16. Transport

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16.1 Introduction

16.1.1 Overview

This chapter provides the traffic and transport assessment undertaken as part of the environmental impact statement for the Lower Fitzroy River Infrastructure Project (Project). The traffic and transport assessment addresses how road transport infrastructure, primarily, will be impacted by the Project. Consideration is also given to impacts on rail, sea and air transport infrastructure as applicable. The traffic and transport impacts associated with the Project are assessed and methods by which these impacts can be avoided, mitigated and/or managed are identified. The assessment addresses Section 5.135 - 5.145 of the terms of reference (ToR). A table cross-referencing the ToR requirements is provided in Appendix B. Appropriate management measures relating to traffic and transport are used to inform the environmental management plan (EMP) (Chapter 23).

Material prepared in support of the traffic and transport assessment is provided in Appendix Q as referenced in this chapter.

16.1.2 Assessment scope and objectives

A desktop review of existing rail, air, port, and road infrastructure was undertaken and overviews are provided in Sections 16.2.1, 16.2.2, 16.2.3 and 16.2.4 respectively.

Transport planning has been undertaken to assess the traffic impacts as a result of construction and operation of the Project on the state-controlled and local[1] road transport network and routes. In broad terms the transport assessment addressed the following:

- Road accessibility related to inundated or impacted river crossings (including upgraded crossings proposed as part of the Project)
- The impact of traffic generated by the Project during the construction phase
- The impact of operational traffic, primarily during the first year of operations.

The Project will inundate (within the river bed and banks) sections of the Fitzroy, Mackenzie and Dawson rivers and impact on existing river crossing infrastructure as follows:

- Glenroy Crossing (Ridgelands/Glenroy Roads) - Eden Bann Weir Stage 2, at full supply level (FSL) 18.2 m Australian height datum (AHD)[2]
- Riverslea Crossing (Riverslea/Rookwood Roads) - Rookwood Weir Stage 1 at FSL 45.5 m AHD
- Foleyvale Crossing (Duaringa-Apis Creek Road) - Rookwood Weir Stage 2 at FSL 49 m AHD. Duaringa-Apis Creek Road forms part of the state-controlled road network (Rd 5101)
- Operational releases from Rookwood Weir will impact on Hanrahan Crossing (Hanrahan Road).

The traffic investigation considered the following road links and intersections within the study area:

[1] Local road in this context implies the subdivisional road within a particular developed area. Local roads are used solely as local access roads, but traffic volumes and types of vehicles will depend on the intensity and nature of the development (RTA 2002)

[2] AHD refers to Australian Height Datum.

- Eden Bann Road, Mona Vale Road and Atkinson Road and the Bruce Highway / Atkinson Road Intersection. The Bruce Highway forms part of the state-controlled road network (Rd 10F)
- Ridgelands Road (a local road) and a new access track to Eden Bann Weir. The first 29 km of the Rockhampton-Ridgelands Road leading out of Rockhampton City is part of the state-controlled road network (Rd 511)
- Thirsty Creek Road and the Capricorn Highway / Third Street Intersection at Gogango. The Capricorn Highway forms part of the state-controlled road network (Rd 16A).

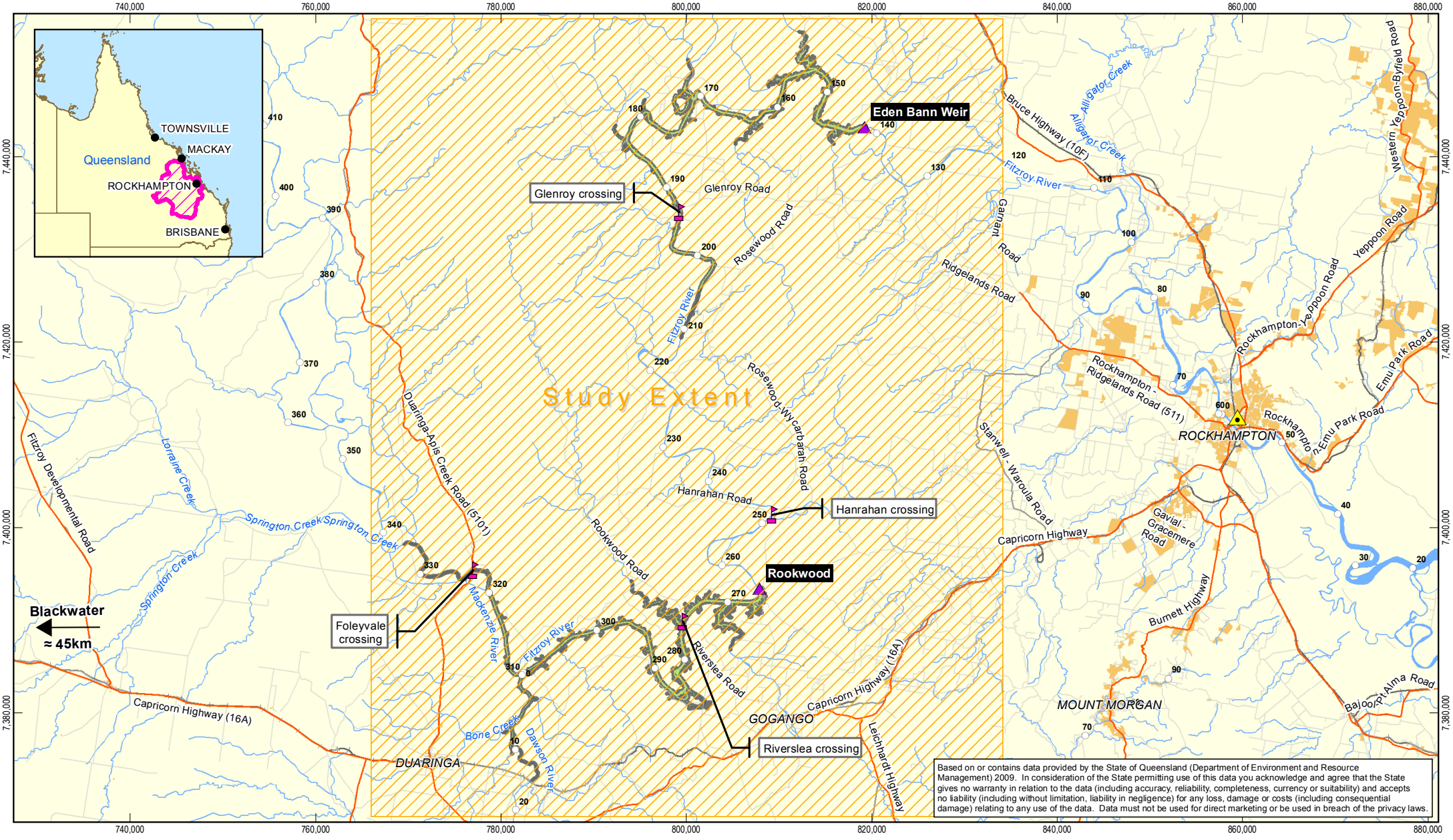
Figure 16-1 shows the extent of the study area (including river crossing locations) for the traffic, and transport assessment.

Impacts associated with road and bridge construction and/or upgrading on land tenure and on terrestrial and aquatic flora and fauna values are addressed separately in Chapter 5 Land, Chapter 6 Flora, Chapter 7 Aquatic ecology and Chapter 8 Terrestrial fauna, respectively. Impacts on sensitive receptors are addressed in Chapter 12 Air quality and Chapter 14 Noise and vibration.

16.1.3 Approach and methodology

The road traffic impact assessment for the state-controlled Bruce Highway / Atkinson Road intersection and the state-controlled Capricorn Highway / Third Street intersection at Gogango was undertaken in line with the method outlined in the Guidelines for Assessment of Road Impacts of Development (GARID) (DTMR) 2006). Qualitative road traffic assessments were undertaken with regard to the construction of a new access road to the right bank at Eden Bann Weir, upgrades required along Thirsty Creek Road, the construction of low level bridges at Glenroy Crossing and Riverslea Crossing and a raised crossing at Foleyvale Crossing. The following tasks were carried out for the assessments:

- Literature review, including:
  - Proposal for raising of the Eden Bann Weir and construction of Rookwood Weir: An assessment of impacts on access roads (KBR 2007) (Appendix Q)
  - Fitzroy Industry and Infrastructure Study (GHD 2007)
  - Report on Fitzroy River Weir Study (Keane 2004)
- Review of concept level construction methodologies and Project design reports
- Site visits conducted on 7 and 8 October 2009 to observe site access arrangements and general road condition
- Meetings with the Department of Transport and Main Roads (DTMR) (Brisbane and Rockhampton) and Rockhampton Regional Council (RRC) to discuss their requirements in relation to the state-controlled road network and local roads, respectively
- A review of DTMR and industry standard publications, policies and guidelines



Based on or contains data provided by the State of Queensland (Department of Environment and Resource Management) 2009. In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data. Data must not be used for direct marketing or be used in breach of the privacy laws.

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Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA94)
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N

LEGEND

- AMTD (km)
- Weir Location
- Fitzroy Barrage
- River Crossing
- State Controlled Road
- Major Road
- Streets (Local)
- Railway
- Waterways (lines)
- Fitzroy Basin
- Rookwood Weir Stage 1 impoundment
- Rookwood Weir Stage 2 impoundment
- Urbanised Area
- Eden Bann Weir Stage 2 impoundment
- Eden Bann Weir Stage 3 impoundment
- Study Extent

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Traffic and transport assessment study area

Figure 16-1

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- Review of traffic volume data and information provided by DTMR (Appendix Q) to determine existing traffic volumes, namely:
  - Bruce Highway / Atkinson Road Intersection –12 hour Traffic Counts, 9 June 1999;
  - Capricorn Highway / Third Street Intersection – 12 hour Traffic Counts, 11 November 1999;
  - Capricorn Highway (Site No: 60045) – Weekly Volume Report, 2nd January 2012 to 30th December 2012;
  - Bruce Highway (Site No: 60003) – Weekly Volume Report, 2nd January 2012 to 30th December 2012
  - Duaringa Apis Creek Road (Site No: 159542) – Annual Average Daily Traffic (AADT) Segment Report 2008, Weekly Volume Report 2008 and Annual Volume Report 2008.
- Estimate future background traffic as follows (Appendix Q):
  - Current (2012) 24- hour traffic volumes were estimated from traffic count data presented above
  - Predicted 24-hour traffic volumes on the Bruce Highway in 2015, 2020 and 2025 were estimated by applying a linear growth rate of 9 per cent per annum for through traffic movements and a 2.5 per cent per annum for turning movements based on historical (2009 – 2012) data
  - Predicted 24-hour traffic volumes on the Capricorn Highway in 2015, 2020 and 2025 were estimated by applying a linear growth rate of 7.3 per cent per annum for through traffic movements and 4 per cent per annum for turning movements based on historical (2009 – 2012) data
- Conduct an assessment of expected traffic generation for both weir sites during the construction and operation phase based on a 2015 (short term), 2020 (medium term) and 2025 (long term) commencement of construction
- Assess the impact of Project generated traffic on the existing road network (at the Bruce Highway / Atkinson Road intersection and the Capricorn Highway / Third Street intersection at Gogango) in accordance with the DTMR guidelines
- Review accessibility issues related to river crossings
- Identify mitigation and management measures required as a result of the Project to inform traffic management plans and further assessment requirements (such as pavement impact assessments) as part of Project's EMP (Chapter 23).

16.1.4 Qualifications

The Project is expected to be staged in response to demand triggers (Chapter 1 Introduction), however road and/or bridge design criteria considered the impacts associated with the upper limits of development, namely Eden Bann Weir Stage 3 and Rookwood Weir Stage 2, as applicable:

- Eden Bann Weir
  - Raising Eden Bann Weir to Stage 2 will trigger construction of a new low level bridge at Glenroy Crossing. To avoid the need for further upgrades to accommodate impoundment impacts associated with raising Eden Bann Weir to Stage 3, the low level bridge at Glenroy Crossing has been designed to accommodate Stage 3 impoundment impacts and no further upgrades of the bridge would be required for raising Eden Bann Weir to Stage 3.

- Rookwood Weir
  - Construction of Rookwood Weir Stage 1 will trigger construction of a new low level bridge at Riverslea Crossing. To avoid the need for further upgrades to accommodate impoundment impacts associated with raising Rookwood Weir to Stage 2, the low level bridge at Riverslea Crossing has been designed to accommodate Stage 2 impoundment impacts and no further upgrades of the bridge would be required for raising Rookwood Weir to Stage 2
  - Construction of Rookwood Weir Stage 1 does not impact Foleyvale Crossing. Raising Rookwood Weir to Stage 2 will require construction of a new low level bridge at Foleyvale Crossing to accommodate impoundment impacts
  - Operation of Rookwood Weir Stage 1 will trigger upgrading of Hanrahan Crossing to accommodate operational water releases. To avoid the need for further upgrades to accommodate operational releases associated with Rookwood Weir Stage 2 Hanrahan Crossing has been designed to accommodate Stage 2 releases and no further upgrades would be required for the raised Rookwood Weir Stage 2.

Opportunistic and internal property crossings are not included within the transport assessment. Consideration of the potential impacts on individual properties is provided in Chapter 18 Social impact.

16.2 Existing environment

16.2.1 Rail network

Aurizon Network Pty Ltd (Aurizon) operates the rail network in the traffic and transport study area, specifically the Blackwater system. The Blackwater system services the Bowen Basin coal region and links the mines to export terminals at the Port of Gladstone. The Blackwater system also services a number of non-coal users including Stanwell and Gladstone Power Stations, Cement Australia and the Comalco Refinery. The Blackwater system consists of 985 km of bi-directional track, of which 807 km is electrified and is operated from the Rockhampton Control Centre.

Two electrified tracks of the Blackwater system traverse Third Street/Riverslea Road at Gogango. This road will access the proposed Rookwood Weir. An active (boomed) level crossing is in place at this location. The crossing has a power line height clearance of 5.2 m.

A high level rail crossing traverses the Dawson River at Boolburra (15.9 km AMTD[3]). As detailed in Chapter 9 Surface water resources, no impacts on rail infrastructure as a result of the Project are expected at this location.

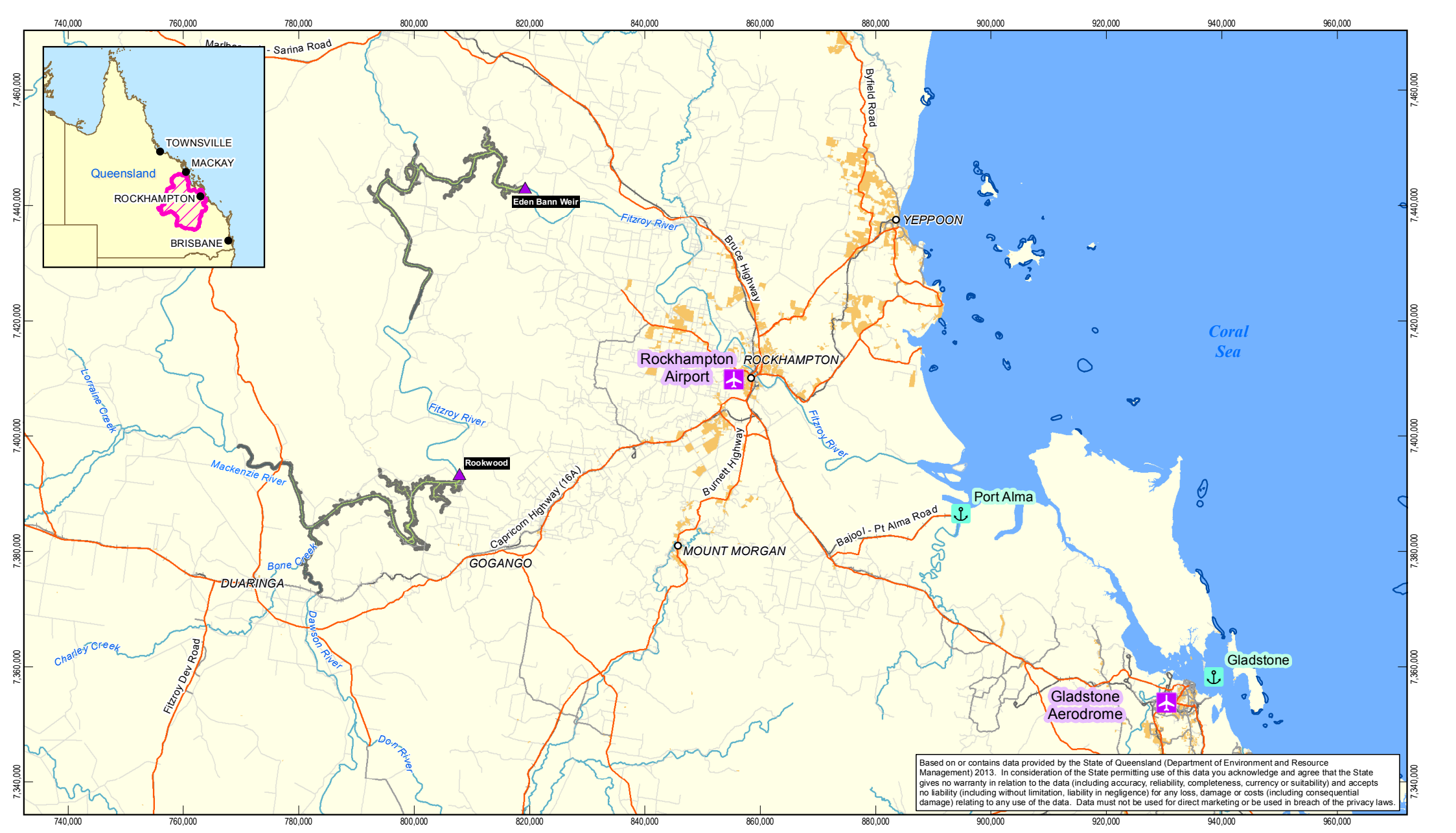
16.2.2 Port facilities

Two major ports service the region, namely Port Alma and the Port of Gladstone:

- Port Alma is located 62 km east of Rockhampton on the southern tip of the Fitzroy River delta
- The Port of Gladstone is one of the largest coal export ports in Australia, situated approximately 120 km south-west of Rockhampton.

Figure 16-2 shows the existing port locations.

[3] AMTD refers to the Adopted Middle Thread Distance, the distance measured along the middle of a watercourse, from the mouth or junction.



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Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA94)
Grid: Map Grid of Australia 1994, Zone 55

N

LEGEND

- Weir Location
- Airport
- Port
- State Controlled Road
- Major Road
- Streets (Local)
- Waterway (Major)
- Railway
- Fitzroy Basin
- Urbanised Area
- Rookwood Weir Stage 1 impoundment
- Rookwood Weir Stage 2 impoundment
- Eden Bann Weir Stage 2 impoundment
- Eden Bann Weir Stage 3 impoundment

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Port and airport locations

Figure 16-2

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Data Source: © Copyright Commonwealth of Australia (Geoscience Australia): Places, Waterways, Airports (2007); Sunwater: Waterways, Weir Locations - 2008; DNRM: Railways, Roads (2010), State Controlled Raods - (2014); GHD: Port (2012). Created by: MS *See Appendix for disclaimers and copyrights.

Both Port Alma and the Port of Gladstone are owned and operated by the Gladstone Ports Corporation Limited. It is not expected that the Project will utilise Port facilities and there will be no impact on Port operations from the Project.

16.2.3 Airport facilities

The Rockhampton Airport is a commercial business unit of RRC and is responsible for the management and operations of the airport. Approximately 750,000 domestic passengers pass through the terminal annually. Three emergency service providers are based at and use the facilities of the Rockhampton Airport: the Royal Flying Doctor Service, RACQ Capricorn Helicopter Rescue Service and Airservices Australia. Figure 16-2 shows the existing airport locations in the region.

As discussed in Chapter 18 Social impact, the Project will not comprise a large fly-in-fly-out construction workforce. Given the current capacity of the Rockhampton Airport, there will be negligible impacts as a result of the Project construction on airport facilities.

Mobilisation and demobilisation of construction machinery and equipment and delivery of materials are proposed to be transported to Eden Bann Weir and the proposed Rookwood Weir by road and air freight services are not expected to be required. In the event that air freight is required by the Project, it is not expected to negatively impact on existing freight services.

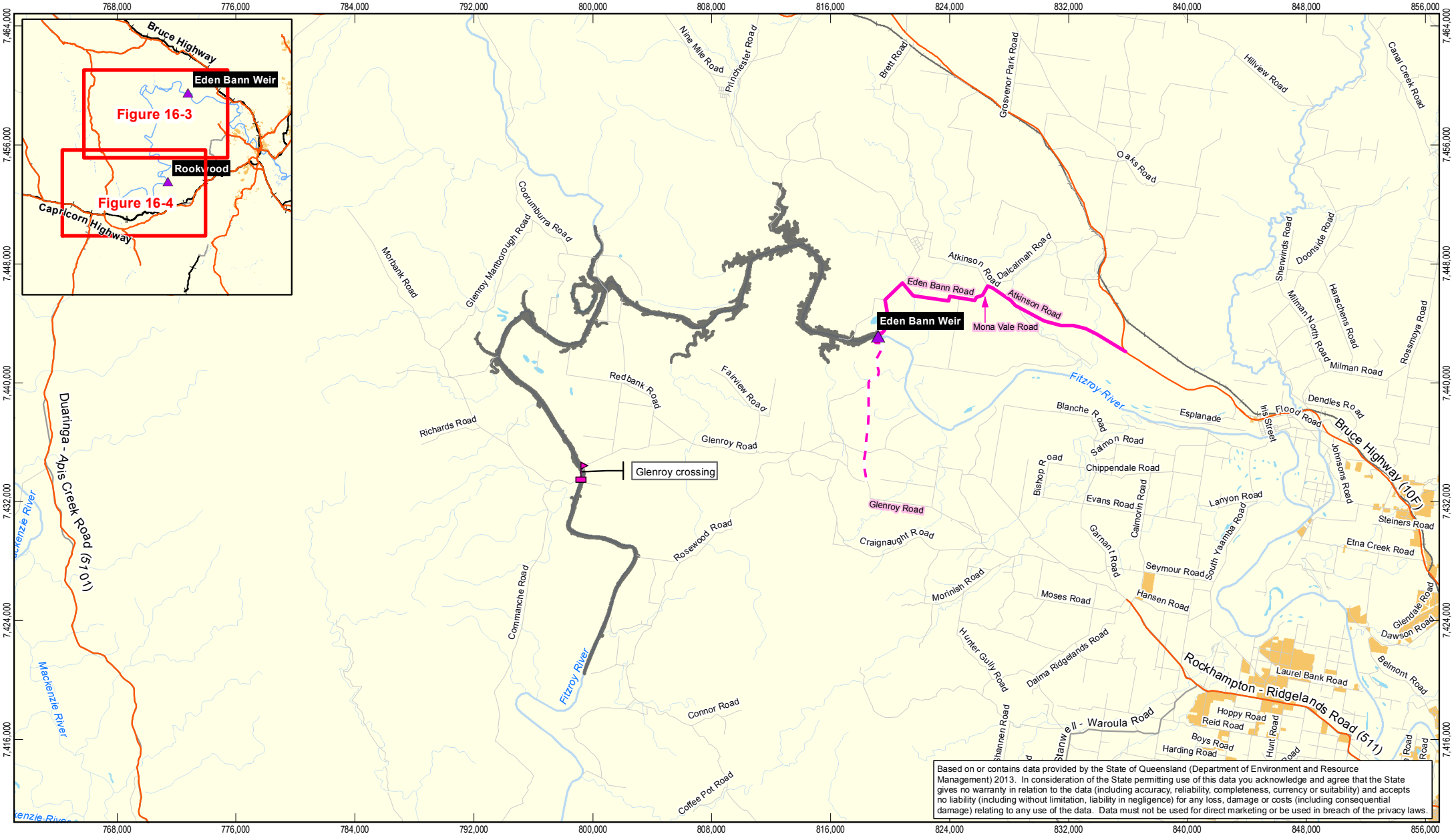
16.2.4 Road network

The existing road network in the Project area is shown in Figure 16-3 and Figure 16-4 for Eden Bann Weir and Rookwood Weir, respectively.

The existing roads in the study area comprise largely council roads with some private access roads. State-controlled highways border the study area to the north/north-east (Bruce Highway (Rd 10F)) and south/south-west (Capricorn Highway (Rd 16A)). The Bruce and Capricorn highways form part of the State's strategic road network (DTMR 2013). The state-controlled road, namely the Duaringa-Apis Creek Road (Rd 5101) borders the western extent of the study area. No major upgrade or new works are proposed for the National or State networks in the Project area. DTMR (2013) reports spending proposed in the next few years primarily on pavement rehabilitation, sealing shoulders, relocating hazardous objects and routine maintenance. Commonwealth funding facilitated the Fitzroy River Floodplain and Road Planning Study being undertaken by DTMR (Aecom 2011). The study covered an area of the Bruce Highway commencing in the south at Midgee/Archer and extended north of Rockhampton to the intersection of the Bruce Highway and Atkinson Road at Canoona.

Plans developed for improving the Capricorn Highway at Gogango (DTMR pers comm 2009) remain unfunded (Appendix Q).

The council roads fulfil a local traffic function while the state-controlled road and highways facilitate strategic access to towns like Stanwell, Gracemere, and the city of Rockhampton (located to the east), Duaringa and Blackwater (located to the west), and Marlborough (located to the north-east).



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Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA94)
Grid: Map Grid of Australia 1994, Zone 55

N

LEGEND

- Weir Location
- River Crossing
- Waterway (Major)
- Waterway (Minor)
- Railway
- State Controlled Road
- Major Road
- Streets (Local)
- Existing (northern) access road
- New (southern) access road
- Stage 3 Impoundment
- Urbanised Area

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Revision I
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Road network and river crossings associated with Eden Bann Weir

Figure 16-3

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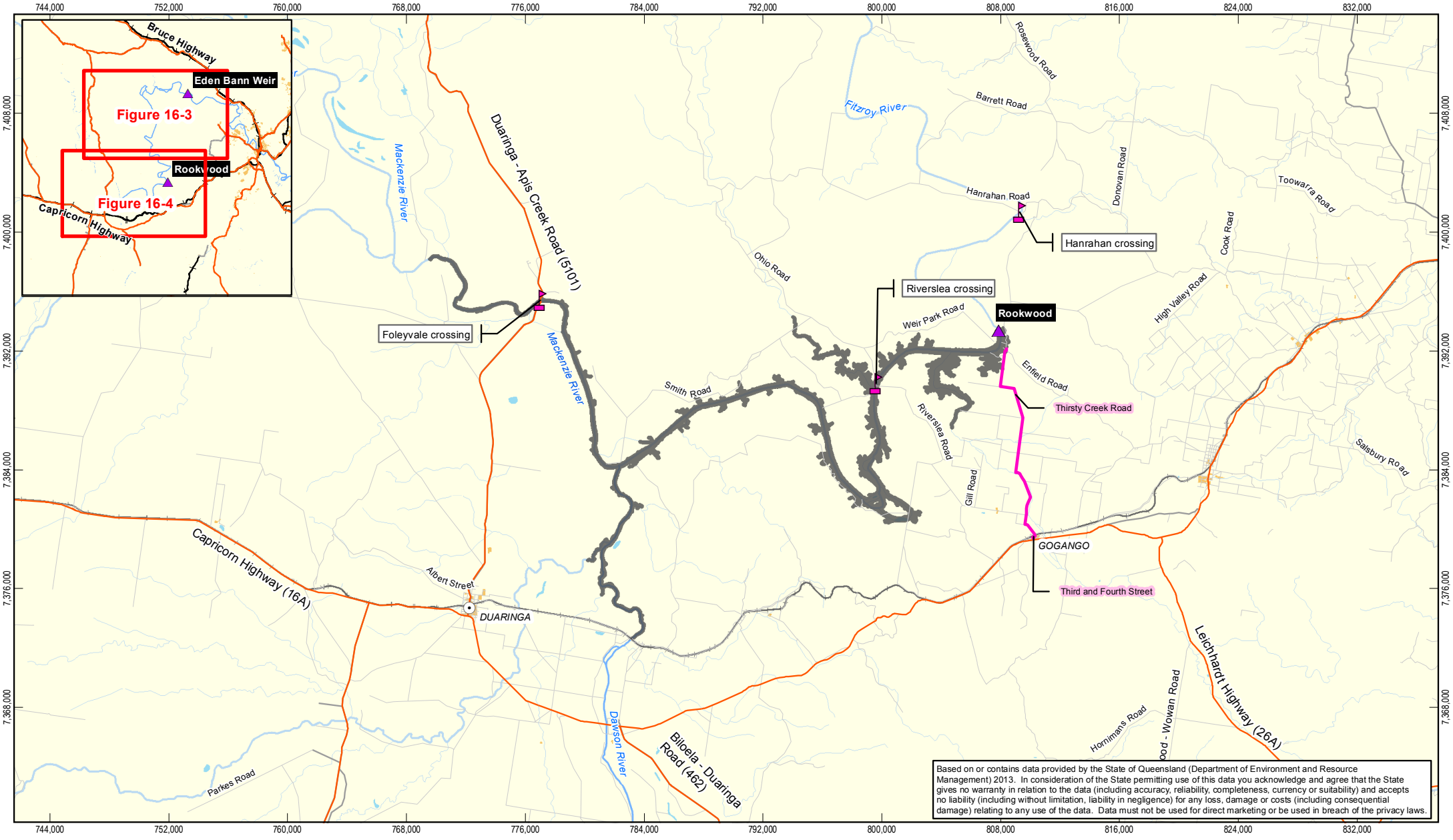

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Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA94)
Grid: Map Grid of Australia 1994, Zone 55

N

LEGEND

- River Crossing
- Waterway (Major)
- Waterway (Minor)
- Railway
- State Controlled Road
- Major Road
- Streets (Local)
- Stage 2 Impoundment
- Urbanised Area

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Road network and river crossings associated with Rookwood

Figure 16-4

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Data source: © DNRM: Roads, State Controlled Raods - (2014); © Copyright Commonwealth of Australia (Geoscience Australia): Waterways (2007); Sunwater: Waterways, Weir Locations - (2008); GHD: Access Roads (2013); Created by: MS *See Appendix for disclaimers and copyrights

Local roads in the study area comprise a combination of bitumen sealed and unsealed gravel roads. Examples of typical local roads are shown in Figure 16-5 and Figure 16-6. In general few local roads are considered likely to meet the existing 80 km/h speed limit due to construction and geometry limitations and are more suited to a 60 km/h speed limit. The flood immunity of the roads is generally poor and culverts and bridges are subject to frequent flooding (GHD 2007). Types of vehicles that use the local roads are typically cars and utility vehicles (including 4WD), cattle trucks, grain trucks and heavy farm machinery.

Access from the Bruce Highway and Capricorn Highway to Eden Bann Weir and the proposed Rookwood Weir site, respectively, is via the following local roads:

- Eden Bann Weir (existing access): Atkinson Road, Mona Vale Road and Eden Bann Road
- Rookwood Weir site: Third Street, Riverslea Road and Thirsty Creek Road.

A new 12 km access route is proposed to the southern bank of Eden Bann Weir. This route leads out of Rockhampton via the state-controlled Rockhampton-Ridgelands Road (Rd 511) for the first 29 km; onto Ridgelands Road (a local RRC road). The new access is required to intersect with the local Ridgelands Road section to access the weir site.

Access to river crossings is via existing state and local controlled roads as follows:

- Glenroy Crossing: via Rockhampton on Rockhampton-Ridgelands Road, Ridgelands Road and Glenroy Road (heading east) and from Eden Bann Weir via the new private access road (heading south) and Glenroy Road (heading east)
- Riverslea Crossing: via the Capricorn Highway/Third Street intersection at Gogango and Riverslea Road and from Rookwood via Thirsty Creek Road (heading south) and Riverslea Road (heading north-east)
- Foleyvale Crossing: via the Capricorn Highway and Duaringa-Apis Creek Road at Duaringa
- Hanrahan Crossing: from Rockhampton on the Capricorn Highway and the Rosewood-Wycarbarah Road at Wycarbarah (heading north-east), and from Rookwood on Thirsty Creek Road (heading north).

Table 16-1 describes the status and condition of existing roads and river crossings proposed to be utilised by the Project based on road traffic count data obtained from DTMR, discussions with DTMR, RRC and community members, site visits undertaken and landholder surveys (Appendix Q). Figure 16-3 and Figure 16-4 show the existing and proposed locations of access roads to Eden Bann Weir and Rookwood Weir, respectively and the location of river crossings relative to existing access roads.

Figure 16-5 A typical unsealed gravel local road in the study area

Figure 16-6 A typical bitumen sealed local road in the study area

Table 16-1 Existing roads in the Project area

Road	Description
Eden Bann Weir	
Bruce Highway	• State-controlled road (Rd 10F) that forms part of the national highway network, but is maintained and administered by DTMR • Intersects with Atkinson Road. The intersection consists of a basic right turn and an auxiliary[4] (AUL) off the Bruce Highway (Figure 16-7). Predicted current background traffic volumes are shown in Figure 16-8 • Sealed two-lane road with a total pavement width of between 8 m and 11 m • Alignment accommodates speeds of 80 km/h to 100 km/h.
Atkinson Road	• Local road (Livingstone Shire Council (LSC)) • Intersects with the Bruce Highway north of Rockhampton). Predicted current background traffic volumes are shown in Figure 16-8 • Comprises a single lane gravel road with widths between 3.5 m and 5.5 m • Flat to rolling terrain with some hilly sections • Provides access to properties • Provides current access for maintenance and operations at Eden Bann Weir.
Mona Vale Road	• Local road • Intersects with Atkinson Road and runs into Eden Bann Road • Comprises a single lane gravel road of sufficient width to enable vehicles to pass at slow speeds • Provides access to properties • Provides current access for maintenance and operations at Eden Bann Weir.
Eden Bann Road	• Local road • Single lane gravel road • Provides access to a homestead • Provides current access for maintenance and operations at Eden Bann Weir and access.

[4] Auxiliary lanes are those added adjacent to through lanes to enhance traffic flow and maintain the required level of service for the road in question. Auxiliary lanes are usually of relatively short length (DTMR 2006).

Road	Description
Rockhampton-Ridgeland Road and Ridgelands Road	• Rockhampton to Ridgelands: – This section of road is a state-controlled road (Rd 511) from Rockhampton to the vicinity of Dalma Road, approximately 29 km in length – Assessment undertaken for the Fitzroy Industry and Infrastructure Study (GHD 2007) estimated average daily traffic (ADT) volumes (vehicles per day) along sections of Rockhampton-Ridgelands Road as follows: 0 – 0.8 km: 4,797 0.8 – 2.0 km: 5,395 2.0 – 4.0 km: 2,836 4.0 – 20.4 km: 1,307 20.4 – 29.0 km: 406 – Bitumen sealed two-lane section with some narrow sections (3.1 m). Timber bridges traverse Lion Creek, Black Gin Creek and Limestone Creek – Acceptable condition for 80 km/h speed limit. • Ridgelands to Rosewood (local road): – This section of road from Dalma Road to the Rosewood-Wycarbarah Road turnoff is a local road in the order of 28 km in length – Two-lane sealed road (3.3 m lanes) reduces to single lane (3.5 m) bitumen sealed road – The road is windy with steep gradients and generally poor horizontal visibility – The new right bank access road to Eden Bann Weir turns off this section of road – Runs into Glenroy Road.
Glenroy Road and Glenroy Crossing	• Local road from Ridgelands Road terminating at the Fitzroy River approximately 13 km in length • Glenroy Crossing is located on Glenroy Road at the Fitzroy River at 193 km adopted middle thread distance (AMTD) • Connects of the eastern side of the Fitzroy River to Glenroy–Marlborough Road, Coorumburra Road and the Marlborough-Sarina Road, providing a route north to the township of Marlborough and to Commanche Road leading south • AADT is estimated at 53 vehicles per day (KBR 2007) • RRC has indicated that the Glenroy Road and the crossing are used as a 'through road' even though it has a local function. The crossing is considered important for communities in the northern part of the region providing a link to Rockhampton • The crossing comprises a 190 m long causeway with culverts and pipes (Figure 16-9) • Results from landholders surveyed (ten respondents use the crossing) indicate that the crossing is utilised for 319 trips per month (two-way traffic) with 25 per cent comprising heavy or commercial vehicles such as heavy cattle (B-doubles) and grain trucks. Road trains have been observed on the route

Road	Description
	• Flood immunity of the crossing is poor with the crossing not trafficable in the wet season for between one and one-and-a-half months a year. Alternate access to Rockhampton during this time is via Marlborough (Glenroy-Marlborough Road) and the Bruce Highway.
Rookwood Weir	
Capricorn Highway	• A state-controlled road (Rd 16A) • Two-lane road with sealed shoulders (approximately 3.3 m wide lanes) • Intersects with Third and Fourth Streets at Gogango (Figure 16-10). The existing Capricorn Highway / Third Street intersection comprises an auxiliary left turn (AUL(S)) with short lanes on the Capricorn Highway. While it is legal to turn right from the Capricorn highway there is no provision for turning right other than road markings. Predicted current background traffic volumes are shown in Figure 16-11 • The Capricorn Highway Bridge over the Dawson River (at 23 km AMTD) provides high level access across the Fitzroy River for east-west traffic. However, this high level crossing and/or its approaches are not trafficable in larger floods.
Third Street (local road)	• A local (RRC) road that intersects with the Capricorn Highway at Gogango (Figure 16-10) (T-junction type A rural) • Runs into Riverslea Road.
Riverslea Road and Riverslea Crossing	• A local (RRC) road from Gogango to the Riverslea Crossing on the Fitzroy River (at 276 km AMTD) upstream from the proposed Rookwood Weir site • A bitumen/gravel road of varying widths between 3.5 m and 5 m with broken road shoulders • The road is windy with many sharp corners. A short section is traversed to intersect with Thirsty Creek Road to access Rookwood Weir. Access to Riverslea Crossing traverses Riverslea Road • An active rail level crossing is located about 200 m away from the highway. The crossing has a height clearance of 5.2 m • AADT along Riverslea Road is estimated at 71 vehicles per day • Riverslea Crossing comprises a low level, 120 m long causeway and bridge (Figure 16-12) • Local access to the crossing is via Rookwood Road north of the river and Riverslea Road south of the river. The crossing is considered important for communities north of the river and provides access to Duaringa and Rockhampton • Results landholders surveyed (17 respondents use the crossing) indicate that the crossing is utilised for 331 trips per month (two-way traffic) with ten per cent comprising heavy or commercial vehicles such as cattle and grain trucks • RRC maintain Riverslea Road and Rookwood Road and the crossing • Flood immunity is poor. The crossing is not trafficable for between one and three months annually during the wet season. Alternative access is via Duaringa-Apis Creek Road to the north via Marlborough.

Road	Description
Thirsty Creek Road	• A local (RRC) road that commences at a T-junction with Riverslea Road • A single lane gravel road with widths between 4 m and 5 m traversing rolling terrain and hilly in parts • Road condition is variable, with many sharp turns and poor flood immunity • Pipe culverts with a concrete deck are in place over Gogango Creek • RRC utilise the road to access gravel pits using heavy vehicles • Low lying sections that dip may prove difficult for some long heavy vehicles to negotiate and may require amelioration.
Duaringa-Apis Creek Road and Foleyvale Crossing	• A state-controlled road (Rd 5101) crossing the Mackenzie River (at 324 km AMTD). Accessed from the south via the Capricorn Highway and via the Marlborough-Sarnia Road off the Bruce highway from the north • The crossing comprises a low causeway with 18 semi-circular arches (Figure 16-13) • Duaringa-Apis Creek Road is considered a primary north-south connection between Marlborough Road (north) and the Capricorn Highway (south). Foleyvale Crossing maintains connectivity along these routes • The crossing also provides access to Duaringa, and Rockhampton. Duaringa is the nearest town centre for residents in the south-west region and provides employment, services and facilities. Local access to the crossing is via Smith Road, Yarra Road and Rookwood Road • The AADT at a point 10 km north of the crossing is 72 vehicles per day with 35 per cent being heavy commercial vehicles • Results from landholders surveyed (four respondents use the crossing) indicate that the crossing is utilised for 145 trips per month (two-way traffic) with ten per cent comprising heavy or commercial vehicles such as cattle and grain trucks. The crossing is also utilised by stock crossing • The crossing is not trafficable for approximately one to three months each year during the wet season. Alternative access is via Riverslea Road and Riverslea Crossing (south) and/or Duaringa-Apis Creek Road to the north via Marlborough and then south along the Bruce Highway.
Hanrahan Road and Hanrahan Crossing	• A local (RRC) road crossing the Fitzroy River (at 249 km AMTD) downstream from the proposed Rookwood Weir site • Hanrahan Road is a 3.5 m wide single lane gravel road. It is windy with some steep sections. The crossing comprises a 600 m track along the riverbed with a 30 m to 40 m long concrete causeway over the low flow section (Figure 16-14) • Hanrahan Road connects to the Capricorn Highway via the Rosewood Wycarbarah Road heading east. To the west, Hanrahan Road terminates at a private property. RRC maintains Hanrahan Road • No daily traffic volumes are available. Results from landholder surveys (one respondent uses the crossing) indicate that the crossing is utilised for 65 trips per month (two-way), with five per cent comprising heavy commercial vehicles such as cattle trucks. It is also reported that visiting campers utilise the crossing • The flood immunity of the crossing is poor and not trafficable for an estimated few weeks per year during the wet season. Alternative access is via boat across the river or by road via tracks through neighbouring properties.

Road	Description
Rosewood-Wycarbarah Road	• A local road that intersects with the Capricorn Highway (via Ranger Road) at Wycarbarah in the south (T-junction type B rural) and crosses over an active rail level crossing located about 30 m away from the highway. The crossing has a height clearance of 5.2 m • In the north the road intersects with Hanrahan Road • The road comprises a single lane with some sections of sealed bitumen and some sections of gravel of varying widths (3.5 to 5 m) • The road is windy with sharp corners and hilly terrain. A 6 m wide and 14 m long timber bridge traverses Neerko Creek.

Figure 16-7 Existing Bruce Highway / Atkinson Road intersection

Source: Google Earth Pro (GHD Licensed Version) (image dated 11/09/2013)

Figure 16-8 **Bruce Highway/Atkinson Road intersection predicted background traffic volumes**

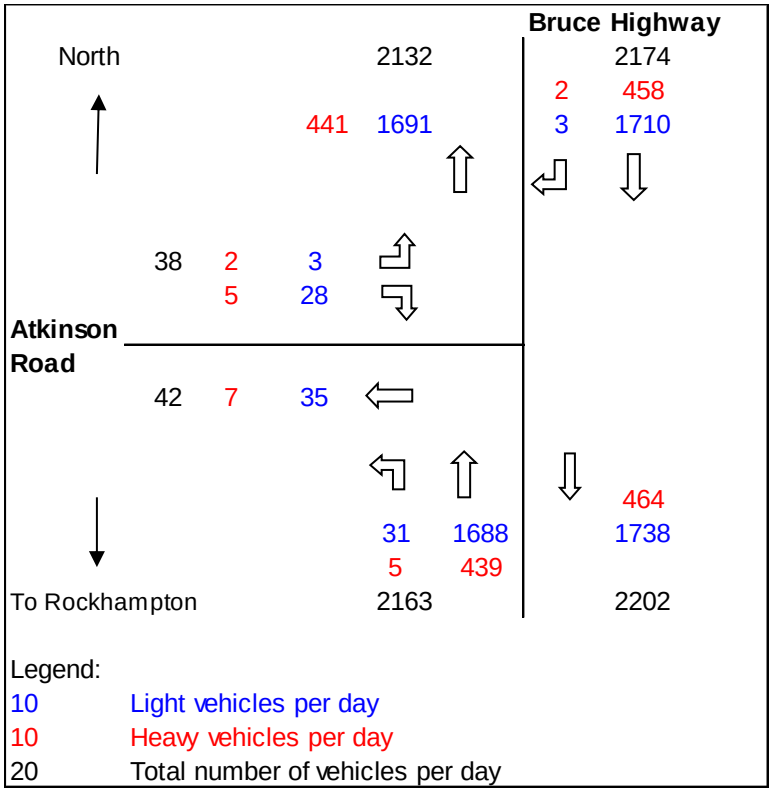
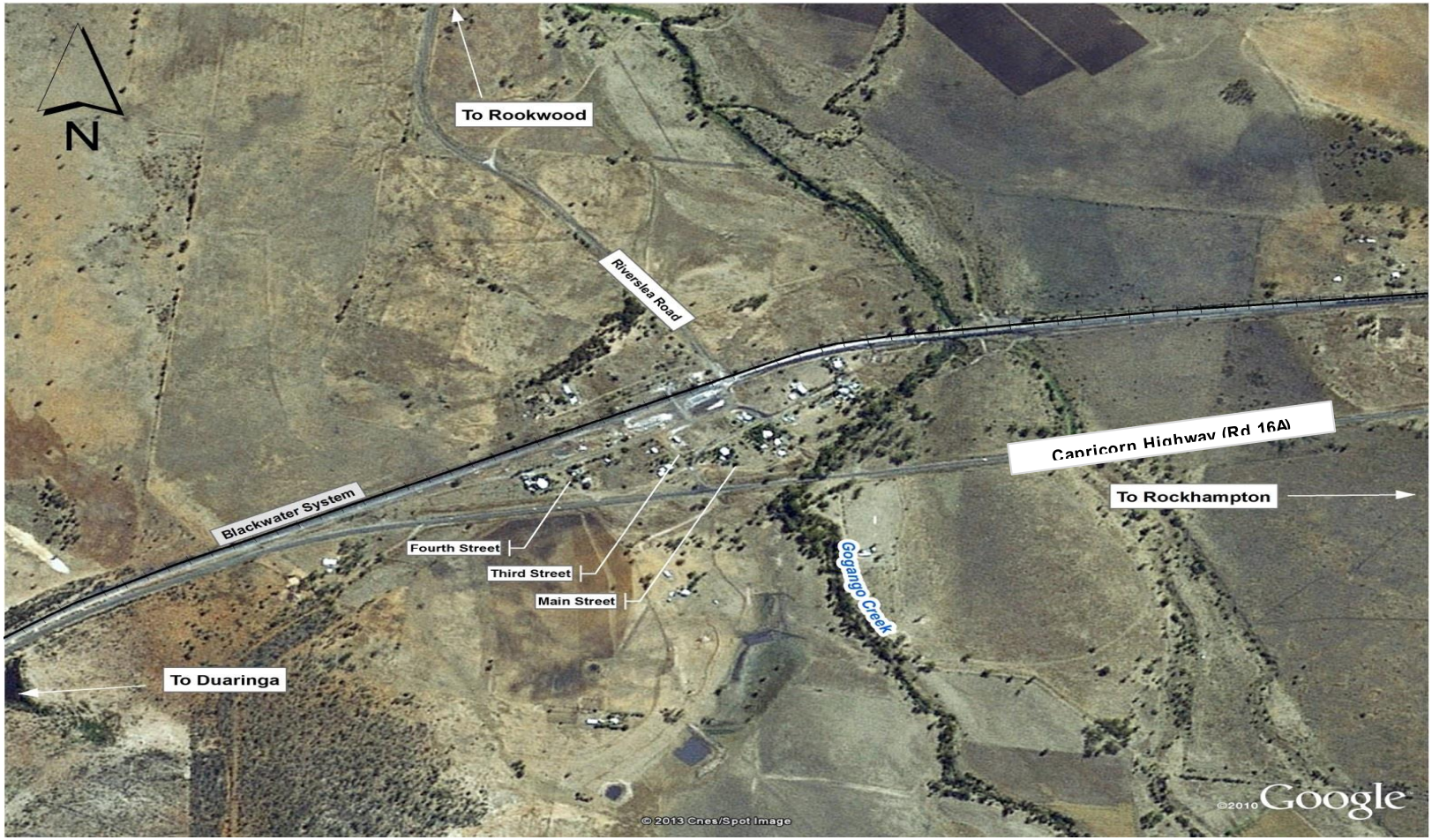


Figure 16-9 **Glenroy Crossing**

Figure 16-10 Existing Capricorn Highway / Third Street intersection at Gogango



Source: Google Earth Pro (GHD Licensed Version) (image dated 08/03/2013)

Figure 16-11 Capricorn Highway/third Street intersection predicted background traffic volumes

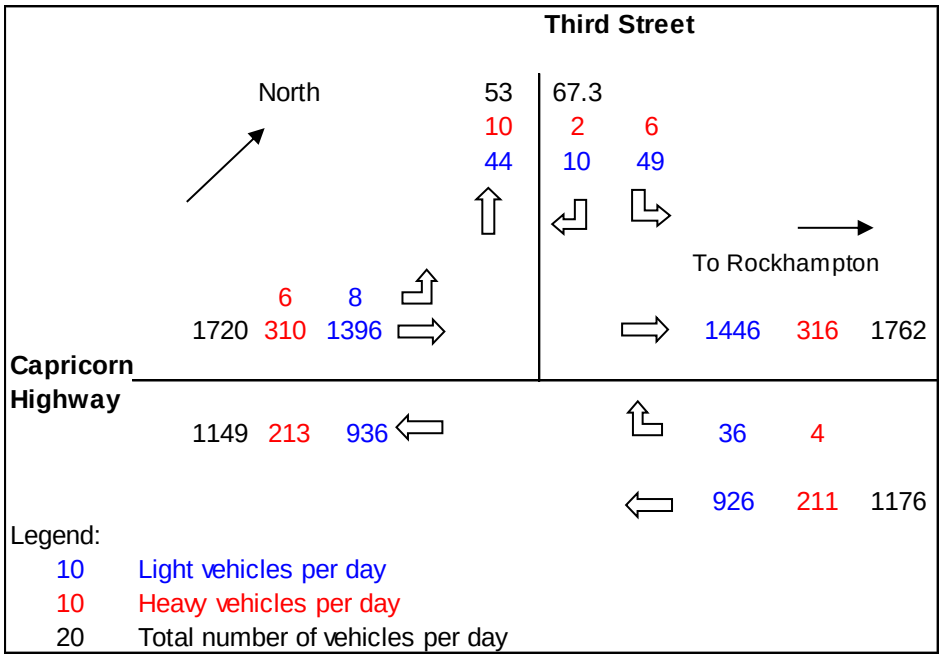


Figure 16-12 Riverslea Crossing

Figure 16-13 Foleyvale Crossing

Figure 16-14 Hanrahan Crossing

16.2.5 School, public passenger and active transport infrastructure and services

A number of regional school bus routes operate in the vicinity of the study area (Figure 16-15):

- Eden Bann Weir
  - Route S727 operates between Marlborough and Rockhampton along the Bruce Highway
  - Routes 886, P1219 and P1355 operate along Rockhampton-Ridgelands Road and Ridgelands Road to Rockhampton
- Rookwood Weir
  - Route S133 operates between Gogango (Willis Street terminus) and Rockhampton along the Capricorn Highway
  - Routes S134, S134B, S422, S556, S591, S641 and S676 operate along the Capricorn Highway between Gracemere and Rockhampton
  - Route S421 operates along the Capricorn Highway between Stanwell and Rockhampton.

While none of these routes operate on local access roads to be used by the Project, local access roads are used to access drop-off and pick-up locations.

Public transport services are restricted to operation within Rockhampton City and immediate surrounds (Bouldercombe to Mount Morgan). No public transport services operate in the vicinity of the Project.

A number of long distance coach services operate throughout the region on the Bruce and Capricorn highways, including routes between Emerald and Rockhampton, via Gogango (amongst others), and Toowoomba to Rockhampton.

The Project area is rural and remote. There are no existing pedestrian or cycle networks in the Project area.

16.3 Potential impacts and mitigation measures

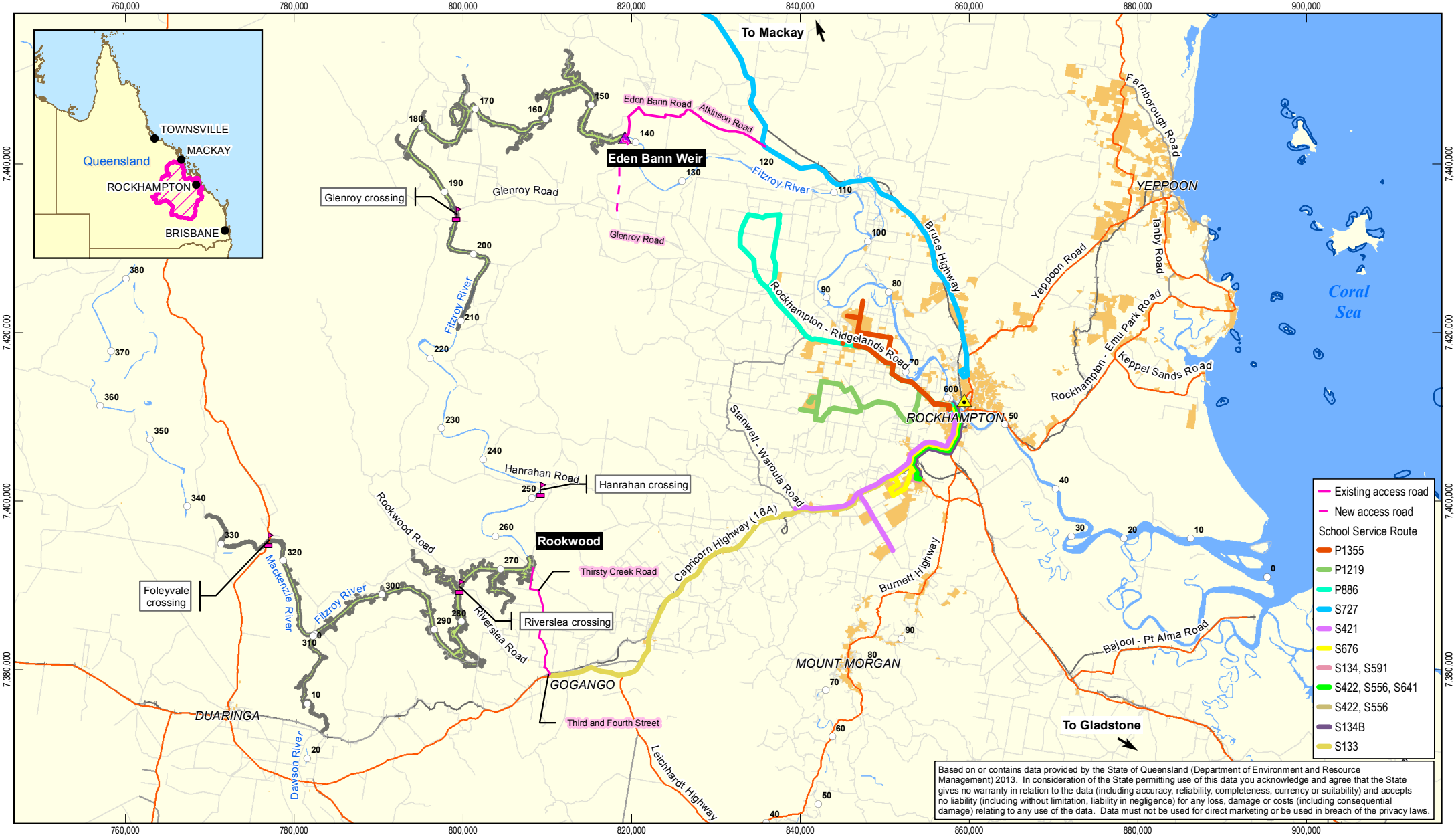
16.3.1 Overview

Potential impacts to traffic and transport infrastructure associated with the Project are primarily related to road traffic and road infrastructure as follows:

- The generation of construction traffic and impacts to state-controlled and local roads
- The generation of operational traffic and impacts to state-controlled and local roads
- The loss of access as a result of river crossings becoming inundated during operations and/or changes to flood immunity.

Potential impacts to rail infrastructure at Gogango during construction are discussed. The Project is not expected to impact on port and airport facilities in the region.

During construction and operation the weir sites will be fenced and visitor access to the weirs would be restricted. Security will be present onsite and clear identification is to be worn by all personnel. Warning signs will be installed along access roads and tracks approaching the constructions sites notifying of restricted access. During operation, the Proponent will provide adequate signage to warn the public against use of the area for recreational purpose and will conduct routine inspections of fencing.



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0 5 10 15 20

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA94)
Grid: Map Grid of Australia 1994, Zone 55

N

LEGEND

- AMTD (km)
- Weir
- Location
- Fitzroy Barrage
- River Crossing
- State Controlled Road
- Major Road
- Streets (Local)
- Fitzroy Basin
- Waterway
- Urbanised Area
- Rookwood Weir Stage 1 impoundment
- Rookwood Weir Stage 2 impoundment
- Eden Bann Weir Stage 2 impoundment
- Eden Bann Weir Stage 3 impoundment

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School bus routes

Figure 16-15

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Data Source: © Copyright Commonwealth of Australia (Geoscience Australia): Places, Waterways (2007); Sunwater: Waterways, Weir Locations - 2008; DNRM: Railways, Roads (2007), State Controlled Roads (2014); GHD/QLD Buses: School Service Route (2013); GHD: Access Roads (2013).
Created by: MS *See Appendix for disclaimers and copyrights.

16.3.2 Rail network

Construction and operations traffic will traverse two electrified tracks of Aurizon's Blackwater system at Gogango on route to the proposed Rookwood Weir (Section 16.2.1) via Riverslea Road. The crossing location and layout is not anticipated to impact on Project construction activities and nor are Project construction activities expected to impact on operation of the rail system. The crossing is on Riverslea Road which is currently used by heavy commercial vehicles similar to those proposed for construction of the weirs and bridges. Further, the crossing is currently active and a boomed level crossing facilitates that safety measures are in place for traversing the line. Concept design has not identified any over-size loads that could not be accommodated by the crossing. During detailed design, discussions will be undertaken with Aurizon and DTMR to inform the development of appropriate management plans (as applicable) for use of the crossing, including provision of dilapidation surveys and repair, maintenance and reinstatement requirements. In the event that access restrictions are realised, alternative access to the Proposed Rookwood Weir site and Riverslea Crossing are available via Duaringa-Apis Creek, Smith and Yarra road from the west and Hanrahan, Rosewood-Wycarbarah roads from the north.

16.3.3 Road network and flooding

Current access and river crossing flood immunity in the study area is poor; with many roads and all river crossings becoming inaccessible for some time during the wet season. Consideration has been given to the connectivity and function of the existing road network in relation to access, inundation and flood immunity as a result of the Project. Flood hydrology modelling was conducted for the Project (Chapter 9 Surface water resources). A detailed assessment of potential impacts on the road network as a result of inundation and flooding is provided in Appendix Q. Impacts associated with construction of crossings is provided in Section 16.3.5.

Upgrades to existing crossings are proposed at Glenroy Crossing, Riverslea Crossing and Foleyvale Crossing. The level of flood immunity to be reinstated at each crossing was determined accordingly and recommendations made such that the existing road network was not adversely impacted by the Project. Conversely it is evident from Table 16-2 that the proposed upgrades will significantly improve hydraulic immunity of the road network by reducing the annual average time of closure (AATOC) and the duration of flooding above the crossing levels thereby providing a significant community benefit.

Table 16-2 provides an estimate of the AATOC and the duration of flooding for 2 year, 5 year, 10 year, 20 year, 50 year and 100 year average recurrence interval (ARI) flood events pre- and post-development.

Hydraulic immunity at Smith Road, Coorumburra Road (also known as Glenroy-Marlborough Road) and Commanche Road (south of Glenroy Crossing) were also considered. Potential changes to accessibility and flood immunity are considered low at these locations and diminish as flood magnitude increases and the weir becomes drowned:

- Post-development of Rookwood Weir increases the duration of flooding along Smith Road by two days during a 5 year ARI event and about half a day during a 10 year ARI event. Negligible changes are experienced during higher level flood events
- Post-development at Eden Bann Weir, the flood duration along a section of Commanche Road is increased by half a day during a 5 year ARI event. No increase to the duration of flooding is experienced at higher ARIs

Table 16-2 Hydraulic immunity of current and proposed crossing infrastructure

Crossing	AATOC		Duration of flooding (days above crossing level per event)											
	Current	New	2 year ARI		5 year ARI		10 year ARI		20 year ARI		50 year ARI		100 year ARI	
			Current	New *	Current	New *	Current	New *	Current	New *	Current	New *	Current	New *
Glenroy	11.8	5.3	23.5	2.2	24.2	13.3	24.5	15.5	24.8	17.6	25.3	19.3	25.3	20.3
Riverslea	11.8	1.7	23.8	0	24.1	2.3	24.1	7.3	24.1	10.4	24.5	12.8	24.8	14.1
Foleyvale	16.4	2.5	26.0	0	36.1	5.2	36.7	8.5	39.1	11.2	40.5	13.5	40.5	14.2

* New infrastructure values include weirs in operations.

- Post-development of Eden Bann Weir, the flood duration along Coorumburra Road during a 5 year ARI event is increased by approximately a day and a half and less than a day (0.2) during a 10 year ARI event. Negligible changes (0.1 day increases) are experienced during higher level flood events.

Given the low traffic use of the roads and opportunities for alternative access, no upgrade is proposed.

Hydraulic modelling undertaken for the Project (Appendix P) included assessment of the peak water levels for all annual exceedance probability (AEP) events on the Dawson River at the Capricorn Highway. As discussed in Chapter 9 Surface water resources, the 1 in 2 year AEP event modelled outputs show that the afflux at the Capricorn Highway post-development is estimated at 0.09 m. Impacts of flooding as a result of the Project on the Capricorn Highway are considered negligible.

Operational releases (up to 50 m^3/s) from Rookwood Weir will inundate the existing Hanrahan Crossing. Installation of new culverts will however mitigate this impact (Chapter 2 Project description) and maintain connectivity along Hanrahan Road across the Fitzroy River. The Eden Bann Weir impoundment does not impact on Hanrahan Crossing and accessibility during flood events at Hanrahan Crossing will not be adversely impacted by the either of weirs. Under a Rookwood Weir Stage 2 scenario, spillway releases will be made as the flood rises. Releases will be made such that the peak water level at Hanrahan Crossing occurs within 12 to 18 hours after the start of the release and the rate of rise is such that the crossing will not be inundated by a wave or 'flash flood' type event.

16.3.4 Weir access and construction

16.3.4.1 Basis of weir construction traffic assessment

Construction traffic types and traffic volumes have been estimated using typical construction type vehicles and experience from similar projects. It is assumed that construction will commence at both Eden Bann Weir and Rookwood Weir simultaneously and that construction to Stage 3 and Stage 2 respectively will occur. This is a conservative assumption given that lower staged developments will require less construction effort. Further, construction traffic estimates will be reviewed and revised during detailed design once the Project receives a decision to proceed and a specific stage build is nominated.

It is anticipated that construction will be a six-day per week operation with one construction shift limited to daylight hours (operating from 6.00 am to 6.00 pm) as far as is practicable. It is not anticipated that night-time haulage of materials and plant on public roads will be required.

The region within which the study area is located experiences seasonal flooding that result in roads and river crossings being inaccessible to traffic and inhibits in stream works.

Loss of access to construction areas is likely to be limited to periods of short duration. In stream works may be restricted for longer periods of time (between one and two months). Thus, for the purpose of the analysis it was conservatively assumed that construction activities in general will largely be timed to avoid the wet season and will be concentrated within the drier months.

The construction periods and activities (for the purposes of the traffic and transport assessment) per site are described in Table 16-3. The range of construction equipment and vehicles that are expected to be required for the construction of both weirs by phase is summarised in Table 16-4.

Table 16-3 Construction staging and activities

Construction phase	Duration (months)	Description
1 Mobilisation and site preparation	Eden Bann Weir – 7 Rookwood Weir - 7	• Bulldozers, back hoes, excavators, cranes, plant and machinery will be delivered to the site using a vehicle transporter (Class 6 vehicle) • Construction equipment will be delivered and assembled; for example site office / sheds / storage silos, aggregate screening plant and concrete batching plant, etc. • Aggregate will largely be sourced in situ or from locations immediately adjacent to the weir sites and will not require haulage over long distances of local or state-controlled roads (Chapter 2 Project description and Chapter 5 Land) but cement and fly ash will be delivered. It is considered likely that a Class 9 vehicle (for example a bulk tanker) will be used to transport these materials • Construction vehicles, plant and machinery are assumed to be stationed on site for the duration of Phase 1 works. By Phase 2 some of this equipment (for example extra bulldozers and excavators) will not be required for the construction of the weir • Haulage trucks (Class 4 vehicle) will be required to transport excavated material, steel, reinforcement, equipment, etc. to and/or from the site • A fuel truck (Class 9 vehicle) will be required to deliver fuel on a weekly basis • It is assumed that 50 per cent of the workforce will be required during this phase (approximately 20 workers for Eden Bann Weir and 30 workers for Rookwood Weir) • A construction worker's camp will not be required. Fifty per cent of the workforce will travel to / from the site by private transport (four wheel drive utilities and troop carriers) and the rest by a worker's bus (Class 3 vehicle).
2 Weir construction	Eden Bann Weir – 22 Rookwood Weir - 20	• Construction of the weirs will commence • Cement and fly ash delivery will continue • The peak workforce will be on site during Phase 2 (40 workers at Eden Bann Weir and 60 workers at Rookwood Weir) • A construction worker's camp will not be required. Fifty per cent of the workforce will travel to / from the site by private transport and the rest by a worker's bus (Class 3 vehicle).
3 Flap gates and equipment installation	Eden Bann Weir – 4 Rookwood Weir - 5	Flap gates, mechanical devices and monitoring equipment will be delivered and installed.
4 Demobilisation	Eden Bann Weir – 1 Rookwood Weir - 2	Demobilisation of the site including site cleaning, dismantling of site office, equipment and plant, return of construction of equipment, etc.

Table 16-4 Construction equipment and vehicle types

Vehicle / equipment type	Proposed activity	Vehicle type (Austroads class)	Frequency to / from site
Bulldozers	Clearing of vegetation, removal of topsoil and development of internal roads	Transported to site using a Class 6 vehicle (three axle articulated vehicle)	1 trip each per vehicle (Phase 1 and Phase 4)
Back hoes	Transfer aggregate, moving stockpiles, etc.	Transported to site using a Class 6 vehicle (three axle articulated vehicle)	1 trip each per vehicle (Phase 1 and Phase 4)
Excavators	Excavation of soil and aggregate, levelling the site, etc.	Transported to site using a Class 6 vehicle (three axle articulated vehicle)	1 trip each per vehicle (Phase 1 and Phase 4)
Cranes	Assembling plant and equipment, storage sheds / silos, site. offices, sheet walls, etc.	Transported to site using a Class 6 vehicle (three axle articulated vehicle)	1 trip each per vehicle (Phase 1 and Phase 4)
Trucks	Haulage of excavated material, steel, reinforcement, storage sheds, equipment, etc. to / from site	Class 4 vehicle (three axle truck)	Daily (Phases 1, 2, 3 and 4)
Over-dimension vehicle	Transport of generators, concrete batching plant equipment, aggregate screening plant, spillway gate assemblies, etc. Possible convoy under private escort and police control	Class 6 vehicle (three axle articulated vehicle)	• 10 trips each per vehicle (Phase 1 and Phase 4) • 14 trips for Rookwood Weir (Phase 3) • 18 trips for Eden Bann Weir (Phase 3)
Bulk tankers	Delivery of cement and fly ash	Class 9 vehicle (six axle articulated vehicle)	Daily (Phase 2)
Fuel truck	Delivery of diesel fuel to the site	Class 9 vehicle (six axle articulated vehicle)	Weekly (Phases 1, 2, 3, and 4)
Passenger car	Work force transport	Class 1 vehicle (two axle light vehicle)	Daily (Phases 1, 2, 3 and 4)
Bus/coach	Work force transport	Class 3 vehicle (two axle truck or bus)	Daily (Phases 1, 2, 3 and 4)

A range of construction plant and equipment will be needed to enable the construction work (Table 16-4). It is expected that the plant and equipment will be sourced predominantly from Rockhampton and also from nearby towns of Emerald, Blackwater, Duaringa, Stanwell, Kunwarara and Marlborough.

The following directional traffic distributions were assumed for the procurement of plant and equipment for the Project:

- Eden Bann Weir
  - 40 per cent from northern regions (for example, Kunwarara and Marlborough)
  - 60 per cent from southern regions (for example, Parkhurst and Rockhampton).
- Rookwood Weir
  - 30 per cent from the west (for example, Emerald, Blackwater and Duaringa)
  - 70 per cent from the east (for example, Stanwell, Gracemere and Rockhampton).

The same assumption was adopted for the traffic distribution of the construction workforce. It is anticipated that a total peak construction workforce of 60 persons is required for Rookwood Weir and 40 persons for the Eden Bann Weir.

As far as is practicable cement and fly ash will be sourced from the nearest location, likely Gladstone for cement and Stanwell for fly ash. The routes likely to be taken are shown in Figure 16-16.

The required number of construction vehicles and plant, staging, workforce, haulage regimes and traffic distributions will be confirmed during the detailed design stage when a detailed construction plan will be prepared. The above assumptions were also adopted for the purpose of the road impact assessment.

16.3.4.2 Weir construction traffic generation

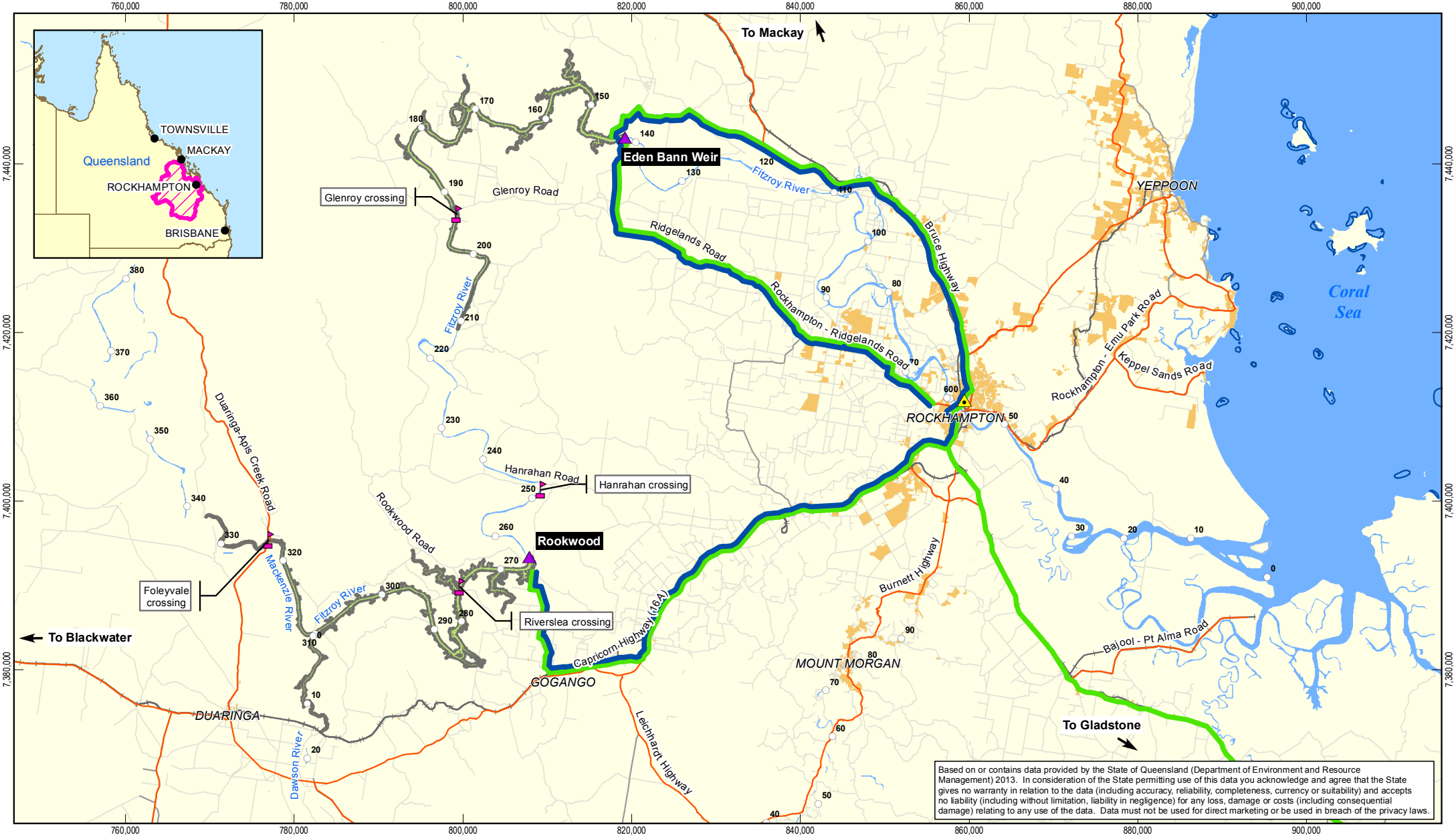
The concept design construction methodologies indicate that the following volumes of concrete are required to construct each weir:

- Eden Bann Weir: 50,000 m^3 of concrete = 12,075 tonnes of concrete
- Rookwood Wei: 90,000 m^3 of concrete = 21,735 tonnes of concrete.

A capacity of 42.5 tonnes has been assumed for the bulk tanker (for the delivery of the cement and fly ash). The resulting traffic generation for the delivery of cement and fly ash is tabulated in Table 16-5. This translates to 1 trip/day of cement and fly ash at Rookwood Weir and 1 trip/day for cement and fly ash at Eden Bann Weir.

Table 16-5 Traffic generation for cement and fly ash delivery

Weir location	Volume required (tonnes) concrete	Volume required		Total no. of loads		Duration		No. of Loads/Day		
		Cement 0.6	Fly Ash 0.4	Cement	Fly Ash	Mths	Days	Cement	Fly Ash	Total
Rookwood	21735	13041	8694	307	205	20	516	0.6	0.4	1.0
Eden Bann	12075	7245	4830	170	114	22	568	0.3	0.2	1.0



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0 5 10 15 20

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA94)
Grid: Map Grid of Australia 1994, Zone 55

N

LEGEND

- AMTD (km)
- Weir Location
- Fitzroy Barrage
- River Crossing
- State Controlled Road
- Major Road
- Streets (Local)
- Fitzroy Basin
- Waterway
- Urbanised Area
- Construction Traffic Route
- Cement Route
- Fly Ash Route
- Rookwood Weir Stage 1 impoundment
- Rookwood Weir Stage 2 impoundment
- Eden Bann Weir Stage 2 impoundment
- Eden Bann Weir Stage 3 impoundment

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Job Number 41-20736
Revision D
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Proposed transport routes for cement and fly ash

Figure 16-16

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As discussed in Chapter 2 Project description and Chapter 5 Land, resource extraction areas have been identified in close proximity (either in situ for sands and gravels or within a short distance (up to a kilometre) of the weirs) to the Project and it is considered unlikely that aggregate will be required to be hauled over long distances over local and state-controlled roads.

The peak traffic generation during the construction phase is likely to be associated with the transporting of plant, equipment and material deliveries. The traffic generated by the Project is detailed in Table 16-6 and Table 16-7 for Eden Bann Weir and Rookwood Weir, respectively. Details of the traffic generation and Equivalent Standard Axle (ESA) load (ESAL) calculations are provided in Appendix Q.

The estimated ESALs associated with the Project are:

- Eden Bann Weir - 24,356 ESA/year
- Rookwood Weir - 24,357 ESA/year.

16.3.4.3 Weir construction road and traffic impact assessment

Road and traffic impacts were generally assessed for the construction phase of the Project. A traffic impact assessment (TIA) has been undertaken for the Bruce Highway/Atkinson Road and Capricorn Highway/Third Street intersections relating to access for construction of Eden Bann Weir and Rookwood Weir, respectively. The TIA was conducted for the 'loaded vehicle' direction and represents the 'worst case' scenario. Improvements identified in the 'loaded vehicle' direction of the carriageway will be deemed to apply to the 'unloaded vehicle' direction as well, particularly for two-lane highways without a median.

The TIA assumed that both the Eden Bann Weir and Rookwood Weir will be constructed to the maximum FSL i.e. Stage 2 construction of the Rookwood Weir will take approximately 34 months. Similarly raising of the Eden Bann Weir to Stage 3 will take approximately 34 months over consecutive dry seasons.

For the TIA construction activities are assumed to commence in early 2015 (short term), however additional calculations for 2020 (medium term) and 2025 (long term) assessment years were also undertaken to align with potential Project demand triggers (Chapter 1 Introduction).

Access for construction vehicles to the Eden Bann Weir will be facilitated via the existing Atkinson Road / Bruce Highway intersection along the state-controlled road network (Rd 10F). A TIA has been undertaken for the intersection. The road links assessed at the intersection are:

- Bruce Highway north approach
- Bruce Highway south approach
- Atkinson Road west approach

A summary of the assessment results for the 2015 construction scenario is provided in Figure 16-17 (further detail is provided in Appendix Q).

Table 16-6 Construction traffic generation for Eden Bann Weir

Vehicle type	Proposed activity (34 months construction period)	Phase 1 – 7 months (site preparation)		Phase 2 – 22 months (weir construction)		Phase 3 – 4 months (install flap gates/equipment)		Phase 4 – 1 month (demobilise)	
		181 days		568 days		103 days		26 days	
		Trips							
Heavy vehicles									
Bulldozers	Clearing vegetation, removal of topsoil and development of internal roads	1	one trip	1	one trip	0	one trip	0	one trip
Back hoe	Transfer aggregate	1	one trip	0	one trip	0	one trip	0	one trip
Excavators	Excavation of soil, aggregate, levelling of the site, etc.	1	one trip	1	one trip	0	one trip	1	one trip
Crane	Assembling plant and equipment, storage sheds	1	one trip	0	one trip	0	one trip	1	one trip
Oversized vehicles	Generators, concrete batching plant equipment, aggregate screening plant	10	one trip	0	one trip	18	one trip	10	one trip
Trucks	Haulage of excavated material, steel, reinforcement, storage sheds, equipment, etc.	30	daily	5	daily	5	daily	30	daily
Bulk tankers	Delivery of cement and fly ash	0	daily	1	daily	0	daily	0	daily
Fuel truck	Delivery of diesel fuel (assume 1 trip per week)	1	weekly	1	weekly	1	weekly	1	weekly
Work force vehicles	Assumes 50% travel by worker's bus (assume 50 seat capacity bus)	1	daily	1	daily	1	daily	1	daily
	*Subtotal**	*46*		*10*		*25*		*44*	
Light vehicles									
Assumes 50% travel by private car Assumes 50% of total workers need in stage 1,3 and 4		10	daily	20	daily	10	daily	10	daily
	*Subtotal**	*10*		*20*		*10*		*10*	
	Total*	**56**		**30**		**35**		**54**	

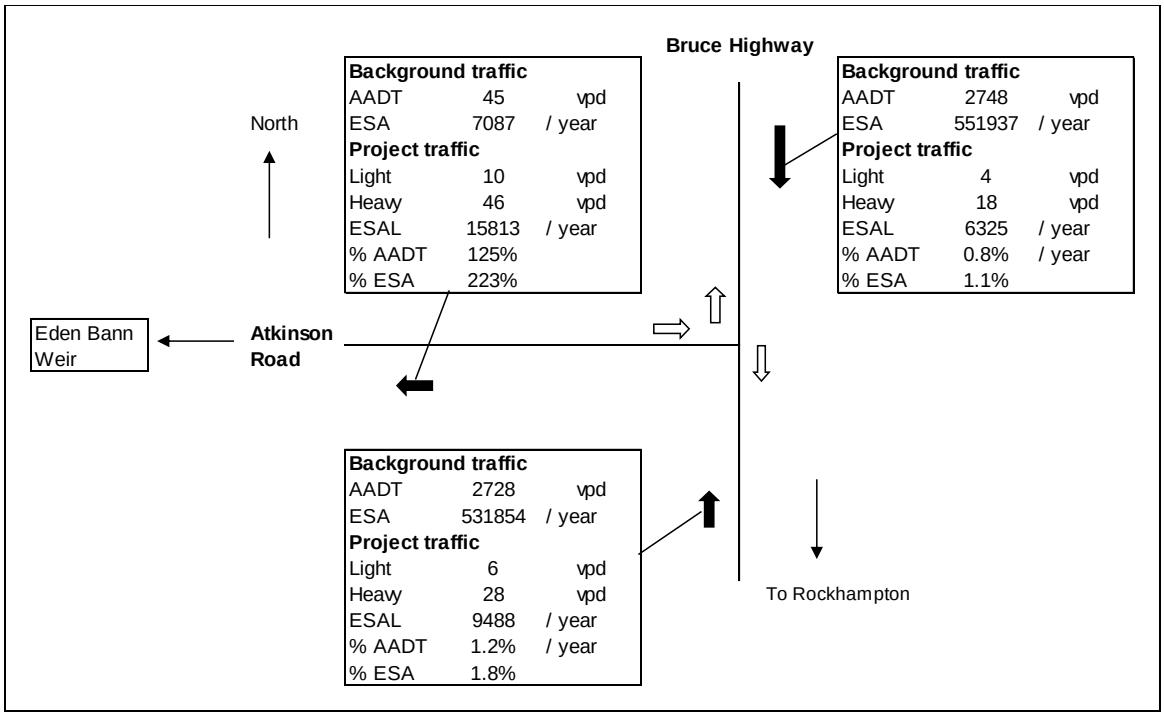
* Volumes presented indicate an upper maximum assuming all movements occurred simultaneously on the same day.

Table 16-7 Construction traffic generation for Rookwood Weir

Vehicle type	Proposed activity (Assumes 34 months construction)	Phase 1 – 7 months (site preparation)		Phase 2 – 20 months (weir construction)		Phase 3 – 5 months (install flap gates/equipment)		Phase 4 – 2 months (demobilise)	
		181 days		516 days		129 days		52 days	
		Trips							
Heavy vehicles									
Bulldozers	Clearing vegetation, removal of topsoil and development of internal roads	1	one trip	1	one trip	0	one trip	0	one trip
Back hoe	Transfer aggregate	1	one trip	0	one trip	0	one trip	0	one trip
Excavators	Excavation of soil, aggregate, levelling of the site, etc.	1	one trip	1	one trip	0	one trip	1	one trip
Crane	Assembling plant and equipment, storage sheds	1	one trip	0	one trip	0	one trip	1	one trip
Oversized vehicles	Generators, concrete batching plant equipment, aggregate screening plant	10	one trip	0	one trip	14	one trip	10	one trip
Trucks	Haulage of excavated material, steel, reinforcement, storage sheds, equipment, etc	30	daily	5	daily	5	daily	30	daily
Bulk tankers	Delivery of cement and fly ash	0	daily	1	daily	0	daily	0	daily
Fuel truck	Delivery of diesel fuel (assume 1 trip per week)	1	weekly	1	weekly	1	weekly	1	weekly
Work force vehicles	Assumes 50% travel by worker's bus (assume 50 seat capacity bus)	1	daily	1	daily	1	daily	1	daily
	Subtotal	*46*		*10*		*21*		*44*	
Light vehicles									
	Assumes 50% travel by private car Assumes 50% of total workers need in stage 1,3 and 4	15	daily	30	daily	15	daily	15	daily
	Subtotal	*15*		*30*		*15*		*15*	
	Total	**61**		**40**		**36**		**59**	

* Volumes presented indicate an upper maximum assuming all movements occurred simultaneously on the same day.

Figure 16-17 Bruce Highway/Atkinson Road intersection assessment summary



The analysis indicated the following:

- Traffic operation on the Bruce Highway approaches is not significantly impacted by the Project (less than five per cent of AADT)
- The impact of heavy vehicle movement related to weir construction on traffic operation of the Bruce Highway approaches is minimal (less than five per cent of ESA) and a pavement impact assessment is not required
- Traffic operation on the Atkinson Road approach is potentially impacted (more than five per cent of AADT)
- The impact of heavy vehicle movement on traffic operation of the Atkinson Road approach is considered significant (more than five per cent of ESA) and a pavement impact assessment will be undertaken during the detailed design phase with consideration of the Assessment of Road Impacts of Development – Notes for Contribution Calculations – Main Roads Fitzroy Region (Rockhampton and Emerald Districts)
- The intersection analysis shows that the current BAR / AUL turn treatment on the Bruce Highway requires augmentation for the “with construction traffic” scenarios in 2015, 2020 and 2025. The Bruce Highway / Atkinson Road intersection will be upgraded to a standard adequate to accommodate Project traffic during the construction phase. The assessment indicated that this would apply to all with construction scenarios
- A road safety audit will be required. Further a road-use management plan will be developed (in consultation with DTMR and in accordance with DTMR, RRC and LSC guidelines and policies) to implement traffic management measures, including an intersection upgrade (as necessary and applicable) and for example improved visibility of warning signage and potentially reduced traffic speeds

- Dilapidation surveys will be undertaken at the Atkinson Road / Bruce Highway intersection prior to construction and provided to DTMR and LSC to ensure that the intersection is restored to its original condition post-construction.

Access to the northern bank at Eden Bann Weir will be via the existing Eden Bann Road, from Mona Vale Road and Atkinson Road (Table 16-1). The existing roads are not likely to require upgrading for access purposes, however, consistent with Atkinson Road, a pavement impact assessment will be required. Dilapidation surveys will be undertaken prior to construction and road use agreements negotiated with LSC regarding maintenance schedules, repairs and reinstatement requirements of the roads to at least the condition prior to the commencement of use.

Traffic generated as a result of construction of Eden Bann Weir (Table 16-6) will increase use of these roads intermittently and for short periods. Given the current low usage (Table 16-1) it is not expected that construction activities will impact operation of Eden Bann Road or Mona Vale Road.

Some upgrading is proposed along Eden Bann Road within the existing easement to provide a flood channel to facilitate flow to waterholes and lake areas as per existing conditions. Upgrading will comprise a raised earth embankment with pipe culverts. The raise will improve the level of service to the landholder's homestead during flood events. The work is located within already disturbed and cleared areas and will not require clearing of vegetation. A construction EMP (Chapter 23 Environmental management plan) will be developed to manage impacts associated with erosion and sedimentation resulting from disturbance at the site. These works will be undertaken simultaneously with weir construction using equipment and machinery available at the Eden Bann Weir site.

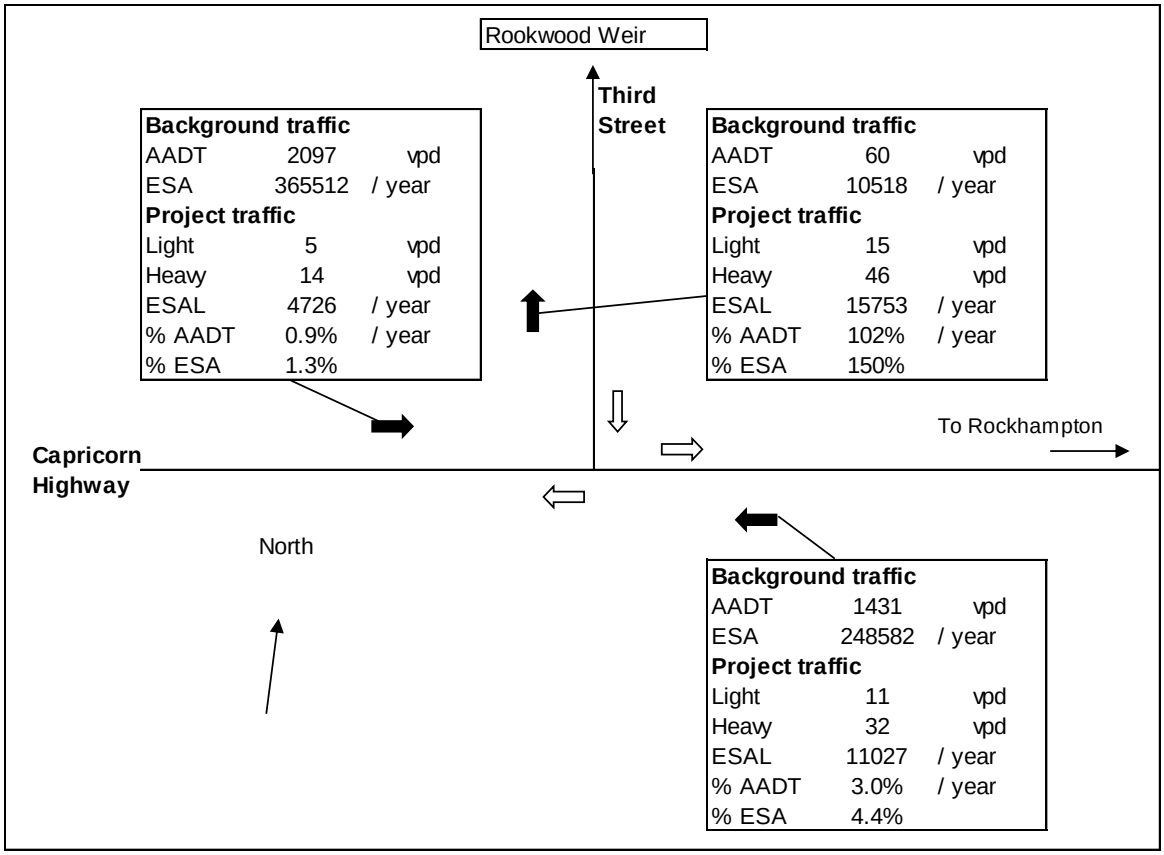
A new permanent private access road is required to service the southern bank of Eden Bann Weir. The concept layout is shown in Appendix Q. As far as possible, the access road is co-located within existing cleared areas and adjacent to existing utility easements and does not traverse any watercourses. Some vegetation clearing is required (Chapter 6 Flora). This new access commences at a T-junction intersection with Ridgelands Road (local road section) and it is expected that a pavement impact assessment will be required and undertaken during detailed design. A road-use management plan will be developed in consultation with DTMR and RRC during detailed design and a construction EMP (Chapter 23 Environmental management plan) will be developed to manage impacts associated with clearing, erosion and sedimentation resulting from disturbance along the route. It is expected that an easement will be sought for the access road.

Access for construction vehicles to the Rookwood Weir site will be facilitated via the existing Capricorn Highway / Third Street intersection at Gogango. A TIA has been undertaken for the intersection. The road links assessed at the intersection are:

- Capricorn Highway east approach
- Capricorn Highway west approach
- Third Street north approach.

A summary of the assessment results for the 2015 construction scenario is provided in Figure 16-18 (further detail is provided in Appendix Q).

Figure 16-18 Capricorn Highway/Third Street intersection assessment summary



The analysis indicated the following:

- Traffic operations on the Capricorn Highway west approaches are not significantly impacted by the weir construction (less than five per cent of AADT)
- The impact of heavy vehicle movements on the traffic operation of the Capricorn Highway west approach is minimal (less than five per cent of ESA) and a pavement impact assessment is not required
- Impacts on traffic operation on the Capricorn Highway east approach is minimal (less than five per cent of AADT)
- The intersection analysis shows that Capricorn Highway approach from the east will require a channelized right turn treatment with a short turn slot (CHR(S)) treatment to cater for the movement of construction traffic scenarios in 2015, 2020 and 2025. Further assessment during detailed design will consider intersection form given the proximity of Young Street and Gogango Creek bridge to the Capricorn Highway / Third Street intersection. This will include reducing speeds and increased signage, the deployment of active/manned traffic control at key times during construction (for example mobilisation) and consideration being given to staged mobilisation and demobilisation to reduce the traffic generated at any one time.
- A road-use management plan will be developed (in consultation with DTMR and in accordance with DTMR, RRC and LSC guidelines and policies) to implement traffic management measures, including an intersection upgrade and for example improved visibility of warning signage and potentially reduced traffic speeds

- The impact on traffic operation on Third Street is considered significant (more than five per cent of AADT)
- The impact of heavy vehicle movement on traffic operation of Third Street is significant (more than five per cent of ESA) and a pavement impact assessment will be undertaken during the detailed design phase with consideration of the Assessment of Road Impacts of Development – Notes for Contribution Calculations – Main Roads Fitzroy Region (Rockhampton and Emerald Districts
- It is considered that the acceleration lane (heading east) from Third street onto the Capricorn Highway requires improvement and will be increased in width and length. Further a road safety audit will be undertaken. With the implementation of traffic management controls (such as reduced speeds and improved signage), in accordance with the road-use management plan, the intersection can accommodate construction generated traffic
- The extent of the improvements / level of assessment required for the Third Street approach will be discussed with DTMR and RRC as the Third Street approach is not of the same standard as the Capricorn Highway approaches
- Dilapidation surveys will be undertaken at the Capricorn highway / Third Street intersection prior to construction and provided to DTMR and RRC to facilitate that the intersection is restored to its original condition post-construction.

Thirsty Creek Road will form part of the construction and operational maintenance access to Rookwood Weir. Thirsty Creek Road connects to Riverslea Road approximately 1.6 km from the town of Gogango. Riverslea Road has relatively low traffic volumes and Thirsty Creek Road is considered a low use road (Table 16-1). Traffic generated as a result of construction of Rookwood Weir (Table 16-7) will increase use of these roads intermittently and for short periods. Given the current low usage (Table 16-1), it is not expected that construction activities will impact on the operation of Riverslea Road or Thirsty Creek Road.

Pavement impact assessments will be undertaken for Riverslea Road and Thirsty Creek Road during the detailed design phase with consideration of the Assessment of Road Impacts of Development – Notes for Contribution Calculations – Main Roads Fitzroy Region (Rockhampton and Emerald Districts.

Thirsty Creek Road, based on current survey, will require road works to be carried out at selected areas to be operable for access for construction vehicles especially low loaders. Most of the areas that require attention are at ephemeral creek and waterway/drainage crossings to allow gentler vertical geometry. Works include regrading, upgrading culverts and/or installing new culverts. The need for road widening, curve widening, pavement repair and other repairs will be reviewed during the detailed design phase. A road-use management plan will be developed in consultation with DTMR and RRC during detailed design and a construction EMP (Chapter 23 Environmental management plan) will be developed to manage impacts associated with clearing, erosion and sedimentation resulting from disturbance along the route. It is expected that, for the most part, works will be undertaken within the existing road reserve. Waterway barrier works approvals will be sought as necessary (Gogango Creek) (Chapter 3 Legislation and project approvals and Chapter 7 Aquatic ecology).

Preliminary road improvements proposed for Thirsty Creek Road are shown in Appendix Q.

The changes of vertical geometry proposed at waterway crossings including at Gogango Creek will help maintain existing flood immunity. If no work was conducted, flood immunity would

decrease by approximately five days for a 1 in 5 annual exceedance probability (AEP) event following construction of Rookwood Weir. Flood immunity was not greatly impacted by higher flood frequency events. For example; a 1 in 10 AEP event was modelled and found to add two days to what is currently a seven day flood event.

Detailed descriptions of new road construction and/or road upgrades are provided in Chapter 2 Project description and design criteria used for new and/or upgraded infrastructure as a result of Project impacts is provided in Appendix Q.

A summary of road-use management commitments is provided in Section 16.4.

16.3.5 Road and crossing construction

During construction of new river crossings, access across the road network will be maintained via the existing crossings. Disruptions to traffic on the road network will arise from the:

- Mobilisation and demobilisation of site equipment and machinery
- Transportation of personnel to and from site daily.
- Delivery of materials and supplies (including concrete, aggregate/earth materials and precast materials and steel reinforcement and other manufactured metal work)
- Transportation of debris and waste off-site during construction and demolition of the existing crossing.

During construction of the river crossings, it is expected that the following vehicles will be utilised:

- Buses and 4WD utility vehicles to transport staff daily to and from site. It is expected that at peak in the order of 40 site staff will travel to and from the site daily. As far as is practicable staff will be transported by bus. It is estimated that two return bus trips from Rockhampton will be required to transport staff. Some individual use of 4WD utility vehicles will however be required
- Low loaders will be used to mobilise and demobilise earth moving equipment (such as bulldozers, front end loaders and excavators), and mobile plant (such as cranes, piling rigs and compactors) at various time during the construction period. Most plant once mobilised will remain on site for the duration and only be demobilised on completion of the activity
- Tip trucks will travel to and from the site on a daily basis to supply materials and remove debris and waste although volumes are expected to be small
- Concrete will be batched offsite and pre-mixed concrete will be delivered to site in transit mixers
- Articulated trucks travelling under escort will be required to transport precast deck girders (between 30 m and 35 m in length) and concrete units
- Semi-trailer trucks will transport steel reinforcement and other manufactured metal work.

Transport logistics in relation to bridge construction will be finalised during detailed design and will inform the development of a road-use management plan. These plans will be informed by future traffic counts (as available and necessary at the time), dilapidation surveys, a road traffic safety audit and pavement impact assessment as applicable to be undertaken during the detailed design phase of the Project and refined as construction methods, logistics and schedules are confirmed. While intermittent delays of short duration will be experienced by road users, it is not considered that construction will adversely impact the overall operability of the road network associated with

the river crossings. It is not possible to confine all works to within existing road reserve areas. As a result of the new crossing locations (despite being in close proximity to the existing infrastructure), realignment of approaches will necessitate resumption of some land (Chapter 5 Land) and road closures will be required as access is replaced by the new crossings:

- Glenroy Crossing: the eastern approach requires 150 m of new road and the western approach requires 520 m of new road
- Riverslea Crossing: in the order of 500 m of new road is required to accommodate realignment of approaches
- Foleyvale Crossing: in the order of 400 m of new road is required either side of the river to accommodate realignment of approaches to the bridge.

During upgrading of Thirsty Creek Road, operation of the road network will be disrupted as a result of reduced speed limits and enforced stop/go controls along sections of the road to accommodate construction traffic and activities. It is not expected that road closure will be required as localised detours (adjacent to the existing road) can be used to move traffic around the construction works as necessary. Site specific traffic management plans will be developed together with RRC during detailed design of the road upgrades. These plans will be informed by future traffic counts (as available and necessary at the time), dilapidation surveys, a road traffic safety audit and pavement impact assessment to be undertaken during the detailed design phase of the Project and refined as construction methods, logistics and schedules are confirmed. Thirsty Creek Road primarily serves as a local access and anecdotal reports are that it has a low usage. While intermittent delays of short duration will be experienced by local road users, it is not considered that construction will adversely impact the overall operability of Thirsty Creek Road. It is unlikely that road upgrades will require resumption of additional land as works will as far possible be confined to within the existing road reserve area (Appendix Q). Thirsty Creek Road is maintained by RRC and it is expected that this will continue following any upgrades.

During improvements to the Capricorn Highway/Third Street intersection, disruptions to traffic on the road network will result from reduced speed limits and enforced stop/go controls. It is not expected that road closure will be required as localised detours (adjacent to the highway on the southern side of the existing intersection) can be used to move traffic around the construction works. Site specific traffic management plans will be developed together with DTMR and RRC during detailed design of the intersection. These plans will be informed by future traffic counts (as available and necessary at the time), dilapidation surveys, a road traffic safety audit and pavement impact assessment to be undertaken during the detailed design phase of the Project and refined as construction methods, logistics and schedules are confirmed. DTMR has a concept design in place for future upgrading of the intersection but, at the present time, funding is not available to carry out the works. The proposed upgrade will be considered and inform detailed design together with negotiations with DTMR. While some disruption and delay will occur as a result of the intersection upgrade, it is not expected that the works will adversely impact the overall operability of the Capricorn Highway. It is unlikely that the intersection upgrade will require resumption of additional land as works can be confined to within the existing road reserve area. DTMR and RRC will continue to maintain roads at the intersection within their respective jurisdictions.

No temporary access is required for construction as construction access roads will be retained as permanent operational access. A summary of road-use management commitments is provided in Section 16.4.

16.3.6 School transport infrastructure and services

During the construction phase, access and haulage routes identified for the Project will overlap with school bus and long distance coach services routes, along the Bruce and Capricorn highways and a section of Rockhampton-Ridgelands Road. Construction traffic generated by the Project is not predicted to impact on operation of these highways (Section 16.3.4) and is not expected to impact on school bus and long distance coach services on these routes. The Project will not impact on access to transport for people with a disability.

While no services exist along local access roads, these roads are however used by local residents to access pick up and drop off locations. Traffic generated as a result of construction of Eden Bann Weir (Table 16-6) and Rookwood Weir (Table 16-7) will increase use of these roads intermittently and for short periods. Given the current low usage (Table 16-1), it is not expected that construction activities will impact operation of local roads.

A road-use management plan (Section 16.4) (and where necessary site specific management plans, for example at Gogango) will be developed in consultation with DTMR, the Queensland Police Service and bus operators during detailed design and development of the construction programme. The timing of Project activities will be communicated to local communities and stakeholders and notifications provided as necessary for intended peak traffic movement periods (Chapter 23 Environmental management plan).

16.3.7 Operational traffic

Operational activities include maintenance of the infrastructure and private access roads. Activities are likely to include routine maintenance, emergency maintenance, and surveillance. The types of vehicles potentially involved will include utility vehicles, occasional haul trucks (to facilitate crane movements) and other large equipment such as dozers and graders (primarily for access road maintenance).

The impact of traffic generated during the operation phase of the Project is expected to be minimal and largely relates to maintenance personnel accessing the weir sites on a weekly basis using a utility vehicle.

16.4 Summary

The potential Project impacts on the capacity of existing port and/or air infrastructure in the region was found to be negligible.

The location and layout of the Gogango rail crossing is not anticipated to impact on Project construction activities and nor are Project construction activities expected to impact on operation of the rail system. Discussions will be held with Aurizon and DTMR to inform the development of appropriate management plans (as applicable) for use of the crossing, including provision of dilapidation surveys and repair, maintenance and reinstatement requirements.

Construction generated traffic will overlap with school transport services on state-controlled roads but, given the current capacity of these roads, are not expected to impact on the operations of these services. A road use management plan (and where necessary site specific management plans, for example at Gogango) will be developed in consultation with DTMR, the Queensland Police Service and bus operators and appropriate notifications provided.

New bridges will be constructed at Glenroy Crossing, Riverslea Crossing and Foleyvale Crossing. Flood immunity will be improved and the road network maintained. A bank of culverts and a causeway will be installed at Hanrahan Crossing to facilitate access during water releases from

Rookwood Weir. Upgrades of Thirsty Creek Road will be undertaken to facilitate construction access and maintain operational access to Rookwood Weir.

The TIA undertaken for the state-controlled Atkinson Road / Bruce Highway and Third Street / Capricorn Highway intersections concluded the following:

- Traffic operation on the Bruce Highway and Capricorn Highway approaches are not significantly impacted by the Project (less than five per cent of AADT)
- The impact of heavy vehicle movement on traffic operation of the Bruce and Capricorn highway approaches are minimal (less than five per cent of ESA) and pavement impact assessments are not required
- Traffic operations on the Atkinson Road and Third Street approaches are impacted (more than five per cent of AADT), with the impact of heavy vehicle movement on traffic operations considered significant (more than five per cent of ESA). Pavement impact assessments will be undertaken, along with road safety audits during detailed design. Traffic management measures will be implemented. This will include improved visibility of warning signage and potentially reduced traffic speeds, in accordance with the road use management plans developed for the Project and in accordance with DTMR, RRC and LSC guidelines and policies
- Dilapidation surveys will be undertaken at the Atkinson Road/Bruce Highway and Third Street/Capricorn Highway intersections prior to construction and provided to DTMR, RRC and LSC to ensure that the intersection is restored to its original condition post-construction
- Intersection upgrades are required to adequately accommodate Project traffic during the construction phase at the Bruce Highway / Atkinson Road and Capricorn Highway /Third Street intersections.

Traffic generated as a result of construction of Eden Bann Weir will increase use of the existing access route to the left bank of Eden Bann Weir (on Eden Bann Road, Mona Vale Road and Atkinson Road, off the Bruce Highway) roads intermittently and for short periods. A new access road will be constructed to the right bank off Ridgelands Road. Given the current low usage, it is not expected that construction activities will impact operation of these roads.

Access to Rookwood Weir will be maintained via Thirsty Creek, Riverslea Road and Third Street (at Gogango) off the Capricorn Highway. Thirsty Creek Road will require improvement at low areas (primarily water course crossings).

During detailed design refinement of Project activities will be facilitated through updating traffic counts, undertaking pavement impact assessments and road safety audits and developing site specific traffic management plans. A road use management plan will be developed in consultation with DTMR, RRC and LSC governing upgrades, use, maintenance and restoration (as applicable) of these roads, along with identification of transport targets, updated traffic generation and road-use data and road-use management strategies as per commitments made in Table 16-8..

The impact of traffic generated during the operation phase of the Project is expected to be minimal and largely comprises traffic movements consisting of operations personnel in utility vehicles associated with maintenance activities.

Table 16-8 Road use management plan commitments

No.	Chapter reference	Commitment	Timing/trigger	Issue category
1	16.1.2	Impacts on sensitive receptors (air quality and noise) will be managed in accordance with the EMP.	During construction	Environmental commitments
2	16.1.3 16.3.4 0	Environmental commitments (as per the EMP) included within the road-use management plan will be written into all contracts, for example air quality.		Environmental commitments
3	0	A detailed road use management plan will be developed in consultation with DTMR, RRC, LSC, the Queensland Police Service and bus operators.	During detailed design	Road safety management on public roads
4	16.3.2 16.3.4	The state's Heavy Vehicle Road Operations Program Office will be consulted in advance of any planned over-mass and dimension load movements and approved permits obtained before commencement of travel.	3 months in advance of any planned use.	Over-size / over-mass loads, vehicle management and approvals
5	16.3.4	Works conducted on or within close proximity to roads will have an approved traffic management plan, developed in consultation with DTMR, RRC and LSC.	Prior to construction	DTMR approvals for access
6	16.3.4	The Bruce Highway/Atkinson Road and Capricorn Highway/Third Street intersections will be upgraded to a standard adequate to accommodate Project traffic during the construction phase.	During detailed design	Road safety management on public roads
7	16.3.5	Traffic counts, construction generated traffic volumes and procurement details will be updated and refined.	During detailed design	Road safety management on public roads
8	16.3.4	Pavement impact assessments will be undertaken as applicable (Atkinson Road Eden Bann Road, Mona Vale Road, Third Street, Riverslea Road, Thirsty Creek Road and Ridgelands Road).	During detailed design	Road safety management on public roads
9	16.3.4 16.3.5	Road safety audits will be undertaken for the Bruce Highway / Atkinson Road, Capricorn Highway / Third Street and Ridgelands Road / new site access intersections and along principal workforce travel routes (Capricorn Highway, Bruce Highway and Ridgelands Road).		Road safety management on public roads

No.	Chapter reference	Commitment	Timing/trigger	Issue category
10	16.3.4	Dilapidation surveys will be undertaken and provided to DTMR, RRC and LSC. Road use agreements will be negotiated with RRC and LSC regarding maintenance schedules, repairs and reinstatement requirements of the roads to at least the condition prior to the commencement of use.	Prior to construction	Maintenance to mitigate project traffic impacts
11	16.3.42	Management measures will be implemented including improved visibility of warning signage and potentially reduced traffic speeds, in accordance with DTMR, RRC and LSC guidelines and policies.	During construction	Road safety management on public roads
12	16.3.2	The proponent will consult with Aurizon and update the road-use management plan regarding the Aurizon's Blackwater system level crossing at Gogango.	During detailed design	Environmental commitments
13	16.3.4	It is estimated that fifty per cent of the workforce will travel to / from the site by private transport and the rest by a worker's bus (Class 3 vehicle).	During construction	Other project vehicle/traffic management policies and commitments
14	16.3.4	Night-time haulage of materials and plant on public roads will be minimised as far as practicable.	During construction	Road safety management on public roads