8. Cumulative Impacts

This section describes the potential cumulative and consequential assessment of the Project and proposed projects currently under investigation or expected to commence investigations in the next 5 years within the Galilee Basin. This assessment has been undertaken in accordance with Section 7 of the Project Terms of Reference (ToR) and a table cross-referencing these requirements is provided in Volume 4 Appendix C ToR Cross Reference Table. Baseline studies undertaken as part of the Project EIS and contained within Volume 2 and Volume 3 and other publicly available information on proposed projects in the region have been used to identify potential cumulative and consequential impacts.

8.1 Introduction

8.1.1 Overview

Cumulative impacts can be defined as successive and combined impacts of one or more projects upon the society, economy and the environment (Franks, DM, Brereton, D, CJ, Sarker, T and T, Cohen, 2010). Such impacts may occur due to the accumulation and synergistic interactions arising from other developments, being developed within the same area or over a similar time frame of operation to the project being assessed. Developments may impact upon environmental values as a result of geographic overlap of project areas, scheduling overlap or utilisation of the same infrastructure, services and resources. The majority of the cumulative impacts associated with the Project are derived on the basis of a broader scale from transport, economic and social interactions between the Project and other existing/proposed projects in near vicinity to the Project. Impacts related to air quality, particularly dust generation and dispersion, groundwater, surface water and noise are usually derived on the basis of the regional or catchment scale around the Project Area.

Consequential impacts include impacts facilitated to a significant extent by the development of the Project. The development of one or more projects could lead to consequential impacts, for example necessary supporting infrastructure (locally or regionally) may be developed as a consequence of the development.

8.1.2 Objective

The objective of this assessment is to clearly identify the potential cumulative and consequential impacts upon the existing environment as a result of operating the Project and other proposed projects within the Galilee Basin. These impacts are to be considered:

- on a local level (Project Area) and regional level (Galilee Basin);
- accumulation over time;
- exacerbation of impacts in intensity or scale, frequency or duration; and
- either isolation or combination with other known existing or planned impacts.

An evaluation of the potential cumulative impacts resulting from the Project including an estimation of the overall size, significance and likelihood of these impacts has been undertaken. The impacts of

each relevant project are to be identified on the basis of the undertaken environmental impact assessments that are currently publicly available.

The cumulative impacts identified as part of this assessment are to be concisely categorised into specific environmental values identified as part of the Project EIS.

8.1.3 Methodology

This cumulative impact assessment has been undertaken on the basis of the following steps:

- Review of the impact assessments within Volume 1, Volume 2, Volume 3 and Volume 4 of the Project EIS, which provide a concise list of potential Project impacts in isolation to other proposed projects. This list should also include the potential impacts generated by other projects in general vicinity of the Project Area.
- Identify projects that are either proposed or recently approved but not yet operational and located within general vicinity of the Project Area.
- Define an appropriate spatial boundary to be used for analysis of the cumulative impacts. Where existing projects are located far away from each other cumulative impacts are likely to be less significant.
- Define the temporal boundary to be used for analysis of the cumulative impacts. Where operation schedules for projects are not overlapping, the potential cumulative impacts are likely to be less significant.
- Determine those impacts of the Project (Mine) and Project (Rail) that may overlap with impacts from other identified projects.
- Assess the cumulative impacts of the Project (Mine) and Project (Rail).
- Identify the significance of the cumulative impact upon the existing environment on the basis of significance criteria detailed in Table 8-2.

Consequential impacts have been identified on the basis of the following:

- Identify projects that are either proposed or recently approved but not yet operational and are directly linked to the operation of the Project
- Identify those elements of the linked projects which would not occur unless the Project proceeded.

8.1.4 Assessment Matrix

Table 8-1 presents the assessment matrix that has been utilised as part of the cumulative impact assessment for the Project. This assessment will be applied to any impacts that have the potential to combine with impacts from other projects to cause cumulative impacts.

Table 8-1 Cumulative Impact Assessment Matrix

Aspect	Relevance Factors		
	Low	Medium	High
Probability of cumulative impact	1	2	3
Duration of cumulative impact	1	2	3
Magnitude / Intensity of cumulative impact	1	2	3
Sensitivity of receiving environment, significance of environmental or social values	1	2	3

The relevance factors have been used to determine impacts in Table 8-9 on the basis of professional judgement, past experience with similar developments and Project information presented within Volume 2 and Volume 3. Impact significance criteria used for the cumulative impact assessment are detailed in Table 8-2.

Table 8-2 Cumulative Impact Significance Criteria

Impact Significance	Sum of Relevance Factors	Consequence
Low	4-6	Negative impacts may occur but can be managed if each proponent implements standard environmental management practices. Special approval conditions unlikely to be necessary. 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. Specific approval conditions are likely. Targeted monitoring program required.
High	10-12	Alternative actions should be considered and/or mitigation measures applied to demonstrate improvement. May require collaboration with other proponents/parties to monitor and manage impacts. Specific approval conditions required. Targeted monitoring program necessary.

8.2 Relevant Projects

8.2.1 Overview

The Project is located within the Galilee Basin and as such needs to be considered in the context of other projects currently under investigation or expected to commence investigations in the next five years. A number of projects have been identified as having particular relevance in terms of cumulative impacts associated with project development or that offer the opportunity for co-location of infrastructure, and / or are a consequential development and provide necessary supporting infrastructure for the export of product coal.

The following projects are relevant in terms of cumulative impacts associated with project development and are currently approved and/or under assessment and have been included in the cumulative assessment:

- Alpha Coal Project (EPBC 2008/4648, 2008/4647): Mine element
- Kevin's Corner (EPBC 2009/5033)
- Galilee Coal (Northern Export Facility) (EPBC 2009/4737): Mine element
- South Galilee Coal Project (EPBC 2010/5496)

Adani is also aware of the following proposals within the region; however insufficient information is available at the time of writing (November 2012) to enable inclusion in the cumulative assessment:

- MacMines: development of two open cut and two underground mines with ultimate production and export of 30 Mtpa via a rail spur line linking into the proposed Project (Rail) corridor to export coal through the Port of Abbot Point. Terms of reference for this project are currently under public notification, however no further publicly available information is currently available.

The following projects are relevant as they offer the opportunity for co-location of infrastructure:

- Galilee Coal (Northern Export Facility) (EPBC 2009/4737): Rail element
- Alpha Coal Project (EPBC 2008/4648, 2008/4647): Rail element
- Goonyella to Abbot Point Rail Project (EPBC 2011/6082)
- QR National Central Queensland Integrated Rail Project (EPBC 2012/6321)

The following projects are relevant to consequential development as they are being investigated to provide necessary supporting infrastructure for the export of product coal:

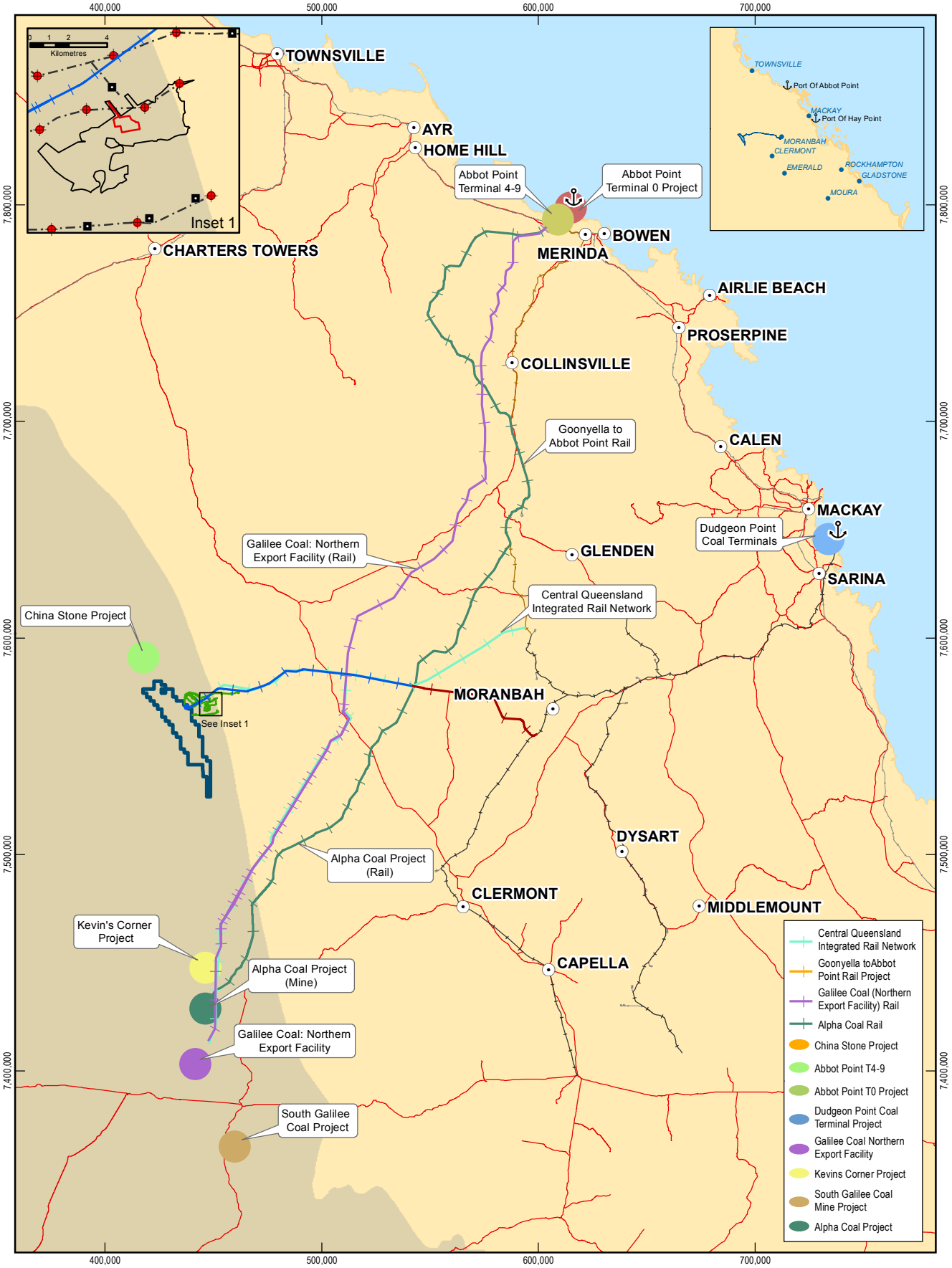
- Abbot Point Terminal 0 Project (EPBC 2011/6194)
- Port of Hay Point (Dudgeon Point Expansion) (EPBC 2012/6240)

Whilst the following projects are within the associated region they are not relevant to this Project and do not give rise to consequential or cumulative impacts. As such they have been excluded from this discussion on related projects.

- Abbot Point Terminal 2 Project (EPBC 2011/6194): this project is a dedicated coal terminal being developed by BHP Billiton for the purpose of servicing its own coal export requirements. It is unlikely that third party access to the coal terminal would be available. BHP Billiton has publically stated in 2012 that this project is on hold.

- Abbot Point Terminal 3 Project (EPBC 2008/4468): this project is a dedicated coal terminal being developed by Hancock Infrastructure Pty Ltd for the purpose of servicing its own coal export requirements. It is unlikely that third party access to the coal terminal would be available.

Figure 8-1 defines the projects relevant to the cumulative impact assessment and shows the footprint of each project included in the cumulative impact assessment.



LEGEND

- Town
- Major Port
- State Road
- Other Rail Network
- Goonyella System
- Newlands System
- Project (Mine)
- Mine (Offsite)
- Galilee Basin
- Rail (West) Mine (Offsite)
- Rail (East)
- Borehole
- Storage Site (Instream)
- Pipeline Network
- Community Area
- Workers Accommodation Village

Based on or contains data provided by the State of QLD (DERM) [2010]. 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 marketing or be used in breach of the privacy laws.

1:2,500,000 (at A4)

0 25 50 75 100

Kilometres

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

N

Adani Mining Pty Ltd

Carmichael Coal Mine and Rail Project

Job Number 41-25215
Revision C
Date 03-09-2012

Cumulative Impact Projects

Figure: 8-1

G:\41\25215\GIS\Maps\MXD\100_Planning\41-25215_195_rev_c.mxd

Level 4, 201 Charlotte St Brisbane QLD 4000 T +61 7 3316 3000 F +61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

© 2012. While GHD Pty Ltd has taken care to ensure the accuracy of this product, GHD Pty Ltd, GA, Gassman, Hyder Consulting, DME, Adani and DERM make no representations or warranties about its accuracy, completeness or suitability for any particular purpose. GHD Pty Ltd, GA, Gassman, Hyder Consulting, DME, Adani and DERM cannot accept liability of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred as a result of the product being inaccurate, incomplete or unsuitable in any way and for any reason.

Data Source: DERM: LGA (2011); DMR: State Roads (2008); DME: EPC1690 (2010), EPC1080 (2011); Adani: Alignment Opt9 Rev3 (2012); Gassman/Hyder: Mine (Offsite) (2012); Other Projects (2012). Created by: NR,MS

8.2.2 Alpha Coal and Rail Project (EPBC 2008/4648, 2008/4647)

Hancock Prospecting Pty Ltd (Hancock) proposes to establish a new open cut coal mine in the Galilee Basin, Central Queensland, to service international export energy markets for thermal coal. Hancock's proposal involves the development of the following:

- A coal mine and processing plant
- A mine-to-port railway to transport processed coal to an export terminal at Abbot Point
- Associated infrastructure, including an airport near the mine site and power and water supply infrastructure

This project was declared to be a significant project requiring an EIS under the SDPWO Act and also a controlled action under the EPBC Act.

The project will initially be a 30 Mtpa open cut coal mine, with the potential for developing significant underground reserves. The coal will be treated by a coal preparation plant (CPP) and conveyed to a rail load-out facility. It is expected that the coal will be railed to the Port of Abbot Point for export. Initially all product coal is planned for export, however domestic use will be explored. The project has an expected mine life of 30 plus years, with sufficient Joint Ore Reserves Committee (JORC) compliant resources to significantly extend the Project life beyond 30 years. The rail facility will be designed to transport coal at a capacity greater than Hancock production thereby catering for possible future neighbouring Galilee Basin producers and other downstream producers.

The proposed north-south rail line has a design capacity of 60 Mtpa product. Following declaration of this rail project as an Infrastructure Facility of State Significance under the SDPWO Act, the rail operator is obliged to provide third party access to the infrastructure where it is available. However it is expected that the majority of the available capacity would be utilised by the Kevin's Corner Project, which is also being developed by Hancock Galilee Pty Ltd.

The project is currently in the feasibility stage of development with the EIS being undertaken in parallel. The Coordinator General gave environmental approval subject to conditions on 29 May 2012 and the Commonwealth Minister gave approval on 23 August 2012. The project is expected to be operational by 2016.

The proposed rail facility is an option that Adani considered but is not pursuing to provide access north to the Port of Abbot Point.

8.2.3 Kevin's Corner (EPBC 2009/5033)

Hancock Galilee Pty Ltd propose to develop a 30 Mtpa thermal coal mine for the export market for a period of 30 years. The coal mine which is comprised of both open-cut and underground workings is targeting the thermal coal seams in the Upper Permian coal measures of the Galilee Basin in Queensland, Australia. The coal mine, known as the Kevin's Corner Coal Project (the project), will be situated in central Queensland approximately 110 km south-west of Clermont, 340 km south-west of Mackay and 65 km north of the township of Alpha, the nearest residential area to the Project site.

The project will consist primarily of three underground longwall operations, supplemented in the early years with two open-cut pits. It is planned that the project would link with the rail line currently being proposed as part of the Alpha Coal Rail Project.

The mine contains sufficient resources to extend the project life beyond 30 years. The overall scope of the project includes accessing and using the proposed Alpha Rail Line and expansion of the existing port facilities at Abbot Point.

8.2.4 Galilee Coal (Northern Export Facility) (EPBC 2009/4737)

Waratah Coal Pty Ltd (Waratah) proposes to establish a new coal mine in the Galilee Basin, Central Queensland, to supply thermal coal to overseas customers. The project would involve:

- Coal mine near Alpha incorporating open cut and underground techniques
- Construction of a new/upgraded railway, approximately 500 km long, to transport processed coal from the mine for export through the Port of Abbot Point
- Coal stockyards and associated transfer infrastructure within the Abbot Point State Development Area (APSDA), to link with the port through a proposed APSDA multi-user infrastructure corridor
- Major new water and power supply infrastructure

The project was declared to be a significant project requiring an EIS under the SDPWO Act and also a controlled action under the EPBC Act.

The coal will be sourced from Waratah's mining tenements near Alpha in the Galilee Basin, Central Queensland and taken by rail to the APSDA where stockyards will be established that tie in with a proposed multi-user infrastructure corridor linking industrial areas within the APSDA with the Port of Abbot Point. The coal will then be exported through the proposed Abbot Point Multi-cargo Facility (MCF), or a new jetty, berth, and conveyor of a design similar to that currently in use at Abbot Point. The EIS was publicly notified between 26 September and 19 December 2009 and the proponent is currently preparing supplementary information for submission to the Coordinator-General.

The proposed rail facility is an option that Adani considered but is not pursuing to provide access north to the Port of Abbot Point.

8.2.5 South Galilee Coal Project (EPBC 2010/5496)

AMCI (Alpha) Pty Ltd (AMCI) and Alpha Coal Pty Ltd (Bandanna Energy) are seeking to establish a new coal mine on two of their exploration tenements near Alpha in the Galilee Basin. The mine will produce up to 20 Mtpa of high volatile, low sulphur steaming coal for export to international markets. The project is referred to as the South Galilee Coal Project (SGCP).

The project will target thermal coal at depths suitable for both open cut and underground mining. Current exploration has identified a JORC compliant thermal coal resource of 982 Mt, with potential for significant additional resources. The currently proposed mine life is 43 years. A high level concept study based around the existing exploration data and confirmed reserves indicates a total mine life of 43 years with phased open cut and underground developments. Current proposed timeframe target commencement of construction in 2012, with the first shipment of coal proposed for 2014 – 2015. Public notification of the EIS is being undertaken between October and December 2012.

Open cut mining methods will be determined following further mine planning, but will involve truck and shovel, shovel and conveyor, and/or dragline options and is likely to involve a number of active pits.

Underground mining is likely to be via traditional longwall mining methods and may include multiple longwalls.

8.2.6 Goonyella to Abbot Point Rail Project (EPBC 2011/6082)

The BHP Billiton Goonyella to Abbot Point Rail Project will involve the construction and operation of a dedicated greenfield rail line and associated infrastructure from the Goonyella Riverside Mine Complex within the Bowen Basin to the Port of Abbot Point. The project is expected to enable the transport of approximately 60 million tonnes per annum of product coal to a dedicated BHP Billiton terminal at the Port of Abbot Point (Abbot Point Terminal 2 Project.

The project would commence adjacent to BMA's existing Goonyella Riverside Mine Complex approximately 24 km north-north-west of Moranbah in Central Queensland. Preliminary investigation corridors have been identified during initial project studies. The preliminary investigation corridors extend northward, bypassing the town of Collinsville, and continue to the Port of Abbot Point near Bowen, Queensland. BHP Billiton has publically stated in 2012 that this project is on hold.

8.2.7 QR National Central Queensland Integrated Rail Project (EPBC 2012/6321, 2012/6322)

The QR National Central Queensland Integrated Rail Project (CQIRP) is proposed to service the needs of the Central and South Galilee Basin providing the Basin's mines with access to the ports of Central Queensland (Abbot Point, Hay Point and Gladstone). The project is also proposed to enhanced access to Abbot Point for the expanding and new mines of the Bowen Basin (QR National, 2011).

The greenfield rail comprises three sections:

- Diamond Creek to Newlands Junction
- Central Galilee to Diamond Creek – this section is proposed to follow an alignment that is broadly consistent with that proposed by Adani Mining Pty Ltd
- South Galilee to Galilee Junction – this section is proposed to follow an alignment that is broadly consistent with that proposed by Waratah Coal

This proposal was declared a significant project on the 27 January 2012. The proposal was determined to be a controlled action requiring an EIS on 19 April 2012.

8.2.8 Abbot Point Coal Terminal 0 Project

Adani Abbot Point Terminal Pty Ltd is proposing to develop the Abbot Point Coal Terminal 0 (T0) at the Port of Abbot Point. The T0 will provide for new coal export facilities immediately adjacent to the existing Abbot Point Coal Terminal 1 facilities. The T0 will enable an initial export of 35 Mtpa and an eventual export of 70 Mtpa of coal and will comprise of onshore and offshore infrastructure, including:

- Rail in loading facilities
- Out-loading trestle jetty and conveyor
- New marine facilities extending to the east from those of T1 coal export facilities.

The development of T0 will provide capacity for the export of coal from the Carmichael Mine.

8.2.9 Port of Hay Point (Dudgeon Point Expansion)

North Queensland Bulk Ports Corporation (NQBP) is proposing to develop two new coal export terminals with a combined capacity of up to 180 Mtpa on strategic port land at Dudgeon Point in the Port of Hay Point. The project will involve:

- Two new coal export terminals
- Six rail loops and train unloading facilities
- Rail connection to Goonyella rail system
- Offshore wharf facilities for up to eight ship berths
- Dredging of approximately 11 - 15 million m^3 to create berth pockets and a departure apron for ships
- Expanded tug facilities to accommodate up to 10 extra tug and service berths

This proposal was declared a significant project requiring an EIS on 27 October 2011 under the SDPWO Act. The action was declared a controlled action under the EPBC Act on the 7 February 2012.

Adani is endorsed by NQBP as a preferred developer for one of the proposed coal terminals, which is expected to have a capacity of 60 Mtpa. This facility would be utilised by Adani to directly export coal from the Port of Hay Point via the Project (Rail) and the Goonyella rail system.

8.2.10 Summary of Relevant Projects

Table 8-3 provides a summary of the relevant projects included in the cumulative assessment.

Table 8-3 Summary of Relevant Projects

Project	Location	Project Description	Project Status (temporal boundary)
Alpha Coal Mine and Rail Project	Galilee Basin, 40 km north-west of Alpha, Central Queensland.	A 30 Mtpa open cut coal mine to be established in Alpha and a 495 km railway line to export coal through the Port of Abbot Point.	EIS approved Expected completion: 2014
Kevin's Corner Project	Galilee Basin, 360 km south-west of Mackay.	Combined open-cut and underground coal with mine an ultimate capacity of 30 Mtpa. To be located near the Alpha Township. The project will utilise the railway line constructed as part of the Alpha Coal and Rail Project to export coal through Port of Abbot Point.	SEIS currently being publicly notified Expected completion: 2014

Project	Location	Project Description	Project Status (temporal boundary)
Galilee Coal (Northern Export Facility)	Mine - Galilee Basin, near Alpha, 450 km west of Rockhampton. Railway line – from mines to the Abbot Point State Development Area near Bowen and port facility at the Port of Abbot Point.	Open cut and underground coal mines with a total of 40 Mtpa and capacity for further expansion, railway line construction and port facility within Port of Abbot Point.	EIS currently being assessed. Expected completion: 2014
South Galilee Coal Mine Project	Galilee Basin, immediately southwest of Alpha and about 160 km west of Emerald.	A 15-20 Mtpa open cut and underground coal mine.	EIS currently being publicly notified Expected completion: 2014
Goonyella to Abbot Point Rail Project	Bowen Basin, running from Goonyella Riverside Mine, approximately 24 km north-west of Moranbah to the Port of Abbot Point.	Rail line construction from the Goonyella Riverside Mine Complex to the Port of Abbot Point	EIS currently being prepared by proponent. Expected completion: 2016 (first coal transport, with progressive ramp up to full capacity in 2020-2025)
Central Queensland Integrated Rail Project	Galilee Basin	Rail line construction from Galilee Basin to Abbot Point	EIS currently being undertaken.
Abbot Point Coal Terminal 0 Project	Port of Abbot Point, near Bowen	New coal export facilities immediately adjacent to existing Abbot Point Coal Terminal 1 facilities to enable export of 35 Mtpa export of coal.	EIS currently being assessed. Expected Completion 2013
Dudgeon Point Coal Terminals Project	Dudgeon Point, in the Port of Hay Point, 25 km south of Mackay	Two new coal export terminals with a combined capacity of up to 180 Mtpa and associated infrastructure.	EIS currently being prepared Expected completion: 2013

8.3 Environmental Values

8.3.1 Land

8.3.1.1 Land Use

The five mine projects in the Galilee Basin included in this assessment will each have a direct impact upon the current land use and tenure in the Galilee Basin. While the overall proportion of land that will be transferred to mining is very small in the context of total land availability, a progressive shift from the current cattle grazing land use to a mining related land use will occur. These impacts are unavoidable due to the location of the coal deposits and should be considered in the context of demand for coal.

The construction and operation of the four rail projects included in the Study Area have the following potential impacts on land use:

- Fragmentation and intrusion of agricultural property, Good Quality Agricultural Land (GQAL) and Strategic Cropping Land (SCL)
- Potential restriction of access to mineral resources
- Opportunity for greater access to resources from third party access to the Project (Rail)

The Queensland government earlier this year announced a policy position that only two rail alignments should be pursued and approved, providing access for all projects in the area. The Project (Rail) alignment has been nominated as one of two preferred options.

8.3.1.2 Landscape Character

The five mine projects in the Galilee Basin included in the Study Area will have a direct impact upon landscape character in the area. Due to the significant distance between Project (Mine) and the other active mine projects (>100 km), the Project (Mine) is not considered to contribute to a significant cumulative impact on landscape character.

The proposed rail projects in proximity to the Project (Rail) are located in a remote region. The vegetation structure, height and form in the region are valuable in contributing to landscape character within the context of a relatively flat and featureless landscape. The four rail projects included in the cumulative impact assessment will fragment the predominantly rural (agricultural) landscape which is currently primarily used for cattle grazing and clear vegetation valuable to landscape character. Each proponent is expected to minimise vegetation clearing impacts, however fragmentation and some vegetation clearing of the land are unavoidable cumulative impacts of rail construction.

8.3.2 Nature Conservation

8.3.2.1 Terrestrial Ecology

Listed Threatened Ecological Communities

Based on current knowledge, the following two EPBC Act protected threatened ecological communities (TEC) are likely to occur or are adjacent to the Project Area (Appendix J Section 4.2):

- Brigalow (*Acacia harpophylla* dominant and co-dominant)
- Natural grasslands of the Queensland Central Highlands and the northern Fitzroy Basin

- The community of native species dependant on natural discharge of groundwater from the Great Artesian Basin (GAB)

With regard to the threatened ecological communities, the Brigalow TEC was detected across the Project Area. The Brigalow TECs was found within both the Mine and Rail Project Areas. It is estimated that 304.4 ha of Brigalow TEC will be cleared. The community of native species dependant on natural discharge of groundwater from the GAB is found approximately 10 km upstream (west) from the western boundary of the Project (Mine) Area. Natural grasslands of the Queensland Central Highlands and the northern Fitzroy Basin are present adjacent to the Rail corridor.

The Brigalow TEC is also present on the Alpha Coal Rail project (Hancock Prospecting Pty Ltd, 2010) and the Galilee Coal Northern Export Facility (Waratah Coal Pty Ltd, 2011). It is estimated that 110 ha of Brigalow will be impacted by the Alpha Coal Rail project (Hancock Prospecting Pty Ltd, 2010). Clearing areas for the Galilee Coal Northern Export Facility and Kevin's Corner Project are unknown however the TEC may be impacted.

Table 8-4 outlines the TECs under the EPBC Act predicted to occur in the Project Area and the likely cumulative impacts from projects in the Study Area.

Table 8-4 Threatened Ecological Communities

Species	Conservation Status	Likelihood of Occurrence in Project Area	Likely Project Impact	Likely Cumulative Impact
Brigalow (*Acacia harpophylla* dominant and co-dominant)	Endangered – EPBC Act	Known to Occur	326.9 ha cleared potential for significant impacts	Clearing of 110 ha for Alpha Coal Rail Project. Also present in Galilee Coal project area.
Natural grasslands of the Queensland Central Highlands and the northern Fitzroy Basin	Endangered – EPBC Act	Known to occur adjacent to the rail corridor	May be subject to indirect impacts	Clearing of 108 ha for Alpha Coal Rail Project. Also present in Galilee Coal and Kevin's Corner project areas.
The community of native species dependant on natural discharge of groundwater from the Great Artesian Basin (GAB)	Endangered – EPBC Act	Known to occur west of Mine Study Area	May be subject to indirect impacts	May be subject to indirect impacts

Within Queensland approximately 65 per cent of extant Brigalow TEC and approximately 20 per cent of extant Natural Grasslands TEC occur within protected area estates. Therefore, there is little risk of extinction of these TECs, however there is the potential for the projects in the Study Area to have a cumulative impact on the TECs through reductions in extent, diversity and abundance of these

communities and the species that utilise them. In relation to the Brigalow TEC there is potential for significant cumulative impact given:

- Clearing from multiple projects of this TEC will reduce the extent of this ecological community within the local and regional landscape
- The clearing has the potential to fragment this TEC, creating smaller patches that may be less viable
- The alteration of the landscape to mining activities will adversely affect the habitat critical to the persistence of this TEC and
- Draw down of groundwater levels may modify factors necessary for this TEC's persistence in the surrounding landscape.

In relation to the Natural Grasslands TEC, significant cumulative impacts could potentially occur on this TEC, given:

- Clearing from multiple projects of this TEC will reduce the extent of this ecological community within the local and regional landscape and
- Clearing will remove some of this TEC and will result in fragmentation of patches of this TEC

Each proponent will be required to offset for lost TECs such that an overall improvement in biodiversity is achieved. Adani has determined that it will be able to fulfil likely offset obligations.

The community of native species dependant on natural discharge of groundwater from the GAB TEC is found at the Doongmabulla Springs, a cluster of 11 springs located within a four kilometre radius of each other along the Carmichael River, approximately ten kilometres upstream (west) from the western boundary of the study area (defined as EPC 1690, EPC 1080, airstrip and mine village footprints) (Fensham pers. comm., 2012). The main threatening processes for this TEC are aquifer draw down (due primarily to uncapped bores, but also to mining activities), excavation of springs, exotic flora and fauna invasion and stock damage, access by tourism, and impoundments (Fensham *et al*., 2010). The mine projects included in the Study Area are not located within the same aquifer and therefore will not contribute cumulatively to impacts on the community of native species dependant on natural discharge of groundwater from the GAB TEC (refer Volume 2 Section 5 Nature Conservation).

Flora

Desktop and field survey findings indicate the following protected matters of national environmental significance (MNES) are predicted to occur within Project Area (Volume 2 Section 5.1 and Volume 3 Section 5):

- *Acacia ramiflora* – vulnerable EPBC Act;
- King bluegrass (*Dichanthium queenslandicum*) – vulnerable EPBC Act;

Neither of the threatened flora species predicted to occur in the Project Area from the EPBC search (*Acacia ramiflora* and *Dichanthium queenslandicum*) were detected during field investigations. As no representatives were detected it is not considered that the Project could fragment any populations, adversely affect habitat critical to the survival of these species, including for reproduction, or reduce their area of occupancy. On this basis, this Project is not expected to significantly affect either the *Acacia ramiflora* or King bluegrass (*Dichanthium queenslandicum*) threatened flora species and is

therefore not likely to significantly contribute to any cumulative impacts on the species in the Study Area.

The following EPBC Act listed threatened flora species were predicted to occur in the Project Area by the Protected Matters Search Tool or were identified in the Project terms of reference for consideration in this assessment. These species are, however, considered unlikely to occur based on their current known distribution and/or the lack of suitable habitat at the Project Area (determined based on field surveys):

- *Acacia deuteroneura* – vulnerable EPBC Act
- *Cycas ophiolitica* – endangered EPBC Act
- *Digitaria porrecta* – endangered EPBC Act
- *Eriocaulon carsonii* – endangered EPBC Act
- *Eryngium fontanum* – endangered EPBC Act
- *Lawrencia buchananensis* – vulnerable EPBC Act
- *Leucopogon cuspidatus* – vulnerable EPBC Act
- *Ozothamnus eriocephalus* – vulnerable EPBC Act

Therefore, as the Project is not expected to impact on any flora species of national significance, it is also not expected to contribute to any significant cumulative impacts on the species.

Regional Ecosystems

A total of 22 Desert Uplands Regional Ecosystems (REs) and 11 Brigalow Belt REs are within the Project (Mine) study area based on field verified RE mapping. All but one of the mapped Desert Uplands REs are classified by the *Vegetation Management Act 1999* (VM Act) as being 'least concern' – the exception is the 'of concern' RE 10.7.4. The mapped Brigalow Belt REs include three 'endangered' REs (RE 11.3.1, RE 11.4.8 and RE 11.4.9) and two 'of concern' REs (RE 11.3.3 and RE 11.4.6).

In the Project (Rail) study area a total of six Desert Uplands REs and 25 Brigalow Belt North REs are mapped. All of the mapped Desert Uplands REs are classified by the VM Act as being least concern. The mapped Brigalow Belt North REs include four endangered, eight of concern and 13 least concern REs. Seven REs with an endangered biodiversity status will be intersected by the proposed rail corridor.

The REs within the Project Area and the approximate area to be cleared by each project in the Study Area is summarised in Table 8-8. There is potential for a cumulative impact on eight Brigalow Belt REs classified by the VM Act as being 'of concern' or 'endangered' with additional area being cleared by other proposed projects in the Study Area (highlighted in orange in Table 8-5). These are RE 11.3.1, 11.3.3, 11.4.5, 11.4.6, 11.4.8, 11.4.9, 11.4.11 and 11.9.10.

Table 8-5 Regional Ecosystems within the Project Study Area

RE	VM Act class/ Biodiversity status	Short Description	Carmichael Coal Mine	Carmichael Coal Rail	Alpha Coal Mine and Rail	Kevin's Corner	Galilee Coal (Nth) Mine and Rail	Carmichael percentage
Desert Uplands REs			ha	ha	ha	ha	ha	
10.3.3	least concern/ no concern at present	*Acacia harpophylla* +/- *Eucalyptus cambageana* low open woodland to open woodland on alluvial plains.	~ 179	~ 0.3	1,576.8	1,036	55.48	6.3
10.3.3b	least concern/no concern at present	Frequently inundated areas (not wetlands or floodplains). *Acacia harpophylla* low woodland to woodland on alluvium.		~ 0.3				100.0
10.3.4	least concern/ of concern	*Acacia cambagei* low open woodland to low woodland on alluvial plains.	~ 107	~ 1.1	160.4	1	14.60	38.0
10.3.6	least concern/ no concern at present	*Eucalyptus brownii* open woodland on alluvial plains.	~ 4,068	~ 2.0				100.0
10.3.12	least concern/ no concern at present	*Corymbia dallachiana and C. plena* or *C. terminalis* open woodland on sandy alluvial terraces (eastern).	~ 198			341.8	81.42	31.9
10.3.13	least concern/of concern	*Melaleuca fluviatilis* +/- *Eucalyptus camaldulensis* woodland along watercourses.	~ 71			575.4	0.12	11.0
10.3.14	least concern/ of concern	*Eucalyptus camaldulensis* +/- *E. coolabah* open woodlands along channels and floodplains.	~ 39		417.8	1,099	5.07	2.5
10.3.28	least concern/ no concern at present	*Eucalyptus melanophloia* or *Eucalyptus crebra* open woodland on sandy alluvial fans.	~ 6,449	~ 3.3	7,534.5	559.3	154.73	43.9

RE	VM Act class/ Biodiversity status	Short Description	Carmichael Coal Mine	Carmichael Coal Rail	Alpha Coal Mine and Rail	Kevin's Corner	Galilee Coal (Nth) Mine and Rail	Carmichael percentage
10.4.3	least concern/ endangered	*Acacia harpophylla* and/or *Eucalyptus cambageana* open woodland on Cainozoic lake beds.	~ 545				13.54	97.6
10.4.5	least concern/ of concern	*Acacia cambagei* low woodland on Cainozoic lake beds.	~ 186			71.1		72.3
10.5.1	least concern/ no concern at present	*Eucalyptus similis* +/- *Corymbia brachycarpa* +/- *Corymbia setosa* low open woodland to open woodland on sand plains.	~ 3,140		174		80.31	92.5
10.5.2	least concern/ no concern at present	*Corymbia dallachiana* with or without *C. plena* open woodland on sand plains.	~ 26				12.04	68.3
10.5.4	least concern/ no concern at present	*Eucalyptus crebra* or *E. drepanophylla* open woodland on sand plains.	~ 322					100.0
10.5.5	least concern/ no concern at present	*Eucalyptus melanophloia* open-woodland on sand plains.	~ 9,974	~ 0.5	969.3	11,870	3,012.95	38.6
10.5.7	least concern/ of concern	*Grevillea striata, G. parallela* and *Acacia coriacea* low open woodland or *Corymbia terminalis* open woodland on relict sand plain.	~ 249					100.0
10.5.8	least concern/ no concern at present	*Corymbia setosa* with *Grevillea pteridifolia* +/- *Melaleuca nervosa* low open woodland on sand plains.	~ 80					100.0

RE	VM Act class/ Biodiversity status	Short Description	Carmichael Coal Mine	Carmichael Coal Rail	Alpha Coal Mine and Rail	Kevin's Corner	Galilee Coal (Nth) Mine and Rail	Carmichael percentage
10.7.2	least concern/ no concern at present	*Eucalyptus persistens* or *Corymbia dallachiana* low open woodland or *Troidia pungens* hummock grassland on ferricrete above scarps.	~ 145					100.0
10.7.3	least concern/ no concern at present	*Acacia shirleyi* woodland +/- *A. catenulata* low woodland at margins of plateaus.	~ 40		380.4	2168	5.73	1.5
10.7.4	of concern/ of concern	*Eucalyptus persistens* low open-woodland on pediments below scarps.	~ 103					100.0
10.7.5	least concern/ of concern	*Eucalyptus thozetiana* open woodland on scarps and on pediments below scarps.	~ 10			228.6	3.73	4.1
10.7.7	least concern/ no concern at present	*Melaleuca* spp +/- *Acacia leptostachya* shrubland on ferricrete (eastern).	~ 1,060		1,011	704.3	5.22	38.1
10.7.11	least concern/ no concern at present	*Eucalyptus melanophloia* low open woodland on ferricrete.	~ 4			692.5		0.6
10.9.3	least concern/ endangered	*Acacia harpophylla* +/- *Eucalyptus cambageana* open woodland to woodland on Mesozoic sediments.	~ 91			16.7		84.5
Brigalow Belt REs								
11.3.1	endangered/ endangered	*Acacia harpophylla* +/- *Casuarina cristata* open forest on alluvial plains.	~ 57	~ 11.0	24.45		1.49	72.4
11.3.3	of concern/ of concern	*Eucalyptus coolabah* woodland on alluvial plains.	~ 92	~ 46.7	15.4		0.26	89.9

RE	VM Act class/ Biodiversity status	Short Description	Carmichael Coal Mine	Carmichael Coal Rail	Alpha Coal Mine and Rail	Kevin's Corner	Galilee Coal (Nth) Mine and Rail	Carmichael percentage
11.3.5	least concern/ of concern	*Acacia cambagei* woodland on alluvial plains.	~ 459	~ 20.5		34.4	4.21	92.5
11.3.7	least concern/ of concern	*Corymbia* spp. woodland on alluvial plains. Sandy soils.	~ 55	~ 12.5			3.92	94.5
11.3.10	least concern/ no concern at present	*Eucalyptus brownii* woodland on alluvial plains.	~ 326	~ 18.4			63.12	84.5
11.3.25	least concern/ of concern	*Eucalyptus tereticornis or E. camaldulensis* woodland fringing drainage lines.	~ 182	~ 32.7			58.02	78.7
11.3.27	least concern/of concern	Freshwater wetlands.	~ 33					100.0
11.3.37	least concern/ no concern at present	*Eucalyptus coolabah* with *Eucalyptus camaldulensis* form a distinct but discontinuous woodland to low woodland canopy layer fringing drainage lines		~ 3.3			8.78	27.3
11.4.4	least concern/ of concern	Tussock grassland dominated by *Dichanthium* spp. +/- *Astrebla* spp. (mainly *A. lappacea* and *A. pectinata* on clay plains.		~ 23			24.18	48.7
11.4.5	of concern/ endangered	*Acacia argyrodendron* on undulating plains		~ 3.5			6.2	36.1
11.4.6	of concern/ endangered	*Acacia cambagei* woodland on Cainozoic clay plains.	~ 150	~ 20.7	0.68		4.21	97.2
11.4.8	endangered/ endangered	*Eucalyptus cambageana* woodland to open forest with *Acacia harpophylla* or *A. argyrodendron* on Cainozoic clay plains.	<1	~ 2.5	25.45		54.72	4.2

RE	VM Act class/ Biodiversity status	Short Description	Carmichael Coal Mine	Carmichael Coal Rail	Alpha Coal Mine and Rail	Kevin's Corner	Galilee Coal (Nth) Mine and Rail	Carmichael percentage
11.4.9	endangered/ endangered	*Acacia harpophylla* shrubby open forest to woodland with *Terminalia oblongata* on Cainozoic clay plains.	~ 210	~ 23.9	51.55		4.36	80.7
11.4.11	of concern/ of concern	*Dichanthium sericeum* and *Astrebla* spp. grassland with patches of low *Acacia harpophylla* or *Eucalyptus coolabah* on Cainozoic clay plains		~ 128.1			7.43	94.5
11.5.3	least concern/ no concern at present	*Eucalyptus populnea* +/- *E. melanophloia* +/- *Corymbia clarksoniana* on Cainozoic sand plains/remnant surfaces.	~ 17	~ 71.8			363.86	19.6
11.5.9c	least concern/ no concern at present	*Eucalyptus crebra* and/or *Eucalyptus melanophloia* woodland on Cainozoic sandplains		~ 33.8			189.9	15.1
11.7.2	least concern/ no concern at present	Monospecific stands of *Acacia* spp. forest/woodland on Cainozoic lateritic duricrusts.		~ 2.4			103.49	2.3
11.9.10	of concern/ endangered	*Eucalyptus populnea* woodland on Cainozoic to Proterozoic consolidated, fine-grained sediments		~ 1.4	4.95		6.27	11.1
11.10.3	least concern/ no concern at present	*Acacia catenulata* and/or *A. shirleyi* low open-forest to open-forest on crests and ridge tops formed on consolidated, medium to coarse-grained sediments		~ 1.1			22.79	4.6

Note: RE highlighted in orange are expected to contribute to cumulative impacts

Each proponent will be required to offset the residual impacts on endangered and of concern regional ecosystems under the Biodiversity Offset Policy (DERM 2011).

Listed Threatened Fauna

The desktop assessment (Volume 2 and 3, Section 5), indicated that a number of EPBC Act listed threatened fauna species have been previously recorded or are predicted to occur within the desktop search extent encompassing the Project Area. Of these, three were confirmed present during field surveys:

- Black-throated finch (southern) (*Poephila cincta cincta*)
- Squatter pigeon (southern) (*Geophaps scripta scripta*)
- Koala (*Phascolarctos cinereus*)

The likelihood of occurrence assessment indicated that the following EPBC Act listed threatened fauna species are likely to occur at the Project Area, based on distribution (including modelled distribution (DSEWPaC, 2011b)) presence of potentially suitable habitat and previous records from the region:

- Ornamental snake (*Denisonia maculata*)
- Yakka skink (*Egernia rugosa*)

Trapping for ground-dwelling reptiles, opportunistic searches and spotlighting surveys failed to detect the threatened reptiles listed above. It is recognised that these are cryptic species, and as such, failure to detect them is not indicative of their absence from the Project Area. Rather, it is considered likely that these species occur at the Project Area, based on their known distribution, the presence of suitable habitat and the fact that they have been previously recorded within approximately 50 km of the Project Area.

Black-throated Finch (Southern)

The black-throated finch (southern) is listed as endangered under the EPBC Act. This small grass-finch has experienced a large decline in range in recent decades (SEWPAC, 2011kd). Where it was once previously found throughout eastern and central Queensland north of the New South Wales border, it is now only known from the Townsville region and scattered sites in central Queensland (SEWPAC, 2011d). The extent of occurrence of the species (i.e. *Poephila cincta*) has declined by approximately 80 per cent since the 1980s, with the majority of this decline in the range of the endangered southern subspecies (SEWPAC, 2011d).

Habitat utilisation beyond the Project study area will be largely based upon the degree of connectivity/fragmentation of potential habitat patches, and the presence of the three critical habitat resources required by the subspecies (mosaic of native grasses, nesting trees and access to water). No surveys have been undertaken to identify whether the black-throated finch (southern) is utilising habitats in the landscape outside the Project Area. The subspecies has been recorded (post-1998) by the Black-throated Finch Recovery Team (2004) within approximately 10-20 km of the study area (at Doongmabulla Station) (SEWPAC, 2011d).

A total of 11,419 ha of the 26,044 ha of identified black-throated finch (southern) important areas is proposed to be impacted by vegetation clearing over the life of the Project. It is possible that the subspecies may disperse away from the developed parts of the Project Area, either to suitable,

undisturbed habitat within other parts of the Project Area, or to potentially suitable habitat in the landscape to the north, west and south of the Project Area. Preservation and enhancement of the corridor along the Carmichael River may compensate for some of the habitat loss, and facilitate dispersal of the subspecies in the local landscape.

A significant, unmitigated impact to the black-throated finch (southern) is predicted to occur as a consequence of the Project. Based on the (currently available) information (acquired from desktop and field studies) and in consideration of DEWHA (2009), it is considered that the Project Area, in particular the Project (Mine) Area, does support a 'population' of the black-throated finch (southern), noting that a 'population' of an (EPBC Act) endangered species is defined in the Significant Impact Guidelines as:

- *A geographically distinct regional population, or collection of local populations, or*
- *A population, or collection of local populations, that occurs within a particular bioregion* (DEWHA, 2009).

Given the presence and prevalence of the black-throated finch (southern) in the Project Area, and given mining activity is expected to remove and extensively degrade large tracts of habitat for this endangered species, the Project has the potential to significantly impact upon this subspecies if mitigation is not provided. As a consequence of habitat losses to mining, and direct impacts, significant impacts to the black-throated finch (southern) are expected to occur. Further, works may interfere with the species recovery by decreasing the availability or quality of habitat to the extent that the species is likely to decline.

The black-throated finch has the potential to be cumulatively impacted by other projects in the Study Area. There is potential habitat within the Alpha Coal Project, Galilee Coal (Northern Export Facility) and Kevin's Corner Project to be removed. This increased pressure on black-throated finch habitat in the Study Area is likely to exacerbate the potential significant impact from the Project.

Each proponent will be required to provide offsets in accordance with Commonwealth and State policies for these unavoidable impacts on habitat.

Squatter Pigeon (Southern) (Vulnerable EPBC Act)

The squatter pigeon (southern) is a ground-dwelling pigeon, listed as vulnerable under the EPBC Act. This species' distribution extends from central Queensland as far north as the Burdekin-Lynd divide to the south-east of the state (SEWPAC, 2011c). At present the total population size of the squatter pigeon (southern) is estimated to be around 40,000 breeding birds, with both the extent and the population size considered to be stable (SEWPAC, 2011c). The squatter pigeon (southern) is locally abundant at some locations in the northern part of its current distribution and is considered to be common in cattle grazed country north of the Tropic of Capricorn (DSEWPaC, 2011c).

Three main threats to the squatter pigeon (southern) consist:

- Loss of habitat due to clearing for agricultural or industrial purposes
- Degradation of habitat by grazing herbivores
- Excessive predation, particularly by foxes and cats (SEWPAC, 2011c)

The presence of potentially suitable habitat extends beyond the Project Area and suggests that the squatter pigeon (southern) is likely to be present in much of the wider landscape, particularly to the west where remnant vegetation dominates the landscape. However, much of the landscape

surrounding the study area is dominated by non-remnant vegetation with fragmented remnant vegetation often restricted to watercourses.

The Squatter pigeon has been observed at the Alpha Coal (Hancock Prospecting Pty Ltd, 2010) and Kevin's Corner project areas (Hancock Prospecting Pty Ltd,) indicating the presence of suitable habitat. Therefore an overall reduction in the regional availability of habitat for the subspecies will occur as a result of the projects, however, squatter pigeon habitat is quite widespread through the region. It is possible that the subspecies may disperse away from the developed parts of the Study Area, to suitable habitat within other parts of the Study Area. Each proponent will be required to provide offsets in accordance with Commonwealth and State policies for unavoidable impacts on habitat.

Koala

The Koala (combined populations of QLD, NSW and ACT) (vulnerable EPBC Act, special least concern NC Act) is a tree dwelling marsupial that has a widespread distribution in both coastal and inland environments (DSEWPaC, 2012b). The koala's diet is typically restricted to foliage of *Eucalyptus spp*. or related genera. However, the diet of individual koalas is usually limited to obtaining most of their nutrition from one or a few tree species present at a site. Species-level preferences may also vary between regions or seasons (DSEWPaC, 2012b). Female koalas can potentially produce up to one offspring a year, giving birth between October and May, however research indicates that breeding averages are more likely to range between 0.3-0.8/year (DSEWPaC, 2012b).

One koala was recorded on one occasion during spotlighting within the south-eastern part of the Project Area (EPC 1080 Study Area) during the Spring 2011 survey. This individual was recorded within an open eucalypt woodland environment representing the '*Ironbark-box grassy woodlands and open woodlands on grey sand plains'* habitat type within the Project Area.

The koala is considered to have 'scattered populations throughout Queensland' and no defined 'important populations' have been listed by DSEWPaC (2012b). With respect to the Significant Impact Guidelines (DEWHA, 2009c), it is not considered that the occurrence of a koala at the Project Area defines it as part of an 'important population' (of an EPBC Act listed vulnerable species). Based on the low estimated density of koalas within the Brigalow Belt and the availability of similarly suitable habitat in the landscape surrounding the Project Area, it is not considered that the Project Area represents *habitat critical to the survival of the species.*

Listed Migratory Fauna

A desktop and field assessment was undertaken to identify EPBC Act listed migratory species that have the potential to occur within the Project (Mine) and Project (Rail) Areas. Three species, eastern great egret (*Ardea modesta*), rainbow bee-eater (*Merops ornatus*) and satin flycatcher (*Myiagra cyanoleuca*) were confirmed present within the Study Area. An additional 11 species are considered likely to occur while four species may occur (Volume 2 and 3, Section 5).

The potential cumulative impacts that are relevant to migratory species include:

- Degradation of terrestrial and aquatic habitat adjacent to and downstream of cleared areas
- Disturbance as a result of increased exposure to light, noise, dust, vehicles and people
- Spread of introduced weeds

- Degradation of aquatic habitats as a result of runoff or an altered catchment landscape
- Mortality as a result of train and maintenance vehicle strikes or interaction with powerlines
- Clearing of land (vegetation clearing) and changes to topography
  - Loss of fauna habitat (roosting, shelter, foraging, breeding) for native fauna including conservation significant fauna
  - Fauna mortality
  - Habitat degradation (i.e. erosion of surface soils, degradation of water quality)
- Disturbance of surface watercourses and removal of watercourses and waterbodies
  - Loss of habitat for species
  - Alteration/degradation of water quality
- Alteration in groundwater regime
  - Changes to terrestrial habitat due to groundwater drawdown
  - Changes to surface water flows and aquatic habitat availability as a result of groundwater drawdown
- Introduction of pest and weed species
  - Competition with native species, predation of native specie
  - Habitat degradation (presence and prevalence of pest and weed species) and reduction in resource availability
- Alteration to air quality and noise environs from altered exposure to disturbance
  - Disturbance to roosting and foraging areas
  - Habitat degradation from dust settling

It is recognised that a cumulative unavoidable loss of habitat for migratory species will occur across the project sites. Alternative habitat suitable for these species exists adjacent to the Project Area and within the region, however whilst the Project is not predicted to have a significant impact on migratory species a potential significant cumulative impact on migratory species cannot be ruled out without further information in regards to each proposed projects' impacts, information which is not available at time of completing of this assessment..

8.3.2.2 Aquatic Ecology

The Project (Mine) is in a different water catchment and is also located over 100 km from the other mines in the region. Therefore, the Project (Mine) is not expected to contribute to cumulative aquatic ecology impacts.

The Project (Rail) has the potential to interact with the Alpha Coal Project (Rail) and the Galilee Coal Northern Export Facility (Rail). The potential cumulative impacts on aquatic environmental values include:

- loss of aquatic habitat
- fauna mortality
- alteration to in-stream and floodplain hydrology
- increased sedimentation, run-off and dust

- light, noise and vibration disturbance
- increase in abundance and diversity of introduced species

Each proponent is expected to implement standard control measures to minimise the above potential impacts and thus no significant cumulative impact is predicted. Alteration to hydrology is discussed in Section 8.3.3.1 below.

No areas of Ramsar wetland are predicted to be impacted by this Project. The closest Ramsar wetland is 380 km from the site disconnected from the Project Area by substantial barriers. Therefore the Project will not contribute to any cumulative impacts on Ramsar wetlands.

8.3.3 Water Resources

8.3.3.1 Surface Water

The Project (Mine) Study Area is located within the Carmichael River catchment which is a sub-catchment of the Belyando River within the Burdekin River Basin. The southern Galilee projects are also located within the Burdekin River Basin.

Extractions from the Belyando River, associated with the offsite water supply infrastructure, have the potential to result in a cumulative impact. Modelling undertaken as part of the surface hydrology assessment showed that all required Water Resource Plan Environmental Flow Objectives were met under operational conditions including extractions for the Project (Mine), therefore within the acceptable threshold for impact.

The Supplementary EIS for the Alpha Coal Project indicates a reduction of -0.4 per cent in baseline median flows in the Belyando River at the Gregory Developmental Road (Hancock 2011). The Supplementary EIS for the Alpha Coal Project states that no adverse water quality impacts are expected as a result of the project based on best practice management being implemented for the control of discharges (Hancock 2011). Similar information is not available from other projects.

These changes are within environmental flow objectives and well within the natural fluctuations in flow of this river.

The Project (Rail) has the potential to interact with the Alpha Coal Project (Rail), the Galilee Coal Northern Export Facility (Rail) and the Central Queensland Integrated Rail Project. It is likely that only one of these rail lines will proceed. Adani is in discussion with these proponents in regards to the design of grade separated crossings and will incorporate design measures to minimise cumulative impacts on hydrology and surface water in the area.

At the current stage of project development (concept design), the Project (Rail) has not adopted specific bridge lengths. As such the magnitude of any afflux, and its impacts on farm roads and other floodplain assets, is defined as a range (Volume 3, Section 6.1). On this basis, flood modelling and analysis will continue to be undertaken at a subsequent stage of project development. Cumulative interactions will be taken into account at this stage and it is expected that a design solution can be developed that will avoid significant exacerbation of afflux or flooding extent.

8.3.3.2 Groundwater

The Project (Mine) is in a different aquifer from the other mines in the southern section of the Galilee Basin. The proposed, Alpha Coal Project and Kevin's Corner Coal Project, located within the Galilee

Basin target coal seams of the Colinlea Sandstone. This Permian age unit and the overlying Permian Bandanna Formation occur below the younger Triassic age Great Artesian Basin (GAB). The Alpha Coal Mine Supplementary EIS conclude that the impacts of mine dewatering on the Rewan Group and ultimately to the Clematis Sandstone resulting from that Project are negligible (Hancock Coal Pty Ltd 2011). The Kevin's Corner Supplementary EIS concludes that projected groundwater levels below the GAB Rewan Formation and Clemetis Sandstone units do not indicate any potential for induced flow which would result in dewatering of GAB units over the life of the mine (Hancock Coal Pty Ltd 2012). Therefore the Project (Mine) is not expected to contribute to cumulative groundwater impacts associated with these projects.

To the north of the Project is the China Stone (MacMines) project. Given this project's proximity, there is potential for cumulative impacts to occur with this project. However given the limited information currently available in regard to this project and that it is yet to complete an EIS the extent of potential impact cannot be established. The terms of reference for the China Stone project require it to consider cumulative impacts.

The Project (Rail) has the potential to interact with the Alpha Coal Project (Rail), the Galilee Coal Northern Export Facility (Rail) and the Central Queensland Integrated Rail Project. It is likely that only one of these rail lines will proceed. Adani is in discussion with these proponents in regards to the design of grade separated crossings and will incorporate design measures to minimise cumulative impacts on groundwater in the area.

The greatest potential for any impact to groundwater is in the vicinity of shallow alluvial aquifers, mostly found near major creeks and rivers, which could be impacted by temporary dewatering for rail construction activities. Potential operational impacts may result in retention of water (pooling/ponding, water logging) from embankment infrastructure thereby locally increasing groundwater levels.

Extraction of groundwater for supply purposes, either during construction or in operational phase, is likely to be limited and alternative sources of water supply may be available. Work on the rail lines will primarily consist of minor cut and fill activities and sourcing of construction materials (possibly quarrying of rock and borrowing of sand). Deeper disturbances of the ground may occur at creek and river crossing where piles for bridge structures and culverts may be required and hence depending on the construction method temporary dewatering may be necessary.

For the Project (Rail), no significant cumulative impacts on groundwater resources and groundwater quality are expected given:

- No long-term lowering of groundwater levels due to construction dewatering activities is anticipated
- The majority of the Project (Rail) area does not contain well developed or extensive alluvial aquifers. Groundwater in the area is therefore not considered threatened or vulnerable as a resource.
- Outside of the main river corridors groundwater and surface water connectivity is thought to be limited

Similarly, no significant long term cumulative impacts on groundwater resources and groundwater quality are anticipated during operation of the Project (Rail) given that:

- It is expected that only a small number of shallow cuttings will be required for each rail line and hence there will be no significant permanent lowering of groundwater levels due to drainage of cutting areas
- River crossing points are expected to be designed by each proponent such that compaction of alluvial sediments and upstream ponding of surface water flow is minimised

8.3.4 Air

8.3.4.1 Air Quality

The assessment of air quality impacts presented in this EIS indicates that air quality objectives can be met at all sensitive receptors surrounding the proposed mine and rail. Development of coal mines over 100 km from the Project (Mine) are too far away geographically to interact cumulatively with the Project (Mine) in terms of impacts on air quality during construction and operation. It is assumed that individual proponents will implement standard dust control measures. The proposed China Stone project is just to the north of the proposed Carmichael Coal Mine, however there are no sensitive receptors in this area that might be affected by cumulative dust impacts.

The operation of multiple rail lines may have cumulative impacts on air quality due to increased coal dust emissions. However, significant cumulative impacts are not considered likely assuming individual proponents implement standard dust control measures during construction and operation.

8.3.4.2 Greenhouse Gas Emissions

Table 8-6 outlines the average greenhouse gas (GHG) emissions predicted for each project in the Study Area. The total GHG emissions for projects in the region for which emissions data is available is 13.0 MtCO2-e per annum. The Project's contribution to cumulative greenhouse gas emissions is considered to be of low significance.

Table 8-6 Greenhouse Gas Emissions

Project	Greenhouse Gas Emissions Average Emissions (t CO2-e / yr)	
Carmichael Coal Mine and Rail Project	Mine	2,286,000
	Rail	637,000
Alpha Coal Mine and Rail Project	Mine	2,036,006
	Rail	280,000
Kevin's Corner Project	Mine	2,019,637
Galilee Coal (Northern Export Facility)	Mine	2,304,495
	Rail	3,437,475
South Galilee Coal Mine Project	Mine	Not publically available
Goonyella to Abbot Point Rail Project	Rail	Not publically available
Total		**13,000,613**

8.3.5 Noise and Vibration

Construction and operation of the Project (Mine) will not contribute cumulatively to noise and vibration impacts from other mines in the Study Area due to the separation distance between the mines (100 km in most cases) and because there are no noise sensitive receptors between the proposed China Stone project and the proposed Carmichael Coal Mine.

Noise and vibration impacts during construction and operation of the Project (Rail) have the potential to interact cumulatively with other proposed rail lines in the Study Area. The Project (Rail) and its interactions with other rail projects would occur in a remote region and there are limited sensitive receptors with the nearest identified sensitive receptor in relation to the Project (Rail) approximately 1.6 km away (homestead).

Rail Construction activities, such as civil works including: earthworks, drainage construction, haul road and access track construction, maintenance and bridgework construction as well as track construction including: track laying, signalling installation and communications installation; have the potential to adversely impact on noise sensitive receptors through:

- Disturbance to sleep, social activities and/or work or study activities
- Disturbance of native fauna and livestock

Given the separation distance between construction work and the nearest sensitive receptors it is unlikely that the Project (Rail) will contribute cumulatively to any adverse noise impacts during construction works. It is expected that each proponent will take reasonable and practical measures to mitigate noise during construction to minimise unreasonable noise.

Potential noise impacts arising during the operational phase may include: disturbance to sleep, social activities and work activities; and disturbance to livestock and native fauna. Potential vibration impacts arising during the operational phase may include: disturbance to sleep, social activities and work activities.

The Project (Rail) assessment indicates that rail noise levels from the proposed corridor are expected to meet the 65dB(A) $L_{Aeq,24hrs}$ and 87dB(A) L_{max} noise targets at all identified sensitive receptors. Similarly, operational vibration targets will readily be met at all identified receptors (Volume 3, Section 9).

Should all proposed projects proceed, there could be a possible magnification of potential noise and vibration impacts where the Project (Rail) intersects with the proposed Galilee Coal (Northern Export Facility) and the proposed Alpha Coal (Rail) Project. However, given the distances to the nearest sensitive receptors at these proposed intersections, it is unlikely that the Project (Rail) will contribute cumulatively to any adverse noise or vibration impacts during operation.

8.3.6 Waste

8.3.6.1 General

There will be a cumulative impact on waste disposal facilities in the region where the Project utilises the same waste disposal facilities as the other projects in the Study Area (Moranbah and Mackay Regional Waste Management Facility). It is expected that each proponent will comply with the *Waste Reduction and Recycling Act 2011* and Waste Reduction and Recycling Strategy 2010–2020 thus minimising impact on the regional waste disposal facilities.

8.3.6.2 Potentially Acid Forming Waste

A small proportion of the Project (Mine) waste would be expected to be potentially acid forming (PAF) and have more than a very low capacity to produce acid. Some minor proportion of excavated materials may leach metals and potentially have an impact on receiving waters. The coal product and weathered coal would be expected to be non-acid forming (NAF) however the coal coarse and fine rejects could be potentially acid forming. With appropriate mitigation measures in place it is not expected that these acid drainage waste impacts would cause any impacts beyond the mine boundary.

8.3.7 Traffic and Transport

8.3.7.1 Road

Potential cumulative negative impacts on roads, traffic and safety include:

- Traffic disruption along the Gregory Developmental Road, Peak Downs Highway (from Mackay), and the Flinders Highway (from Townsville) during construction
- Increased traffic during mine operations on the Gregory Developmental Road, including safety of tourist traffic not familiar with large heavy vehicles on narrow roads
- Increased maintenance requirements on local and state roads as a result of mine construction and operation
- Delays to traffic, including emergency services as a result of level crossings along the rail corridor
- The construction of level crossings along the route may result in potential conflicts between rail and road traffic that will need to be managed by the installation of appropriate safety warning measures. These level crossings may result in delays to emergency services, school bus routes, stock movements (vehicle and foot), and local traffic.

The peak traffic generation during the construction phase of the Project is likely to be associated with the transporting of plant, equipment and material deliveries. The main traffic generated through the operation phase will be from plant, equipment and material deliveries. This traffic will impact on the Flinders Highway and Gregory Developmental Road. The State road network will be cumulatively impacted from the construction and operation of multiple mines and rail lines concurrently. The estimated traffic generated by the Project (Mine) operations is likely to exceed the threshold of a five per cent increase in annual average daily traffic along Flinders Highway and Gregory Developmental Road (Volume 2, Section 11 Transport). Adani will consult with Department of Transport and Main Roads (DTMR) to establish how this should be managed and to identify mitigation measures. It is expected that other proponents will be having similar discussions which will enable DTMR to identify appropriate measures to mitigate cumulative road transport impacts.

8.3.7.2 Rail

It is understood that the additional trains associated with the Project (Mine) production can be accommodated on the existing rail network in conjunction with the Project (Rail), subject to planned capacity upgrades proposed by QRN.

During operation the Project (Rail) may interact with each of the three rail lines in the Study Area over time. Adani will discuss the operation and crossing design with these proponents and the design and

operation constraints will be determined to minimise any potential cumulative impacts on the rail network.

8.3.7.3 Air

Cumulative capacity demands on regional airports will be experienced during construction of the mine and rail projects in the Study Area. Domestic and regional airports and local airstrips that could potentially be affected are located at:

- Townsville (International)
- Mackay (Domestic)
- Proserpine (Domestic)
- Emerald (Regional)
- Moranbah
- Clermont
- Bowen
- Collinsville

The airstrip for the Project (Mine) is scheduled for completion in 2014 and will facilitate the movement of personnel during the construction phase and prior to the operational phase of the mine. This will alleviate the Project's contribution to cumulative demand on the domestic and regional airports and local airstrips.

8.3.8 Cultural Heritage

8.3.8.1 Non-Indigenous Cultural Heritage

Searches of relevant databases for within and around the Project Area identified two areas of national heritage significance (Volume 1, Section 7). The Great Barrier Reef (also listed as a World Heritage Place) and the Tree of Knowledge. Both these places are in excess of 200 km from the Project Area.

Impacts to the Tree of Knowledge will not occur as part of the Project. The Great Barrier Reef is downstream of the Project Area via the Belyando River and not expected to be impacted by the Project. The Project is not expected to impact matters of state heritage significance. Where items of archaeological importance are identified during construction or operation of the Project the procedures identified in the Queensland Government publication Onsite Procedures for Historical Archaeology will be implemented. As the Project is not expected to impact on non-indigenous cultural heritage, no cumulative impacts are predicted.

8.3.8.2 Indigenous Cultural Heritage

Table 8-7 outlines the indigenous parties and native title claims affected by the projects included in the cumulative impact assessment. The Project (Mine and Rail) affects four native title/Aboriginal Party areas. Two of these parties will be cumulatively impacted (the Wangan and Jagalingou People and the Jangga People) by multiple projects occurring in the Galilee Basin. This impact is likely to result in increased pressure on Aboriginal parties to respond to requests for involvement (surveys, advice etc.). If construction activities requiring the involvement of Aboriginal Parties coincide for

multiple projects, the pressures on these groups to respond to requests for involvement may be significant.

Table 8-7 Indigenous Parties and Native Title Claims for Cumulative Assessment Projects

Project	Aboriginal Parties	Native Title Claim No.
Carmichael Coal Mine and Rail Project	Wangan and Jagalingou People	QUD85/04
	Jangga People	QUD6230/98
	Barada Barna Kabalbara & Yetimarla People	QUD6023/01
	Barada Barna People	QUD380/08
Alpha Coal Mine and Rail Project	Wangan and Jagalingou People	QUD85/04
	Jangga People	QUD6230/98
	Birri People	QUD6244/98
Kevin's Corner Project	Wangan and Jagalingou People	QUD85/04
Galilee Coal (Northern Export Facility)	Wangan and Jagalingou People	QUD85/04
	Jangga People	QUD6230/98
	Birri People	QUD6244/98
South Galilee Coal Mine Project	Bidjara 3	QC97/49
	Wangan & Jagalingou People	QC04/6
	Wangan/Jagalingou People	QC05/4
Goonyella to Abbot Point Rail Project	Unknown	

8.3.9 Social and Community

The Galilee Basin is at present dominated by pastoral farming serviced by a number of towns with long histories of settlement. With a number of mines proposed in the Galilee Basin, the landscape of the area is going to change considerably in the coming years. Some of the largest coal mines in Australia are potentially going to be within the Galilee Basin.

The projects included in the cumulative impact assessment have the potential to provide a substantial economic contribution to the local, district, regional, state and national economy through employment, population growth, business growth, increase in incomes, and other socio-economic benefits. There is also considerable potential for substantial contribution to the local communities within the area, particularly at Clermont. Potential adverse effects from increased traffic, higher costs of living in local areas, an ever expanding gap between those employed in the mining sector and those who are not (the 'two-speed' economy), pressures on emergency and social services and impacts on pastoral

farming activities, many of which are multi-generational businesses may also occur and it is necessary to implement measures to balance these with potential benefits.

8.3.9.1 Housing and Accommodation Demand

It is likely that the cumulative effects of mining development will exacerbate shortages in housing supply and decrease housing affordability leading to higher living costs for everyone, particularly affecting those not employed in the mining sector. With the continuing development of the Galilee Basin there are likely to be increasing demands on some communities for short term accommodation (hotels, motels, caravan parks, etc.). Clermont and Moranbah already have very high occupancy rates for short term accommodation and increasing mining investigation and development is likely to justify the development of more short term accommodation in these communities.

Housing prices in the region along with rental costs have increased as a result of demands from mining activity as discussed in the social impact assessment (Volume 4, Appendix F- Social Impact Assessment Report). There is a strong desire from local communities to attract workers and their families into the community however land development in Clermont in particular is slow and there is a perceived lack of living options to attract workers and their families to town. A shortage of emergency (social) housing, especially in Moranbah, is creating stress on families and social services with an increasing number of new mine developments expected to place even more pressure on emergency housing. Adani will be working with Isaac Regional Council and the Isaac Region Affordable Housing Trust to address the issue of affordable housing in a collaborative way with other organisations. Other proponents undertaking resource sector projects in the IRC will also engage on these matters which then provides an opportunity to address cumulative impacts.

The construction and operation of the Project (Mine) will not contribute significantly to cumulative social impacts in surrounding regional towns as construction workers will be accommodated in a permanent workers accommodation village accommodating up to 3,000 people in a 2,000 bed camp, immediately east of the Mine site. This will be a fully self-contained village providing accommodation, recreational, security and medical facilities for workers. As the Project (Mine) construction and operation workforce is located outside of existing communities it is unlikely it will contribute to cumulative impacts associated with changed demographics (single male population) including increased community concern over potential anti-social behaviour and changed perceptions of safety.

The construction of the Project (Rail) will involve series of temporary construction camps to accommodate workers, other support services, visitors and capacity contingency. The majority of the operational rail personnel are likely to be based out of Bowen and Mackay and will work shifts to the Mine where they will rest before returning via Dudgeon Point Coal Terminal or Abbot Point Coal Terminal. As most of the operational personnel are likely to be based in Mackay or Bowen, a fly-in-fly-out (FIFO) workforce is not anticipated. Rail crew will work shifts to the Mine site, where they would stay before returning to the coast on another shift.

Multiple construction camps could add additional pressure to existing emergency services and inflationary pressure from increased demand for goods and services may increase the cost of living. However, the construction of projects included in the cumulative impact assessment will also generate a number of opportunities for local and regional businesses and it is likely that businesses will be impacted positively through increased opportunity to expand and or diversify.

8.3.9.2 Landholders and Amenity

The cumulative impacts of the projects will result in land currently utilised for agricultural purposes being converted to mines or rail lines. Some landholders will have their property (or properties) split by projects which will, for some, necessitate new property management practices, during both construction and operation. Often the use of land for a mine or rail corridor is considered by landholders to be 'sterilising' the land. Potential negative impacts on landholders and amenity include:

- Changes to the living environment from increased noise and dust and reduced visual amenity
- Changes to the natural environment from changes to overland flow paths with potential for increased ponding
- Disruption to cattle operations and increased labour requirements
- Increased fire risk along the rail corridor

8.3.9.3 Capacity of Social Services and Infrastructure

Potential impacts on social services and infrastructure include:

- Increased demands on emergency services, including police, as well as health and education services as a result of an increased population
- Increased demands on social services to respond to the needs of the FIFO population
- Reduced participation rates in community service groups, sports clubs and volunteer organisations

Landholders impacted by the Project will be compensated for any loss of productivity, inconvenience and other issues through compensation agreements that are to be negotiated. It is expected that other proponents will also provide compensation to landholders. Adani will work with each landholder to understand the potential impacts, identify suitable mitigation measures and develop appropriate compensation packages. Adani has developed a number of management and mitigation measures and made several commitments in order to address both the positive and negative potential social and community impacts of the Project. These measures need to be carefully developed in collaboration with many other organisations, agencies and individuals in order to manage and mitigate cumulative impacts.

8.3.10 Economics

Table 8-8 shows the capital expenditure for each project in the Study Area and the estimated job generation during construction and operation. There will cumulatively be $649.4 billion spent during construction of the projects and 17,763 full time equivalent jobs will be generated. This job creation will be ongoing with an estimated 9,990 jobs created during operation.

Table 8-8 Expenditure and Job Generation

Project	Capital Expenditure (billion)	Construction jobs generated (fte)	Operational jobs generated (fte)
Carmichael Coal Mine and Rail Project	Rail $1.2 Mine $21.5	2,649 at peak 3,000	1,161 at peak 2,366

Project	Capital Expenditure (billion)	Construction jobs generated (fte)	Operational jobs generated (fte)
Alpha Coal Mine and Rail Project	Rail $2.8 Mine $4.2	2,680 1,060	225 2,300
Kevin's Corner Project	$6.9	2,500	1,500
Galilee Coal (Northern Export Facility)	$8.3	1,874	1,098
South Galilee Coal Mine Project	$1.5	2,000	750
Goonyella to Abbot Point Rail Project	Unknown	2,000	500
Total	**$46.4**	**17,763**	**9,900**

The potential of the projects in the Study Area to produce significant positive impacts on the economies is substantial. However, construction of multiple large projects simultaneously will require an influx of workers to the Galilee Basin region. This pressure from large resource projects can push demand well ahead of supply for a range of goods and services, leading to localised inflation. Those who remain outside the coal and transport industries or industries servicing coal export can be disadvantaged because of a wide range of affordability issues (e.g. higher costs and poor availability of services, and a loss of skilled labour to sectors offering much higher remuneration).

In order to ensure the range and extent of positive economic impacts can be achieved, a number of negative impact mitigation measures should be put in place, it is expected that each proponent will work to implement these strategies. Such strategies include the Indigenous Employment and Training Strategy and the Mackay Isaac and Whitsunday Regional Plan (Volume 1, Section 8). The strategies aim to increase local participation of regional and Queensland based industry as well as encouraging the participation and up-skilling of disadvantaged groups such as indigenous communities and the disabled. Such strategies will require assessment frameworks to be developed that should include a mix of project specific indicators as well as quantitative statistics well proven in tracking the success of strategies and policies.

8.4 Project's Contribution to Potential Cumulative Impacts

Table 8-9 provides details of the Project's contribution to cumulative impacts. This assessment is based on residual impacts.

Table 8-9 Significance Assessment

Environmental Value	Land Use	Landscape Character (Rail)	Terrestrial Ecology	Aquatic Ecology	Surface Water	Groundwater	Air Quality	Greenhouse Gas	Noise (Rail)	Waste	Traffic and Transport	Cultural Heritage (Indigenous)	Cultural Heritage (Non- Indigenous)	Social and Community	Economics
Probability of impact	3	3	3	1	1	1	1 1 1			2	2 2 1			2	3
Duration of impact	3	3	3	2	3	3	1 3 2			2	2 2 1			3	2
Magnitude / Intensity of impact	2	2	2	1	1	1	1 1 1			1	2 1 1			2	2
Sensitivity of receiving environment	1	1	2	2	3	3	1 1 1			1	1 2 1			1	2
Total	**9**	**9**	**10**	**6**	**8**	**8**	**4**	**6**	**5**	**6**	**7**	**7**	**4**	**8**	**9***
Impact Significance	Medium	Medium	High	Low	Medium	Medium	Low	Low	Low	Low	Medium	Medium	Low	Medium	Medium

Note: *Economics is a positive impact

8.5 Consequential Impacts

Consequential impacts arise where a project may create a requirement for additional development.

Due to existing capacity restrictions on coal exports and the over-subscription to new export capacity currently in the project pipeline, the development of a new coal export terminal is likely to be required for the export of the Project coal, along with upgrades to existing rail networks. The relevant projects included are:

- Abbot Point Terminal 0 Project (EPBC 2011/6194)
- Port of Hay Point (Dudgeon Point Expansion) (EPBC 2012/6240)
- Goonyella to Abbot Point Rail Project (EPBC 2011/6082)

Approval requirements at Federal, State and Local levels will apply to any such proposals and they will require examination of potential impacts in the application stage and imposition of approval conditions by relevant administering authorities. On this basis, adequate controls are considered to be in place to identify and manage impacts from development that may by consequential to the Project.

In addition, the Project (Rail) has been designed with a 100 Mtpa capacity, which is in excess of the 60 Mtpa required for output from the Project (Mine). This has been done in accordance with Queensland Government common user infrastructure policies to allow for additional users to access capacity of the Project (Rail).

The intention is to reduce the need to develop multiple additional rail lines within the region surrounding the Project to keep pace with the development of new mines. As stated this strategy is in accordance with the stated Queensland policy on rail infrastructure development in the Galilee Basin. The facilitation of shared infrastructure use for transporting resources from mines to ports will reduce the overall cumulative impacts for the region.

8.6 Summary

The cumulative assessment defined the spatial and temporal boundary for assessment and reviewed stated residual impacts from other projects and utilising a relevance factor the significance impacts were determined. In summary the cumulative impacts having a low significance, include:

- Aquatic ecology
- Air quality
- Greenhouse gas emission
- Noise
- Waste
- Cultural Heritage (Non-Indigenous)

The cumulative impacts having a medium significance include:

- Land use
- Landscape character (Rail)

- Surface water
- Groundwater
- Traffic and transport
- Cultural heritage (Indigenous)
- Social and community
- Economics (positive impact)

The cumulative impacts having a high significance include:

- Terrestrial ecology

Implementation of the proposed Project offsets (as described in Volume 1 Section 9) it is considered that the overall impact of the Project can be managed.