to social characteristics and values of the communities of interest, or the community has substantial capacity to adapt and cope with change	Short-term opportunities emanating from the Project
Moderate	Medium-term recoverable changes to social characteristics and values of the communities of interest, or the community has some capacity to adapt and cope with change	Medium-term opportunities emanating from the Project
Major	Long-term recoverable changes to social characteristics and values of the community, or communities, of interest, has limited capacity to adapt and cope with change	Long-term opportunities emanating from the Project
Catastrophic	Irreversible changes to social characteristics and values of the communities of interest, or the community has no capacity to adapt and cope with change	N/A

Source: Adapted from the *Social Impact Assessment Guideline* (DSDIP, 2013a).

21.2.4 Assessable projects

Twenty-three projects have been identified for preliminary consideration for their potential to contribute to cumulative impacts, in combination with the Project. These projects are listed in Table 21.6 and shown on Figure 21.1.

These 23 projects were identified in reference to the development types listed in Section 21.2.1 and have been subject to preliminary consideration for their potential to contribute to cumulative impacts.

Projects that are already operational would not traditionally be considered in a cumulative impact assessment, as their operation would typically be included in baseline assessments for an impact assessment; however, projects that are regarded as operational have been included in the initial list for preliminary consideration for cumulative impact potential in response to feedback from consultation during the draft EIS process. In some instances, operational projects have known or potential expansion plans, e.g. Commodore Mine. Such projects have warranted consideration through cumulative impact assessment. Other operational projects have not progressed beyond preliminary consideration.

Table 21.7 presents the assumed timing of each of the 23 projects in relation to the Project.

Justification for the selection of projects from the initial list of 23 for further assessment is provided in each of the corresponding specific matter assessments in Section 21.3.

TABLE 21.6 PRELIMINARY LIST OF PROJECTS FOR CONSIDERATION IN THE CUMULATIVE IMPACT ASSESSMENT

Projects	Location	Description	Status	Construction dates	Construction jobs	Operation years	Operation jobs
Wetalla Water Pipeline	From the Wetalla Wastewater Reclamation Facility in Toowoomba to the New Acland coal mine, 35 km northwest of the city Adjacent to north of the Project footprint	A 45 km underground water pipeline to supply up to 5,500 megalitres of treated wastewater to the New Acland coal mine	EIS approved with conditions in 2008 The Wetalla Water Pipeline is completed and operational	2010 to 2013	N/A	Ongoing	N/A
New Acland Coal Mine Stage 3	35 km northwest of Toowoomba 18 km north of the Project footprint	Expansion of the existing New Acland open-cut coal mine to up to 7.5 Mtpa	EIS approved with conditions in 2014, but currently subject to legal challenge	The mine is operational. Stage 3 expansion works will proceed if legal proceeding ends favourably for New Acland Coal.	260	Sequential development of resource areas expected to extend coal production until 2042	435
Australia Pacific LNG Project	Walloons gas fields (approximately 20 km west of Millmerran) 13 km west of the Project footprint	Integrated LNG project. The Walloons gas fields, located to the west of the Project, supplies coal seam gas (CSG) to support the liquified natural gas (LNG) facility on Curtis Island.	EIS approved, with conditions, in 2011	Project started operation in 2015, but subject to continual gas field development	9,900	Expected project life of 30 years	9,000
Toowoomba Bypass (formerly the Toowoomba Second Range Crossing)	The 41-km long bypass route extends from the Warrego Highway at Helidon Spa in the east to the Gore Highway at Athol in the west, via Charlton. 1 km to south and east of the Project footprint	This bypass takes heavy vehicle through-traffic around the north of Toowoomba	Opened in September 2019	2015 to 2019	1,800	Ongoing	N/A
InterLinkSQ	13 km west of Toowoomba Adjacent to south of the Project footprint	A 200-ha transport, logistics and business hub. Located on the narrow-gauge regional rail network and interstate network. Located at the junction of the Gore, Warrego and New England Highways.	Under construction	2018 to unknown. Assumed to continue development until Inland Rail is operational.	N/A	Ongoing once complete	1,500 Up to 4,000 including indirect jobs

Projects	Location	Description	Status	Construction dates	Construction jobs	Operation years	Operation jobs
Toowoomba Wellcamp Airport	Wellcamp, Queensland 1 km east of the Project footprint	Airport servicing Toowoomba, promoting interstate, intrastate and international connection for the Darling Downs, Granite Belt, Surat Basin and Southern Downs regions	Operational	2013 to 2014	N/A	Ongoing	N/A
Wellcamp Business Park	Wellcamp, Queensland 1.5 km east of the Project footprint	A 500-hectare (ha) industrial and commercial park that forms part of the Toowoomba Enterprise Hub. The business park is located in close proximity to the Toowoomba Wellcamp Airport and other major transportation infrastructure.	Operational	2013 to 2014	>20	Ongoing	Unknown
Witmack Industry Park and Charlton Logistics Park	Wellcamp, Queensland 3 km southeast of the Project footprint (Witmack Industry Park) Charlton, Queensland 3 km south of the Project footprint (Charlton Logistics Park)	The Witmack Industry Park is a large industrial land development that offers large industrial land parcels. Businesses situated within the Witmack Industrial Park include the Toowoomba Pulse Data Centre. The Charlton Logistics Park is part of the Toowoomba Enterprise Hub and provides fully serviced 2-ha sites and is well situated for potential transport and logistics operators due to its proximity to transport infrastructure.	Operational	2016 to 2018	30	Ongoing	30
Asterion Medicinal Cannabis Facility	Wellcamp, Queensland Adjoins the Project footprint 1 km south of Toowoomba–Cecil Plains Road	A high-tech medicinal cannabis cultivation, research and manufacturing facility. The project involves construction of a 40-ha glasshouse to produce 20,000 plants per day at full capacity. Medicinal-grade cannabis grown at the facility will be manufactured into a range of medicinal products, including single patient packs, cannabis oils, gels, salts and related products, destined solely for the medicinal market. This facility is anticipated to be the largest facility of its kind in the world.	Under construction	2020 to 2021	800	Ongoing once complete	150

Projects	Location	Description	Status	Construction dates	Construction jobs	Operation years	Operation jobs
Commodore Mine and Millmerran Power Station	Domville, Queensland Intersects the Project footprint, located primarily to the east	The Commodore Mine is an open-cut coal mine that provides coal for the 850 MW Millmerran Power Station (MiningLink, n.d.) The Millmerran Power Station is a coal-fired power station that supplies enough electricity to power approximately 1.1 million homes (Power Technology, 2018)	Operational	2001 to 2003. Subject to annual maintenance shutdown and continual pit expansion. Also potential for coal reserves to be accessed beyond the current footprint.	N/A	Ongoing	50
Pittsworth Industrial Precinct and Enabling Project	Pittsworth, Queensland 500 m to the south of the Project footprint	Road and sewerage upgrades at the Pittsworth Industrial Precinct to allow for industrial land for industries servicing agriculture and the wider region	Operational	2017 to 2019	Unknown	Ongoing	~30
Doug Hall Poultry	Millmerran, Queensland Intersects the Project footprint, located primarily to northwest	Poultry farming operation with capacity of approximately 20,000 chickens. Operations include egg grading, a feedmill with output of 1,500 tonnes per week, piggery, cropping and solar farm.	Operational	N/A	N/A	Ongoing	N/A
Yarranbrook Feedlot	Whetstone, Queensland Intersects the Project footprint, located predominantly to the north	Cattle feedlot licenced for 25,000 heads	Operational	N/A	N/A	Ongoing	N/A
Sapphire Feedlot	Kildonan, Queensland Adjacent to the south of the Project footprint	Cattle feedlot that currently has a 6,000 head capacity, with plans to expand to 8,700 in the future	Operational	N/A	N/A	Ongoing 2017–2022	Unknown
Wyemo Piggery	Glenarbon, Queensland 8 km south of the Project footprint	Piggery with approval for 55,000 pig units	Approved, with conditions, by GRC	Unknown	Unknown	Ongoing once complete	Unknown

Projects	Location	Description	Status	Construction dates	Construction jobs	Operation years	Operation jobs
Yarranlea Solar	Yarranlea, Queensland Intersects the Project footprint, generally extends equally to north and south	Solar Farm that will have a generation capacity of up to 100 megawatts (MW) once completed	Operational	2018 to 2019	200	30 years	Unknown
Goondiwindi Abattoir	Goondiwindi, Queensland 13 km north of the Project footprint	A new beef Abattoir located on the outskirts of Goondiwindi with beef processing of up to 72,000 tonnes per year	Approved with conditions by GRC	Unknown	Unknown	Ongoing once complete	380
North Star to NSW/QLD Border (Inland Rail)	Rail alignment from North Star, NSW to the NSW/QLD border Adjoins the Project footprint to the south	New 37 km rail corridor to connect North Star (NSW) to the Queensland Rail (QR) South West Rail Line just north of the NSW/QLD border	Reference design and draft EIS	2021 to 2024	300 peak	>100 years	15
Gowrie to Helidon Project (Inland Rail)	Rail alignment from Gowrie to Helidon, Queensland Adjoins the Project footprint to the north	New 26 km dual-gauge track between Gowrie (north-west of Toowoomba) and Helidon (east of Toowoomba), extending through the local government areas (LGAs) of Toowoomba and Lockyer Valley. The project includes a 6.38 km tunnel to create an efficient route through the steep terrain of the Toowoomba Range.	Reference design and draft EIS	2021 to 2025	596 peak	>100 years	15
Helidon to Calvert (Inland Rail)	Rail alignment from Helidon to Calvert, Queensland 26 km to the east of the Project footprint	New 47 km dual-gauge rail line connecting Helidon (east of Toowoomba) with Calvert (near Ipswich), via Placid Hills, Gatton, Forest Hill, Laidley and Grandchester, extending through the LGAs of Lockyer Valley and Ipswich City. The project includes a 1.1 km tunnel to create an efficient route through the steep terrain of the Little Liverpool Range.	Reference design and draft EIS	2021 to 2025	410 peak	>100 years	15

Projects	Location	Description	Status	Construction dates	Construction jobs	Operation years	Operation jobs
Calvert to Kagaru (Inland Rail)	Rail alignment from Calvert to Kagaru, Queensland 70 km to the southeast of the Project footprint	New 53 km dual-gauge track from Calvert to Kagaru to provide convenient access for freight to major proposed industrial developments at Ebenezer in the City of Ipswich, and at Bromelton near Beaudesert in the Scenic Rim Region. The project includes a 1.1 km tunnel through the Teviot Range.	Reference design and draft EIS	2021 to 2025	660 peak	>100 years	15
Kagaru to Acacia Ridge (Inland Rail)	Rail alignment from Kagaru to Acacia Ridge, Queensland 113 km to the southeast of the Project footprint	Enhancements to, as well as commissioning of, dual-gauge operations along the existing interstate track between Kagaru and Acacia Ridge. The project involves 49 km of existing track to be enhanced, enabling double-stacking capability along the existing interstate route both south from Kagaru to Bromelton and north from Kagaru to Brisbane's major intermodal terminal at Acacia Ridge. It extends across three LGAs—Scenic Rim, Logan and Brisbane.	Reference design and EIS	2023 to 2025	Unknown	>100 years	15
Cross River Rail	Brisbane, Queensland 120 km to the east of the Project footprint	New 10.2 km passenger rail line from Dutton Park to Bowen Hills, which includes 5.9 km of tunnel under the Brisbane River and the CBD. The Project will include four new underground stations at Boggo Road, Woolloongabba, Albert Street and Roma Street, and upgrades to Dutton Park and Exhibition stations.	Construction	2019 to 2024	Average 1,500 Max 3,000	>100 years	Unknown

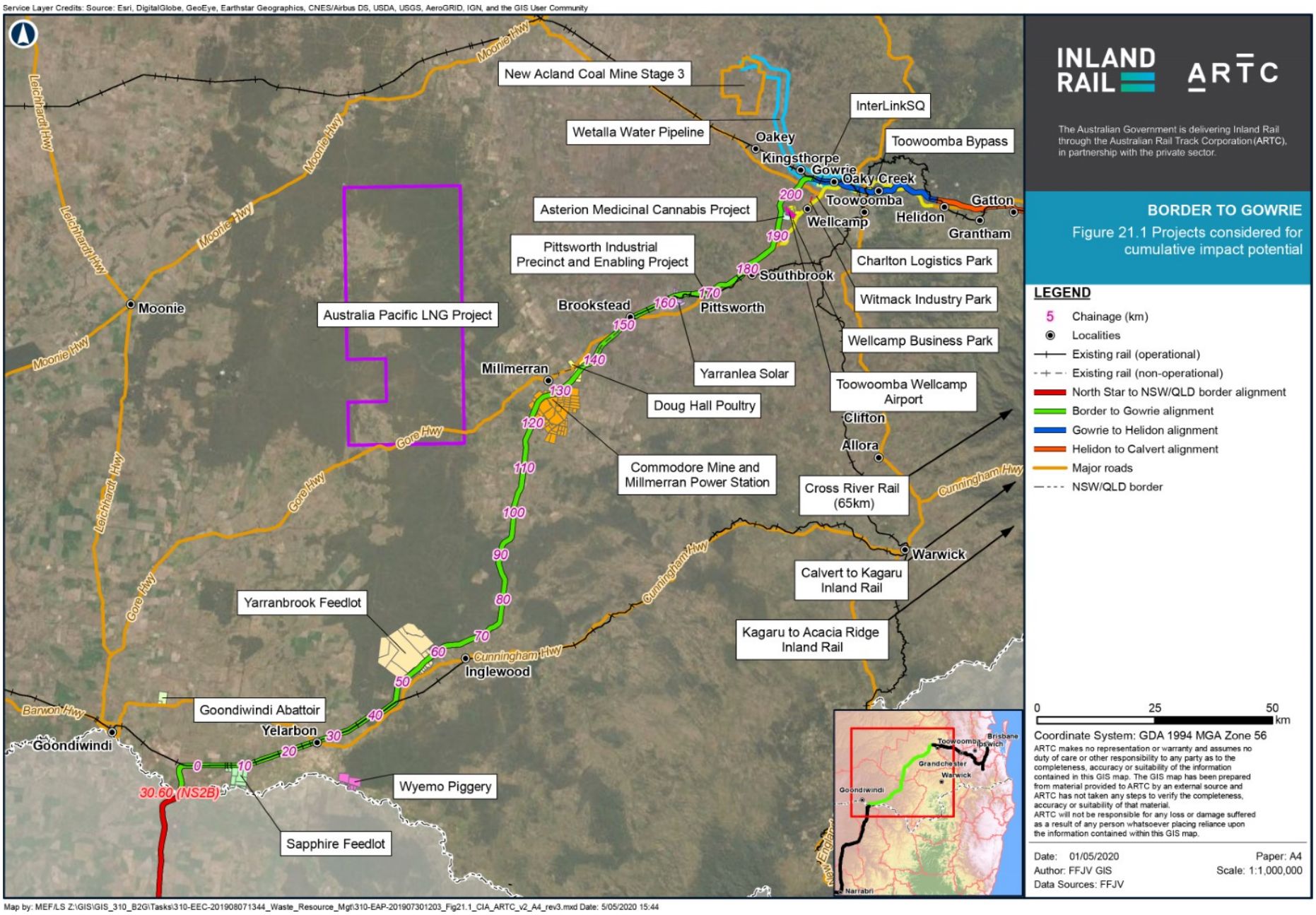
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
New Acland Coal Mine Stage 3
Wetalla Water Pipeline
InterLinkSQ
Toowoomba Bypass
Oakey
Kingsthorpe
Gowrie
Oaky Creek
Toowoomba
Wellcamp
Helidon
Gatton
Grantham
Asterion Medicinal Cannabis Project
Pittsworth Industrial Precinct and Enabling Project
Charlton Logistics Park
Witmack Industry Park
Wellcamp Business Park
Toowoomba Wellcamp Airport
Southbrook
Pittsworth
Brookstead
Millmerran
Yarranlea Solar
Doug Hall Poultry
Australia Pacific LNG Project
Moonie
Commodore Mine and Millmerran Power Station
Clifton
Allora
Cross River Rail (65km)
Warwick
Calvert to Kagaru Inland Rail
Kagaru to Acacia Ridge Inland Rail
Yarranbrook Feedlot
Inglewood
Goondiwindi Abattoir
Yelarbon
Goondiwindi
Wyemo Piggery
Sapphire Feedlot
30.60 (NS2B)
Moonie Hwy
Leichhardt Hwy
Gore Hwy
Cunningham Hwy
Barwon Hwy
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 21.1 Projects considered for cumulative impact potential
LEGEND
Chainage (km)
Localities
Existing rail (operational)
Existing rail (non-operational)
North Star to NSW/QLD border alignment
Border to Gowrie alignment
Gowrie to Helidon alignment
Helidon to Calvert alignment
Major roads
NSW/QLD border
0 25 50 km
Coordinate System: GDA 1994 MGA Zone 56
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TABLE 21.7 CUMULATIVE PROJECT TIMING

Project	Project status[1]	Overlap in construction periods—by project year						
		2020	2021	2022	2023	2024	2025	2026+
Border to Gowrie (Inland Rail)	Early works, early 2021. Construction, late 2021–2026		Early works					
Wetalla Water Pipeline	Operational							
New Acland Coal Mine Stage 3	The mine is operational. Stage 3 expansion yet to commence.							
Australia Pacific LNG Project	Operational in 2015, but subject to continual gas field development							
Toowoomba Bypass (formerly the Toowoomba Second Range Crossing)	Operational							
InterLinkSQ	Assumed to continue development until Inland Rail is operational							
Toowoomba Wellcamp Airport	Operational							
Wellcamp Business Park	Operational							
Witmack Industry Park and Charlton Logistics Park	Operational							
Asterion Medicinal Cannabis Facility	Construction							
Commodore Mine and Millmerran Power Station	Operational but subject to annual maintenance shutdown and continual pit expansion							
Pittsworth Industrial Precinct and Enabling Project	Operational							
Doug Hall Poultry	Operational							
Yarranbrook Feedlot	Operational							
Sapphire Feedlot	Operational							
Wyemo Piggery	Construction yet to commence. Unknown timeframes.							
Yarranlea Solar	Operational							
Goondiwindi Abattoir	Unknown							

Project	Project status[1]	Overlap in construction periods—by project year						
		2020	2021	2022	2023	2024	2025	2026+
North Star to NSW/QLD Border (Inland Rail)	Construction 2021–2024							
Gowrie to Helidon Project (Inland Rail)	Construction 2021–2025							
Helidon to Calvert (Inland Rail)	Construction 2021–2025							
Calvert to Kagaru (Inland Rail)	Construction 2021–2025							
Kagaru to Acacia Ridge (Inland Rail)	Construction 2023–2025							
Cross River Rail	Construction 2019–2024							

Table note:
1. Indicative construction timeframe only
2. Black—construction/expansion, White—No activity, Grey—Operational

21.3 Potential cumulative impacts and mitigation measures

The following sections present the cumulative impact assessments undertaken for each specific matter.

Cumulative impacts could be temporal in nature (e.g. traffic movements) or spatial (e.g. habitat loss). The initial construction of a project is typically more likely to result in the most material impacts as the project is new to the location and the amount of disturbance and activity to get the project established is at a peak. Once a project is established and operational, new disturbance impacts are typically restricted to expansion activities. The impacts of a project once operational are often stabilised or have reached a steady state that is below that at the peak of construction. It is for this reason that this cumulative impact assessment has generally focused on the potential of the Project to contribute to cumulative impacts during construction. Exceptions to this are noted where they occur.

21.3.1 Land use and tenure

For the purposes of land use and tenure, projects that directly interface the Border to Gowrie Project and will have temporal overlap in construction or expansion activities are considered to have potential to result in cumulative impacts. Only 4 of the initial 23 projects identified meet these criteria. These projects are:

- InterLinkSQ
- Commodore Mine and Millmerran Power Station
- North Star to NSW/Queensland Border Project (Inland Rail)
- Gowrie to Helidon Project (Inland Rail).

There may be a brief overlap in 2021 between the conclusion of construction for the Asterion Medicinal Cannabis Facility and the commencement of early works activities for the Project; however, it is anticipated that by this point the footprint for the Asterion Medicinal Cannabis Facility will have been established, so new impacts to land use and tenure from this development will no longer be occurring.

The combined land requirements of these projects have the potential to result in cumulative impacts associated with:

- Loss of Class A and Class B agricultural land, and land within an important agricultural area
- Disruption to agricultural operations
- Impacts on accessibility within the wider road network and to private properties
- Temporary disruption to services and utilities.

Due to a lack of publicly available quantitative data on land use and tenure impacts for the projects specified above, a qualitative assessment method has been applied for assessing the cumulative impacts.

Assessment of the potential impacts identified above is provided in Table 21.8, with a summary of how potential cumulative impacts would be managed. This assessment has concluded that the cumulative land use and tenure impacts of the Project are expected to be of **low significance**. The following factors contributed to this determination:

- The Project has been positioned to maximise the use of existing rail corridors or, where this is not feasible, to be aligned parallel to road reserves and property boundaries. This is consistent with State land-use planning expectations for the region. For example:
  - In proximity to the North Star to NSW/Queensland Border Project, the Project is aligned along the eastern boundary of Rainbow Reserve and connects into the existing South Western Line at the earliest opportunity
  - In proximity to the Commodore Mine, the Project is aligned in parallel to Millmerran–Inglewood Road. Properties that the Project extends through in this area are owned by entities that also have an owning stake in the Commodore Mine and Millmerran Power Station.
  - In proximity to InterLinkSQ, the Project is aligned to enable connection into the existing West Moreton Line, approximately 300 m beyond the point of interface with the Gowrie to Helidon Project.
- The North Star to NSW/Queensland Border and Gowrie to Helidon projects immediately adjoin the Project and are expected to have similar land use and tenure impacts. Once established, these projects will not be perceived as separable developments. Instead they will combine to form part of Inland Rail.

- InterLinkSQ is strategically located adjacent to the existing West Moreton Line and in proximity to the Warrego Highway and Toowoomba Wellcamp Airport. InterLinkSQ is not a component part of Inland Rail; however, once operational, Inland Rail will enable the operational potential of developments such as InterLinkSQ to be maximised.
- Where land is acquired for the Project by the compulsory acquisition process, in accordance with the *Acquisition of Land Act 1967* (Qld) (AL Act), the affected landowner will be compensated. Compensation will be assessed on an individual basis, based on the market value of the land as at the date of resumption. Additional compensation amounts for disturbance caused by the resumption of a property will also be payable.

It is recognised that the Project may contribute to cumulative impacts to land use and tenure, as the development of agricultural land cannot be fully mitigated; however, the Project has been assessed against the intent of the *State Planning Policy* (SPP) (Department of Infrastructure, Local Government and Planning (DILGP), 2017c), *South East Queensland Regional Plan* (ShapingSEQ) (DILGP, 2017a) and the *Darling Downs Regional Plan* (Department of State Development, Manufacturing, Infrastructure and Planning (DSDMIP), 2013b) and has been determined to be consistent with the objectives of each (refer Chapter 7: Land Use and Tenure).

TABLE 21.8 CUMULATIVE IMPACT ASSESSMENT FOR LAND USE AND TENURE

Project	Cumulative impact	Impact characteristic	Relevance factor	Sum of relevance factors	Impact significance	Comments
InterLinkSQ	Loss of Class A and Class B agricultural land within an IAA	Probability of the impact	Low (1)	6	Low	Will be managed through: ▸ Refining the Project design during detail design to minimise the Project footprint to the extent required for the construction works and safe operation of the Project in proximity to the InterLinkSQ site ▸ Rehabilitation of land that is temporarily disturbed in support of construction activities (e.g. for access tracks, laydown areas, etc.) at the end of its use for construction, unless otherwise agreed with the relevant landowner ▸ Development and implementation of a Rehabilitation and Landscaping Management Sub-plan, as a component of the Construction Environmental Management Plan (CEMP) for the Project, which is consistent with the Inland Rail Landscaping and Rehabilitation Strategy and compatible with InterLinkSQ's adjoining activities and addresses cumulative impacts to agricultural land.
		Duration of the impact	High (3)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Low (1)			
	Disruption to agricultural operations	Probability of the impact	Low (1)	6	Low	Will be managed through the development of individual property treatments in consultation with landowners/occupants, with respect to the management of cumulative construction activities on, or immediately adjacent to, private properties. These will detail any required adjustments to fencing, access, farm infrastructure or relocation of impacted structures, as required. Measures, where agreed, will be documented in individual property agreements.
		Duration of the impact	High (3)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Low (1)			
	Impacts on accessibility to the road network and to private properties	Probability of the impact	Low (1)	5	Low	▸ Will be managed through: ▸ The detail design process to ensure legal access to properties is maintained. Alternative access to and from a public road will be provided to an equivalent standard where feasible and practicable. Alternative access arrangements will be developed in consideration of cumulative accessibility impacts, in combination with InterLinkSQ activities.
		Duration of the impact	Medium (2)			

Project	Cumulative impact	Impact characteristic	Relevance factor	Sum of relevance factors	Impact significance	Comments
InterLinkSQ (Continued)	Impacts on accessibility to the road network and to private properties	Magnitude/intensity of the impact	Low (1)			▸ An open channel of communication between the Australian Rail Track Corporation (ARTC) and the operators of InterLinkSQ to establish a shared understanding of construction, operation and maintenance schedules for both projects. This information sharing will be used to inform property owners, occupants and businesses in advance of the timing and scope of activities in their area; and potential impacts or interruptions to access or property operational arrangements.
		Sensitivity of the receiving environment	Low (1)			
	Temporary disruptions to services and utilities	Probability of the impact	Low (1)	4	Low	ARTC will liaise with the operators of InterLinkSQ to establish a shared understanding for the utility and service requirements for each of the two projects during construction, operation and maintenance. This information sharing will be used to inform the optimal timing of temporary service disruptions and realignment/relocation of services, if either is required. This information sharing will also be used to inform property owners, occupants and businesses in advance of the timing and scope of disruptions to services and utilities in their area.
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Low (1)			
Commodore Mine and Millmerran Power Station	Loss of Class A and Class B agricultural land within an IAA	Probability of the impact	Low (1)	6	Low	▸ Will be managed through: ▸ Refinement of the Project design during detail design to minimise the Project footprint to the extent required for the construction works and safe operation of the Project in proximity to the Commodore Mine and Millmerran Power Station ▸ Rehabilitation of land that is temporarily disturbed in support of construction activities (e.g. for access tracks, laydown areas, etc.) will be rehabilitated at the end of its use for construction, unless otherwise agreed with the relevant landowner ▸ Development and implementation of a Rehabilitation and Landscaping Management Sub-plan, as a component of the CEMP for the Project that is consistent with the Inland Rail Landscaping and Rehabilitation Strategy and that is compatible with plans for the adjoining Commodore Mine and Millmerran Power Station and addresses cumulative impacts to agricultural land.
		Duration of the impact	High (3)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Low (1)			

Project	Cumulative impact	Impact characteristic	Relevance factor	Sum of relevance factors	Impact significance	Comments
Commodore Mine and Millmerran Power Station (continued)	Disruption to agricultural operations	Probability of the impact	Low (1)	6	Low	Will be managed through the development of individual property treatments in consultation with landowners/occupants, with respect to the management of cumulative construction activities on or immediately adjacent to private properties. These will detail any required adjustments to fencing, access, farm infrastructure or relocation of impacted structures, as required. Measures, where agreed, will be documented in individual property agreements (or similar). It is noted that a large number of properties surrounding the Commodore Mine and Millmerran Power Station are owned and leased for private occupancy by entities that also have an ownership interest in the mine and power station.
		Duration of the impact	High (3)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Low (1)			
	Impacts on accessibility to the road network and to private properties	Probability of the impact	Low (1)	5	Low	Will be managed through: ▸ The detail design process to ensure legal access to properties is maintained. Alternative access to and from a public road will be provided to an equivalent standard, where feasible and practicable. Alternative access arrangements will be developed in consideration of cumulative accessibility impacts, in combination with plans for the adjoining Commodore Mine and Millmerran Power Station. ▸ An open channel of communication between ARTC and the operators of the Commodore Mine and Millmerran Power Station to establish a shared understanding of construction, expansion, operation and maintenance schedules for both projects. This information sharing will be used to inform property owners, occupants and businesses in advance of the timing and scope of activities in their area; and potential impacts or interruptions to access or property operational arrangements.
		Duration of the impact	Medium (2)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Low (1)			
	Temporary disruptions to services and utilities	Probability of the impact	Low (1)	4	Low	ARTC will liaise with the operators of the Commodore Mine and Millmerran Power Station to establish a shared understanding for the utility and service requirements for each of the two projects during construction, operation and maintenance. This information sharing will be used to inform the optimal timing of temporary service disruptions and realignment/relocation of services, if either is required. This information sharing will also be used to inform property owners, occupants and businesses in advance of the timing and scope of disruptions to services and utilities in their area.
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Low (1)			

Project	Cumulative impact	Impact characteristic	Relevance factor	Sum of relevance factors	Impact significance	Comments
North Star to NSW/QLD Border (Inland Rail)	Loss of Class A and Class B agricultural land within an IAA	Probability of the impact	Low (1)	6	Low	ARTC is the proponent for both projects and therefore potential cumulative impacts will be managed through: ▸ Refinement of both projects during detail design to minimise the footprint to the extent required for the construction works and safe operation of the Project ▸ Rehabilitation of land that is temporarily disturbed in support of construction activities (e.g. for access tracks, laydown areas, etc.) at the end of its use for construction, unless otherwise agreed with the relevant landowner ▸ ARTC to ensure that Rehabilitation and Landscaping Management sub-plans (or equivalent) are prepared for both adjoining Inland Rail projects, and that these sub-plans are complementary and are consistent with the Inland Rail Landscaping and Rehabilitation Strategy ▸ ARTC to ensure that construction contract documentation for adjoining projects have consistent clauses regarding the monitoring and defect correction for revegetated and rehabilitated areas, particularly in areas designated as Class A and Class B agricultural land or within an IAA.
		Duration of the impact	High (3)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Low (1)			
	Disruption to agricultural operations	Probability of the impact	Low (1)	6	Low	ARTC is the proponent for both projects and therefore potential cumulative impacts will be managed through: ▸ The development of individual property treatments in consultation with landowners/occupants, with respect to the management of cumulative construction activities on, or immediately adjacent to, private properties. These will detail any required adjustments to fencing, access, farm infrastructure or relocation of impacted structures, as required. Measures, where agreed, will be documented in individual property arrangements. ▸ All site personnel will be required to adhere to ARTC land access protocols and procedures and property agreements when entering private properties adjacent to the Project footprint.
		Duration of the impact	High (3)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Low (1)			

Project	Cumulative impact	Impact characteristic	Relevance factor	Sum of relevance factors	Impact significance	Comments
North Star to NSW/QLD Border (Inland Rail) (continued)	Impacts on accessibility to the road network and to private properties	Probability of the impact	Low (1)	5	Low	ARTC is the proponent for both projects and therefore potential cumulative impacts will be managed through: ▸ Maintaining legal access to properties through the detail design process. Alternative access to and from a public road will be provided to an equivalent standard where feasible and practicable. Alternative access arrangements will be developed in consideration of cumulative accessibility impacts associated with the adjoining Inland Rail projects. ▸ Disruptions to access during construction will be addressed through temporary diversions and onsite traffic management in consultation with the local community. Roads will only be closed permanently where the impact of diversions or consolidations is considered acceptable, or where the existing location is not considered safe and cannot reasonably be made safe. In consultation with landowners, an appropriate level of access will be maintained for agricultural businesses across and between properties affected by the Project. ▸ During construction, regular Project updates will be provided to stakeholders, including affected landowners, which forecast road works, road realignments and closures, and explain alternative routes to enable agricultural and other business operators to plan their travel with minimal disruptions ▸ Depending on the compartmentalisation of contracts for the adjoining Inland Rail projects, ARTC will facilitate an open channel of communication between principal contractors to establish a shared understanding of construction, expansion, operation and maintenance schedules for both projects. This information sharing will be used to inform property owners, occupants and businesses in advance of the timing and scope of activities in their area and the potential impacts or interruptions to access or property operational arrangements.
		Duration of the impact	Medium (2)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Low (1)			

Project	Cumulative impact	Impact characteristic	Relevance factor	Sum of relevance factors	Impact significance	Comments
North Star to NSW/QLD Border (Inland Rail) (continued)	Temporary disruptions to services and utilities.	Probability of the impact	Medium (2)	6	Low	Depending on the compartmentalisation of contracts for the adjoining Inland Rail projects, ARTC will facilitate an open channel of communication between principal contractors to establish a shared understanding of the utility and service requirements for each of the two projects during construction, operation and maintenance. This information sharing will be used to inform the optimal timing of temporary service disruptions and realignment/relocation of services, if either is required. This information sharing will also be used to inform property owners, occupants and businesses in advance of the timing and scope of disruptions to services and utilities in their area.
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Medium (2)			
		Sensitivity of the receiving environment	Low (1)			
Gowrie to Helidon (Inland Rail)	Loss of Class A and Class B agricultural land within an IAA	Probability of the impact	Low (1)	6	Low	ARTC is the proponent for both projects and therefore potential cumulative impacts will be managed through: ▸ The design for both projects will be refined during detail design to minimise the footprint to the extent required for the construction works and safe operation of the Project ▸ Land that is temporarily disturbed in support of construction activities (e.g. for access tracks, laydown areas, etc.) will be rehabilitated at the end of its use for construction, unless otherwise agreed with the relevant landowner ▸ ARTC to ensure that Rehabilitation and Landscaping Management Sub-plans (or equivalent) are prepared for both adjoining Inland Rail projects, and that these sub-plans are complementary and are consistent with the Inland Rail Landscaping and Rehabilitation Strategy ▸ ARTC to ensure that construction contract documentation for adjoining projects have consistent clauses regarding the monitoring and defect correction for revegetated and rehabilitated areas, particularly in areas designated as Class A and Class B agricultural or within an IAA.
		Duration of the impact	High (3)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Low (1)			

Project	Cumulative impact	Impact characteristic	Relevance factor	Sum of relevance factors	Impact significance	Comments
Gowrie to Helidon (Inland Rail (continued)	Disruption to agricultural operations	Probability of the impact	Low (1)	6	Low	ARTC is the proponent for both projects and therefore potential cumulative impacts will be managed through: ▸ The development of individual property treatments in consultation with landowners/occupants, with respect to the management of cumulative construction activities on, or immediately adjacent to, private properties. These will detail any required adjustments to fencing, access, farm infrastructure or relocation of impacted structures, as required. Measures, where agreed, will be documented in individual property agreements (or similar). ▸ All site personnel will be required to adhere to ARTC land access protocols and procedures, and property agreements, when entering private properties.
		Duration of the impact	High (3)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Low (1)			
	Impacts on accessibility to the road network and to private properties	Probability of the impact	Low (1)	5	Low	ARTC is the proponent for both projects and therefore potential cumulative impacts will be managed through: ▸ Maintaining legal access to properties through the detail design process. Alternative access to and from a public road will be provided to an equivalent standard where feasible and practicable. Alternative access arrangements will be developed in consideration of cumulative accessibility impacts associated with the adjoining Inland Rail projects. ▸ Disruptions to access during construction will be addressed through temporary diversions and onsite traffic management in consultation with the local community. Roads will only be closed permanently where the impact of diversions or consolidations is considered acceptable, or where the existing location is not considered safe and cannot reasonably be made safe. In consultation with landowners, an appropriate level of access will be maintained for agricultural businesses across and between properties affected by the Project. ▸ During construction, regular Project updates will be provided to stakeholders, including affected landowners, which forecast road works, road realignments and closures, and explain alternative routes to enable agricultural and other business operators to plan their travel with minimal disruptions. ▸ Depending on the compartmentalisation of contracts for the adjoining Inland Rail projects, ARTC will facilitate an open channel of communication between principal contractors to establish a shared understanding of construction, expansion, operation and maintenance schedules for both projects. This information sharing will be used to inform property owners, occupants and businesses in advance of the timing and scope of activities in their area; and potential impacts or interruptions to access or property operational arrangements.
		Duration of the impact	Medium (2)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Low (1)			

Project	Cumulative impact	Impact characteristic	Relevance factor	Sum of relevance factors	Impact significance	Comments
Gowrie to Helidon (Inland Rail (continued)	Temporary disruptions to services and utilities	Probability of the impact	Medium (2)	6	Low	Depending on the compartmentalisation of contracts for the adjoining Inland Rail projects, ARTC will facilitate an open channel of communication between principal contractors to establish a shared understanding of the utility and service requirements for each of the two projects during construction, operation and maintenance. This information sharing will be used to inform the optimal timing of temporary service disruptions and realignment/relocation of services, if either is required. This information sharing will also be used to inform property owners, occupants and businesses in advance of the timing and scope of disruptions to services and utilities in their area.
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Medium (2)			
		Sensitivity of the receiving environment	Low (1)			

21.3.2 Land resources

For the purposes of land resources, projects that directly interface the Border to Gowrie project and will have temporal overlap in construction or expansion activities are considered to have potential to result in cumulative impacts. Only 5 of the initial 23 projects identified meet these criteria. These projects are:

- InterLinkSQ
- Commodore Mine and Millmerran Power Station
- North Star to NSW/Queensland Border Project (Inland Rail)
- Gowrie to Helidon Project (Inland Rail)
- Asterion Medicinal Cannabis Facility.

Unlike the cumulative impact assessment for land use and tenure (refer Section 21.3.1), the Asterion Medicinal Cannabis Facility has been included for assessment here as disturbance to landform and soils may still be occurring for this development, which may coincide with early works activities and initial construction tasks for the Project, including site clearing and establishment.

Although the identified projects may have different land-resource impacts to the Project, the following impacts are likely to be common to each project if not managed:

- Land contamination
- Loss of soil resources
- Potential disturbance of acid sulfate soils (ASS)
- Change to landform and topography
- Secondary salinity
- Erosion of soils
- Increases in weed occurrence.

An assessment of cumulative impacts that may arise from these projects in combination with the Project is presented in Table 21.9, with a summary of how potential cumulative impacts would be managed. This assessment has concluded that the cumulative land resources impacts of the Project are expected to be of **low to medium significance**. The following factors contributed to this determination:

- The Project has been aligned to be co-located with existing rail and road infrastructure where possible, minimising the need to develop land and modify landform that has not previously been subject to disturbance for transport infrastructure purposes
- The site-based developments may result in impacts to land resources; however, the nature of these impacts is likely to differ to those generated by a large-scale, linear infrastructure project
- As an existing worked mine, the Commodore Mine will be operating within the requirements of its environmental authority and subsequent environmental management framework. While expansion of this operation may occur, it is assumed that the current practices implemented to minimise impacts to land resources would be extended to an expanded mine footprint.
- It is assumed that adjoining projects that are yet to be constructed will achieve landform stability once established and operational.

Soil conditions across the Project footprint will continue to be characterised (at a suitable scale) with identification of potential/actual problematic soils, including: acid sulfate, reactive, erosive, dispersive, saline, acidic, alkaline and liberation of contaminant(s) by a suitably qualified soil practitioner to ensure that the design of structures, embankments, erosion control measures (temporary and permanent), soil treatment and management, and site rehabilitation planning are reflective of site-specific soil conditions. Once obtained, the additional soil data will be used in combination with existing soils data to reassess the potential for cumulative impacts to arise.

TABLE 21.9 CUMULATIVE IMPACT ASSESSMENT FOR LAND RESOURCES

Project	Potential cumulative impact	Impact characteristic	Relevance factor	Sum of relevance factors	Impact significance	Comments and management measures
InterLinkSQ	Leaks or spills leading to migration of contaminants through surface water/soil/groundwater or increased human health risk through ingestion/dermal contact	Probability of the impact	Medium (2)	5	Low	Will be managed through: ▸ Development and implementation of a Hazardous Materials Management Sub-plan and Contaminated Land Management Sub-plan, as a component of the CEMP for the Project ▸ Consultation with InterLinkSQ regarding scheduling of construction activities ▸ Development and implementation of emergency response procedures, compatible with InterLinkSQ's adjoining activities.
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Low (1)			
	Permanent loss of soil resources within the permanent footprint	Probability of the impact	Medium (2)	7	Medium	Will be managed through: ▸ The Project will be refined during detail design to minimise the Project footprint to the extent required for the construction works and safe operation of the Project in proximity to the InterLinkSQ site ▸ Land that is temporarily disturbed in support of construction activities (e.g. for access tracks, laydown areas, etc.) will be rehabilitated at the end of its use for construction, unless otherwise agreed with the relevant landowner ▸ Development and implementation of a Rehabilitation and Landscaping Management Sub-plan, as a component of the CEMP for the Project that is compatible with InterLinkSQ's adjoining activities and addresses cumulative impacts to agricultural land.
		Duration of the impact	Medium (2)			
		Magnitude/intensity of the impact	Medium (2)			
		Sensitivity of the receiving environment	Low (1)			
	ASS, including the potential to disturb ASS	Probability of the impact	Low (1)	4	Low	The likelihood of encountering ASS in proximity to the InterLinkSQ site is considered to be low. If detailed geotechnical and soil investigations identify a potential for ASS to occur in this location, an ASS Management Plan will be prepared and implemented, in accordance with the requirements of *Queensland Acid Sulfate Soil Technical Manual: Soil Management Guidelines 2014* (Dear et al., 2014)
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Low (1)			
		Probability of the impact	Medium (2)	7	Medium	

Project	Potential cumulative impact	Impact characteristic	Relevance factor	Sum of relevance factors	Impact significance	Comments and management measures
InterLinkSQ (continued)	Change to landform and topography	Duration of the impact	High (3)			The design levels of the Project will need to be assessed for compatibility with landform modifications and land management practices within the InterLinkSQ site. Cross-drainage and longitudinal drainage provided as part of the Project will need to be developed to accommodate for overland flows that move into the Project footprint from the adjoining InterLinkSQ site.
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Low (1)			
	Secondary salinity	Probability of the impact	Medium (2)	6	Low	The potential for the Project to contribute to secondary salinity will be managed through the development and implementation of a Soil Management Sub-plan. Site levels within the Project footprint will be established to prevent the inadvertent ponding of water.
		Duration of the impact	Medium (2)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Low (1)			
	Erosion	Probability of the impact	Medium (2)	7	Medium	The potential for the Project to contribute to exacerbated erosion will be managed through: ▸ The implementation of location-specific erosion and sediment control measures, developed by a certified practitioner in erosion and sediment control in accordance with the *Best Practice Erosion and Sediment Control* (International Erosion Control Association (IECA), 2008) ▸ ARTC will consult with InterLinkSQ regarding the scheduling of construction activities and the compatibility of proposed erosion control measures with activities and land management measures on the adjoining site ▸ The effectiveness of erosion controls that are within the Project footprint will be monitored by the Principal Contractor during construction ▸ Permanent erosion control measures will be monitored for ongoing effectiveness as part of ARTC's rail corridor maintenance program.
		Duration of the impact	Medium (2)			
		Magnitude/intensity of the impact	Medium (2)			
		Sensitivity of the receiving environment	Low (1)			

Project	Potential cumulative impact	Impact characteristic	Relevance factor	Sum of relevance factors	Impact significance	Comments and management measures
InterLinkSQ (continued)	Weed management	Probability of the impact	Medium (2)	7	Medium	The potential for the Project to contribute to the degradation of land and soil due to weed infestation will be managed through the development and implementation of a Biosecurity Management Sub-plan, as a component of the CEMP for the Project.
		Duration of the impact	Medium (2)			
		Magnitude/intensity of the impact	Medium (2)			
		Sensitivity of the receiving environment	Low (1)			
Commodore Mine and Millmerran Power Station	Leaks or spills leading to migration of contaminants through surface water/soil/groundwater or increased human health risk through ingestion/dermal contact	Probability of the impact	Medium (2)	5	Low	Will be managed through: ▸ Development and implementation of a Hazardous Materials Management Sub-plan and Contaminated Land Management Sub-plan, as a component of the CEMP for the Project ▸ Consultation with Intergen regarding scheduling of mine expansion activities that may interface with construction activities for the Project ▸ Development and implementation of emergency response procedures, compatible with Intergen's adjoining activities.
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Low (1)			
	Permanent loss of soil resources within the permanent footprint	Probability of the impact	Medium (2)	7	Medium	Will be managed through: ▸ The Project will be refined during detail design to minimise the Project footprint to the extent required for the construction works and safe operation of the Project in proximity to the Commodore Mine site ▸ Land that is temporarily disturbed in support of construction activities (e.g. for access tracks, laydown areas etc.) will be rehabilitated at the end of its use for construction, unless otherwise agreed with the relevant landowner ▸ Development and implementation of a Rehabilitation and Landscaping Management Sub-plan, as a component of the CEMP for the Project that is compatible with Intergen's adjoining activities and addresses cumulative impacts to agricultural land
		Duration of the impact	Medium (2)			
		Magnitude/intensity of the impact	Medium (2)			
		Sensitivity of the receiving environment	Low (1)			

Project	Potential cumulative impact	Impact characteristic	Relevance factor	Sum of relevance factors	Impact significance	Comments and management measures
Commodore Mine and Millmerran Power Station (continued)	ASS, including the potential to disturb ASS	Probability of the impact	Low (1)	4	Low	The likelihood of encountering ASS in proximity to the Commodore Mine site is considered to be low. If detailed geotechnical and soil investigations identify a potential for ASS to occur in this location, an ASS Management Plan will be prepared and implemented, in accordance with the requirements of the *Queensland Acid Sulfate Soil Technical Manual: Soil Management Guidelines 2014* (Dear et al., 2014)
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Low (1)			
	Change to landform and topography	Probability of the impact	Medium (2)	7	Medium	The design levels of the Project will need to be assessed for compatibility with landform modifications and land management practices within the Commodore Mine site. Cross-drainage and longitudinal drainage provided as part of the Project will need to be developed to accommodate for overland flows that move into the Project footprint from the adjoining Commodore Mine site.
		Duration of the impact	High (3)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Low (1)			
	Secondary salinity	Probability of the impact	Medium (2)	6	Low	The potential for the Project to contribute to secondary salinity will be managed through the development and implementation a Soil Management Sub-plan. Site levels within the Project footprint will be established to prevent the inadvertent ponding of water.
		Duration of the impact	Medium (2)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Low (1)			
	Erosion	Probability of the impact	Medium (2)	7	Medium	The potential for the Project to contribute to exacerbated erosion will be managed through: ▸ The implementation of location-specific erosion and sediment control measures, developed by a certified practitioner in erosion and sediment control in accordance with the *Best Practice Erosion and Sediment Control* (IECA, 2008) ▸ ARTC will consult with Intergen regarding the scheduling of construction activities and the compatibility of proposed erosion control measures with activities and land management measures on the adjoining site ▸ The effectiveness of erosion controls that are within the Project footprint will be monitored by the Principal Contractor during construction ▸ Permanent erosion control measures will be monitored for ongoing effectiveness as part of ARTC's rail corridor maintenance program.
		Duration of the impact	Medium (2)			
		Magnitude/intensity of the impact	Medium (2)			
		Sensitivity of the receiving environment	Low (1)			

Project	Potential cumulative impact	Impact characteristic	Relevance factor	Sum of relevance factors	Impact significance	Comments and management measures
Commodore Mine and Millmerran Power Station (continued)	Weed management	Probability of the impact	Medium (2)	7	Medium	The potential for the Project to contribute to the degradation of land and soil due to weed infestation will be managed through the development and implementation of a Biosecurity Management Sub-plan, as a component of the CEMP for the Project.
		Duration of the impact	Medium (2)			
		Magnitude/intensity of the impact	Medium (2)			
		Sensitivity of the receiving environment	Low (1)			
North Star to NSW/QLD Border (Inland Rail)	Leaks or spills leading to migration of contaminants through surface water/soil/groundwater or increased human health risk through ingestion/dermal contact	Probability of the impact	Medium (2)	5	Low	Will be managed through: ▸ Development and implementation of a Hazardous Materials Management Sub-plan and Contaminated Land Management Sub-plan, as a component of the CEMP for the Project ▸ ARTC will facilitate discussions between principal contractors for adjoining Inland Rail projects regarding the scheduling of construction activities and the development and implementation of compatible emergency response procedures.
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Low (1)			
	Permanent loss of soil resources within the permanent footprint	Probability of the impact	Medium (2)	7	Medium	Will be managed through: ▸ The Project will be refined during detail design to minimise the Project footprint to the extent required for the construction works and safe operation of the Project ▸ Land that is temporarily disturbed in support of construction activities (e.g. for access tracks, laydown areas, etc.) will be rehabilitated at the end of its use for construction, unless otherwise agreed with the relevant landowner ▸ Development and implementation of a Rehabilitation and Landscaping Management Sub-plan, as a component of the CEMP for the Project that addresses cumulative impacts to agricultural land.
		Duration of the impact	Medium (2)			
		Magnitude/intensity of the impact	Medium (2)			
		Sensitivity of the receiving environment	Low (1)			

Project	Potential cumulative impact	Impact characteristic	Relevance factor	Sum of relevance factors	Impact significance	Comments and management measures
North Star to NSW/QLD Border (Inland Rail) (continued)	ASS, including the potential to disturb ASS	Probability of the impact	Low (1)	4	Low	There is potential of ASS to be encountered in the Macintyre River; however, if presented, the cumulative impacts from ASS are expected to be low, as disturbance of ASS material will be undertaken under a single construction package. If detailed geotechnical and soil investigations identify a potential for ASS to occur in this location, an ASS Management Plan will be prepared and implemented, in accordance with the requirements of the *Queensland Acid Sulfate Soil Technical Manual: Soil Management Guidelines 2014* (Dear et al., 2014)
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Low (1)			
	Change to landform and topography	Probability of the impact	Medium (2)	6	Low	These two adjoining projects are part of the same Inland Rail Program; therefore, the projects will not be viewed as separate contributors to modifications in landform and topography.
		Duration of the impact	Medium (2)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Low (1)			
	Secondary salinity	Probability of the impact	Medium (2)	6	Low	The potential for the Project to contribute to secondary salinity will be managed through the development and implementation of a Soil Management Sub-plan. Site levels within the Project footprint will be established to prevent the inadvertent ponding of water.
		Duration of the impact	Medium (2)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Low (1)			
	Erosion	Probability of the impact	Medium (2)	7	Medium	The potential for the Project to contribute to exacerbated erosion will be managed through: ▸ The implementation of location-specific erosion and sediment control measures, developed by a certified practitioner in erosion and sediment control in accordance with the *Best Practice Erosion and Sediment Control* (IECA, 2008)

Project	Potential cumulative impact	Impact characteristic	Relevance factor	Sum of relevance factors	Impact significance	Comments and management measures
North Star to NSW/QLD Border (Inland Rail) (continued)	Erosion (continued)	Duration of the impact	Medium (2)			▸ ARTC will facilitate discussions between principal contractors for the adjoining packages regarding the scheduling of construction activities and the compatibility of proposed erosion control measures
		Magnitude/intensity of the impact	Medium (2)			▸ The effectiveness of erosion controls that are within the Project footprint will be monitored by the Principal Contractor during construction
		Sensitivity of the receiving environment	Low (1)			▸ Permanent erosion control measures will be monitored for ongoing effectiveness as part of ARTC's rail corridor maintenance program.
	Weed management	Probability of the impact	Medium (2)	7	Medium	The potential for the Project to contribute to the degradation of land and soil due to weed infestation will be managed through the development and implementation of a Biosecurity Management Sub-plan, as a component of the CEMP for the Project.
		Duration of the impact	Medium (2)			
		Magnitude/intensity of the impact	Medium (2)			
		Sensitivity of the receiving environment	Low (1)			
Gowrie to Helidon (Inland Rail)	Leaks or spills leading to migration of contaminants through surface water/soil/groundwater or increased human health risk through ingestion/dermal contact	Probability of the impact	Medium (2)	5	Low	Will be managed through: ▸ Development and implementation of a Hazardous Materials Management Sub-plan and Contaminated Land Management Sub-plan, as a component of the CEMP for the Project ▸ ARTC will facilitate discussions between principal contractors for adjoining Inland Rail projects, regarding the scheduling of construction activities and the development and implementation of compatible emergency response procedures.
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Low (1)			

Project	Potential cumulative impact	Impact characteristic	Relevance factor	Sum of relevance factors	Impact significance	Comments and management measures
Gowrie to Helidon (Inland Rail) (continued)	Permanent loss of soil resources within the permanent footprint	Probability of the impact	Medium (2)	7	Medium	Will be managed through: ▸ The Project will be refined during detail design to minimise the Project footprint to the extent required for the construction works and safe operation of the Project ▸ Land that is temporarily disturbed in support of construction activities (e.g. for access tracks, laydown areas, etc.) will be rehabilitated at the end of its use for construction, unless otherwise agreed with the relevant landowner ▸ Development and implementation of a Rehabilitation and Landscaping Management Sub-plan, as a component of the CEMP for the Project that addresses cumulative impacts to agricultural land.
		Duration of the impact	Medium (2)			
		Magnitude/intensity of the impact	Medium (2)			
		Sensitivity of the receiving environment	Low (1)			
	ASS, including the potential to disturb ASS	Probability of the impact	Low (1)	4	Low	If detailed geotechnical and soil investigations identify a potential for ASS to occur in this location, an ASS Management Plan will be prepared and implemented, in accordance with the requirements of *Queensland Acid Sulfate Soil Technical Manual: Soil Management Guidelines 2014* (Dear et al., 2014)
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Low (1)			
	Change to landform and topography	Probability of the impact	Medium (2)	6	Low	These two adjoining projects are part of the same Inland Rail Program; therefore, the projects will not be viewed as separate contributors to modifications in landform and topography. The design levels of the Project will need to be assessed for compatibility with landform modifications and land management practices on surrounding land. Cross-drainage and longitudinal drainage provided as part of the Project will need to be developed to accommodate for overland flows that move into the Project footprint.
		Duration of the impact	Medium (2)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Low (1)			
	Secondary salinity	Probability of the impact	Medium (2)	6	Low	The potential for the Project to contribute to secondary salinity will be managed through the development and implementation a Soil Management Sub-plan. Site levels within the Project footprint will be established to prevent the inadvertent ponding of water.
		Duration of the impact	Medium (2)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Low (1)			

Project	Potential cumulative impact	Impact characteristic	Relevance factor	Sum of relevance factors	Impact significance	Comments and management measures
Gowrie to Helidon (Inland Rail) (continued)	Erosion	Probability of the impact	Medium (2)	7	Medium	The potential for the Project to contribute to exacerbated erosion will be managed through: ▸ The implementation of location-specific erosion and sediment control measures, developed by a certified practitioner in erosion and sediment control in accordance with the *Best Practice Erosion and Sediment Control* (IECA, 2008) ▸ ARTC will facilitate discussions between principal contractors for the adjoining packages regarding the scheduling of construction activities and the compatibility of proposed erosion control measures ▸ The effectiveness of erosion controls that are within the Project footprint will be monitored by the Principal Contractor during construction ▸ Permanent erosion control measures will be monitored for ongoing effectiveness as part of ARTC's rail corridor maintenance program.
		Duration of the impact	Medium (2)			
		Magnitude/intensity of the impact	Medium (2)			
		Sensitivity of the receiving environment	Low (1)			
	Weed management	Probability of the impact	Medium (2)	7	Medium	The potential for the Project to contribute to the degradation of land and soil due to weed infestation will be managed through the development and implementation of a Biosecurity Management Sub-plan, as a component of the CEMP for the Project.
		Duration of the impact	Medium (2)			
		Magnitude/intensity of the impact	Medium (2)			
		Sensitivity of the receiving environment	Low (1)			
Asterion Medicinal Cannabis Facility	Leaks or spills leading to migration of contaminants through surface water/soil/groundwater or increased human health risk through ingestion/dermal contact	Probability of the impact	Medium (2)	5	Low	Will be managed through: ▸ Development and implementation of a Hazardous Materials Management Sub-plan and Contaminated Land Management Sub-plan, as a component of the CEMP for the Project ▸ Consultation with Asterion regarding scheduling of construction activities ▸ Development and implementation of emergency response procedures, compatible with Asterion's adjoining activities.
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Low (1)			

Project	Potential cumulative impact	Impact characteristic	Relevance factor	Sum of relevance factors	Impact significance	Comments and management measures
Asterion Medicinal Cannabis Facility (continued)	Permanent loss of soil resources within the permanent footprint	Probability of the impact	Low (1)	6	Low	Will be managed through: ▸ The Project will be refined during detail design to minimise the Project footprint to the extent required for the construction works and safe operation of the Project in proximity to the Asterion site ▸ Land that is temporarily disturbed in support of construction activities (e.g. for access tracks, laydown areas, etc.) will be rehabilitated at the end of its use for construction, unless otherwise agreed with the relevant landowner ▸ Development and implementation of a Rehabilitation and Landscaping Management Sub-plan, as a component of the CEMP for the Project that is compatible with Asterion's adjoining activities and addresses cumulative impacts to agricultural land.
		Duration of the impact	Medium (2)			
		Magnitude/intensity of the impact	Medium (2)			
		Sensitivity of the receiving environment	Low (1)			
	ASS, including the potential to disturb ASS	Probability of the impact	Low (1)	4	Low	The likelihood of encountering ASS in proximity to the Asterion site is considered to be low. If detailed geotechnical and soil investigations identify a potential for ASS to occur in this location, an ASS Management Plan will be prepared and implemented, in accordance with the requirements of *Queensland Acid Sulfate Soil Technical Manual: Soil Management Guidelines 2014* (Dear et al., 2014)
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Low (1)			
	Change to landform and topography	Probability of the impact	Medium (2)	7	Medium	The design levels of the Project will need to be assessed for compatibility with landform modifications and land management practices within the Asterion site. Cross-drainage and longitudinal drainage provided as part of the Project will need to be developed to accommodate for overland flows that move into the Project footprint from the adjoining Asterion site.
		Duration of the impact	High (3)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Low (1)			

Project	Potential cumulative impact	Impact characteristic	Relevance factor	Sum of relevance factors	Impact significance	Comments and management measures
Asterion Medicinal Cannabis Facility (continued)	Secondary salinity	Probability of the impact	Medium (2)	7	Medium	The potential for the Project to contribute to secondary salinity will be managed through the development and implementation a Soil Management Sub-plan. Site levels within the Project footprint will be established to prevent the inadvertent ponding of water.
		Duration of the impact	Medium (2)			
		Magnitude/intensity of the impact	Medium (2)			
		Sensitivity of the receiving environment	Low (1)			
	Erosion	Probability of the impact	Medium (2)	7	Medium	The potential for the Project to contribute to exacerbated erosion will be managed through: ▸ The implementation of location-specific erosion and sediment control measures, developed by a certified practitioner in erosion and sediment control in accordance with the *Best Practice Erosion and Sediment Control* (IECA, 2008). ▸ ARTC will consult with Asterion regarding the scheduling of construction activities and the compatibility of proposed erosion control measures with activities and land management measures on the adjoining site ▸ The effectiveness of erosion controls that are within the Project footprint will be monitored by the Principal Contractor during construction ▸ Permanent erosion control measures will be monitored for ongoing effectiveness as part of ARTC's rail corridor maintenance program.
		Duration of the impact	Medium (2)			
		Magnitude/intensity of the impact	Medium (2)			
		Sensitivity of the receiving environment	Low (1)			
	Weed management	Probability of the impact	Low (1)	5	Low	The potential for the Project to contribute to the degradation of land and soil due to weed infestation will be managed through the development and implementation of a Biosecurity Management Sub-plan, as a component of the CEMP for the Project.
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Medium (2)			
		Sensitivity of the receiving environment	Low (1)			

21.3.3 Landscape and visual amenity

Cumulative impacts to the landscape and visual amenity of the Project will largely be the product of:

- Temporal construction impacts—presence of construction traffic, workforce and machinery operating on adjoining projects at the same time
- Spatial operational impacts—the residual impact of the visibility of infrastructure of identified projects to sensitive receptors, including increases in the visibility of infrastructure as a result of the introduction of additional visual receptors (including residential receptors) into an area and with potential to view the Project.

An area of 50 km (approximately 30 minutes' drive) beyond the Project footprint was established for the assessment of landscape and visual amenity cumulative impacts. Beyond this distance, it is considered that there would be no reasonable expectation of cumulative landscape or visual amenity impact being registered by a receptor.

For the purposes of landscape and visual amenity, projects that are within the assessment area and will have temporal overlap in construction or expansion activities are considered to have potential to result in cumulative impacts. Only 9 of the initial 23 projects identified meet these criteria. These projects are:

- InterLinkSQ
- Commodore Mine and Millmerran Power Station
- North Star to NSW/Queensland Border Project (Inland Rail)
- Gowrie to Helidon Project (Inland Rail)
- Helidon to Calvert Project (Inland Rail)
- Goondiwindi Abattoir
- New Acland Coal Mine Stage 3
- Australia Pacific LNG Project
- Asterion Medicinal Cannabis Facility.

For each of these projects, the potential for the following cumulative impacts has been assessed:

- Construction impacts associated with views of increases in:
  - Construction traffic
  - Construction areas.
- Operation impacts associated with combined, successive and sequential views of adjoining projects
- Impacts of night lighting.

An assessment of cumulative impacts that may arise from these projects in combination with the Project is presented in Table 21.10, with a summary of how potential cumulative impacts would be managed. This assessment has concluded that the cumulative landscape and visual amenity impacts of the Project are expected to be of **low to medium significance**. No cumulative impacts are expected to be attributed to lighting.

The following factors contributed to this determination:

- In terms of temporal (construction) impact, it is likely that the other sections of Inland Rail (i.e. North Star to NSW/QLD Border, Gowrie to Helidon and Helidon to Calvert), the Goondiwindi Abattoir, Asterion Medicinal Cannabis Facility and InterLinkSQ may have some overlap in construction periods. In addition, ongoing growth and expansion of Commodore Mine and Millmerran Power Station, Australia Pacific LNG and the New Acland Coal Mine may result in some temporal overlap. Collectively, these projects have the potential to result in the perception of relatively high amounts of construction activity and views of the movement of heavy vehicles and plant within the assessment area.
- The locations within the assessment area most likely to be affected by construction cumulative activity are the Cunningham Highway, Millmerran–Inglewood Road, Gore Highway, Toowoomba Bypass and Warrego Highway, with the greatest activity in the north-eastern part of the Project footprint located west of Toowoomba. The potential for cumulative impacts during construction is considered to be of **low significance,** as the sight of large vehicles on the highway and main roads would be common and the construction activities will be temporary.

- In terms of the spatial (operational) impacts of other linear transport infrastructure projects, the North Star to NSW/QLD Border and the Gowrie to Helidon sections of Inland Rail immediately adjoin the Project. Some receptors will experience views of both the Project and the North Star to NSW/QLD Border section of Inland Rail or both the Project and the Gowrie to Helidon section of Inland Rail. While the visual impacts of new rail lines cannot be avoided, these developments will be viewed as part of the same integrated Inland Rail Program once operational, which, in turn, will also connect into the existing QR South Western Line and West Moreton Line in proximity to these Project interface points. This is considered to be an impact of **medium significance**.
- With regards to InterLinkSQ, there would be potential for the perception of development intensification in the northern part of the corridor, with potential cumulative impacts of up to **medium significance**. Similar effects of **medium significance** are likely associated with views from the Toowoomba–Cecil Plains Road for the Asterion Medicinal Cannabis Facility as this is the first facility as part of the broader Charlton Wellcamp Enterprise Area that is to be developed on the western side of the Toowoomba Wellcamp Airport. Combined or successive impacts with Australia Pacific LNG (located 13 km west of the Project footprint) and New Acland Mine (located 18 km north of the Project footprint) are less likely due to the separation distances from the Project and are considered to be of **low significance**.
- The Goondiwindi Abattoir is unlikely to result in meaningful operational cumulative impact on landscape or visual values. This is because it is proposed to be a discrete rural development project that is in keeping with the rural and agricultural character of the landscape; therefore, although there may be successive and/or sequential views of the two projects, these views are unlikely to be substantially altered from those of the Project in isolation. This would have a **low significance**. Similarly, Commodore Mine and Millmerran Power Station are existing facilities. In the context of the expansion of this development, the cumulative landscape and visual impact of the Project is considered to be generally very modest and therefore of **low significance**.
- The significance of the contribution of the Helidon to Calvert section of Inland Rail to cumulative impact is considered to be **low** for both landscape and visual values, due to the separation distance from the Project (located 26 km to the east of the Project footprint).

TABLE 21.10 CUMULATIVE IMPACT ASSESSMENT FOR LANDSCAPE AND VISUAL AMENITY

Project	Impact	Impact characteristic	Relevance factor	Sum of relevance factors	Impact significance	Comments and management measures
InterLinkSQ	Construction impacts associated with views of increases in: ▸ Construction traffic ▸ Construction areas.	Probability of the impact	Medium (2)	7	Medium	Will be managed through: ▸ Development and implementation of a Rehabilitation and Landscaping Management Sub-plan, as a component of the CEMP for the Project that is compatible with InterLinkSQ's adjoining activities ▸ Consultation with InterLinkSQ regarding scheduling of construction activities.
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Medium (2)			
		Sensitivity of the receiving environment	Medium (2)			
	Operation impacts associated with combined, successive and sequential views of adjoining projects	Probability of the impact	Medium (2)	9	Medium	Will be managed through: ▸ Maintenance of landscaping and rehabilitation treatments applied to the Project in proximity to InterLinkSQ.
		Duration of the impact	High (3)			
		Magnitude/intensity of the impact	Medium (2)			
		Sensitivity of the receiving environment	Medium (2)			
	Impacts of night lighting	Probability of the impact	Nil	Nil	Nil	Nil
		Duration of the impact	Nil			
		Magnitude/intensity of the impact	Nil			
		Sensitivity of the receiving environment	Nil			
Commodore Mine and Millmerran Power Station	Construction impacts associated with views of increases in: ▸ Construction traffic ▸ Construction areas.	Probability of the impact	Low (1)	5	Low	Will be managed through: ▸ Development and implementation of a Rehabilitation and Landscaping Management Sub-plan, as a component of the CEMP for the Project that is compatible with Intergen's adjoining activities ▸ Consultation with Intergen regarding scheduling of construction activities.
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Medium (2)			
		Sensitivity of the receiving environment	Low (1)			

Project	Impact	Impact characteristic	Relevance factor	Sum of relevance factors	Impact significance	Comments and management measures
Commodore Mine and Millmerran Power Station (continued)	Operation impacts associated with combined, successive and sequential views of adjoining projects	Probability of the impact	Medium (2)	6	Low	Will be managed through: ▸ Maintenance of landscaping and rehabilitation treatments applied to the Project in proximity to Commodore Mine and Millmerran Power Station.
		Duration of the impact	Medium (2)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Low (1)			
	Impacts of night lighting	Probability of the impact	Nil	Nil	Nil	Nil
		Duration of the impact	Nil			
		Magnitude/intensity of the impact	Nil			
		Sensitivity of the receiving environment	Nil			
North Star to NSW/QLD Border (Inland Rail)	Construction impacts associated with views of increases in: ▸ Construction traffic ▸ Construction areas.	Probability of the impact	High (3)	7	Medium	Will be managed through: ▸ ARTC to ensure that Rehabilitation and Landscaping Management Sub-plans are prepared for both adjoining Inland Rail projects, that these sub-plans are complementary and are consistent with the Inland Rail Landscaping and Rehabilitation Strategy.
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Medium (2)			
		Sensitivity of the receiving environment	Low (1)			
	Operation impacts associated with combined, successive and sequential views of adjoining projects	Probability of the impact	Medium (2)	9	Medium	Will be managed through: ▸ Maintenance of landscaping and rehabilitation treatments applied to all Inland Rail projects.
		Duration of the impact	High (3)			
		Magnitude/intensity of the impact	Medium (2)			
		Sensitivity of the receiving environment	Medium (2)			
	Impacts of night lighting	Probability of the impact	Nil	Nil	Nil	Nil
		Duration of the impact	Nil			
		Magnitude/intensity of the impact	Nil			
		Sensitivity of the receiving environment	Nil			

Project	Impact	Impact characteristic	Relevance factor	Sum of relevance factors	Impact significance	Comments and management measures
Gowrie to Helidon (Inland Rail)	Construction impacts associated with views of increases in: ▸ Construction traffic ▸ Construction areas.	Probability of the impact	High (3)	8	Medium	Will be managed through: ▸ ARTC to ensure that Rehabilitation and Landscaping Management Sub-plans are prepared for both adjoining Inland Rail projects, that these sub-plans are complementary and are consistent with the Inland Rail Landscaping and Rehabilitation Strategy.
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Medium (2)			
		Sensitivity of the receiving environment	Medium (2)			
	Operation impacts associated with combined, successive and sequential views of adjoining projects	Probability of the impact	Medium (2)	9	Medium	Will be managed through: ▸ Maintenance of landscaping and rehabilitation treatments applied to all Inland Rail projects.
		Duration of the impact	High (3)			
		Magnitude/intensity of the impact	Medium (2)			
		Sensitivity of the receiving environment	Medium (2)			
	Impacts of night lighting	Probability of the impact	Nil	Nil	Nil	Nil
		Duration of the impact	Nil			
		Magnitude/intensity of the impact	Nil			
		Sensitivity of the receiving environment	Nil			
Helidon to Calvert (Inland Rail)	Construction impacts associated with views of increases in: ▸ Construction traffic ▸ Construction areas.	Probability of the impact	Low (1)	4	Low	Will be managed through: ▸ Development and implementation of a Rehabilitation and Landscaping Management Sub-plan, as a component of the CEMP (refer Chapter 22: Outline Environmental Management Plan).
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Medium (2)			
	Operation impacts associated with combined, successive and sequential views of adjoining projects	Probability of the impact	Low (1)	4	Low	Will be managed through: ▸ Maintenance of landscaping and rehabilitation treatments applied to the Project.
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Medium (2)			

Project	Impact	Impact characteristic	Relevance factor	Sum of relevance factors	Impact significance	Comments and management measures
Helidon to Calvert (Inland Rail) (continued)	Impacts of night lighting	Probability of the impact	Nil	Nil	Nil	Nil
		Duration of the impact	Nil			
		Magnitude/intensity of the impact	Nil			
		Sensitivity of the receiving environment	Nil			
Goondiwindi Abattoir	Construction impacts associated with views of increases in: ▸ Construction traffic ▸ Construction areas.	Probability of the impact	Medium (2)	5	Low	Will be managed through: ▸ Development and implementation of a Rehabilitation and Landscaping Management Sub-plan, as a component of the CEMP (refer Chapter 22: Outline Environmental Management Plan).
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Low (1)			
	Operation impacts associated with combined, successive and sequential views of adjoining projects	Probability of the impact	Low (1)	4	Low	Will be managed through: ▸ Maintenance of landscaping and rehabilitation treatments applied to the Project.
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Low (1)			
	Impacts of night lighting	Probability of the impact	Nil	Nil	Nil	Nil
		Duration of the impact	Nil			
		Magnitude/intensity of the impact	Nil			
		Sensitivity of the receiving environment	Nil			
New Acland Coal Mine Stage 3	Construction impacts associated with views of increases in: ▸ Construction traffic ▸ Construction areas.	Probability of the impact	Low (1)	4	Low	Will be managed through: ▸ Development and implementation of a Rehabilitation and Landscaping Management Sub-plan, as a component of the CEMP (refer Chapter 22: Outline Environmental Management Plan).
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Low (1)			

Project	Impact	Impact characteristic	Relevance factor	Sum of relevance factors	Impact significance	Comments and management measures
New Acland Coal Mine Stage 3 (continued)	Operation impacts associated with combined, successive and sequential views of adjoining projects	Probability of the impact	Low (1)	4	Low	Will be managed through: ▸ Maintenance of landscaping and rehabilitation treatments applied to the Project.
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Low (1)			
	Impacts of night lighting	Probability of the impact	Nil	Nil	Nil	Nil
		Duration of the impact	Nil			
		Magnitude/intensity of the impact	Nil			
		Sensitivity of the receiving environment	Nil			
Australia Pacific LNG Project	Construction impacts associated with views of increases in: ▸ Construction traffic ▸ Construction areas.	Probability of the impact	Low (1)	4	Low	Will be managed through: ▸ Development and implementation of a Rehabilitation and Landscaping Management Sub-plan, as a component of the CEMP (refer Chapter 22: Outline Environmental Management Plan).
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Low (1)			
	Operation impacts associated with combined, successive and sequential views of adjoining projects	Probability of the impact	Low (1)	4	Low	Will be managed through: ▸ Maintenance of landscaping and rehabilitation treatments applied to the Project.
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Low (1)			
	Impacts of night lighting	Probability of the impact	Nil	Nil	Nil	Nil
		Duration of the impact	Nil			
		Magnitude/intensity of the impact	Nil			
		Sensitivity of the receiving environment	Nil			

21.3.4 Flora and fauna

The cumulative impacts of multiple projects occurring in the vicinity of the Project will likely include the continued loss of biodiversity in the Southeast Queensland bioregion.

Twenty (20) of the 23 initially identified projects are within close-enough proximity (50 km) to the Project that potential cumulative impacts to ecological values may occur. Ecological cumulative impacts are most appropriately considered at a biologically relevant spatial scale. A distance of 50 km from the Project was selected, as many of the sensitive environmental receptors of relevance to the Project (incorporating all habitat categories) do not occur beyond this area and, if they do occur, any cumulative impacts associated with the Project are not considered to be relevant beyond this extent.

The projects considered applicable for assessment of ecological impacts are:

- Wetalla Water Pipeline
- New Acland Coal Mine Stage 3
- Australia Pacific LNG Project
- Toowoomba Bypass (formerly the Toowoomba Second Range Crossing)
- InterLinkSQ
- Toowoomba Wellcamp Airport
- Wellcamp Business Park
- Witmack Industry Park and Charlton Logistics Park
- Asterion Medicinal Cannabis Facility
- Commodore Mine and Millmerran Power Station
- Pittsworth Industrial Precinct and Enabling Project
- Doug Hall Poultry
- Yarranbrook Feedlot
- Sapphire Feedlot
- Wyemo Piggery
- Yarranlea Solar
- Goondiwindi Abattoir
- North Star to NSW/Queensland Border Project (Inland Rail)
- Gowrie to Helidon Project (Inland Rail)
- Helidon to Calvert Project (Inland Rail).

Operational projects have been included in the assessment of ecological cumulative impacts due to the potential for such developments to continue to have an ongoing impact on ecological sensitive receptors and processes, e.g. through the degradation of adjoining habitats or disturbance of species through noise, operational emissions, light, weed incursion, etc.

Cumulative ecological impacts may arise due to one or more of the following processes:

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

A quantitative approach has been adopted for the assessment of cumulative ecological impacts. To enable this, the following has been determined and presented in Table 21.11:

- The total extent of significant sensitive environmental receptors within:
  - The assessed 50 km radius of the Project
  - The combined footprints of the 20 projects included in the assessment
  - The combined footprints of the Border to Gowrie Project, plus the 20 projects included in the assessment.
- The percentage area of disturbance to significant sensitive environmental receptors as a result of the 20 projects included in the assessment
- The percentage area of disturbance to significant sensitive environmental receptors as a result of the Border to Gowrie Project.

For the purpose of these calculations, the areas of assessment vary between matters of State environmental significance (MSES) and matters of national environmental significance (MNES). For MNES, assessment included areas contained within NSW as well as Queensland, considering projects within both states; however, for MSES, the cumulative impact assessment only considered projects and areas within Queensland, as MSES are bound by State borders.

The results of the significance assessment of these cumulative impacts are summarised as follows:

- *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) listed Threatened Ecological Communities (TECs):
  - Weeping Myall Woodlands TEC—Project impact makes a 1.55 per cent contribution to the clearing of approximately 2,558.03 ha (sum of cumulative impact), which constitutes 6.38 per cent of the available habitat within the cumulative impact assessment area
  - Poplar box woodlands TEC— Project impact makes a 1.48 per cent contribution to the clearing of approximately 2,679.39 ha (sum of cumulative impact), which constitutes 5.09 per cent of the available habitat within the cumulative impact assessment area.
- EPBC Act listed threatened flora species habitat:
  - *Bertya opponens*—Project impact makes a 0.21 per cent contribution to the clearing of approximately 5,037.50 ha (sum of cumulative impact), which constitutes 6.80 per cent of the available habitat within the cumulative impact assessment area
  - *Homopholis belsonii* (Belson's panic)—Project impact makes a 3.12 per cent contribution to the clearing of approximately 9,313.44 ha (sum of cumulative impact), which constitutes 8.02 per cent of the available habitat within the cumulative impact assessment area
  - *Lepidium peregrinum* (Wandering peppercress) —Project impact makes a 1.62 per cent contribution to the clearing of approximately 3,116.30 ha (sum of cumulative impact), which constitutes 5.40 per cent of the available habitat within the cumulative impact assessment area
  - *Leucopogon* sp. Coolmunda (Coolmunda leucopogon)—Project impact makes a 1.34 per cent contribution to the clearing of approximately 3,609.62 ha (sum of cumulative impact), which constitutes 10.52 per cent of the available habitat within the cumulative impact assessment area.
- EPBC Act listed threatened fauna species habitat:
  - Painted honeyeater (*Grantiella picta*)—Project impact makes a 3.19 per cent contribution to the clearing of approximately 13,567.36 ha (sum of cumulative impact), which constitutes 3.27 per cent of the available habitat within the cumulative impact assessment area
  - Swift parrot (*Lathamus discolor*)—Project impact makes a 1.99 per cent contribution to the clearing of approximately 13,243.25 ha (sum of cumulative impact), which constitutes 3.12 per cent of the available habitat within the cumulative impact assessment area
  - South-eastern long-eared bat (*Nyctophilus corbeni*)—Project impact makes a 2.57 per cent contribution to the clearing of approximately 13,409.64 ha (sum of cumulative impact), which constitutes 3.30 per cent of the available habitat within the cumulative impact assessment area
  - Greater glider (*Petauroides volans*)—Project impact makes a 1.89 per cent contribution to the clearing of approximately 10,485.24 ha (sum of cumulative impact), which constitutes 5.55 per cent of the available habitat within the cumulative impact assessment area
  - Five-clawed worm-skink (*Anomalopus mackayi*)—Project impact makes a 4.47 per cent contribution to the clearing of approximately 4,162.35 ha (sum of cumulative impact), which constitutes 4.64 per cent of the available habitat within the cumulative impact assessment area

- Collared delma (*Delma torquata*)—Project impact makes a 3.46 per cent contribution to the clearing of approximately 8,538.86 ha (sum of cumulative impact), which constitutes 3.12 per cent of the available habitat within the cumulative impact assessment area
- Yakka skink (*Egernia rugosa*)—Project impact makes a 2.63 per cent contribution to the clearing of approximately 13,856.73 ha (sum of cumulative impact), which constitutes 3.43 per cent of the available habitat within the cumulative impact assessment area
- Condamine earless dragon (*Tympanocryptis condaminensis*)—Project impact makes a 31.20 per cent contribution to the clearing of approximately 787.21 ha (sum of cumulative impact), which constitutes 3.69 per cent of the available habitat within the cumulative impact assessment area.

- EPBC Act listed, non-threatened migratory species:
  - Common sandpiper (*Actitis hypoleucos*), sharp-tailed sandpiper (*Calidris acuminata*), pectoral sandpiper (*Calidris melanotos*), red-necked stint (*Calidris ruficollis*), yellow wagtail (*Motacilla flava*), glossy ibis (*Plegadis falcinellus*), common greenshank (*Tringa nebularia*)—Project impact makes a 0.17 per cent contribution to the clearing of approximately 77,993.16 ha (sum of cumulative impact), which constitutes 42.9 per cent of the available habitat within the cumulative impact assessment area.
- *Nature Conservation Act 1992* (Qld) (NC Act) listed flora and species habitat:
  - *Digitaria porrecta* (Finger panic)—Project impact makes a 9.89 per cent contribution to the clearing of approximately 4,608.69 ha (sum of cumulative impact), which constitutes 7.44 per cent of the available habitat within the cumulative impact assessment area
  - Common death adder (*Acanthophis antarcticus*)—Project impact makes a 3.54 per cent contribution to the clearing of approximately 15,258.00 ha (sum of cumulative impact), which constitutes 2.14 per cent of the available habitat within the cumulative impact assessment area
  - Category B regulated vegetation 'of concern'—Project impact makes a 4.12 per cent contribution to the clearing of approximately 3,681.57 ha (sum of cumulative impact), which constitutes 1.82 per cent of the available habitat within the cumulative impact assessment area
  - MSES wildlife habitat—Project impact makes an 8.79 per cent contribution to the clearing of approximately 1,385.80 ha (sum of cumulative impact), which constitutes 1.64 per cent of the available habitat within the cumulative impact assessment area.

The results of the significance assessment of these cumulative impacts are presented in aggregated form in Table 21.12, i.e., a level of cumulative impact significance is not attributed for each project. Unmitigated, the cumulative impacts resulting from existing and proposed developments within the cumulative impact assessment area include some that may be irreversible and permanent and be of **low to moderate significance**.

The potential contribution of the Project's activities to cumulative ecological impacts will be managed through:

- Refinement of the Project footprint through detail design, to limit the extent of disturbance to sensitive environmental receptors to that required to enable safe and efficient construction, operation and maintenance of the Project
- Detailed ecological surveys of the Project footprint will be undertaken in parallel to the development of the detail design. Where MNES or MSES are found to occur, condition assessment will be undertaken (using a BioCondition assessment approach). Data obtained from these detailed surveys will be used to refine the quantification of ecological impacts, revise the analysis of significant residual impacts and re-calculate offset requirements for the Project.
- Annual monitoring of MNES and MSES (or their habitat) retained within the Project footprint against the initial BioCondition assessment. Corrective actions to be implemented where Project-associated impacts are identified.

TABLE 21.11 ECOLOGICAL CUMULATIVE IMPACTS CALCULATED WITHIN THE CUMULATIVE IMPACT ASSESSMENT AREA

Sensitive environmental receptor	Occurrence in the cumulative impact assessment area (ha)[1]	Occurrence in the cumulative impact project area (excluding Project footprint)[2]	Occurrence in the footprint of all projects, including the Project	% disturbance in cumulative impact assessment area of all projects, including the Project	% disturbance in cumulative impact assessment area as a result of the Project	Magnitude of disturbance[3]
Australian Government significant ecological constraints						
TECs (EPBC Act)						
Brigalow (*Acacia harpophylla* dominant and co-dominant)	29,809.15	159.77	222.66	0.75	28.24	Low
Natural grassland on basalt and fine-textured alluvial plains of northern NSW and southern Queensland	2,278.37	60.44	60.44	2.65	0.00	Low
Weeping myall woodlands	40,077.38	2,518.31	2,558.03	6.38	1.55	2,558.03
White box-yellow box-Blakely's red gum grassy woodland and derived native grassland	140,376.00	23.80	23.80	0.02	0.00	Low
Poplar box grassy woodland on alluvial plains	52,611.28	2,639.67	2,679.39	5.09	1.48	Low
Threatened flora habitat (EPBC Act)						
Acacia lauta (Tara wattle)	270,012.58	8,995.49	9,294.34	3.44	3.22	Low
Arthraxon hispidus (Hairy-joint grass)	104,535.28	4,112.49	4,145.58	3.96	0.80	Low
Bertya opponens	74,060.99	5,026.90	5,037.50	6.80	0.21	Low
Cadellia pentastylis (Ooline)	9,967.50	241.49	246.05	2.47	1.85	Low
Clematis fawcettii (Stream clematis)	747.67	0.00	0.00	0.00	0.00	None
Dichanthium queenslandicum (King blue-grass)	46,727.72	1,009.51	1,131.44	2.42	10.78	Low
Dichanthium setosum (Bluegrass)	46,819.62	1,009.51	1,070.00	2.29	5.65	Low
Eucalyptus virens (Shiny-leaved ironbark)	248,597.94	8,665.68	8,958.24	3.60	3.273	Low
Homopholis belsonii (Belson's panic)	116,142.08	9,022.55	9,313.44	8.02	3.12	Low
Lepidium monoplocoides (Winged peppercress)	312,467.35	11,745.18	12,115.70	3.88	3.06	Low
Lepidium peregrinum (Wandering pepper-cress)	57,727.63	3,065.91	3,116.30	5.40	1.62	Low
Leucopogon sp. Coolmunda (D. Halford Q 1635) (Coolmunda leucopogon)	34,296.05	3,561.43	3,609.62	10.52	1.34	Low
Macrozamia machinii	104,937.28	3,062.88	3,140.59	2.99	2.47	Low
Picris evae (Hawkweed)	160,083.62	4,726.26	5,320.24	3.32	11.16	Low

Sensitive environmental receptor	Occurrence in the cumulative impact assessment area (ha)[1]	Occurrence in the cumulative impact project area (excluding Project footprint)[2]	Occurrence in the footprint of all projects, including the Project	% disturbance in cumulative impact assessment area of all projects, including the Project	% disturbance in cumulative impact assessment area as a result of the Project	Magnitude of disturbance[3]
Prostanthera sp. Dunmore (Dunmore prostanthera)	100,230.59	3,460.92	3,566.77	3.56	2.97	Low
Rhaponticum australe (Austral cornflower)	70,967.63	2,601.69	2,824.22	3.98	7.88	Low
Sophora fraseri (Brush sophora)	22,960.66	327.93	327.93	1.43	0	Low
Thesium australe (Austral toadflax)	72,373.58	1,869.06	2,071.66	2.86	9.78	Low
Tylophora linearis (Slender tylophora)	220,874.12	5,238.38	5,467.79	2.48	4.20	Low
Xerothamnella herbacea	21,833.42	250.50	317.47	1.45	21.10	Low
Westringia parvifolia	14,556.51	0.00	0.00	0.00	0.00	Absent—not applicable
Threatened fauna habitat (EPBC Act)						
Birds						
Regent honeyeater (*Anthochaera phrygia*)	176,116.89	6,573.48	6,730.87	3.82	2.33	Low
Australasian bittern (*Botaurus poiciloptilus*)	47,137.39	442.96	487.94	1.04	9.22	Low
Curlew sandpiper (*Calidris ferruginea*)	21,214.89	251.52	265.32	1.25	5.20	Low
Red goshawk (*Erythrotriorchis radiatus*)	339,517.32	12,015.86	12,355.20	3.64	2.74	Low
Grey falcon (*Falco hypoleucos*)	645,134.52	13,485.73	14,324.44	2.22	5.86	Low
Squatter pigeon—southern subspecies (*Geophaps scripta scripta*)	307,545.26	10,311.00	10,650.34	3.46	3.19	Low
Painted honeyeater (*Grantiella picta*)	414,530.36	13,134.37	13,567.36	3.27	3.19	Low
Swift parrot (*Lathamus discolor*)	424,007.53	12,979.59	13,243.25	3.12	1.99	Low
Australian painted snipe (*Rostratula australis*)	47,451.51	442.96	487.94	1.03	9.22	Low
Black-breasted button-quail (*Turnix melanogaster*)	43,303.76	164.02	164.02	0.38	0	Low
Fish						
Maccullochella peelii (Murray cod)	20,899.39	101.47	114.29	0.55	11.22	Low
Mammals						
Large-eared pied bat (*Chalinolobus dwyeri*)	103,741.82	3,307.17	3,362.11	3.24	1.63	Low
Spotted-tailed quoll (*Dasyurus maculatus maculatus*)	146,145.71	4,177.76	4,259.19	2.91	1.91	Low

Sensitive environmental receptor	Occurrence in the cumulative impact assessment area (ha)[1]	Occurrence in the cumulative impact project area (excluding Project footprint)[2]	Occurrence in the footprint of all projects, including the Project	% disturbance in cumulative impact assessment area of all projects, including the Project	% disturbance in cumulative impact assessment area as a result of the Project	Magnitude of disturbance[3]
South-eastern long-eared bat (*Nyctophilus corbeni*)	405,983.87	13,065.54	13,409.64	3.30	2.57	405,983.87
Greater glider (*Petauroides volans*)	188,901.99	10,286.82	10,485.24	5.55	1.89	188,901.99
Brush-tailed rock-wallaby (*Petrogale penicillata*)	6,239.60	0.54	0.54	0.01	0	Low
Koala (*Phascolarctos cinereus*)	521,674.94	16,881.67	17,374.73	3.33	2.84	Low
Grey-headed flying-fox (*Pteropus poliocephalus*)	202,963.26	1,820.14	1,930.63	0.95	5.72	Low
Reptiles						
Five-clawed worm-skink (*Anomalopus mackayi*)	89,794.23	3,984.09	4,162.35	4.64	4.47	Low
Collared delma (*Delma torquata*)	273,942.02	8,243.10	8,538.86	3.12	3.46	Low
Yakka skink (*Egernia rugosa*)	414,435.87	13,492.26	13,856.73	3.43	2.63	Low
Dunmall's snake (*Furina dunmalli*)	295,290.03	9,509.38	9,808.23	3.32	3.05	Low
Condamine earless dragon (*Tympanocryptis condaminensis*)	21,307.47	541.62	787.21	3.69	31.20	Low
Invertebrates						
Brigalow woodland snail (*Adclarkia cameroni*)	150,415.22	2,218.55	2,350.01	1.56	5.59	Low
Migratory bird species habitat						
Common sandpiper (*Actitis hypoleucos*)	181,418.10	77,860.56	77,993.16	42.9	0.17	Low
Fork-tailed swift (*Apus pacificus*)	2,874,133.44	814,808.92	818,012.70	28.46	0.39	Low
Sharp-tailed sandpiper (*Calidris acuminata*)	183,807.58	77,437.14	77,569.74	42.20	0.17	Low
Pectoral sandpiper (*Calidris melanotos*)	181,418.10	77,860.56	77,993.16	42.99	0.17	Low
Red-necked stint (*Calidris ruficollis*)	124,397.79	77,702.65	77,835.25	62.57	0.17	Low
Oriental cuckoo (*Cuculus optatus*)	47,909.55	13,310.09	13,334.54	27.83	0.18	Low
Latham's snipe (*Gallinago hardwickii*)	185,580.54	78,005.98	78,138.58	42.10	0.17	Low
Black-faced monarch (*Monarcha melanopsis*)	52,922.99	13,699.97	13,724.42	25.93	0.18	Low
Yellow wagtail (*Motacilla flava*)	181,418.10	77,860.56	77,993.16	42.99	0.17	Low
Satin flycatcher (*Myiagra cyanoleuca*)	55,340.01	13,311.39	13,335.84	24.10	0.18	Low

Sensitive environmental receptor	Occurrence in the cumulative impact assessment area (ha)[1]	Occurrence in the cumulative impact project area (excluding Project footprint)[2]	Occurrence in the footprint of all projects, including the Project	% disturbance in cumulative impact assessment area of all projects, including the Project	% disturbance in cumulative impact assessment area as a result of the Project	Magnitude of disturbance[3]
Osprey (*Pandion haliaetus*)	51,620.01	7,930.23	7,975.21	15.45	0.56	Low
Glossy ibis (*Plegadis falcinellus*)	186,069.48	77,251.00	77,383.60	41.59	0.17	Low
Rufous fantail (*Rhipidura rufifrons*)	57,292.63	13,501.46	13,525.91	23.61	0.18	Low
Spectacled monarch (*Symposiachrus trivirgatus*)	50,033.69	13,346.07	1,3370.52	26.72	0.18	Low
Common greenshank (*Tringa nebularia*)	181,418.10	77,860.56	77,993.16	42.99	0.17	Low
State significant ecological constraints						
Protected nature areas: ▸ Alice Creek Nature Refuge ▸ Berlin Scrub Nature Refuge ▸ Dilladerri Nature Refuge ▸ Ellangowan Nature Refuge ▸ Fair Hills Nature Refuge ▸ Gattonview Nature Refuge ▸ JAL Nature Refuge ▸ Kalisha Nature Refuge ▸ Long Grass Nature Refuge ▸ Myall Park Nature Refuge ▸ Pine Cliffs Nature Refuge ▸ Ravensbourne Nature Refuge ▸ The Gullies Nature Refuge ▸ Thompson's Nature refuge ▸ Walker's Wilderness Nature Refuge ▸ Whilalloo Nature Refuge ▸ Wilga Park Nature Refuge ▸ Xanthorrhoea Nature Refuge	7,946.28	0.00	0.00	0.00	0.00	Low
Protected area estates (*excluding State forests*): ▸ Bendidee National Park ▸ Coolmunda Conservation Park ▸ Crow's Nest National Park ▸ Dwyers Scrub Conservation Park ▸ Esk National Park ▸ Flagstone Creek Conservation Park ▸ Gatton National Park ▸ Geham National Park ▸ Hampton National Park ▸ Irongate Conservation Park ▸ Lockyer National Park ▸ Lockyer Resources Reserve ▸ Mount Binga National Park ▸ Ravensbourne National Park ▸ Tenthill Conservation Park ▸ Wondul Range National Park *Note: State forests are not an MSES*	295,306.56	4,450.10	4,610.46	1.56	3.48	Low

Sensitive environmental receptor	Occurrence in the cumulative impact assessment area (ha)[1]	Occurrence in the cumulative impact project area (excluding Project footprint)[2]	Occurrence in the footprint of all projects, including the Project	% disturbance in cumulative impact assessment area of all projects, including the Project	% disturbance in cumulative impact assessment area as a result of the Project	Magnitude of disturbance[3]
Regulated vegetation (VM Act)						
Category B—'Endangered' REs:	46,668.45	201.32	264.06	0.57	23.76	Low
Category B—'Of concern' REs:	202,417.66	3,530.07	3681.57	1.82	4.12	Low
Category B—'Least concern' REs:	465,876.54	11,556.00	11905.00	2.56	2.93	Low
Category C—'High value regrowth' (HVR)	33,835.69	228.87	233.10	0.69	1.81	Low
MSES wildlife habitat	84,262.99	1,263.97	1385.80	1.64	8.79	Low
State significant wetlands (HES Wetlands)	7,476.06	22.02	22.02	0.29	0.00	Low
Threatened flora habitat (NC Act):						
Cyperus clarus (A sedge)	42,108.95	886.54	992.54	2.36	10.68	Low
Digitaria porrecta (Finger panic)	61,952.92	4,153.08	4608.69	7.44	9.89	Low
Picris barbarorum (Tall hawkweed)	336,729.74	11,856.53	12424.02	3.69	4.57	Low
Threatened fauna habitat (NC Act):						
Common death adder (*Acanthophis antarcticus*)	714,191.76	14,717.13	15258.00	2.14	3.54	Low
Glossy black-cockatoo (*Calyptorhynchus lathami lathami*)	439,933.59	13,484.88	13965.74	3.17	3.44	Low
Major Mitchell's cockatoo (*Lophochroa leadbeateri*)	434,798.66	13,427.68	13815.45	3.18	2.81	Low
'Least concern' flora and fauna, SLC fauna (NC Act) and Priority Back on Track flora and fauna species						
Platypus (*Ornithorhynchus anatinus*)	104,511.33	2,304.67	2392.40	2.29	3.67	Low
Echidna (*Tachyglossus aculeatus*)	841,385.10	16,508.94	17245.66	2.05	4.27	Low
'Least concern' flora and fauna	2,367,317.00	47,908.34	49348.84	2.08	2.92	Low
Priority Back on Track species (not listed under the EPBC Act or NC Act)	2,367,317.00	47,908.34	49348.84	2.08	2.92	Low

Sensitive environmental receptor	Occurrence in the cumulative impact assessment area (ha)[1]	Occurrence in the cumulative impact project area (excluding Project footprint)[2]	Occurrence in the footprint of all projects, including the Project	% disturbance in cumulative impact assessment area of all projects, including the Project	% disturbance in cumulative impact assessment area as a result of the Project	Magnitude of disturbance[3]
Biodiversity Planning Assessment (BPA) areas						
BPA habitat values (local or other)	2,034.26	0.00	1,112.29	1.36	8.56	Low
BPA habitat values (regional)	81,685.73	1,017.06	13,543.18	2.39	0.36	Low
BPA habitat values (State)	566,566.36	13,494.22	1,958.89	1.60	12.02	Low
Corridor (regional terrestrial)	122,194.40	1,723.52	7,429.71	1.79	2.17	Low
Corridor (State riparian)	58,074.21	305.42	1,112.29	1.36	8.56	Low
Corridor (State terrestrial)	415,966.65	7,268.32	13,543.18	2.39	0.36	Low

Table note:

1. Area—2,367,317.00 ha
2. Area—48,648.44 ha
3. Magnitude is calculated based on the proportional disturbance from the Project to each receptor within the cumulative impact assessment area and the percentage contribution of the Project to the overall disturbance of that receptor. Low magnitude—project contribution of less than 2 per cent OR an overall cumulative impact of <10 per cent. For example, the Project's contribution to cumulative impacts to the Brigalow TEC is 28.24% of 0.75%, which equates to 0.21%.

TABLE 21.12 CUMULATIVE IMPACT ASSESSMENT FOR FLORA AND FAUNA

Sensitive environmental receptor(s)	Potential cumulative impact	Relevance factor of aspects				Sum of relevance factors	Impact significance
		Probability	Duration	Magnitude	Sensitivity		
MNES							
Australian Government significant ecological constraint (community listed under the EPBC Act) ▸ Brigalow (*Acacia harpophylla* dominant and co-dominant) ▸ Natural grassland on basalt and fine-textured alluvial plains of northern NSW and southern Queensland ▸ Weeping myall woodlands ▸ White box-yellow box-Blakely's red gum grassy woodland and derived native grassland ▸ Poplar box grassy woodland on alluvial plains	▸ Habitat loss from vegetation clearing/removal	1	3	1	3	8	Medium
	▸ Edge effects ▸ Habitat fragmentation ▸ Barrier effects ▸ Reduction in connectivity of biodiversity corridors	1	2	1	3	7	Medium
	▸ Fauna species injury or mortality	1	1	1	3	6	Low
	▸ Dust and light and contaminant disturbance	1	1	1	3	6	Low
	▸ Increase in litter (waste)	1	1	1	3	6	Low
	▸ Reduction in biological viability of soil to support growth due to soil compaction	1	2	1	3	7	Medium
	▸ Displacement of species from invasion of weed and pest species	1	1	1	3	6	Low

Sensitive environmental receptor(s)	Potential cumulative impact	Relevance factor of aspects				Sum of relevance factors	Impact significance
		Probability	Duration	Magnitude	Sensitivity		
Australian Government significant ecological constraint (species listed under the EPBC Act): **Flora** ▸ *Acacia lauta* (Tara wattle) ▸ *Arthraxon hispidus* (Hairy-joint grass) ▸ *Bertya opponens* ▸ *Cadellia pentastylis* (Ooline) ▸ *Clematis fawcettii* (Stream clematis) ▸ *Dichanthium queenslandicum* (King blue-grass) ▸ *Dichanthium setosum* (Bluegrass) ▸ *Eucalyptus virens* (Shiny-leaved ironbark) ▸ *Homopholis belsonii* (Belson's panic) ▸ *Lepidium monoplocoides* (Winged peppercress) ▸ *Lepidium peregrinum* (Wandering pepper-cress) ▸ *Leucopogon sp.* Coolmunda (D. Halford Q 1635) ▸ (Coolmunda Leucopogon) ▸ *Macrozamia machinii* ▸ *Picris evae* (Hawkweed) ▸ *Prostanthera sp. Dunmore* (Dunmore prostanthera) ▸ *Rhaponticum australe* (Austral cornflower) ▸ *Sophora fraseri* (Brush sophora) ▸ *Thesium australe* (Austral toadflax) ▸ *Tylophora linearis* (Slender tylophora) ▸ *Xerothamnella herbacea*	▸ Habitat loss from vegetation clearing/removal	2	3	1	3	9	Medium
	▸ Edge effects ▸ Habitat fragmentation ▸ Barrier effects ▸ Reduction in connectivity of biodiversity corridors	2	2	1	3	8	Medium
	▸ Fauna species injury or mortality	1	1	1	3	6	Low
	▸ Dust and light and contaminant disturbance	1	1	1	3	6	Low
	▸ Increase in litter (waste)	1	1	1	3	6	Low
	▸ Reduction in biological viability of soil to support growth due to soil compaction	1	2	1	3	7	Medium
	▸ Displacement of species from invasion of weed and pest species	1	1	1	3	6	Low

Sensitive environmental receptor(s)	Potential cumulative impact	Relevance factor of aspects				Sum of relevance factors	Impact significance
		Probability	Duration	Magnitude	Sensitivity		
Fauna							Low
▸ Regent honeyeater (Anthochaera phrygia)							
▸ Australasian bittern (Botaurus poiciloptilus)							
▸ Curlew sandpiper (Calidris ferruginea)							
▸ Red goshawk (Erythrotriorchis radiatus)							
▸ Gray falcon (Falco hypoleucos)							
▸ Squatter pigeon—southern subspecies (Geophaps							
▸ scripta scripta)							
▸ Painted honeyeater (Grantiella picta)							
▸ Swift parrot (Lathamus discolor)							
▸ Australian painted snipe (Rostratula australis)							
▸ Black-breasted button-quail (Turnix melanogaster)							
▸ Murray cod (Maccullochella peelii)							
▸ Large-eared pied bat (Chalinolobus dwyeri)							
▸ Spotted-tailed quoll (Dasyurus maculatus maculatus)							
▸ South-eastern long-eared bat (Nyctophilus corbeni)							
▸ Greater glider (Petauroides volans)							
▸ Brush-tailed rock-wallaby (Petrogale penicillata)							
▸ Koala (Phascolarctos cinereus)							
▸ Grey-headed flying-fox (Pteropus poliocephalus)							
▸ Five-clawed worm-skink (Anomalopus mackayi)							
▸ Collared delma (Delma torquata)							
▸ Yakka skink (Egernia rugosa)							
▸ Dunmall's snake (Furina dunmalli)							
▸ Condamine earless dragon (Tympanocryptis							
▸ condaminensis)							
▸ Brigalow woodland snail (Adclarkia cameroni)							

Sensitive environmental receptor(s)	Potential cumulative impact	Relevance factor of aspects				Sum of relevance factors	Impact significance
		Probability	Duration	Magnitude	Sensitivity		
Australian Government significant ecological constraint (species listed as migratory under the EPBC Act): **Fauna** ▸ Common sandpiper (Actitis hypoleucos) ▸ Fork-tailed swift (Apus pacificus) ▸ Sharp-tailed sandpiper (Calidris acuminata) ▸ Pectoral sandpiper (Calidris melanotos) ▸ Red-necked stint (Calidris ruficollis) ▸ Oriental cuckoo (Cuculus optatus) ▸ Latham's snipe (Gallinago hardwickii) ▸ Black-faced monarch (Monarcha melanopsis) ▸ Yellow wagtail (Motacilla flava) ▸ Satin flycatcher (Myiagra cyanoleuca) ▸ Osprey (Pandion haliaetus) ▸ Glossy ibis (Plegadis falcinellus) ▸ Rufous fantail (Rhipidura rufifrons) ▸ Spectacled monarch (Symposiachrus trivirgatus) ▸ Common greenshank (Tringa nebularia)	▸ Edge effects ▸ Habitat fragmentation ▸ Barrier effects ▸ Reduction in connectivity of biodiversity corridors	2	2	1	3	8	Medium
	▸ Habitat loss from vegetation clearing/removal	2	3	1	3	9	Medium
	▸ Fauna species injury or mortality	1	1	1	3	6	Low
	▸ Dust and light and contaminant disturbance	1	1	1	3	6	Low
	▸ Increase in litter (waste)	1	1	1	3	6	Low
	▸ Reduction in biological viability of soil to support growth due to soil compaction	1	2	1	3	7	Medium
	▸ Displacement of species from invasion of weed and pest species	1	1	1	3	6	Low
MSES							
State significant ecological constraint (VM Act): ▸ Regulated Vegetation—Category B— ▸ Endangered remnant vegetation (REs) ▸ Essential habitat ▸ MSES wildlife habitat	▸ Habitat loss from vegetation clearing/removal	2	3	1	3	9	Medium
	▸ Edge effects ▸ Habitat fragmentation ▸ Barrier effects ▸ Reduction in connectivity of biodiversity corridors	1	2	1	3	7	Medium
	▸ Fauna species injury or mortality	1	1	1	3	6	Low
	▸ Dust and light and contaminant disturbance	1	1	1	3	6	Low
	▸ Increase in litter (waste)	1	1	1	3	6	Low
	▸ Reduction in biological viability of soil to support growth due to soil compaction	1	2	1	3	7	Medium
	▸ Displacement of species from invasion of weed and pest species	1	1	1	3	6	Low

Sensitive environmental receptor(s)	Potential cumulative impact	Relevance factor of aspects				Sum of relevance factors	Impact significance
		Probability	Duration	Magnitude	Sensitivity		
State significant ecological constraint (VM Act): ▸ Regulated Vegetation—Category B—'Of concern' remnant vegetation (REs)	▸ Habitat loss from vegetation clearing/removal	2	3	1	2	8	Medium
	▸ Edge effects ▸ Habitat fragmentation ▸ Barrier effects ▸ Reduction in connectivity of biodiversity corridors	1	2	1	2	6	Low
	▸ Fauna species injury or mortality	1	1	1	2	5	Low
	▸ Dust and light and contaminant disturbance	1	1	1	2	5	Low
	▸ Increase in litter (waste)	1	1	1	2	5	Low
	▸ Reduction in biological viability of soil to support growth due to soil compaction	1	2	1	2	6	Low
	▸ Displacement of species from invasion of weed and pest species	1	1	1	2	5	Low
State significant ecological constraint (VM Act): Regulated Vegetation—Category B—'Least concern' ▸ remnant vegetation (REs)	▸ Habitat loss from vegetation clearing/removal	2	3	1	1	7	Medium
	▸ Edge effects ▸ Habitat fragmentation ▸ Barrier effects ▸ Reduction in connectivity of biodiversity corridors	1	2	1	1	5	Low
	▸ Fauna species injury or mortality	1	1	1	1	4	Low
	▸ Dust and light and contaminant disturbance	1	1	1	1	4	Low
	▸ Increase in litter (waste)	1	1	1	1	4	Low
	▸ Reduction in biological viability of soil to support growth due to soil compaction	1	2	1	1	5	Low
	▸ Displacement of species from invasion of weed and pest species	1	1	1	1	4	Low

Sensitive environmental receptor(s)	Potential cumulative impact	Relevance factor of aspects				Sum of relevance factors	Impact significance
		Probability	Duration	Magnitude	Sensitivity		
State significant ecological constraint (VM Act): ▸ Regulated vegetation (Category C—HVR)	▸ Habitat loss from vegetation clearing/removal	2	3	1	2	6	Low
	▸ Edge effects ▸ Habitat fragmentation ▸ Barrier effects ▸ Reduction in connectivity of biodiversity corridors	1	2	1	2	8	Medium
	▸ Fauna species injury or mortality	1	1	1	2	5	Low
	▸ Dust and light and contaminant disturbance	1	1	1	2	5	Low
	▸ Increase in litter (waste)	1	1	1	2	5	Low
	▸ Reduction in biological viability of soil to support growth due to soil compaction	1	2	1	2	6	Low
	▸ Displacement of species from invasion of weed and pest species	1	1	1	2	5	Low
State significant ecological constraint: ▸ State significant wetlands (HES)	▸ Habitat loss from vegetation clearing/removal	1	3	1	3	8	Medium
	▸ Edge effects ▸ Habitat fragmentation ▸ Barrier effects ▸ Reduction in connectivity of biodiversity corridors	1	2	1	3	7	Medium
	▸ Fauna species injury or mortality	1	1	1	3	6	Low
	▸ Dust and light and contaminant disturbance	1	1	1	3	6	Low
	▸ Increase in litter (waste)	1	1	1	3	6	Low
	▸ Reduction in biological viability of soil to support growth due to soil compaction	1	2	1	3	7	Medium
	▸ Displacement of species from invasion of weed and pest species	1	1	1	3	6	Low

Sensitive environmental receptor(s)	Potential cumulative impact	Relevance factor of aspects				Sum of relevance factors	Impact significance
		Probability	Duration	Magnitude	Sensitivity		

State significant ecological constraint (species listed as threatened under the NC Act):
▸ Flora
  ▸ *Cyperus clarus* (A sedge)
  ▸ *Digitaria porrecta* (Finger panic)
  ▸ *Picris barbarorum* (Tall hawkweed)
▸ Fauna
  ▸ Common death adder (Acanthophis antarcticus)
  ▸ Glossy black-cockatoo (Calyptorhynchus lathami lathami)
  ▸ Major Mitchell's cockatoo (Lophochroa leadbeateri)
	▸ Habitat loss from vegetation clearing/removal	2	3	1	3	9	Medium

	▸ Edge effects ▸ Habitat fragmentation ▸ Barrier effects ▸ Reduction in connectivity of biodiversity corridors	1	2	1	3	7	Medium
	▸ Fauna species injury or mortality	1	1	1	3	6	Low
	▸ Dust and light and contaminant disturbance	1	1	1	3	6	Low
	▸ Increase in litter (waste)	1	1	1	3	6	Low
	▸ Reduction in biological viability of soil to support growth due to soil compaction	1	2	1	3	7	Medium
	▸ Displacement of species from invasion of weed and pest species	1	1	1	3	6	Medium
State Significant Ecological Constraint (SLC fauna species): ▸ Platypus (Ornithorhynchus anatinus) ▸ Echidna (Tachyglossus aculeatus)	▸ Habitat loss from vegetation clearing/removal	2	3	1	2	8	Medium
	▸ Edge effects ▸ Habitat fragmentation ▸ Barrier effects ▸ Reduction in connectivity of biodiversity corridors	1	2	1	2	6	Low
	▸ Fauna species injury or mortality	1	1	1	2	5	Low
	▸ Dust and light and contaminant disturbance	1	1	1	2	5	Low
	▸ Increase in litter (waste)	1	1	1	2	5	Low
	▸ Reduction in biological viability of soil to support growth due to soil compaction	1	2	1	2	6	Low
	▸ Displacement of species from invasion of weed and pest species	1	1	1	2	5	Low

Sensitive environmental receptor(s)	Potential cumulative impact	Relevance factor of aspects				Sum of relevance factors	Impact significance
		Probability	Duration	Magnitude	Sensitivity		
State significant ecological constraint: ▸ Priority Back on Track flora and fauna species (that are not listed under as threatened under the provisions of the EPBC Act or NC Act)	▸ Habitat loss from vegetation clearing/removal	2	3	1	1	7	Medium
	▸ Edge effects ▸ Habitat fragmentation ▸ Barrier effects ▸ Reduction in connectivity of biodiversity corridors	1	2	1	1	5	Low
	▸ Fauna species injury or mortality	1	1	1	1	4	Low
	▸ Dust and light and contaminant disturbance	1	1	1	1	4	Low
	▸ Increase in litter (waste)	1	1	1	1	4	Low
	▸ Reduction in biological viability of soil to support ▸ growth due to soil compaction	1	2	1	1	5	Low
	▸ Displacement of species from invasion of weed and pest species	1	1	1	1	4	Low
State significant ecological constraint: ▸ Flora and fauna species not listed under the EPBC Act but listed as 'least concern' under the provisions of the NC Act and flora that is listed as SLC under the provisions of the NC Act	▸ Habitat loss from vegetation clearing/removal	3	3	1	1	8	Medium
	▸ Edge effects ▸ Habitat fragmentation ▸ Barrier effects ▸ Reduction in connectivity of biodiversity corridors	1	2	1	1	5	Low
	▸ Fauna species injury or mortality	1	1	1	1	4	Low
	▸ Dust and light and contaminant disturbance	1	1	1	1	4	Low
	▸ Increase in litter (waste)	1	1	1	1	4	Low
	▸ Reduction in biological viability of soil to support growth due to soil compaction	1	2	1	1	5	Low
	▸ Displacement of species from invasion of weed and pest species	1	1	1	1	4	Low

Sensitive environmental receptor(s)	Potential cumulative impact	Relevance factor of aspects				Sum of relevance factors	Impact significance
		Probability	Duration	Magnitude	Sensitivity		
State significant ecological constraint (BPA): ▸ BPA habitat values (State) ▸ State habitat for EVNT taxa ▸ Corridor (State terrestrial) ▸ Corridor (State riparian)	▸ Habitat loss from vegetation clearing/removal	1	3	1	3	8	Medium
	▸ Edge effects ▸ Habitat fragmentation ▸ Barrier effects ▸ Reduction in connectivity of biodiversity corridors	1	2	1	3	7	Medium
	▸ Fauna species injury or mortality	1	1	1	3	6	Low
	▸ Dust and light and contaminant disturbance	1	1	1	3	6	Low
	▸ Increase in litter (waste)	1	1	1	3	6	Low
	▸ Reduction in biological viability of soil to support ▸ growth due to soil compaction	1	2	1	3	7	Medium
	▸ Displacement of species from invasion of weed and pest species	1	1	1	3	6	Low
State significant ecological constraint (BPA): ▸ BPA habitat values (regional) ▸ Corridor (regional terrestrial)	▸ Habitat loss from vegetation clearing/removal	1	3	1	2	7	Medium
	▸ Edge effects ▸ Habitat fragmentation ▸ Barrier effects ▸ Reduction in connectivity of biodiversity corridors	1	2	1	2	6	Low
	▸ Fauna species injury or mortality	1	1	1	2	5	Low
	▸ Dust and light and contaminant disturbance	1	1	1	2	5	Low
	▸ Increase in litter (waste)	1	1	1	2	5	Low
	▸ Reduction in biological viability of soil to support growth due to soil compaction	1	2	1	2	6	Low
	▸ Displacement of species from invasion of weed and pest species	1	1	1	2	5	Low

Sensitive environmental receptor(s)	Potential cumulative impact	Relevance factor of aspects				Sum of relevance factors	Impact significance
		Probability	Duration	Magnitude	Sensitivity		
State significant ecological constraint (BPA): ▸ BPA habitat values (local or other) (MLES)	▸ Habitat loss from vegetation clearing/removal	1	3	1	1	6	Low
	▸ Edge effects ▸ Habitat fragmentation ▸ Barrier effects ▸ Reduction in connectivity of biodiversity corridors	1	2	1	1	5	Low
	▸ Fauna species injury or mortality	1	1	1	1	4	Low
	▸ Dust and light and contaminant disturbance	1	1	1	1	4	Low
	▸ Increase in litter (waste)	1	1	1	1	4	Low
	▸ Reduction in biological viability of soil to support growth due to soil compaction	1	2	1	1	5	Low
	▸ Displacement of species from invasion of weed and pest species	1	1	1	1	4	Low

21.3.5 Air quality

21.3.5.1 Construction cumulative air-quality impacts

Dust is predicted to be the primary emission from the Project during construction. The *Guidance on the assessment of dust from demolition and construction* (United Kingdom Institute of Air Quality Management (UK IAQM), 2014) specifies that receptors located 350 m or more from a dust-generation source are expected to have a sensitivity to human health impacts that is 'low'. Therefore, for the purposes of construction air quality, projects that directly interface the Border to Gowrie Project, and will have temporal overlap in construction or expansion activities, are considered to have potential to result in cumulative impacts. Only 5 of the initial 23 projects identified meet these criteria. These projects are:

- InterLinkSQ
- Commodore Mine and Millmerran Power Station
- North Star to NSW/Queensland Border Project (Inland Rail)
- Gowrie to Helidon Project (Inland Rail)
- Asterion Medicinal Cannabis Facility.

An assessment of cumulative impacts that may arise during construction of these projects, in combination with the Project, is presented in Table 21.14, with a summary of how potential cumulative impacts would be managed. This assessment has concluded that the construction phase cumulative air-quality impacts of the Project are expected to be of **low significance**. The following factors contributed to this determination:

- Impact assessment for the Project has concluded that unmitigated air emissions from the construction of the Project pose a 'low' risk of human health impacts but a 'medium' risk of dust soiling (refer Chapter 11: Air Quality); however, mitigation measures for the emission of dust and other construction air pollutants will be implemented, and these risks are expected to be further reduced.
- The emission sources of air pollutants during construction of the Project are expected to be activities that are reasonably short in duration, and mobile; therefore, no single sensitive receptor is expected to be subject to medium- or long-term impacts.

To improve the understanding of background air quality in the area around Commodore Mine, an air-quality monitoring station has been installed at a residential dwelling on Millmerran–Inglewood Road, Millmerran. Monitoring data from this location will improve understanding of ambient air quality and emissions from the mine and will be used to guide the detail design and finalisation of the construction approach for the Project. The data will also be used to establish a local baseline against which performance of the Project can be assessed during construction, thereby enabling cumulative impacts to be identified.

TABLE 21.13 CUMULATIVE IMPACT ASSESSMENT FOR AIR QUALITY (CONSTRUCTION)

Project	Potential cumulative impact	Impact characteristic	Relevance factor	Sum of relevance factors	Impact significance	Comments and management measures
InterLinkSQ	Emissions of air pollutants, specifically dust (construction)	Probability of the impact	Medium (2)	6	Low	The potential for cumulative impacts during construction to air quality is considered to be low; therefore, specific mitigation measures to address cumulative impacts are not warranted. The potential for the Project to contribute to such impacts is considered to be appropriately managed through the development and implementation of a Dust Management Sub-plan, as a component of the CEMP for the Project. ARTC will consult with InterLinkSQ regarding scheduling of construction activities to avoid the simultaneous undertaking of dust-generating activities, where possible.
		Duration of the impact	Medium (2)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Low (1)			
Commodore Mine and Millmerran Power Station	Emissions of air pollutants, specifically dust (construction)	Probability of the impact	Medium (2)	6	Low	The potential for cumulative impacts during construction to air quality is considered to be low; therefore, specific mitigation measures to address cumulative impacts are not warranted. The potential for the Project to contribute to such impacts is considered to be appropriately managed through: ▸ Development and implementation of a Dust Management Sub-plan, as a component of the CEMP for the Project ▸ Establish a local baseline for particulate matter, using data collected from the Millmerran air quality monitoring station (AQMS) ▸ Undertake dust deposition (total suspended particulate [TSP]) monitoring, at locations where baseline data is collected, while construction activities occur in proximity to Commodore Mine (e.g. where dust-generating activities occur between Ch 120.0 km to Ch 128.0 km) ▸ Consultation with Intergen regarding scheduling of construction activities, to avoid the simultaneous undertaking of dust-generating activities, where possible.
		Duration of the impact	Medium (2)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Low (1)			
North Star to NSW/QLD Border (Inland Rail)	Emissions of air pollutants, specifically dust (construction)	Probability of the impact	Low (1)	6	Low	The potential for cumulative impacts during construction to air quality is considered to be low; therefore, specific mitigation measures to address cumulative impacts are not warranted. The potential for the Project to contribute to such impacts is considered to be appropriately managed through the development and implementation of a Dust Management Sub-plan, as a component of the CEMP for the Project. A complaint hotline for the Project will be established and advertised to enable members of the public to notify ARTC of issues, including the generation of excessive dust or other air emissions during construction, either from a single project or a combination of adjoining Inland Rail projects.
		Duration of the impact	Medium (2)			
		Magnitude/intensity of the impact	Medium (2)			
		Sensitivity of the receiving environment	Low (1)			

Project	Potential cumulative impact	Impact characteristic	Relevance factor	Sum of relevance factors	Impact significance	Comments and management measures
Gowrie to Helidon (Inland Rail)	Emissions of air pollutants, specifically dust (construction)	Probability of the impact	Low (1)	6	Low	The potential for cumulative impacts during construction to air quality is considered to be low; therefore, specific mitigation measures to address cumulative impacts are not warranted. The potential for the Project to contribute to such impacts is considered to be appropriately managed through the development and implementation of a Dust Management Sub-plan, as a component of the CEMP for the Project. A complaint hotline for the Project will be established and advertised to enable members of the public to notify ARTC of issues, including the generation of excessive dust or other air emissions during construction, either from a single project or a combination of adjoining Inland Rail projects.
		Duration of the impact	Medium (2)			
		Magnitude/intensity of the impact	Medium (2)			
		Sensitivity of the receiving environment	Low (1)			
Asterion Medicinal Cannabis Facility	Emissions of air pollutants, specifically dust (construction)	Probability of the impact	Low (1)	5	Low	The potential for cumulative impacts during construction to air quality is considered to be low; therefore, specific mitigation measures to address cumulative impacts are not warranted. The potential for the Project to contribute to such impacts is considered to be appropriately managed through the development and implementation of a Dust Management Sub-plan, as a component of the CEMP for the Project. ARTC will consult with Asterion regarding scheduling of construction activities to avoid the simultaneous undertaking of dust-generating activities, where possible.
		Duration of the impact	Medium (2)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Low (1)			

21.3.5.2 Operational cumulative air-quality impacts

Section 11.134 (b) of the ToR requires that the assessment of operational-phase air-quality impacts incorporate the emission contributions of existing or planned developments that are, or will be, a source of pollutants of interest that are also relevant to the Project.

The National Pollutant Inventory (NPI) (DAWE, 2020) is regulated by the Australian Government. The purpose of the NPI is to track pollution sources across Australia and ensure that the community has access to information about the emission and transfer of toxic substances that may affect them locally. Facilities that exceed NPI reporting thresholds are required by the Australian Government to submit annual reports of their emissions to air.

A search of the NPI identified eight operational facilities within the air-quality impact assessment area that are required to report emissions annually. Of these eight facilities, only two—the Commodore Mine and the Millmerran Power Station—are recognised as generating emissions that are also pollutants of concern for the operation of the Project (i.e. particulate matter, oxides of nitrogen and carbon monoxide). Consequently, NPI-reported emissions for pollutants of interest for the mine and power station were included in the dispersion model developed for the assessment.

In addition to these operational cumulative NPI-regulated sources, the following emission sources have been included in the dispersion model for the assessment due to their potential to contribute to cumulative air-quality impacts at receptors in the impact assessment area:

- North Star to NSW/Queensland Border Project (Inland Rail)—1 km of this project has been included in the dispersion modelling for the Project
- Gowrie to Helidon Project (Inland Rail)—1 km of this project has been included in the dispersion modelling for the Project
- West Moreton Line—This is the existing rail west of the junction between this Project and the Gowrie to Helidon section of Inland Rail—3.5 km of this rail line has been included in the dispersion modelling for the Project.

In addition to the NPI sources (Commodore Mine and Millmerran Power Station) and the adjoining rail lines, other local emission sources will include Environmentally Relevant Activities (ERAs), local commercial and industrial uses, and vehicle traffic. Local commercial uses near the Project will include InterLinkSQ and the Asterion Medicinal Cannabis Facility, which are approved but not currently operational. Operation of InterLinkSQ and the Asterion Medicinal Cannabis Facility are not anticipated to generate significant emissions and do not require detailed assessment.

It is expected that emissions from ERAs, local commercial and industrial uses and vehicle traffic will be adequately represented by the assumed background concentrations, and these activities emit significantly lower quantities of pollutants than the major polluters that report to the NPI.

The primary pollutant of concern for the feedlots and poultry farms is ammonia. Ammonia is not a pollutant of concern for the Project and emissions from these facility types were not included in the cumulative model.

The results of operational dispersion modelling show that compliance against air-quality goals adopted from the *Environmental Protection (Air) Policy 2019* are predicted at all modelled sensitive receptors for all pollutants and all averaging periods for peak operational train numbers, with the exception of 24-hour average PM_{10}. Exceedance of the 24-hour average PM_{10} air-quality goal is predicted at one sensitive receptor, located approximately 1.1 km to the north of the existing Commodore Mine and to the north of the Project alignment. The predicted PM_{10} 24-hour cumulative concentration at this sensitive receptor is 50.1 µg/m^3, which represents a 0.1 µg/m^3 exceedance of the air-quality goal of 50 µg/m^3.

Commodore Mine and Millmerran Power Station operate under Environmental Authority (EA) permits, which state that they must take all reasonable and feasible avoidance measures so that particulate matter emissions generated do not exceed the specified levels. For $PM_{10,}$ this level is 50 µg/m^3 over a 24-hour averaging time (no allowable exceedances per year). Therefore, based on the assessment methodology applied, the contribution of the Project to an estimated PM_{10} level of 50.1 µg/m^3 at a sensitive receptor 1.1 km from Commodore Mine is considered to be minor.

This assessment of cumulative operational air-quality impacts has considered peak train numbers, in the year 2040. As typical train numbers will be lower than peak volumes, predicted emission levels and the impact to sensitive receptors would be reduced for the typical number of train movements.

Based on the results of the modelling, the operation of the Project is not expected to significantly adversely impact environmental values of the air environment. The assessment has considered background air quality in the prediction of cumulative concentration and deposition levels at sensitive receptors and has therefore considered the assimilative capacity of the air environment in determining the impact of the Project.

Further discussion on the quantitative air quality impact assessment for operation of the Project is provided in Chapter 11: Air Quality.

21.3.6 Surface water

For the purposes of surface water quality, projects that will have temporal overlap in construction or expansion activities and may cause impacts to existing environmental values that are additive to impacts from the Project are considered to have potential to result in cumulative impacts. Only 7 of the initial 23 projects identified meet these criteria. These projects are:

- New Acland Coal Mine Stage 3
- InterLinkSQ
- Asterion Medicinal Cannabis Facility
- Commodore Mine and Millmerran Power Station
- Goondiwindi Abattoir
- North Star to NSW/Queensland Border Project (Inland Rail)
- Gowrie to Helidon Project (Inland Rail).

Water-quality sampling has been undertaken to inform the baseline water-quality conditions for the impact assessment area; therefore, existing developments operating at their current scale and intensity have been factored into the establishment of background water-quality conditions and the assessment of Project impacts (refer Chapter 12: Surface Water and Hydrology).

Each of the above-mentioned projects has potential to result in one or more of the following impacts, which may overlap with those that could occur due to the Project:

- All of these projects may result in an extent of:
  - Riparian vegetation loss, reducing ecosystem services to water quality
  - Impacts to aquatic fauna species through water quality and barrier works
  - Reduction in waterway connectivity
  - Increase in erosion and sedimentation of waterways
  - Increase in contamination of waterways
  - Saline discharge into proximal waterway (intra-catchment)
  - Increase in surface expression within alluvial waterways.

An assessment of cumulative impacts that may arise from these projects in combination with the Project is presented in Table 21.14, with a summary of how potential cumulative impacts would be managed. This assessment has concluded that the cumulative surface water impacts of the Project are expected to be of **low to medium significance**. The following factors contributed to this determination:

- Riparian vegetation loss from vegetation clearing/removal—loss of ecosystem service to water quality:
  - A potential exists for a cumulative impact from the loss of sensitive receptors (riparian vegetation communities) with works involving waterways and associated crossings across the projects. Impacts may be compounded with interface between the Project and other listed projects, in regard to decreased resilience to biotic and abiotic factors. Potential consequences include loss of bank stability, loss of diversity and reduction in water-quality values due to decreased performance of ecosystem services to water quality. The proximity of other projects to watercourses and inadequate rehabilitation on those projects and the Border to Gowrie Project would result in the highest risk of significant cumulative impact.
  - Interaction of impacts leading to a loss of ecosystem services or water quality are considered possible between the Project and the New Acland Coal Mine Stage 3 expansion, Asterion Medicinal Cannabis Facility, InterLinkSQ, Commodore Mine and Millmerran Power Station operations, and construction of the North Star to NSW/QLD Border and Gowrie to Helidon sections of Inland Rail.
- Potential impacts to aquatic fauna species both through impacts to water quality and barrier works:
  - There is potential for cumulative downstream impacts from water-quality issues associated with overland works and waterway barrier works, if not appropriately managed. Cumulative impacts would be expected to occur in relatively short spatial distances (as cumulative point-source impacts) and would be expected to 'dilute' with increasing distance downstream from point-source impact.
  - It is expected that cumulative impacts would occur between projects linked spatially and temporally during construction. As such, the current Project and North Star to NSW/QLD Border and Gowrie to Helidon sections of Inland Rail are expected to generate cumulative impacts, as well as Asterion Medicinal Cannabis Facility and InterLinkSQ.

- Permanent reduction in the connectivity of waterways:
  - There is potential for impact if not appropriately managed due to multiple permanent crossings, or temporary disturbances of waterways. If left unmanaged, these impacts would progressively accumulate between projects. Whole catchments may be impacted from separate projects on separate waterways but the greatest cumulative impacts would be expected where there is spatial interface between separate projects. Water-quality degradation may arise from reduced waterway connectivity and the associated decrease in ecosystem resilience.
  - Cumulative impacts are most likely to arise due to projects in proximity to waterways that are crossed by the Border to Gowrie project, being the New Acland Coal Mine Stage 3 expansion, Asterion Medicinal Cannabis Facility, InterLinkSQ, Commodore Mine and Millmerran Power Station operations, and construction of the North Star to NSW/QLD Border and Gowrie to Helidon sections of Inland Rail. Note that the Goondiwindi Abattoir is removed from this potential cumulative impact due to sub-catchment separation from the Project.
- Increase in erosion and sedimentation in waterways during construction:
  - Cumulative impacts may arise due to increase in waterway sedimentation from simultaneous construction activities within catchments. Cumulative impacts in regard to erosion may arise from impaction of waterway structure/hydrological regimes and may be further impacted by cumulative riparian vegetation loss.
  - Due to this specific cumulative impact, it is expected that the greatest cumulative impact would be generated from close-proximity projects, including InterLinkSQ, Asterion Medicinal Cannabis Facility, the Commodore Mine and Millmerran Power Station operations and construction of the North Star to NSW/QLD Border and Gowrie to Helidon sections of Inland Rail.
- Increase in contamination of waterways (water column and sediment):
  - There is potential for cumulative impacts to arise from contamination of waterways during construction, from in-blow or direct deposition of contaminants into waterways. This is most likely to occur where projects are being constructed and located in the same hydrological catchment (e.g. sub-catchments within a greater catchment). The likelihood of occurrence decreases with greater distance between projects.
  - Based on this, it would be expected that the New Acland Coal Mine Stage 3 expansion, Asterion Medicinal Cannabis Facility, InterLinkSQ, Commodore Mine and Millmerran Power Station operations, Goondiwindi Abattoir and construction of the North Star to NSW/QLD Border and Gowrie to Helidon sections of Inland Rail may contribute to potential cumulative impacts.
- Saline discharge into proximal waterways:
  - There is a potential for cumulative impacts to arise from overlapping construction activities within high salinity risk rating areas, resulting in increased potential of sodosol erosion and dispersive soil discharge. This cumulative impact may arise due to construction activities that occur within the same sub-catchment and in moderate to high salinity hazard areas. As such, it would be expected that potential cumulative impacts may be expected with all projects, excluding the Goondiwindi Abattoir.
- Increase in surface salinity around alluvial waterways:
  - Salinity expression may arise due to overlapping construction activities, requiring the clearing of riparian vegetation within alluvial-based waterways. This is most likely to occur where there is a direct spatial interface between projects and a temporal overlap in construction.
  - Due to the regional geology across the catchment, the potential for this cumulative impact is limited to the region (and projects within) of clay alluvia and lacustrine deposits between Millmerran and Pittsworth (associated with the Condamine River alluvial aquifer). While other waterways may demonstrate highly localised alluvia, it is expected that the highest risk of this cumulative impact occurring would be restricted to this region of alluvia (as surface salinity from drainage line expressions). As such, it is expected that the potential for cumulative impact would be restricted to the potential expansion of the Commodore Mine and Millmerran Power Station.
- The cumulative impacts of multiple projects occurring in the vicinity of the impact assessment area may contribute to impacts to water quality if not managed appropriately; however, based on the highly ephemeral nature of the majority of waterways in the impact assessment area, this risk is generally considered to be low.
- All concurrent projects or future projects are subject to environmental controls, either through EIS assessment processes, operational licences, such as an EA under the EP Act, or through the implementation of detailed environmental management plans (EMPs); therefore, it is assumed that other projects will have in place measures to prevent impacts to surface waters.

TABLE 21.14 CUMULATIVE IMPACT ASSESSMENT FOR SURFACE WATER

Project	Potential cumulative impact	Impact characteristic	Relevance factor	Sum of relevance factors[a]	Impact significance[b]	Comments and management measures
New Acland Coal Mine Stage 3	Riparian vegetation loss from vegetation clearing and /or removal	Probability of the impact	Medium (2)	7	Medium	The potential for cumulative impacts during construction will be managed through development and implementation of the following, as part of the CEMP: ▸ Rehabilitation and Landscaping Management Sub-plan ▸ Surface Water Management Sub-plan, including the establishment of baseline conditions and construction phase monitoring ▸ Soil Management Sub-plan, including erosion and sediment control measures ▸ Hazardous Materials Management Sub-plan. The potential for cumulative impacts during construction will also be managed through adherence to the following, through detail design and construction: ▸ Riverine protection permit exemption requirements (WSS/2013/726) ▸ *Accepted development requirements for operational work that is constructing or raising waterway barrier works* (Department of Agriculture and Fisheries (DAF), 2018e) ▸ Permit/approval conditions if either of the previous two listed requirements cannot be adhered to or do not apply ▸ The success of riparian rehabilitation for the Project will be monitored to ensure that its contribution to riparian vegetation loss is appropriately rectified.
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Medium (2)			
		Sensitivity of the receiving environment	Medium (2)			
	Potential impacts to aquatic fauna species both through impacts to water quality and barrier works.	Probability of the impact	Low (1)	5	Low	
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Medium (2)			
	Reduction in waterway connectivity	Probability of the impact	Medium (2)	6	Low	
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Medium (2)			
	Increase in erosion and sedimentation of waterways	Probability of the impact	Low (1)	5	Low	
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Medium (2)			
	Increase in waterway contamination	Probability of the impact	Medium (2)	6	Low	
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Medium (2)			
	Saline discharge into proximal waterways (intra-catchment scope)	Probability of the impact	Medium (2)	6	Low	
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Medium (2)			
	Increase in surface salinity around alluvial waterways	Probability of the impact	Low (1)	5	Low	
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Medium (2)			

Project	Potential cumulative impact	Impact characteristic	Relevance factor	Sum of relevance factors[a]	Impact significance[b]	Comments and management measures
Asterion Medicinal Cannabis Facility	Riparian vegetation loss from vegetation clearing and /or removal	Probability of the impact	Medium (2)	7	Medium	The potential for cumulative impacts during construction will be managed through development and implementation of the following, as part of the CEMP: ▸ Rehabilitation and Landscaping Management Sub-plan ▸ Surface Water Management Sub-plan, including the establishment of baseline conditions and construction phase monitoring ▸ Soil Management Sub-plan, including erosion and sediment control measures ▸ Hazardous Materials Management Sub-plan. The potential for cumulative impacts during construction will also be managed through adherence to the following through detail design and construction: ▸ Riverine protection permit exemption requirements (WSS/2013/726) ▸ *Accepted development requirements for operational work that is constructing or raising waterway barrier works* (DAF, 2018e) ▸ Permit/approval conditions if either of the previous two listed requirements cannot be adhered to or do not apply. The success of riparian rehabilitation for the Project will be monitored to ensure that its contribution to riparian vegetation loss is appropriately rectified.
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Medium (2)			
		Sensitivity of the receiving environment	Medium (2)			
	Potential impacts to aquatic fauna species both through impacts to water quality and barrier works.	Probability of the impact	Medium (2)	5	Low	
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Low (1)			
	Reduction in waterway connectivity	Probability of the impact	Low (1)	4	Low	
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Low (1)			
	Increase in erosion and sedimentation of waterways	Probability of the impact	Low (1)	4	Low	
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Low (1)			
	Increase in waterway contamination	Probability of the impact	Low (1)	4	Low	
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Low (1)			

Project	Potential cumulative impact	Impact characteristic	Relevance factor	Sum of relevance factors[a]	Impact significance[b]	Comments and management measures
InterLinkSQ	Riparian vegetation loss from vegetation clearing and /or removal	Probability of the impact	Medium (2)	7	Medium	The potential for cumulative impacts during construction will be managed through development and implementation of the following, as part of the CEMP: ▸ Rehabilitation and Landscaping Management Sub-plan ▸ Surface Water Management Sub-plan, including the establishment of baseline conditions and construction phase monitoring ▸ Soil Management Sub-plan, including erosion and sediment control measures ▸ Hazardous Materials Management Sub-plan. The potential for cumulative impacts during construction will also be managed through adherence to the following through detail design and construction: ▸ Riverine protection permit exemption requirements (WSS/2013/726) ▸ *Accepted development requirements for operational work that is constructing or raising waterway barrier works* (DAF, 2018e) ▸ Permit/approval conditions if either of the previous two listed requirements cannot be adhered to or do not apply. The success of riparian rehabilitation for the Project will be monitored to ensure that its contribution to riparian vegetation loss is appropriately rectified.
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Medium (2)			
		Sensitivity of the receiving environment	Medium (2)			
	Potential impacts to aquatic fauna species both through impacts to water quality and barrier works.	Probability of the impact	Medium (2)	6	Low	
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Medium (2)			
	Reduction in waterway connectivity	Probability of the impact	Medium (2)	6	Low	
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Medium (2)			
	Increase in erosion and sedimentation of waterways	Probability of the impact	Medium (2)	6	Low	
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Medium (2)			
	Increase in waterway contamination	Probability of the impact	Medium (2)	6	Low	
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Medium (2)			
	Saline discharge into proximal waterways (intra-catchment scope)	Probability of the impact	Medium (2)	6	Low	
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Medium (2)			
	Increase in surface salinity around alluvial waterways	Probability of the impact	Low (1)	5	Low	
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Medium (2)			

Project	Potential cumulative impact	Impact characteristic	Relevance factor	Sum of relevance factors[a]	Impact significance[b]	Comments and management measures
Commodore Mine and Millmerran Power Station	Riparian vegetation loss from vegetation clearing and /or removal	Probability of the impact	Medium (2)	7	Medium	The potential for cumulative impacts during construction will be managed through development and implementation of the following, as part of the CEMP: ▸ Rehabilitation and Landscaping Management Sub-plan ▸ Surface Water Management Sub-plan, including the establishment of baseline conditions and construction phase monitoring ▸ Soil Management Sub-plan, including erosion and sediment control measures ▸ Hazardous Materials Management Sub-plan. The potential for cumulative impacts during construction will also be managed through adherence to the following through detail design and construction: ▸ Riverine protection permit exemption requirements (WSS/2013/726) ▸ *Accepted development requirements for operational work that is constructing or raising waterway barrier works* (DAF, 2018e) ▸ Permit/approval conditions if either of the previous two listed requirements cannot be adhered to or do not apply The success of riparian rehabilitation for the Project will be monitored to ensure that its contribution to riparian vegetation loss is appropriately rectified.
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Medium (2)			
		Sensitivity of the receiving environment	Medium (2)			
	Potential impacts to aquatic fauna species both through impacts to water quality and barrier works.	Probability of the impact	Low (1)	5	Low	
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Medium (2)			
	Reduction in waterway connectivity	Probability of the impact	Medium (2)	6	Low	
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Medium (2)			
	Increase in erosion and sedimentation of waterways	Probability of the impact	Medium (2)	6	Low	
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Medium (2)			
	Increase in waterway contamination	Probability of the impact	Medium (2)	6	Low	
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Medium (2)			
	Saline discharge into proximal waterways (intra-catchment scope)	Probability of the impact	Medium (2)	6	Low	
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Medium (2)			
	Increase in surface salinity around alluvial waterways	Probability of the impact	Medium (2)	6	Low	
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Medium (2)			

Project	Potential cumulative impact	Impact characteristic	Relevance factor	Sum of relevance factors[a]	Impact significance[b]	Comments and management measures
Goondiwindi Abattoir	Riparian vegetation loss from vegetation clearing and /or removal	Probability of the impact	Low (1)	6	Low	The potential for cumulative impacts during construction will be managed through development and implementation of the following, as part of the CEMP: ▸ Rehabilitation and Landscaping Management Sub-plan ▸ Surface Water Management Sub-plan, including the establishment of baseline conditions and construction phase monitoring ▸ Soil Management Sub-plan, including erosion and sediment control measures ▸ Hazardous Materials Management Sub-plan. The potential for cumulative impacts during construction will also be managed through adherence to the following through detail design and construction: ▸ Riverine protection permit exemption requirements (WSS/2013/726) ▸ *Accepted development requirements for operational work that is constructing or raising waterway barrier works* (DAF, 2018e) ▸ Permit/approval conditions if either of the previous two listed requirements cannot be adhered to or do not apply. The success of riparian rehabilitation for the Project will be monitored to ensure that its contribution to riparian vegetation loss is appropriately rectified.
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Medium (2)			
		Sensitivity of the receiving environment	Medium (2)			
	Potential impacts to aquatic fauna species both through impacts to water quality and barrier works	Probability of the impact	Low (1)	5	Low	
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Medium (2)			
	Reduction in waterway connectivity	Probability of the impact	Low (1)	4	Low	
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Low (1)			
	Increase in erosion and sedimentation of waterways	Probability of the impact	Low (1)	5	Low	
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Medium (2)			
	Increase in waterway contamination	Probability of the impact	Medium (2)	6	Low	
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Medium (2)			
	Saline discharge into proximal waterways (intra-catchment scope)	Probability of the impact	Low (1)	5	Low	
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Medium (2)			
	Increase in surface salinity around alluvial waterways	Probability of the impact	Low (1)	5	Low	
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Medium (2)			

Project	Potential cumulative impact	Impact characteristic	Relevance factor	Sum of relevance factors[a]	Impact significance[b]	Comments and management measures
North Star to Border (Inland Rail)	Riparian vegetation loss from vegetation clearing and /or removal	Probability of the impact	Medium (2)	7	Medium	The potential for cumulative impacts during construction will be managed through development and implementation of the following, as part of the CEMP: ▸ Rehabilitation and Landscaping Management Sub-plan ▸ Surface Water Management Sub-plan, including the establishment of baseline conditions and construction phase monitoring ▸ Soil Management Sub-plan, including erosion and sediment control measures ▸ Hazardous Materials Management Sub-plan. The potential for cumulative impacts during construction will also be managed through adherence to the following through detail design and construction: ▸ Riverine protection permit exemption requirements (WSS/2013/726) ▸ *Accepted development requirements for operational work that is constructing or raising waterway barrier works* (DAF, 2018e) ▸ Permit/approval conditions if either of the previous two listed requirements cannot be adhered to or do not apply. The success of riparian rehabilitation for the Project will be monitored to ensure that its contribution to riparian vegetation loss is appropriately rectified.
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Medium (2)			
		Sensitivity of the receiving environment	Medium (2)			
	Potential impacts to aquatic fauna species both through impacts to water quality and barrier works	Probability of the impact	Medium (2)	6	Low	
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Medium (2)			
	Reduction in waterway connectivity	Probability of the impact	Medium (2)	6	Low	
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Medium (2)			
	Increase in erosion and sedimentation of waterways	Probability of the impact	Medium (2)	6	Low	
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Medium (2)			
	Increase in waterway contamination	Probability of the impact	Medium (2)	6	Low	
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Medium (2)			
	Saline discharge into proximal waterways (intra-catchment scope)	Probability of the impact	Medium (2)	6	Low	
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Medium (2)			
	Increase in surface salinity around alluvial waterways	Probability of the impact	Low (1)	5	Low	
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Medium (2)			

Project	Potential cumulative impact	Impact characteristic	Relevance factor	Sum of relevance factors[a]	Impact significance[b]	Comments and management measures
Gowrie to Helidon (Inland Rail)	Riparian vegetation loss from vegetation clearing and /or removal	Probability of the impact	Medium (2)	7	Medium	The potential for cumulative impacts during construction will be managed through development and implementation of the following, as part of the CEMP: ▸ Rehabilitation and Landscaping Management Sub-plan ▸ Surface Water Management Sub-plan, including the establishment of baseline conditions and construction phase monitoring ▸ Soil Management Sub-plan, including erosion and sediment control measures ▸ Hazardous Materials Management Sub-plan. The potential for cumulative impacts during construction will also be managed through adherence to the following through detail design and construction: ▸ Riverine protection permit exemption requirements (WSS/2013/726) ▸ *Accepted development requirements for operational work that is constructing or raising waterway barrier works* (DAF, 2018e) ▸ Permit/approval conditions if either of the previous two listed requirements cannot be adhered to or do not apply. The success of riparian rehabilitation for the Project will be monitored to ensure that its contribution to riparian vegetation loss is appropriately rectified.
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Medium (2)			
		Sensitivity of the receiving environment	Medium (2)			
	Potential impacts to aquatic fauna species both through impacts to water quality and barrier works.	Probability of the impact	Medium (2)	6	Low	
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Medium (2)			
	Reduction in waterway connectivity	Probability of the impact	Medium (2)	6	Low	
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Medium (2)			
	Increase in erosion and sedimentation of waterways	Probability of the impact	Medium (2)	6	Low	
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Medium (2)			
	Increase in waterway contamination	Probability of the impact	Medium (2)	6	Low	
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Medium (2)			
	Saline discharge into proximal waterways (intra-catchment scope)	Probability of the impact	Medium (2)	6	Low	
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Medium (2)			
	Increase in surface salinity around alluvial waterways	Probability of the impact	Low (1)	5	Low	
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Medium (2)			

21.3.7 Hydrology

The hydrology and flooding assessment for the Project has involved the development of hydrologic and hydraulic models for key waterways and floodplains to reflect the existing conditions (Base Case) in these areas and to predict what affect development of the Project will have (Developed Case).

For cumulative impacts to arise, another project will need to be located within a sub-catchment that elements of the Border to Gowrie Project are also located in and to be located close enough to the Project footprint for an overlap in any hydrological impacts. The distance from the Project beyond which impacts are no longer expected to occur varies between floodplains; however, all modelled upstream and downstream hydrological impacts are confined to a distance of less than 1 km from the Project alignment. Based on these criteria, only 10 of the 23 initial projects have potential to result in cumulative hydrological impacts. These projects are listed in Table 21.15, with details of the catchment area which each is located in and their inclusion in Base Case or Developed Case modelling.

Of these projects, six are existing operations. The landform and structures associated with these projects have been incorporated into the development of hydrologic and hydraulic models for the base case and the developed case.

As part of the Inland Rail Program, the proposed infrastructure and landform details for the North Star to NSW/Queensland Border and Gowrie to Helidon projects are known to ARTC; therefore, these details have been incorporated into the development of hydrologic and hydraulic models for the developed case.

Only InterLinkSQ and the Asterion Medicinal Cannabis Facility have not been reflected in either the existing case or developed case modelling of hydrologic and hydraulic impacts. While the location of these two developments are known, information on the ultimate landform and structure size and configuration are not publicly available at a level of detail that could be incorporated into modelling for the Project; therefore, the hydrological effects of these developments have not been quantitatively assessed.

TABLE 21.15 PROJECTS WITH POTENTIAL FOR CUMULATIVE HYDROLOGICAL IMPACTS

Projects with potential for cumulative hydrological impacts	Floodplain model extent in which the development is located	Model inclusion
Toowoomba Bypass (formerly the Toowoomba Second Range Crossing)	Westbrook Creek model	Base case and developed case
InterLinkSQ	Gowrie Creek model	Not included. Not constructed and insufficient details of future landform and structures.
Toowoomba Wellcamp Airport	Westbrook Creek model	Base case and developed case
Asterion Medicinal Cannabis Facility	Westbrook Creek model	Not included. Not constructed and insufficient details of future landform and structures.
Commodore Mine and Millmerran Power Station	Back Creek model	Base case and developed case
Doug Hall Poultry	Condamine River model	Base case and developed case
Yarranbrook Feedlot	Macintyre Brook model	Base case and developed case
Sapphire Feedlot	Macintyre River model	Base case and developed case
North Star to NSW/QLD Border (Inland Rail)	Macintyre River model	Developed case
Gowrie to Helidon Project (Inland Rail)	Gowrie Creek model	Developed case

Table 21.16 summarises how the Project design performs against each of the flood-impact objectives that have been adopted for the Project.

TABLE 21.16 FLOOD IMPACT OBJECTIVES AND OUTCOMES

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

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

The hydrologic and flooding assessment undertaken has demonstrated that the Project is predicted to result in impacts on the existing flooding regime that generally comply with the flood-impact objectives that have been adopted for the Project; therefore, it is concluded that the cumulative hydrological impacts of the Project are expected to be of **low significance** in relation to projects that have been included in the Base Case and/or Developed Case modelling.

Cumulative hydrological impacts with InterLinkSQ and Asterion Medicinal Cannabis Facility have not been quantitatively assessed; however, the cumulative hydrological impact potential of these projects is also expected to be of **low significance.** This qualitative determination has been made in recognition of the general compliance that the Project has already demonstrated with the adopted flood-impact objectives. These flood-impact objectives, and the design requirements to achieve them, will continue to apply to the Project through the detail design process. Design modifications during the detail design phase will be subject to re-runs of the existing flood models to demonstrate continued compliance with the design objectives of the Project, including for extent and duration of inundation, afflux and flow velocities. The models for Gowrie Creek and Westbrook Creek will be modified at that time to include the latest landform structural details for the InterLinkSQ and Asterion Medicinal Cannabis Facility sites.

Details on the existing case and developed case results for the models listed in Table 21.15 are provided in Chapter 12: Surface Water and Hydrology.

21.3.8 Groundwater

Projects and operations surrounding the groundwater impact assessment area were evaluated in terms of the potential of each to impact groundwater receptors of relevance to the Project.

Cumulative impacts to groundwater are most likely to occur where multiple projects intersect and/or take groundwater from the same shallow aquifer units. The resultant impacts to groundwater may be:

- Change in groundwater levels
- Reduction in groundwater quality, including from contamination.

Impact modelling indicates that no registered bores located outside of the Project footprint are expected to experience groundwater drawdown as a result of Project activities; therefore, due to the localised potential of groundwater impacts associated with the Border to Gowrie Project and the distance and nature of many of the surrounding projects considered, only 4 of the initial 23 projects are considered to have potential to result in cumulative impacts to groundwater. These projects are:

- Commodore Mine and Millmerran Power Station
- North Star to NSW/Queensland Border Project (Inland Rail)
- Gowrie to Helidon Project (Inland Rail)
- Asterion Medicinal Cannabis Facility.

An assessment of cumulative impacts that may arise from these projects in combination with the Project is presented in Table 21.17, with a summary of how potential cumulative impacts would be managed. This assessment has concluded that the construction phase cumulative groundwater impacts of the Project are expected to be of **low significance**. The following factors contributed to this determination:

- Commodore Mine and Millmerran Power Station:
  - There is potential for overlap of dewatering impacts on shallow aquifers intersected by Project cuttings and dewatering from the Commodore Mine open pit; however, if drawdown occurs due to the Project, in proximity to the Commodore Mine, it will be due to localised and temporary dewatering activities. As such, cumulative impacts to groundwater levels are considered unlikely.
  - Cumulative impacts on the quality of groundwater within shallow aquifers may arise due to the compounding of spills and leaks from heavy machinery, drill rigs, etc.; however, if a spill or leak were to occur, the volume of contaminant in any one instance is expected to be small. Therefore, the likelihood of impact to groundwater is considered to be low.
- North Star to NSW/Queensland Border Project (Inland Rail):
  - There are no major cuts into the Border Rivers Alluvium required for the North Star to NSW/Queensland Border Project; therefore, drawdown impacts are likely to be restricted to localised and temporary dewatering activities. As such, cumulative impacts to groundwater levels in the Border Rivers Alluvium are considered unlikely.
  - Cumulative impacts on the quality of groundwater within the Border Rivers Alluvium may arise due to the compounding of spills and leaks from heavy machinery, drill rigs, etc.; however, if a spill or leak were to occur, the volume of contaminant in any one instance is expected to be small. Therefore, the likelihood of impact to groundwater is considered to be low.
- Gowrie to Helidon Project (Inland Rail):
  - Both projects, at the point of interface, overlie the Main Range Volcanics (MRV) but neither of the projects require cuts with potential to encounter groundwater at this location; therefore, drawdown impacts are likely to be restricted to localised and temporary dewatering activities. As such, cumulative impacts to groundwater levels in the MRV are considered unlikely.
  - Cumulative impacts on the quality of groundwater within the MRV may arise due to the compounding of spills and leaks from heavy machinery, drill rigs, etc.; however, if a spill or leak were to occur, the volume of contaminant in any one instance is expected to be small and, therefore, the likelihood of impact to groundwater is considered to be low.
- Asterion Medicinal Cannabis Facility:
  - Both projects, at the point of interface, overlie the MRV but due to the nature of the development, the Asterion Medicinal Cannabis Facility is expected to have very little or no interaction with groundwater in the area. Therefore, cumulative impacts to groundwater levels are considered unlikely.
  - Cumulative impacts on the quality of groundwater within the MRV may arise due to the compounding of spills and leaks from heavy machinery, drill rigs, etc.; however, if a spill or leak were to occur, the volume of contaminant in any one instance is expected to be small and, therefore, the likelihood of impact to groundwater is considered to be low.

TABLE 21.17 CUMULATIVE IMPACT ASSESSMENT FOR GROUNDWATER

Project	Potential cumulative impact	Impact characteristic	Relevance factor	Sum of relevance factors	Impact significance	Comments and management measures
North Star to NSW/QLD Border Project	Change in groundwater levels	Probability of impact	Low (1)	5	Low	The potential for cumulative impacts during construction to groundwater levels is considered to be low; therefore, specific mitigation measures to address cumulative impacts are not warranted. The potential for the Project to contribute to such impacts is considered to be appropriately managed through the development and implementation of the Groundwater Management and Monitoring Program (GMMP), including the establishment of baseline conditions and construction-phase monitoring.
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of receiving environment	Medium (2)			
	Groundwater quality and contamination	Probability of impact	Low (1)	6	Low	The potential for cumulative impacts during construction to groundwater quality is considered to be low; therefore, specific mitigation measures to address cumulative impacts are not warranted. The potential for the Project to contribute to such impacts is considered to be appropriately managed through: ▸ The development and implementation of the GMMP, including the establishment of baseline conditions and construction-phase monitoring ▸ The development and implementation of a Hazardous Materials Management Sub-plan for the Project, thereby ensuring the safe handling, storage and usage of hazardous materials and dangerous goods.
		Duration of the impact	Medium (2)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of receiving environment	Medium (2)			
Gowrie to Helidon Project	Change in groundwater levels	Probability of impact	Low (1)	5	Low	The potential for cumulative impacts during construction to groundwater levels is considered to be low; therefore, specific mitigation measures to address cumulative impacts are not warranted. The potential for the Project to contribute to such impacts is considered to be appropriately managed through the development and implementation of the GMMP, including the establishment of baseline conditions and construction-phase monitoring.
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of receiving environment	Medium (2)			

Project	Potential cumulative impact	Impact characteristic	Relevance factor	Sum of relevance factors	Impact significance	Comments and management measures
Gowrie to Helidon Project (continued)	Groundwater quality and contamination	Probability of impact	Low (1)	6	Low	The potential for cumulative impacts during construction to groundwater quality is considered to be low; therefore, specific mitigation measures to address cumulative impacts are not warranted. The potential for the Project to contribute to such impacts is considered to be appropriately managed through: ▸ The development and implementation of the GMMP, including the establishment of baseline conditions and construction-phase monitoring ▸ The development and implementation of a Hazardous Materials Management Sub-plan for the Project, thereby ensuring the safe handling, storage and usage of hazardous materials and dangerous goods.
		Duration of the impact	Medium (2)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of receiving environment	Medium (2)			
Asterion Medicinal Cannabis Facility	Change in groundwater levels	Probability of impact	Low (1)	5	Low	The potential for cumulative impacts during construction to groundwater levels is considered to be low; therefore, specific mitigation measures to address cumulative impacts are not warranted. The potential for the Project to contribute to such impacts is considered to be appropriately managed through the development and implementation of the GMMP, including the establishment of baseline conditions and construction-phase monitoring.
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of receiving environment	Medium (2)			
	Groundwater quality and contamination	Probability of impact	Low (1)	6	Low	The potential for cumulative impacts during construction to groundwater quality is considered to be low; therefore, specific mitigation measures to address cumulative impacts are not warranted. The potential for the Project to contribute to such impacts is considered to be appropriately managed through: ▸ The development and implementation of the GMMP, including the establishment of baseline conditions and construction-phase monitoring ▸ The development and implementation of a Hazardous Materials Management Sub-plan for the Project, thereby ensuring the safe handling, storage and usage of hazardous materials and dangerous goods.
		Duration of the impact	Medium (2)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of receiving environment	Medium (2)			

Project	Potential cumulative impact	Impact characteristic	Relevance factor	Sum of relevance factors	Impact significance	Comments and management measures
Commodore Mine and Millmerran Power Station	Change in groundwater levels	Probability of impact	Low (1)	6	Low	The potential for cumulative impacts during construction to groundwater levels is considered to be low; therefore, specific mitigation measures to address cumulative impacts are not warranted. The potential for the Project to contribute to such impacts is considered to be appropriately managed through the development and implementation of the GMMP, including the establishment of baseline conditions and construction-phase monitoring.
		Duration of the impact	Medium (2)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of receiving environment	Medium (2)			
	Groundwater quality and contamination	Probability of impact	Low (1)	6	Low	The potential for cumulative impacts during construction to groundwater quality is considered to be low; therefore, specific mitigation measures to address cumulative impacts are not warranted. The potential for the Project to contribute to such impacts is considered to be appropriately managed through: ▸ The development and implementation of the GMMP, including the establishment of baseline conditions and construction-phase monitoring ▸ The development and implementation of a Hazardous Materials Management Sub-plan for the Project, thereby ensuring the safe handling, storage and usage of hazardous materials and dangerous goods.
		Duration of the impact	Medium (2)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of receiving environment	Medium (2)			

21.3.9 Noise and vibration

For the purposes of noise and vibration, projects that directly interface the Border to Gowrie Project and will have temporal overlap in construction, expansion activities or commencement of operation are considered to have the potential to result in cumulative impacts. Only 5 of the initial 23 projects meet these criteria. These projects are:

- InterLinkSQ
- Commodore Mine and Millmerran Power Station
- North Star to NSW/Queensland Border Project (Inland Rail)
- Gowrie to Helidon Project (Inland Rail)
- Asterion Medicinal Cannabis Facility.

Cumulative noise and vibration impacts may be in the form of increased noise and vibration levels at sensitive receptors during construction or cooperation of the Project.

An assessment of cumulative impacts that may arise from the above-mentioned projects in combination with the Project is presented in Table 21.18, with a summary of how potential cumulative impacts would be managed. Quantitatively combining the predicted noise levels with impacts from other projects would overstate the impacts of the Project; therefore, the noise levels due to cumulative impacts that may arise from adjoining projects have been assessed qualitatively.

This assessment has concluded that the construction-phase cumulative noise and vibration impacts of the Project are expected to be of **medium significance** and operational cumulative noise and vibration impacts are expected to be of **low significance**. The following factors contributed to this determination:

- Simultaneous noise from construction works of adjoining projects has the potential to increase noise levels at nearby noise-sensitive receivers also impacted by construction noise associated with the Project; however, the modelling approach adopted for the impact assessment methodology includes simulation of simultaneous construction works by assuming that, as a worst-case, all activities could occur at any time within a defined area, including up to the limit of the Project footprint. The noise levels due to cumulative impacts are not expected to significantly increase above the levels predicted for the Project in isolation.
- The construction methodology will be developed and refined with the aim of achieving compliance with construction noise and vibration performance criteria as specified in in the Outline EMP (Chapter 22: Outline Environmental Management Plan)
- During operation, it is expected that receptors will perceive the operation of the Inland Rail network as a single project, acting as a single linear noise source; therefore, cumulative impacts with adjoining Inland Rail projects will be no different to those predicted for the Project in isolation
- It is anticipated that operational noise arising from InterLinkSQ, the Asterion Medicinal Cannabis Facility and an expanded Commodore Mine operation would differ from the noise generated from an operational railway, regarding tone, frequency and volume. It is also anticipated that, in each instance, adjoining developments would be mitigating and managing noise in accordance with conditions of development approval. As a result, the contributing effect of noise from these adjoining operations is regarded as unlikely to result in significant cumulative impacts.
- Mitigations for operational railway noise and vibration will be implemented to achieve compliance with operational noise and vibration performance criteria as specified in the Outline EMP (Chapter 22: Outline Environmental Management Plan). The type of mitigations and their location will be confirmed based on assessment of the Project detail design. Feasible and practicable options for noise management are expected to be limited to consideration of:
  - Consideration of rail noise barriers (or similar) at Yelarbon, Brookstead and Pittsworth. Conceptual noise barrier options have been reviewed in Appendix T: Operational Railway Noise and Vibration Technical Report.
  - Architectural acoustic treatments to buildings to control rail noise within the internal environment of the building
  - Upgrades to existing property boundary fencing to improve screening of rail noise levels.

The rail alignment of the Project will, in places, intersect and be alongside the existing road network and the future new and upgraded roads proposed with the Project. Concern has been raised regarding the potential for road traffic and railway operations to result in cumulative noise impacts.

The subjective response to the different noise levels and noise characteristics of the intermittent sources of road traffic and railway noise are such that individuals are less likely to perceive or determine impacts based on a cumulative exposure of the combined transport noise. Consequently, the ToR requires road traffic and noise, and railway noise to be assessed, and, if necessary, mitigated separately. While the policies and guidelines referenced by the ToR do not specify criteria or management objectives for combined road and railway transport noise, an overview assessment of potential cumulative transport noise has been undertaken to inform the draft EIS.

Based on the predicted existing road traffic noise levels and the assessed road traffic and railway noise with the Project, the overview assessment determined:

- In general terms, cumulative transport noise levels would generally be expected only where road traffic or railway noise is within 10 A-weighted decibels (dB(A)) of each other (where the same noise metric and timeframes are applied to quantify both sources of transport noise)
- The majority of the new and upgraded roads within the Project are adjacent to or intersect with the rail alignment of the Project. Consequently, at the nearest sensitive receptors to the local road networks, the predicted road traffic and railway noise levels are typically within 10 dB(A) of each other. The future noise environment could therefore be influenced by the cumulative noise from both sources of transport noise.
- Any increase in the overall daily transport noise at sensitive receptors in proximity to both the local road traffic and the Project's rail alignment would be a marginal perceptible increase of not more than 3 dB(A). Because road traffic and railway noise are perceived differently, there may not be an increased potential for noise-related impacts where there is a cumulative increase in transport noise levels.
- The road and railway traffic will not be continuous and there will be periods throughout the daytime and night-time where there could be minimal or no transport noise
- Specific measures to manage or mitigate cumulative transport noise are not required in areas where the Project's rail alignment crosses, or is adjacent to, the future local road network. Any specific mitigations implemented to control railway noise at road–rail interfaces would be expected to also assist in reducing and controlling perceived cumulative noise impacts.

Operational road-traffic noise impacts will be iteratively re-assessed during the detail design process, in accordance with *Transport Noise Management Code of Practice Volume 1—Road Traffic Noise* (CoP Vol 1) (DTMR, 2013a), to confirm the receptors at which noise criteria may be exceeded.

Where CoP Vol 1 criteria may be exceeded at a sensitive receptor, the following potential mitigation measures for both upgraded and new road sections will be investigated for effectiveness and incorporated into the detail design, as appropriate:

- A noise barrier in the form of a landscaped earth mound and/or a noise fence
- Pavement surface treatment
- Provision of acoustic façade treatments to affected sensitive receptors.

A combination of mitigation measures may be appropriate.

TABLE 21.18 CUMULATIVE IMPACT ASSESSMENT FOR CONSTRUCTION AND OPERATIONAL NOISE

Project	Potential cumulative impact	Impact characteristic	Relevance factor	Sum of relevance factors	Impact significance	Comments and management measures
InterLinkSQ	Increased noise and vibration levels at sensitive receptors—construction	Probability of the impact	Medium (2)	7	Medium	The potential for cumulative impacts from noise and vibration during construction will be managed through: ▸ Development and implementation of a Noise and Vibration Management Sub-plan, as a component of the CEMP for the Project ▸ Consultation with InterLinkSQ regarding scheduling of construction activities to avoid simultaneous undertaking of noisy construction activities, e.g. piling ▸ Consultation with sensitive receptors within the extent of impact from noise and vibration generated by construction activities for the Project to agree appropriate mitigation measures.
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Medium (2)			
		Sensitivity of the receiving environment	Medium (2)			
	Increased noise and vibration levels at sensitive receptors—operation	Probability of the impact	Low (1)	5	Low	The potential for cumulative impacts from noise and vibration is considered to be low; therefore, specific mitigation measures to address cumulative impacts are not warranted. The potential for the Project to contribute to such impacts is considered to be appropriately managed through inspection and maintenance of the Inland Rail network in accordance with ARTC's network procedures.
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Medium (2)			
Asterion Medicinal Cannabis Facility	Increased noise and vibration levels at sensitive receptors—construction	Probability of the impact	Medium (2)	6	Low	The potential for cumulative impacts from noise and vibration during construction is considered to be low; therefore, specific mitigation measures to address cumulative impacts are not warranted. The potential for the Project to contribute to such impacts is considered to be appropriately managed through the development and implementation of a Noise and Vibration Management Sub-plan, as a component of the CEMP for the Project. ARTC will consult with Asterion regarding scheduling of construction activities to avoid the simultaneous undertaking of activities that generate loud noises, where possible.
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Medium (2)			
	Increased noise and vibration levels at sensitive receptors—operation	Probability of the impact	Low (1)	5	Low	The potential for cumulative impacts from noise and vibration during operation is considered to be low; therefore, specific mitigation measures to address cumulative impacts are not warranted. The potential for the Project to contribute to such impacts is considered to be appropriately managed through inspection and maintenance of the Inland Rail network in accordance with ARTC's network procedures.
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Medium (2)			

Project	Potential cumulative impact	Impact characteristic	Relevance factor	Sum of relevance factors	Impact significance	Comments and management measures
Commodore Mine and Millmerran Power Station	Increased noise and vibration levels at sensitive receptors—construction	Duration of the impact	Medium (2)	6	Low	The potential for cumulative impacts from noise and vibration during construction is considered to be low; therefore, specific mitigation measures to address cumulative impacts are not warranted. The potential for the Project to contribute to such impacts is considered to be appropriately managed through the development and implementation of a Noise and Vibration Management Sub-plan, as a component of the CEMP for the Project. ARTC will consult with Intergen regarding scheduling of construction activities to avoid the simultaneous undertaking of activities that generate loud noises, where possible.
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Low (1)			
		Sensitivity of the receiving environment	Medium (2)			
	Increased noise and vibration levels at sensitive receptors—operation	Probability of the impact	Low (1)	5	Low	The potential for cumulative impacts from noise and vibration during operation is considered to be low; therefore, specific mitigation measures to address cumulative impacts are not warranted. The potential for the Project to contribute to such impacts is considered to be appropriately managed through inspection and maintenance of the Inland Rail network in accordance with ARTC's network procedures.
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Medium (2)			
North Star to NSW/QLD Border (Inland Rail)	Increased noise and vibration levels at sensitive receptors—construction	Probability of the impact	Medium (2)	8	Medium	The potential for cumulative impacts from noise and vibration during construction will be managed through: ▸ Development and implementation of a Noise and Vibration Management Sub-plan, as a component of the CEMP for the Project ▸ ARTC will facilitate discussions between principal contractors on adjoining Inland Rail sections regarding the scheduling of construction activities, to avoid simultaneous undertaking of noisy construction activities, e.g. piling. ▸ Consultation with sensitive receptors within the extent of impact from noise and vibration generated by construction activities for the Project to agree appropriate mitigation measures.
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Medium (2)			
		Sensitivity of the receiving environment	High (3)			
	Increased noise and vibration levels at sensitive receptors—operation	Probability of the impact	Low (1)	6	Low	The potential for cumulative impacts from noise and vibration during operation is considered to be low; therefore, specific mitigation measures to address cumulative impacts are not warranted. The potential for the Project to contribute to such impacts is considered to be appropriately managed through inspection and maintenance of the Inland Rail network in accordance with ARTC's network procedures.
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	High (3)			

Project	Potential cumulative impact	Impact characteristic	Relevance factor	Sum of relevance factors	Impact significance	Comments and management measures
Gowrie to Helidon (Inland Rail)	Increased noise and vibration levels at sensitive receptors—construction	Probability of the impact	Medium (2)	7	Medium	The potential for cumulative impacts from noise and vibration during construction will be managed through: ▸ Development and implementation of a Noise and Vibration Management Sub-plan, as a component of the CEMP for the Project ▸ ARTC will facilitate discussions between principal contractors on adjoining Inland Rail sections regarding the scheduling of construction activities to avoid simultaneous undertaking of noisy construction activities, e.g. piling ▸ Consultation with sensitive receptors within the extent of impact from noise and vibration generated by construction activities for the Project to agree appropriate mitigation measures.
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Medium (2)			
		Sensitivity of the receiving environment	Medium (2)			
	Increased noise and vibration levels at sensitive receptors—operation	Probability of the impact	Low (1)	5	Low	The potential for cumulative impacts from noise and vibration during operation is considered to be low; therefore, specific mitigation measures to address cumulative impacts are not warranted. The potential for the Project to contribute to such impacts is considered to be appropriately managed through inspection and maintenance of the Inland Rail network in accordance with ARTC's network procedures.
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Medium (2)			

21.3.10 Non-Indigenous heritage

Sites and places of non-Indigenous cultural heritage interest that have been identified through impact assessment for the Project are isolated in nature and generally within 50 m of the Project footprint. Consequently, the area of impact on heritage features of this Project is not expected to overlap with other non-Inland Rail projects. Based on this understanding, only 2 of the 23 identified projects are considered to have potential to result in cumulative impacts to non-Indigenous heritage. These projects are:

- North Star to NSW/Queensland Border Project (Inland Rail)
- Gowrie to Helidon Project (Inland Rail).

An assessment of cumulative impacts that may arise from these projects in combination with the Project is presented in Table 21.19, with a summary of how potential cumulative impacts would be managed. This assessment has concluded that the cumulative heritage impacts of the Project are expected to be of **medium significance**. This determination has been largely driven by the understanding that it is highly probable that places of cultural interest will be impacted by adjoining Inland Rail projects and that these impacts may be permanent in nature. While adjoining Inland Rail projects are unlikely to simultaneously result in impacts to the same area or place of cultural interest, combined impacts across more than one place may constitute a cumulative impact on the cultural fabric of the region. For example, the North Star to NSW/Queensland Border Project may result in impacts to artefact remains of the Logger's Camp on Tucka Tucka Road and the Whalan Creek Bridge, both of which are in NSW. The Gowrie to Helidon Project may result in impacts to the Main Range Railway overbridge of Ruthven Street, in Harlaxton.

The results of cumulative impact assessments undertaken for cultural heritage sites and places must be interpreted with caution, because they are based (in part) on heritage datasets that are inevitably incomplete and contain various inconsistencies and errors. Godwin (2011) has questioned the value of cumulative impact assessments to cultural heritage management in Australia, arguing that the 'fundamentals' necessary for undertaking such assessments simply do not exist. The fundamentals Godwin is referring to are robust regional and national data sets for measuring proposed impacts and the determination of acceptable scientific and cultural impact thresholds.

TABLE 21.19 CUMULATIVE IMPACT ASSESSMENT FOR NON-INDIGENOUS HERITAGE

Project	Potential cumulative impact	Impact characteristic	Relevance factor	Sum of relevance factors	Impact significance	Comments and management measures
North Star to NSW/QLD Border (Inland Rail)	Loss of cultural heritage sites	Probability of the impact	High (3)	9	Medium	Will be managed through: ▸ Design will be developed and refined in response to the outcomes of additional heritage surveys undertaken through the detail design phase, to avoid direct impacts to identified items or sites of heritage significance, where possible and practical to do so ▸ Development and implementation of a Cultural Heritage Management Sub-plan as a component of the CEMP for the Project ▸ Archival photographic recording of sites or places that will be directly impacted by the Project in accordance with the *Guideline: Archival Recording of Heritage Places* (Department of Environment and Heritage Protection (DEHP), 2013b) ▸ ARTC to ensure that compatible management measures are applied across projects within the Inland Rail Program.
		Duration of the impact	High (3)			
		Magnitude/intensity of the impact	Medium (2)			
		Sensitivity of the receiving environment	Low (1)			
Gowrie to Helidon (Inland Rail)	Loss of cultural heritage sites	Probability of the impact	High (3)	9	Medium	Will be managed through: ▸ Design will be developed and refined in response to the outcomes of additional heritage surveys undertaken through the detail design phase, to avoid direct impacts to identified items or sites of heritage significance, where possible and practical to do so ▸ Development and implementation of a Cultural Heritage Management Sub-plan as a component of the CEMP for the Project ▸ Archival photographic recording of sites or places that will be directly impacted by the Project in accordance with the *Guideline: Archival Recording of Heritage Places* (DEHP, 2013b) ▸ ARTC to ensure that compatible management measures are applied across projects within the Inland Rail Program.
		Duration of the impact	High (3)			
		Magnitude/intensity of the impact	Medium (2)			
		Sensitivity of the receiving environment	Low (1)			

21.3.11 Traffic and transport

The traffic tasks associated with existing developments in the region, operating at their current scale and intensity, have been factored into the background traffic numbers established for the impact assessment (refer Chapter 18: Traffic, Transport and Access). Therefore, for the purpose of traffic and transport, construction of new projects or expansion of existing operations that will have a temporal overlap and may result in traffic usage of the same road network as the Border to Gowrie Project are considered to have the potential to result in cumulative impacts. Only 8 of the initial 23 projects identified meet these criteria. The projects considered applicable to the traffic and transport cumulative impact assessment are:

- New Acland Coal Mine Stage 3
- Australia Pacific LNG Project
- InterLinkSQ
- Commodore Mine and Millmerran Power Station
- Asterion Medicinal Cannabis Facility
- Wyemo Piggery
- Goondiwindi Abattoir
- North Star to NSW/Queensland Border (Inland Rail)
- Gowrie to Helidon Project (Inland Rail).

If construction transportation tasks for the above-mentioned projects occur simultaneously to transportation tasks for the Border to Gowrie Project, then a cumulative increase in traffic volumes on the local road network may occur. Generally, the following impacts may arise because of the increased number of vehicle movements on the existing road network during construction:

- Increased journey times on road linkages used by construction traffic
- Reduced level of service on road links used by construction traffic
- Increased waiting time at intersections used by construction traffic
- Accelerated degradation of road pavements due to increased volume of traffic and greater axle load.

A qualitative assessment of cumulative impacts that may arise from these projects in combination with the Project is presented in Table 21.20, with a summary of how potential cumulative impacts would be managed. This assessment has concluded that the cumulative traffic and transport impacts of the Project are expected to be up to a **medium significance**. The following factors contributed to this determination:

- The assessment has only considered the potential for cumulative impacts above and beyond those that have already been factored into the traffic impact assessment for the Project. A linear growth rate of 2 per cent was applied to the annual average daily traffic volumes of roads nominated for use by construction traffic to determine future background traffic volumes for the traffic impact assessment. This means that the addition of Project construction traffic has already been assessed against a future background traffic scenario that includes allowance for growth in road usage.
- When establishing the scale of the construction task for the Project, buffer factors were applied to derive vehicle movement numbers for each of the foreseeable construction transportation activities. These buffer factors allow for additional journeys that may be required to deliver the Project; however, these factors also provide contingency in the traffic impact assessment for the addition of background traffic volumes that may be marginally greater than the forecast future scenario.

The traffic impact assessment will be updated and finalised during the detail design phase, in accordance with the process specified in the *Guideline to Traffic Impact Assessment* (DTMR, 2018b), to reflect the detail design, construction method (including material sources and quantities), and the finalised construction traffic routes. Other developments and activities in the region that may contribute to background traffic volumes over the construction period for the Border to Gowrie Project will be identified and confirmed in consultation with Goondiwindi and Toowoomba regional councils and DTMR. These volumes will be incorporated into the revised traffic impact assessment.

This revised traffic impact assessment will be used to develop a Traffic Management Sub-plan and a Road Use Management Plan (RUMP) for the Project, for implementation during construction.

TABLE 21.20 CUMULATIVE IMPACT ASSESSMENT FOR TRAFFIC

Project	Potential cumulative impact	Impact characteristic	Relevance factor	Sum of relevance factors	Impact significance	Comments and mitigation measures
New Acland Coal Mine Stage 3	Increase traffic volumes on local road network	Probability of the impact	Low (1)	5	Low	The potential for cumulative traffic impacts to arise due to New Acland Coal Mine Stage 3 is considered to be low due to the separation distance between the two projects (18 km north of the Project footprint). The potential for the Project to contribute to increased traffic volumes on the local road network will be managed through: ▸ Development and implementation of a RUMP and Traffic Management Sub-plan ▸ Consultation with DTMR and TRC through the detail design and construction phases of the Project to identify newly occurring issues and risks to the road network that will be used by Project traffic.
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Medium (2)			
Australia Pacific LNG Project	Increase traffic volumes on local road network	Probability of the impact	Low (1)	5	Low	The potential for cumulative traffic impacts to arise due to the Australia Pacific LNG Project is considered to be low due to the separation distance between the two projects (13 km north of the Project footprint). The potential for the Project to contribute to increased traffic volumes on the local road network will be managed through: ▸ Development and implementation of a RUMP and Traffic Management Sub-plan ▸ Consultation with DTMR and TRC through the detail design and construction phases of the Project to identify newly occurring issues and risks to the road network that will be used by Project traffic.
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Medium (2)			

Project	Potential cumulative impact	Impact characteristic	Relevance factor	Sum of relevance factors	Impact significance	Comments and mitigation measures
InterLinkSQ	Increase traffic volumes on local road network	Probability of the impact	Medium (2)	8	Medium	Both projects are expected to be reliant on use of roads north of the Warrego Highway. The shared use of these roads could occur for a large portion of the construction period for the Project. The potential for the Project to contribute to increased traffic volumes on the local road network will be managed through: ▸ Development and implementation of a RUMP and Traffic Management Sub-plan ▸ Consultation with DTMR and TRC through the construction planning and construction phases of the Project to identify newly occurring issues and risks to the road network used by Project traffic ▸ Consultation with the developers and operators of InterLinkSQ, throughout construction to understand the scheduling of activities for that Project and enable time periods where cumulative traffic impacts may arise to be identified ▸ Where new potential for cumulative impacts are identified through the construction period, additional mitigation measures will be developed in consultation with DTMR, TRC and InterLinkSQ and documented in the Traffic Management Sub-plan and RUMP, as appropriate.
		Duration of the impact	Medium (2)			
		Magnitude/intensity of the impact	Medium (2)			
		Sensitivity of the receiving environment	Medium (2)			
Asterion Medicinal Cannabis Facility	Increase traffic volumes on local road network	Probability of the impact	Medium (2)	6	Low	The potential for cumulative traffic impacts to arise due to the Asterion Medicinal Cannabis Facility is considered to be low due to the short duration of overlap in construction time periods and the likely advanced status of construction of the Medicinal Cannabis Facility by the time peak construction activities for the project occur in the area. The potential for the Project to contribute to increased traffic volumes on the local road network will be managed through: ▸ Development and implementation of a RUMP and Traffic Management Sub-plan ▸ Consultation with DTMR and TRC through the detail design and construction phases of the Project to identify newly occurring issues and risks to the road network that will be used by Project traffic.
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Medium (2)			

Project	Potential cumulative impact	Impact characteristic	Relevance factor	Sum of relevance factors	Impact significance	Comments and mitigation measures
Commodore Mine and Millmerran Power Station	Increase traffic volumes on local road network	Probability of the impact	High (3)	9	Medium	Both projects are expected to be reliant on use of Millmerran–Inglewood Road in the Millmerran and Clontarf areas. The shared use of this road could occur for a large portion of the construction period for the Project. The potential for the Project to contribute to increased traffic volumes on the local road network will be managed through: ▸ Development and implementation of a RUMP and Traffic Management Sub-plan ▸ Consultation with DTMR and TRC through the construction planning and construction phases of the Project to identify newly occurring issues and risks to the road network used by Project traffic ▸ Consultation with the operators of Commodore Mine, Intergen, throughout construction to understand the scheduling of expansion activities for that Project and enable time periods where cumulative traffic impacts may arise to be identified ▸ Where new potential for cumulative impacts are identified through the construction period, additional mitigation measures will be developed in consultation with DTMR, TRC and Intergen and documented in the Traffic Management Sub-plan and RUMP, as appropriate.
		Duration of the impact	Medium (2)			
		Magnitude/intensity of the impact	Medium (2)			
		Sensitivity of the receiving environment	Medium (2)			
Wyemo Piggery	Increase traffic volumes on local road network	Probability of the impact	Low (1)	5	Low	The potential for cumulative traffic impacts to arise due to the Wyemo Piggery is considered to be low due to the separation distance between the two projects (8 km north of the Project footprint). The potential for the Project to contribute to increased traffic volumes on the local road network will be managed through: ▸ Development and implementation of a RUMP and Traffic Management Sub-plan ▸ Consultation with relevant road-controlling authorities through the detail design and construction phases of the Project to identify newly occurring issues and risks to the road network that will be used by Project traffic.
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Medium (2)			

Project	Potential cumulative impact	Impact characteristic	Relevance factor	Sum of relevance factors	Impact significance	Comments and mitigation measures
Goondiwindi Abattoir	Increase traffic volumes on local road network	Probability of the impact	Low (1)	6	Low	The potential for cumulative traffic impacts to arise due to the Goondiwindi Abattoir is considered to be low due to the separation distance between the two projects (13 km north of the Project footprint). The potential for the Project to contribute to increased traffic volumes on the local road network will be managed through: ▸ Development and implementation of a RUMP and Traffic Management Sub-plan ▸ Consultation with relevant road-controlling authorities through the detail design and construction phases of the Project to identify newly occurring issues and risks to the road network that will be used by Project traffic.
		Duration of the impact	Medium (2)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Medium (2)			
North Star to Border (Inland Rail)	Increase traffic volumes on local road network	Probability of the impact	Medium (2)	8	Medium	There is potential for construction traffic for both projects to use roads on the Queensland side of the Macintyre River (e.g. Kildonan Road, Wondalli–Kurumbul Road). The potential for the Project to contribute to increased traffic volumes on the local road network will be managed through: ▸ Development and implementation of a RUMP and Traffic Management Sub-plan ▸ Consultation with road network asset managers through the construction planning and construction phases of the Project to identify newly occurring issues and risks to the road network used by Project traffic ▸ Subject to construction contract arrangements, investigate opportunities to nominate laydown locations that can be shared between this project and the Border to Gowrie Project. This would enable optimisation of the number of delivery movements and routes to/from the construction sites for both projects.
		Duration of the impact	Medium (2)			
		Magnitude/intensity of the impact	Medium (2)			
		Sensitivity of the receiving environment	Medium (2)			

Project	Potential cumulative impact	Impact characteristic	Relevance factor	Sum of relevance factors	Impact significance	Comments and mitigation measures
Gowrie to Helidon (Inland Rail)	Increase traffic volumes on local road network	Probability of the impact	Medium (2)	8	Medium	Both projects are expected to be reliant on use of roads north of the Warrego Highway. The shared use of these roads could occur for a large portion of the construction period for the Project. The potential for the Project to contribute to increased traffic volumes on the local road network will be managed through: ▸ Development and implementation of a RUMP and Traffic Management Sub-plan ▸ Consultation with DTMR and TRC through the construction planning and construction phases of the Project to identify newly occurring issues and risks to the road network used by Project traffic ▸ Subject to construction contract arrangements, investigate opportunities to nominate laydown locations that can be shared between this project and the Border to Gowrie Project. This would enable optimisation of the number of delivery movements and routes to/from the construction sites for both projects.
		Duration of the impact	Medium (2)			
		Magnitude/intensity of the impact	Medium (2)			
		Sensitivity of the receiving environment	Medium (2)			

21.3.12 Hazard and risk

The assessment of cumulative hazard and risk impacts requires consideration of various matters, some of which have been discussed in in other sections of this chapter, as follows:

- Flooding and climate change—Section 21.3.7
- Landslide, sudden subsidence, movement of soil or rocks—Section 21.3.2
- Wildlife and biosecurity—Section 21.3.4
- Traffic—Section 21.3.11
- Utilities, private access and stock route—Section 21.3.1
- Existing land use and infrastructure—Section 21.3.1
- Contaminated land—Section 21.3.2.

Therefore, only potential cumulative impacts associated with hazardous materials and dangerous goods (including explosives) during construction have been assessed in this section.

Impacts from the storage, handling or use of hazardous materials and dangerous goods, if they were to occur, would be considered incidents. It is considered improbable that activities from two projects in proximity to one another would result in such incidents at a time and place that would overlap and result in cumulative impacts; therefore, the storage, handling or use of hazardous materials and dangerous goods have not been considered in the assessment of cumulative impacts.

The potential for cumulative impacts to arise from hazardous materials and dangerous goods is considered to be restricted to the loss of containment of these materials during transportation, either to and from the Project footprint (deliveries or waste removal) or within the Project footprint (moving from point of delivery to point of use).

The types and quantities of hazardous materials that are expected to be used for the construction or operation and maintenance of other projects are not considered to be sufficient to result in significant offsite impacts or the potential to contribute to cumulative impacts at the adjacent, regional and national level. In addition, it is considered unlikely that non-Inland Rail projects in the region would require transportation of hazardous materials and dangerous goods similar to the Project's needs that, if an incident were to occur, would result in a cumulative impact; therefore, in regard to the transportation of hazardous materials and dangerous goods, the projects that are considered to have a potential for cumulative impacts with the Project are:

- North Star to NSW/Queensland Border Project (Inland Rail)
- Gowrie to Helidon Project (Inland Rail).

An assessment of cumulative impacts that may arise from these projects in combination with the Project is presented in Table 21.21, with a summary of how potential cumulative impacts would be managed. This assessment has concluded that the cumulative hazard and risk impacts of the Project are expected to be of **medium significance**.

This determination has been made despite the low likelihood of simultaneous incidents occurring due to activities from two projects at an interface location. This is because, if such an incident were to occur, the impacts could affect a high sensitivity receptor, for example the Macintyre River at the interface with the North Star to NSW/Queensland Border Project and Gowrie Creek at the interface with the Gowrie to Helidon Project. While such an impact may not be permanent, it may be of medium magnitude and duration.

TABLE 21.21 CUMULATIVE IMPACT ASSESSMENT FOR HAZARD AND RISK

Impact	Type	Impact characteristic	Relevance factor	Sum of relevance factors	Impact significance	Comments and management measures
North Star to NSW/QLD Border Inland Rail project	Loss of containment of dangerous goods through transportation during construction	Probability of the impact	Low (1)	8	Medium	Will be managed through: ▸ Development and implementation of a Hazardous Materials Management Sub-plan, as a component of the CEMP for the Project ▸ ARTC to ensure that compatible management measures are applied across projects within the Inland Rail Program ▸ Adherence to the requirements of ARTC's Safety Management System ▸ Adherence to Inland Rail emergency management procedures ▸ The development and implementation of network-wide Incident Management Plan.
		Duration of the impact	Medium (2)			
		Magnitude/intensity of the impact	Medium (2)			
		Sensitivity of the receiving environment	High (3)			
	Loss of containment of dangerous goods through transportation during operation	Probability of the impact	Low (1)	8	Medium	Will be managed through: ▸ Class 1 explosives will not be transported on the Inland Rail network ▸ Dangerous goods will be loaded, labelled, and marshalled in accordance with *the Australian Code for the Transport of Dangerous Goods by Road & Rail* (National Transport Commission, 2018) ▸ Adherence to Inland Rail emergency management procedures ▸ The development and implementation of network-wide Incident Management Plan.
		Duration of the impact	Medium (2)			
		Magnitude/intensity of the impact	Medium (2)			
		Sensitivity of the receiving environment	High (3)			

Impact	Type	Impact characteristic	Relevance factor	Sum of relevance factors	Impact significance	Comments and management measures
Gowrie to Helidon Inland Rail project	Loss of containment of dangerous goods through transportation during construction	Probability of the impact	Low (1)	8	Medium	Will be managed through: ▸ Development and implementation of a Hazardous Materials Management Sub-plan, as a component of the CEMP for the Project ▸ ARTC to ensure that compatible management measures are applied across projects within the Inland Rail Program ▸ Adherence to the requirements of ARTC's Safety Management System ▸ Adherence to Inland Rail emergency management procedures ▸ The development and implementation of network-wide Incident Management Plan.
		Duration of the impact	Medium (2)			
		Magnitude/intensity of the impact	Medium (2)			
		Sensitivity of the receiving environment	High (3)			
	Loss of containment of dangerous goods through transportation during operation	Probability of the impact	Low (1)	8	Medium	Will be managed through: ▸ Class 1 explosives will not be transported on the Inland Rail network ▸ Dangerous goods must be loaded, labelled, and marshalled in accordance with *the Australian Code for the Transport of Dangerous Goods by Road & Rail* (National Transport Commission, 2018) ▸ Adherence to Inland Rail emergency management procedures ▸ The development and implementation of network-wide Incident Management Plan.
		Duration of the impact	Medium (2)			
		Magnitude/intensity of the impact	Medium (2)			
		Sensitivity of the receiving environment	High (3)			

21.3.13 Waste management

Based on the reference design, the Project is expected to have a total material deficit between 822,332 m^3 and 971,237 m^3, depending on the ability to treat and reuse unsuitable material; therefore, cumulative impacts associated with the offsite disposal of spoil are not anticipated as a result of the Project.

Because of this, cumulative impacts arising from waste management activities are expected to be isolated to the disposal of waste, which contributes to the consumption of airspace of local waste-management infrastructure. This, in turn, will reduce the local community's access to such services.

For the purposes of waste management, projects that will have overlapping construction timeframes and shared demand on existing waste-management facilities are regarded as having potential to result in cumulative impacts. Only 2 of the initial 23 projects meet these criteria. These projects are:

- North Star to NSW/Queensland Border Project (Inland Rail)
- Gowrie to Helidon Project (Inland Rail).

An assessment of cumulative impacts that may arise from these projects in combination with the Project is presented in Table 21.23, with a summary of how potential cumulative impacts would be managed. This assessment has concluded that the cumulative waste management impacts of the Project are expected to be of **low significance**. The following factors contributed to this determination:

- Cumulative impacts have been assessed on the basis of the potential decrease in lifespan of the waste and resource management infrastructure in the region. Using data from the *Recycling and Waste in Queensland* (DES, 2018c) report, these aspects have been addressed through the assessment of waste-generation rates from the Project in comparison to waste-generation rates of the region. The waste types and volumes that are expected to be generated during the construction phase of the Project are presented in Table 21.22, with comparison to annual waste-generation volumes for the region. None of the Project waste streams included in Table 21.22 are expected to result in a 10 per cent increase in volume of regional waste generation. Most of the Project waste streams are expected to result in a contribution of less than 1 per cent to existing regional waste generation (i.e. practically immeasurable); therefore, the waste volumes likely to be produced by the Project are considered insignificant in the context of broader waste-generation practices in the region.
- The ability of waste-receiving facilities in the region to receive wastes generated by the Project has been determined based on initial consultation with operators, a review of environmental authority licencing under the EP Act and consideration of the Project's contribution to the regional waste-management network. Feedback from consultation with TRC and GRC has indicated that existing waste-receiving facilities that are owned and/or managed by these councils are expected to have sufficient combined capacity to accept waste materials generated by the Project.
- Both of the projects assessed are part of the broader Inland Rail Program; therefore, despite the potential for cumulative impact on receiving waste-management facilities, ARTC will liaise with the relevant operators in order to negotiate appropriate waste disposal arrangements. Furthermore, the negotiation of spoil reuse across different projects represents a Project opportunity that will have a tangible benefit on the need for offsite (outside Project) management/disposal.

TABLE 21.22 CONSTRUCTION WASTE QUANTITIES FOR THE PROJECT, RELATIVE TO REGIONAL RATES OF WASTE GENERATION

Waste/ resource description	Waste type	Estimated quantity produced over full construction duration	Residual as proportion of existing annual waste generation in the region	Potential reuse
Vegetation	Green waste	14,641,267 m^2	Not applicable—to be reused within the Project	Yes
Topsoil	C&D waste (topsoil for onsite reuse)	100 mm depth: 274,587 m^2 200 mm depth: 5,265,173 m^2 300 mm depth: 55,510 m^2	Not applicable—to be reused within the Project	Yes All topsoil is expected to be reused on the Project.
Steel (existing rail)	C&D waste	5,822 t	5%	Yes Where practical, opportunities for reuse will be explored

Waste/ resource description	Waste type	Estimated quantity produced over full construction duration	Residual as proportion of existing annual waste generation in the region	Potential reuse
Timber sleepers	Regulated waste (regarded as contaminated)	361,700 count	Data on regional proportion of regulated waste is not available	Yes Opportunities for reuse will be considered consistent with the intent of EOW Code: Chemically Treated Solid Timber (ENEW07503218)
Ballast	Regulated waste (regarded as contaminated)	400,100 m^3	Data on regional proportion of regulated waste is not available	Yes Opportunities for reuse will be considered consistent with the intent of an EOW Code, if available
Occupying non-resident workforce accommodation	General waste	115 t	<0.1%	No
Occupying site offices	General waste	26 t	<0.1%	No
Concrete culverts	C&D waste	Assume 2% of 20,721 m^3	0.5%	No
Concrete (in situ)	C&D waste	Assume 2% of 91,076 m^3	2.5%	No
Concrete (pre-cast)	C&D waste	Assume 2% of 24,125 m^3	0.5%	No
Oils, lubricants and greases	Regulated waste	Cannot be determined at present. Waste quantity is dependent on confirmed construction method and the numbers and types of plant and vehicular fleet.	Unknown	No
Packaging	General waste	Cannot be determined at present. Waste quantity is dependent on confirmed construction method, material requirements and packaging of received goods.	Unknown	No

TABLE 21.23 CUMULATIVE IMPACT ASSESSMENT FOR WASTE MANAGEMENT

Project	Potential cumulative impact	Impact characteristic	Relevance factor	Sum of relevance factors	Impact significance	Comments and management measures
North Star to NSW/QLD Border (Inland Rail)	Airspace consumption of local waste-management infrastructure, thereby reducing the local community's access to such services	Probability of the impact	Medium (2)	5	Low	Will be managed during construction through: ▸ Opportunities for material reuse and recycling across projects are to be identified and assessed for feasibility ▸ ARTC to secure agreements with owners and operators for disposal of waste at licensed waste-disposal facilities once the construction schedule for both Inland Rail projects is confirmed ▸ ARTC to ensure that construction contract documentation for adjoining projects have consistent clauses regarding waste management, including reduction targets ▸ ARTC to ensure that Waste Management Sub-plans (or equivalent) are prepared for both adjoining Inland Rail projects, and that these sub-plans are complementary and are consistent with the Inland Rail Environment and Sustainability Policy, the Inland Rail Sustainable Procurement Policy and the Inland Rail Environmental Management System.
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Low (1)			
Gowrie to Helidon (Inland Rail)	Airspace consumption of local waste management infrastructure, thereby reducing the local community's access to such services	Probability of the impact	Medium (2)	5	Low	Will be managed during construction through: ▸ Opportunities for material reuse and recycling across projects are to be identified and assessed for feasibility ▸ ARTC to secure agreements with owners and operators for disposal of waste at licensed waste-disposal facilities once the construction schedule for both Inland Rail projects is confirmed ▸ ARTC to ensure that construction contract documentation for adjoining projects have consistent clauses regarding waste management, including reduction targets ▸ ARTC to ensure that Waste Management Sub-plans (or equivalent) are prepared for both adjoining Inland Rail projects, and that these sub-plans are complementary and are consistent with the Inland Rail Environment and Sustainability Policy, the Inland Rail Sustainable Procurement Policy and the Inland Rail Environmental Management System.
		Duration of the impact	Low (1)			
		Magnitude/intensity of the impact	Low (1)			
		Sensitivity of the receiving environment	Low (1)			

21.3.14 Social

For the purpose of social impacts and benefits, projects that meet one or more of the following criteria were considered to have potential to result in cumulative impacts:

- Projects that would be constructed as part of the Inland Rail Program
- Major projects located within the impact assessment area or that may draw on the labour force in the impact assessment area
- Freight and passenger rail projects being constructed in Southeast Queensland (excludes metropolitan light rail, due to differences in labour requirements).

Based on this, 14 projects have been identified that meet these criteria. These projects are:

- New Acland Coal Mine Stage 3
- InterLinkSQ
- Wellcamp Business Park
- Witmack Industry Park and Charlton Logistics Park
- Asterion Medicinal Cannabis Facility
- Commodore Mine and Millmerran Power Station
- Wyemo Piggery
- Goondiwindi Abattoir
- North Star to NSW/Queensland Border (Inland Rail)
- Gowrie to Helidon Project (Inland Rail)
- Helidon to Calvert (Inland Rail)
- Calvert to Kagaru (Inland Rail)
- Kagaru to Acacia Ridge (Inland Rail)
- Cross River Rail.

21.3.14.1 Local impacts

The local area of influence for assessment of cumulative social impacts has been defined for the purposes of this section to include the Project footprint and a buffer of approximately 5 km from the Project footprint, on the basis that the interface of multiple projects may have impacts on social conditions, e.g. housing availability, access to services or access to tradespeople.

Local amenity, character and traffic

Cumulative social impacts may occur in the Kingsthorpe/Gowrie Junction area where construction of the Project, Gowrie to Helidon project and InterLinkSQ could all coincide. In this area, an increase in traffic may be experienced, and construction activities and laydown areas may temporarily detract from local character. With respect to the interface between the Project and the North Star to NSW/Queensland Border Project, the combined impacts of rail construction and road works may impact on scenic character in a localised area west of Kurumbul.

The Asterion Medicinal Cannabis Facility is proposed for a site near the Toowoomba Wellcamp Airport and would have an estimated peak construction workforce of 800 personnel. If the construction program coincides with the Project's construction program, this could result in an increase in construction activities and the number of non-resident workers in the Wellcamp area, and consequent increases in traffic on major roads if construction traffic routes coincide.

Project workforce-management strategies that address potential concerns about community safety include enforcing a code of conduct containing requirements for positive behaviours and respect for local residents and businesses and ensuring that the Principal Contractor has appropriate work conduct policies and procedures, implemented for all Inland Rail work sites.

Accommodation impacts

Up to three non-resident workforce accommodation facilities have been proposed to primarily service the accommodation requirements of workforce for the Project; however, if established, the non-resident workforce accommodation in Yelarbon may also be used by personnel working on the North Star to NSW/Queensland Border Project. Sharing of temporary accommodation across these projects would help to minimise any contributions to demands on local housing and accommodation in the local area.

Concurrent projects, such as other Inland Rail projects in Queensland, Cross River Rail and New Acland Coal Stage 3, may compete with the Project for construction personnel. This may result in a large proportion of personnel being recruited from outside the region. If this were to occur, there is potential for increased pressure on housing supplies in the impact assessment area; however, the potential for this constraint has been recognised by ARTC, and non-resident workforce accommodation facilities are proposed to minimise possible pressures on existing accommodation.

Social infrastructure requirements

A cumulative increase in construction workers within local communities has the potential to temporarily affect demands for policing and emergency services with respect to traffic management, site security (e.g. responding to incidents of theft from work sites) and road safety. Government funding for police, fire and ambulance services available to local communities may require review by the relevant State Government agencies, informed by delivery plans provided by ARTC, to ensure cumulative project demands do not impact on local community access to services.

It is anticipated that non-resident personnel's health service requirements would primarily be met in their home communities, so significant cumulative demands on health services are less likely; however, there is potential for workers to be transported to major hospitals in Toowoomba or Goondiwindi if treatment is required. This is not expected to be a significant drain on hospital services. ARTC will provide workforce ramp-up estimates to the Queensland Police Service (QPS), Queensland Ambulance Service (QAS), Queensland Fire and Emergency Service (QFES) and Queensland Health to assist with their planning.

There is potential for stresses associated with Inland Rail and other construction projects to increase local demands for support services. ARTC is proactively addressing the risk of increased community stress through the implementation of the Inland Rail Mental Health Support Program, delivered in partnership with the Darling Downs and West Moreton Primary Healthcare Network. The Project will also consult with Department of Communities, Disability Services and Seniors (DCDSS) to identify any existing service shortfalls and monitor any increases in service demands resulting from the Project, to enable cooperative solutions to address any strain.

Community benefits

Potential local benefits if a number of projects are constructed concurrently include:

- Potential for increased trade for businesses in Gowrie Junction and Goondiwindi with concurrent Inland Rail projects, and in Millmerran and Pittsworth with regard to Millmerran Power Station's regular maintenance shutdowns
- A substantial increase in the number and diversity of jobs available to local residents
- Facilitation of long-term employment opportunities and regional development, with potential to support development of the Charlton Wellcamp Enterprise Area.

21.3.14.2 Regional impacts

The Project region is considered as the regional level for assessment of cumulative social impacts, with consideration to adjacent LGAs where other Inland Rail projects may be constructed in the same timeframe.

Traffic

The coincidence of construction of projects would have cumulative impacts on traffic volumes and potentially lead to traffic delays during the construction period, throughout the impact assessment area. Impacts would depend on the timing and location of the works of multiple projects at that time. A wide range of mitigation measures relating to safety, intersection impacts, link-road impacts, pavement impacts, and road/rail interface impacts have been proposed for construction and operation of the Project and are expected to mitigate the Project's contribution to cumulative impacts on traffic. Such measures include:

- Development and implementation of a RUMP and Traffic Management Sub-plan
- Development and implementation of traffic control plans for localised short-term activities requiring traffic control
- Consultation with DTMR and TRC through the detail design and construction phases of the Project to identify newly occurring issues and risks to the road network that will be used by Project traffic
- Maximising opportunities to move materials, plant and workforce within the Project footprint, instead of using the public road network
- Implementation of a travel demand management awareness campaign to inform the public of the proposed construction works and its potential effect on local road network operations. The purpose of this awareness campaign would be to relieve congestion by encouraging travel outside of peaks and increase public awareness of planned construction works.

Employment opportunities and labour draw

The Project has potential to contribute to significant cumulative increases in employment opportunities in the Project region, both directly through construction employment opportunities, and through involvement of local businesses in the supply chain.

If the six Inland Rail projects were constructed simultaneously, and all workforce peaks coincided, a total of approximately 3,016 construction personnel could be required across several LGAs. This represents a maximum case, as the likelihood that all workforces would peak simultaneously is low. In the context of the labour force and business strengths available, particularly in the Toowoomba LGA, and as the North Star to NSW/Queensland Border project is likely to draw on labour from New South Wales, this is unlikely to cause a significant adverse impact on other industries' access to labour. Given existing strengths in the construction industry, particularly in Toowoomba, and the increase in unemployment that has resulted from COVID-19 restrictions, employment opportunities relating to Inland Rail and other projects are likely to be a significant social and economic benefit to residents in LGAs where Inland Rail projects will be constructed.

Coincidence of construction for projects such as Charlton Wellcamp Enterprise Area projects and the Asterion Medicinal Cannabis Facility is possible. If multiple additional projects were constructed in the same time frame, there may be a significant draw on trades and construction labour contributing to labour shortages across the region.

Social infrastructure

Cumulative increases in construction workers across the Project region have the potential to affect demands for policing and emergency services with respect to traffic management, site security (e.g. responding to incidents of theft from work sites), road safety policing and, potentially, community protests against Inland Rail or other projects. Government funding for police, fire and ambulance services available to local communities may require review by the relevant departments to ensure cumulative project demands do not impact on community access to services. The Project will provide workforce ramp-up estimates to the QPS, QAS, QFES, DCDSS and Queensland Health to assist with their planning.

As personnel's health service requirements would primarily be met in their home communities, cumulative demands on health services are less likely but there is potential for workers to be transported to major hospitals in Toowoomba or Goondiwindi if treatment is required. This is not expected to be a significant drain on hospital services.

Broader regional labour requirements

The construction period for Cross River Rail (Dutton Park to Bowen Hills in the Brisbane LGA) may overlap with construction phases for the Queensland Inland Rail projects. Cross River Rail has an estimated average construction workforce number of 1,600 personnel and a peak of 2,200 personnel. If the peak labour demand for Cross River Rail (1,500) was to coincide with the peak labour demand period for all of the Queensland Inland Rail projects (approximately 2,716), then approximately 4,916 construction personnel would be required for rail projects in southern Queensland. This is an unlikely scenario, as peak labour demand for all projects is not expected to align, but it represents a 'maximum case' estimate in relation to the demands on labour and in relation to employment opportunities. In combination, the cumulative impacts of railway construction projects in southern Queensland could lead to significant demands for construction personnel, significantly increasing employment opportunities, but potentially affecting access to labour and tradespeople for residents, businesses and other industries. The potential contribution of the Project to the cumulative labour demand will be managed through the implementation of the Social Impact Management Plan (SIMP), particularly those elements that pertain to the provision of training and development opportunities for local personnel (e.g. Inland Rail Skills Academy) (refer Chapter 15: Social).

The expansion in the construction sector would support additional flow-on demand through the construction industry supply chain and additional spending on consumer-orientated products by the construction workforce in the region. The associated supply of construction materials, the development of associated external infrastructure and complementary services will also require additional workforce beyond those directly associated with the Inland Rail and other major projects, stimulating job creation and economic development in the region.

The Project has the potential to catalyse positive impacts for industrial development by attracting rail-dependent industry to the Charlton Wellcamp Enterprise Area, and possibly also to Goondiwindi. This would generate significant positive cumulative employment opportunities in the impact assessment area.

21.3.14.3 Cumulative impact summary

Potential cumulative impacts have been evaluated in relation to their likelihood and consequence to the social environment, applying the criteria defined in Section 21.2.3. The likelihood of social impacts and opportunities occurring has been assessed with reference to the social baseline (e.g. findings regarding community vulnerabilities to impacts), stakeholder inputs and findings of technical assessment of specific matters in this draft EIS. A detailed assessment of the potential for cumulative social impacts on local and regional communities is provided in Appendix U: Social Impact Assessment Report.

Potential cumulative impacts have been designated as negative (-) or positive (+) and are summarised in Table 21.24.

TABLE 21.24 CUMULATIVE IMPACT ASSESSMENT FOR SOCIAL IMPACTS

Projects	Potential cumulative social impacts	Likelihood	Consequence	Significance
Inland Rail—North Star to NSW/Queensland Border	Combined impacts of rail construction and road works may impact on scenic character in a localised area west of Kurumbul	C	1	C1 Low (-)
	Goondiwindi and Yelarbon businesses are likely to benefit from Project and personnel expenditure of the combined Inland Rail projects	B	3	B3 High (+)
Inland Rail—Gowrie to Helidon	Combined impacts of rail construction may affect rural character between Gowrie Mountain and Kingsthorpe, particularly with additional proximity to InterLinkSQ site	B	1	B1 Moderate (-)
	Potential for increased trade for businesses in the Gowrie Junction area	C	3	C3 High (+)
Other Inland Rail projects in Queensland	Substantial increase in the availability of employment in the impact assessment area	B	3	B3 High (+)
	Potential labour draw in social impact assessment (SIA) area affecting access to labour by businesses, industries and households during construction	C	2	C2 Moderate (-)
	Potential for incremental increases in demands on health, police and emergency services	B	2	B2 High (-)
Goondiwindi Abattoir Wyemo Piggery	Requirement for civil construction labour, resulting in reduced access to skilled trades and construction labour in the Goondiwindi LGA	C	3	C3 High (+)
	Increase in the availability of employment in the Goondiwindi LGA	C	3	C3 High (+)
	Potential for incremental increases in demands on health, police and emergency services in the Goondiwindi LGA	C	2	C2 Moderate (-)
InterLinkSQ Wellcamp Business Park Witmack Industry Park and Charlton Logistics Park New Acland Coal Mine—Stage 3 Commodore Mine and Millmerran Power Station Asterion Medicinal Cannabis Production Facility	Substantial increase in the availability of employment, facilitation of development and future job growth in the Toowoomba LGA	B	3	B3 High (+)
	Requirement for civil construction labour, resulting in cumulative demand for skilled trades and civil construction labour; however, development is likely to be incremental over a longer period	C	2	C2 Moderate (-)
	Potential for incremental increases in demands on health, police and emergency services in the Toowoomba LGA	C	2	C2 Moderate (-)
Cross River Rail	Potential labour draw in South East Queensland (SEQ) affecting access by businesses, industries and households	C	2	C2 Moderate (-)

21.3.15 Economics

The cumulative economic impact assessment refers to the potential impact of cumulative stimulus to the economy resulting from a set of existing or planned projects within or adjacent to the economic impact assessment area. Cumulative impacts may result from the spatial and/or temporal interaction between these projects.

For the purposes of this report, the cumulative impact assessment has two components:

- **Inland Rail Program in Queensland**

A quantitative assessment of the cumulative macroeconomic impact of the Inland Rail Program on the economy, resulting from the construction of the Queensland sections of the Inland Rail Program.

- **Broader cumulative assessment**

A qualitative assessment of cumulative impact of other projects on local and regional labour markets, the supply chain and local businesses. Twelve (12) of the initial 23 projects were selected for economic cumulative assessment. These 12 projects are listed in Table 21.25 with a description of the potential for cumulative impacts to arise.

TABLE 21.25 CUMULATIVE PROJECTS AND NATURE OF POTENTIAL IMPACTS

Project	Potential for cumulative impacts
North Star to NSW/QLD Border Project (Inland Rail)	▸ Potential labour draw from the regional economic catchment (peak 300 full-time equivalent (FTE) during construction period) ▸ Potential draw on construction materials from the regional economic catchment ▸ Businesses within the catchment area (e.g. in Goondiwindi and Yelarbon) are likely to benefit from the Project as a result of increased local expenditure from construction personnel of the combined Inland Rail projects ▸ Potential impact on rental housing availability and affordability in Goondiwindi.
Gowrie to Helidon Project (Inland Rail)	▸ Potential labour draw from the regional economic catchment (peak 596 FTE during construction period) ▸ Potential draw on construction materials from the regional economic catchment ▸ Businesses within the catchment area (e.g. in Gowrie Junction area) are likely to benefit from the Project as a result of increased local expenditure from construction personnel of the combined Inland Rail projects ▸ Employment opportunities and regional development in relation to the Toowoomba Enterprise Hub.
Helidon to Calvert Project (Inland Rail)	▸ Potential labour draw from the regional economic catchment (peak 410 FTE during construction period) ▸ Potential draw on construction materials from the regional economic catchment.
Calvert to Kagaru Project (Inland Rail)	▸ Potential labour draw in SEQ may reduce labour availability for more specialised roles (peak 660 FTE during construction period) ▸ Potential regional development opportunities across SEQ's south-west industrial corridor and in the Western Gateway Regional Economic Cluster.
Kagaru to Acacia Ridge Project (Inland Rail)	▸ Potential labour draw in SEQ may reduce labour availability for more specialised roles
Cross River Rail	▸ Potential labour draw in SEQ may reduce labour availability for more specialised roles (1,500 direct and indirect FTE each year during construction)
Goondiwindi Abattoir	▸ Potential labour draw from the regional economic catchment
New Acland Mine—Stage 3	▸ Potential labour draw from the regional economic catchment
Wellcamp Business Park	▸ Requirement for civil construction labour, resulting in cumulative demand for skilled trades and civil construction labour; however, development likely to be incremental over a longer period with relatively modest labour draw ▸ Potential regional development opportunities across SEQ's south-west industrial corridor and in the Western Gateway Regional Economic Cluster.

Project	Potential for cumulative impacts
Witmack Industry Park and Charlton Logistics Park	▸ Requirement for civil construction labour, resulting in cumulative demand for skilled trades and civil construction labour; however, development likely to be incremental over a longer period with relatively modest labour draw ▸ Potential regional development opportunities across SEQ's south-west industrial corridor and in the Western Gateway Regional Economic Cluster.
Commodore Mine and Millmerran Power Station	▸ Potential impact on rental housing availability and affordability in Millmerran and Pittsworth
Asterion Medicinal Cannabis Facility	▸ Where construction schedules overlap, potential labour draw from the regional economic catchment

21.3.15.1 Inland Rail Program in Queensland

The construction phases of the Queensland sections of the Inland Rail Program have been jointly simulated to analyse the cumulative economic impacts of these projects. Under the assumption of slack labour markets, the incremental economic impacts of the Queensland sections include an increase in real Gross State Product (GSP) of $1.75 billion (measured in 2019 dollars) and an increase in the average number of jobs over the period 2020 to 2025 of 2,059 jobs per year. If labour markets are tight, then the incremental benefits are smaller, with real GSP increasing by $0.83 billion and the average number of jobs increasing by 485 per year.

The Border to Gowrie Project is the only section of the Inland Rail Program that is located within the Darling Downs–Maranoa region. Construction activities related to this section will directly impact the Darling Downs–Maranoa economy. The remaining Queensland sections of the Inland Rail Program, which are located in the Greater Brisbane and Toowoomba regions, will impact Darling Downs–Maranoa indirectly.

The regional impact analysis reported the results of simulations when the Border to Gowrie Project was considered in isolation. In that context, the direct and indirect increment to jobs in the Darling Downs–Maranoa economy was estimated to be 344 jobs per year under the assumption of slack labour markets and 78 jobs per year under the assumption of tight labour markets (refer Table 21.26 and Table 21.7.

When all the Queensland projects are considered jointly, the analogous increment to jobs (direct and indirect) in Darling Downs–Maranoa decreases to 290 jobs per year, assuming slack labour markets and 69 jobs per year assuming tight labour markets (refer Table 21.26 and Table 21.7).

The increment to jobs in Darling Downs–Maranoa peaks in 2022 at 722 and 175 jobs under slack and tight labour market conditions, respectively (refer Table 21.26 and Table 21.7), as discussed in the regional impact analysis. The labour market conditions expected to prevail in the Darling Downs–Maranoa economy over the period 2020 to 2025 will be most consistent with those assumed in the slack labour market scenarios that have been simulated. Further, the assessment indicates that the labour market conditions in other regional economies in Queensland, over the construction-phase period, will generally be much closer to the 'slack' than to the 'tight' characterisation.

TABLE 21.26 SUMMARY OF QUEENSLAND—WIDE ECONOMIC IMPACTS—SLACK LABOUR MARKETS

Region	GRP/GDP ($m 2019)	Jobs (persons)		
		Average (annual)	Peak	Year of peak
Greater Brisbane	$595	703	1,610	2022
Darling Downs–Maranoa	$314	290	722	2022
Toowoomba	$821	1,071	2,106	2022
Remainder of Queensland	$24	-5	16	2022
Queensland	$1,754	2,059	4,455	2022
Remainder of Australia	$23	-335	-39	2020
Australia	$1,777	1,724	3,835	2022

Source: Appendix V: Economic Impact Assessment

TABLE 21.27 SUMMARY OF QUEENSLAND—WIDE ECONOMIC IMPACTS—TIGHT LABOUR MARKETS

Region	GRP/GDP ($m 2019)	Jobs (persons)		
		Average (annual)	Peak	Year of Peak
Greater Brisbane	$285	153	370	2022
Darling Downs–Maranoa	$147	69	175	2022
Toowoomba	$370	258	523	2022
Remainder of Queensland	$31	5	23	2022
Queensland	$832	485	1,090	2022
Remainder of Australia	$277	86	249	2022
Australia	$1,109	572	1,339	2022

Source: Appendix V: Economic Impact Assessment

21.3.15.2 Broader cumulative assessment

Cumulative labour market impacts

The concurrent construction of interacting projects has the potential to increase the demand for labour in the local and regional economy, particularly for workers with trade and construction skills/knowledge. The demand for construction workers within a similar timeframe will lead to cumulative demands on construction labour, not only within the local and regional economy, but also across Queensland, NSW and, potentially, nationally.

The results of the regional economic impact assessment indicate that it is reasonable to assume that the regional labour market will have the capacity to supply a portion of the workforce requirements of the Project without major disruption; however, these conditions may change in the context of cumulative labour market demand. Prior to the COVID–19 pandemic, the major infrastructure projects in the adjacent and surrounding areas, including those associated with the Project, had the potential to put some pressure on labour markets if inopportune scheduling resulted in cumulative and competing demand for trades and construction labour; however, the overall labour demands of the various infrastructure projects expected to be constructed were modest and that scheduling could be optimised to minimise market impact. The prevailing trends in the Toowoomba and Greater Brisbane labour market, and the ability of workers to mobilise to project locations, suggested that the risks of labour market disruption were limited. In the current environment, this risk has now been further reduced.

There may be benefits from having additional infrastructure projects in the adjacent and surrounding areas around the same time as the Border to Gowrie Project. These benefits come in the form of lowered mobilisation costs and transfer of labour experience and skills to projects, particularly those constructed in the period leading up to, and the period following, the Project's construction phase.

Cumulative impacts on local businesses

The expansion in construction activity and regional employment (with a subsequent increase in temporary and non-resident population) has the potential to increase demand for a range of local infrastructure and services, including housing, health care, childcare, and education. Further, spending on consumer-orientated products by the construction workforce has the potential to benefit local businesses by increasing their trading levels. Importantly, some businesses may need to scale up their current capacity to support cumulative demand, while also understanding the temporary nature of the construction period for the relevant projects and adjust capacity accordingly.

Cumulative supply chain impacts

Cumulative supply chain impacts are likely to be realised where construction timeframes occur concurrently, and comparable material is required, e.g., the adjacent Inland Rail projects. Opportunities to supply these projects may include supply of fuels, equipment, borrow and quarried material. Where materials are sourced within the surrounding regions, increased local expenditure is likely to increase local and regional economic activity.

Should the demand for fill material exceed supply from cut, input costs to the Border to Gowrie Project may increase (due to increased prices of materials) driving up the total construction cost, negatively impacting on the economic return of the Project.

21.4 Summary of residual cumulative impacts

The cumulative impact assessment has considered the potential for 23 projects within a wide geographic extent to contribute to cumulative impacts, in combination with the Border to Gowrie Project. The projects considered in the assessment of cumulative impacts for each specific matter are summarised in Table 21.28. Also presented is the maximum cumulative impact significance for each project and the overall maximum cumulative impact significance, per specific matter.

The assessment concludes that Project activities have potential to contribute to cumulative impacts that are predominantly considered to be **low** to **medium significance** for the various specific matters that were assessed. There is one exception to this, with cumulative social impacts with other Queensland Inland Rail projects that do not adjoin the Border to Gowrie Project potentially resulting in incremental increases in demands on health, police and emergency services. This potential cumulative impact has been assigned as being of **high significance**.

TABLE 21.28 PROJECTS INCLUDED IN THE CUMULATIVE IMPACT ASSESSMENT FOR EACH SPECIFIC MATTER AND MAXIMUM OVERALL CUMULATIVE IMPACT SIGNIFICANCE

Project	Land use and tenure	Land resources	Landscape and visual amenity	Flora and fauna[1]	Air quality	Surface water	Hydrology	Noise and vibration	Groundwater	Social	Economics[2]	Non-Indigenous heritage	Traffic and transport and access	Hazard and risk	Waste management
Wetalla Water Pipeline				✓											
New Acland Coal Mine Stage 3			✓ L	✓		✓ M				✓ M	✓		✓ L		
Australia Pacific LNG Project			✓ L	✓									✓ L		
Toowoomba Bypass (formerly the Toowoomba Second Range Crossing)				✓			✓ L								
InterLinkSQ	✓ L	✓ M	✓ M	✓	✓ L	✓ M	✓ L	✓ M		✓ M			✓ M		
Toowoomba Wellcamp Airport				✓			✓ L								
Wellcamp Business Park				✓						✓ M	✓				
Witmack Industry Park and Charlton Logistics Park				✓						✓ M	✓				
Asterion Medicinal Cannabis Facility		✓ M		✓	✓ L	✓ M	✓ L	✓ L	✓ L	✓ M	✓		✓ L		
Commodore Mine and Millmerran Power Station	✓ L	✓ M	✓ L	✓	✓ L	✓ M	✓ L	✓ L	✓ L	✓ M	✓		✓ M		
Pittsworth Industrial Precinct and PIP Enabling Project				✓											
Doug Hall Poultry				✓			✓ L								
Yarranbrook Feedlot				✓			✓ L								

Project	Land use and tenure	Land resources	Landscape and visual amenity	Flora and fauna[1]	Air quality	Surface water	Hydrology	Noise and vibration	Groundwater	Social	Economics[2]	Non-Indigenous heritage	Traffic and transport and access	Hazard and risk	Waste management
Sapphire Feedlot				✓			✓								
Wyemo Piggery				✓						✓ M			✓ L		
Yarranlea Solar				✓											
Goondiwindi Abattoir			✓	✓		✓ M				✓ M	✓		✓ L		
North Star to NSW/QLD Border (Inland Rail)	✓ L	✓ M	✓ M	✓	✓ L	✓ M	✓ L	✓ M	✓ L	✓ L	✓	✓ M	✓ M	✓ M	✓ L
Gowrie to Helidon Project (Inland Rail)	✓ L	✓ M	✓ M	✓	✓ L	✓ M	✓ L	✓ M	✓ L	✓ M	✓	✓ M	✓ M	✓ M	✓ L
Helidon to Calvert (Inland Rail)			✓ L	✓						✓ H	✓				
Calvert to Kagaru (Inland Rail)										✓ H	✓				
Kagaru to Acacia Ridge (Inland Rail)										✓ H	✓				
Cross River Rail										✓ M	✓				
Maximum cumulative impact significance rating	L	M	M	M	L	M	L	M	L	H	N/A	M	M	M	L

Table notes:

1. Cumulative impact significance scored in the aggregate only, not per project
2. Cumulative impact significance has not been scored for individual projects or in the aggregate

L = Low, M = Medium/Moderate, H = High. Shading is as per the relevant assessment matrix in Section 21.2.2 or Section 21.2.3 (social only)
Purple is a positive benefit, all other colours are a negative impact
Justification for the selection of projects from the initial list of 23 for further assessment is provided in each of the corresponding specific matter assessments in Section 21.3

21.5 Summary of mitigations

The mitigation and management measures that are proposed to be implemented to minimise the likelihood of cumulative impacts have been identified for each of the specific matters and potential impacts in Section 21.3.1 to Section 21.3.15. These mitigation measures, in addition to other measures in the Outline EMP (refer Chapter 22: Outline Environmental Management Plan), have been proposed to minimise impacts of the Project, including those of a cumulative nature, as far as is reasonably practicable.

Where the potential for cumulative impacts have been identified with other projects in the Inland Rail Program, it is proposed that these potential impacts be managed through a combination of mitigation measures proposed for the Project, in isolation, in addition to the implementation of Program-wide management measures. These will be consistent with the Inland Rail Environment and Sustainability Policy and environmental management framework contained within the Outline EMP for the Project (refer Chapter 22: Outline Environmental Management Plan).

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

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

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

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

ARTC can only reasonably be responsible for managing the contributions of its activities to regional cumulative impacts; therefore, it has been assumed, in the undertaking of this cumulative impact assessment, that proponents/operators of other developments will be equally responsible for mitigating the contributions of those activities to cumulative impacts.