Chapter 34

Cumulative Impacts

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34. CUMULATIVE IMPACT ASSESSMENT

34.1 Introduction

This chapter describes the cumulative impacts of the Byerwen project in consideration with other relevant projects on environmental, social and economic values. The methodology for assessing cumulative impacts is described and the projects which have been considered with the Byerwen project as potentially having cumulative impacts, are also identified. For each environmental, social or economic aspect (e.g. terrestrial ecology, surface water) identified in this EIS, this chapter describes the cumulative impacts, if any, on that environmental or social aspect.

Specialist reports contained in the appendices to this EIS describe cumulative impacts for their particular environmental or social aspect.

34.2 Methodology for Assessing Cumulative Impacts

In order for an impact to be considered cumulative, the impact must be caused by the Byerwen project and another project such that there is an increase in the level impact compared to the Byerwen project in isolation. If the Byerwen project is not causing an impact then, by definition, it cannot be contributing to cumulative impacts from other projects. If the impacts from other projects do not interact with the Byerwen project impacts, due to spatial or temporal separation, then impacts are not considered to be cumulative.

Cumulative impacts can occur on a spatial and temporal level. Developments may impact upon environmental or social values as a result of geographic overlap of project impact areas, scheduling overlap or utilisation of the same infrastructure, services and resources. Depending on the environmental or social values being considered, cumulative impacts may occur at a local, catchment or regional level. For example:

- noise and air emissions from the Byerwen project will only be cumulative with noise emissions from other projects in the local area
- impacts to surface water and aquatic ecology may be cumulative with other projects in the same surface water catchments
- impacts to terrestrial ecology may be cumulative with other projects in the same regional ecosystems
- social, economic and traffic impacts may be cumulative with other projects in the region.

Not every project which was identified as relevant for consideration contributes to cumulative impacts for each environmental or social value, because:

- the project being considered may not result in cumulative impacts on a spatial or temporal basis and / or
- information about the impacts of the project being considered may not be available due to the stage of development of the project (e.g. pre-approvals stage) and any estimate of the project's impacts is likely to be materially incorrect.

The significance level of cumulative impact on each environmental aspect has been determined based on the methodology described in **Chapter 1** (i.e. negligible, minor, moderate, major, critical) in combination with an assessment of the probability of cumulative impacts occurring.

34.3 Projects Considered in Cumulative Impact Assessment

Byerwen Coal has identified future projects with the potential for cumulative environmental and social impacts.

The basis for selection was that identified projects were in the Bowen Basin, within 150 km of the Byerwen project, in the Isaac Regional Council, Whitsunday Regional Council or Mackay Regional Council, and:

- for which an EIS is complete under either the *Environmental Protection Act 1994 (*EP Act) or *State Development and Public Works Organisation Act 1971* (SDPWO Act) or
- for which an EIS process has commenced under the EP Act or SDPWO Act or
- other projects of which Byerwen Coal is aware, including projects for which QCoal is a proponent or which are identified on government maps or websites or
- which are known major infrastructure projects (e.g. power stations or water infrastructure) that are seeking approval or have obtained development approval other than through an EIS.

In general only future projects are considered as existing projects have been approved, with environmental and social conditions imposed on potential impacts; however, in some circumstances existing projects within the local or catchment areas of the Byerwen project have been considered for cumulative impacts. For example where an existing project has, or has the potential to, alter the baseline environmental condition of a particular environmental aspect (e.g. air quality or surface water quality) in the local area or catchment areas, it has been considered.

Table 34-1 lists the future projects which met the above criteria for consideration in cumulative impact assessments as at May 2012 and provides their status, timing and a brief description. These projects are shown in **Figure 34-1** for the whole region considered, **Figure 34-2** for the local area surrounding the Byerwen project and **Figure 34-3** for the area surrounding Moranbah.

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BURDEKIN SHIRE COUNCIL

Home hill

Abbot Point Coal Terminal Expansion Stage 3 (Approximate Location)

BOWEN

Whitsunday

Proserpine

CHARTERS TOWERS REGIONAL COUNCIL

Collinsville

Calen

MACKAY REGIONAL COUNCIL

MACKAY

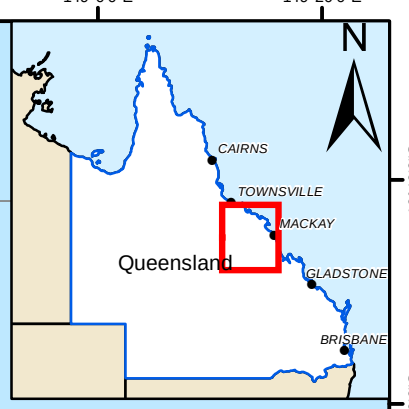
Dudgeon Point Coal Terminal Project (Approximate Location)

Jilalan Rail Yard

Moranbah

Dysart

Clermont



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Kilometres (A3)

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Legend

- Clermont Coal Mine
- Sarsfield Expansion Project
- Drake Coal Project
- Ellensfield Coal Mine Project
- Carborough Downs Mine Expansion Project
- Cordilla Coal Mine Project
- Eagle Downs Coal Project
- Eagle Field Expansion Project
- Grosvenor Coal Project
- Integrated Issac Plains Project
- Millenium Expansion Project
- Moorvale Coal Project
- Suttor Creek Project
- Newlands & Newlands Extension Projects
- Talwood Project
- Dysart East
- Twin Hills
- Sonoma Coal Project
- Vermont Coal Project
- Caval Ridge Mine Project - Change 5
- Bowen Basin Coal Growth - Caval Ridge
- Bowen Basin Coal Growth - Daunia Mine
- Goonyella Riverside Mine
- Jax Project
- Sarum Project
- New Lenton Project
- Burton Project
- Wards Well Underground
- Anthony Project
- Saraji East
- PL 224
- Moranbah CSG Operation
- Moranbah South
- Olive Downs North
- Winchestor South
- Willunga Project
- Arrow Bowen Pipeline Project (Approximate Location)
- Bow Energy Gas Pipeline (Approximate Location)
- Water for Bowen Project (Approximate Location)
- Northern Missing Link
- Central Queensland Integrated Rail Project (Approximate Location)
- Central Queensland Gas Pipeline
- Goonyella to Abbot Point Rail Project
- Connors River Pipeline (Approximate Location)
- North Queensland Gas Pipeline
- Moranbah Airport, Power & Ammoniun Nitrate Projects (Approximate Locations)
- Nebo Power Station
- Connors River Dam (Approximate Location)
- Collinsville Project (Approximate Location)
- Cows Coal Project (Approximate Location)
- Dalrymple Bay Coal Terminal Expansion
- Byerwen Project Area
- Local Government Boundaries
- 15 km extent
- 50 km extent
- 150 km extent
- Main Towns

Cumulative Impacts - Whole Region

QCOAL GROUP

Figure 34-1

Byerwen Coal Project

environmental and licensing professionals pty ltd

Date: *31/01/2013*

Author: emma.lewis

Map Scale: 1:1,250,000

Revision: R1

Coordinate System: GCS GDA 1994

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Collinsville

BOGIE RIVER
RELIC CREEK
EMU CREEK
BOWEN RIVER
ROSELLA CREEK
BROKEN RIVER
LITTLE BOWEN RIVER
ROSETTA CREEK
POLICE CREEK
VERBENA CREEK
SUTTOR RIVER
SUTTOR CREEK
CERITO CREEK

N
CAIRNS
TOWNSVILLE
MACKAY
Queensland
GLADSTONE
BRISBANE

0 5 10 15 20
Kilometres (A3)

1:400,000

Legend

- Cows Coal Project (Approximate Location)
- Collinsville Project (Approximate Location)
- Arrow Bowen Pipeline Project (Approximate Location)
- Northern Missing Link
- Central Queensland Integrated Rail Project (Approximate Location)
- Goonyella to Abbot Point Rail Project
- North Queensland Gas Pipeline
- Suttor Creek East Project
- Lancewood Project
- Drake Coal Project
- Newlands & Newlands Extension Projects
- Suttor Creek Project
- Sonoma Coal Project
- Jax Project
- Sarum Project
- Major Watercourses
- 15 km extent
- 50 km extent
- 150 km extent
- Local Government Boundaries
- Byerwen Project Area

Cumulative Impacts - Byerwen Project Area

Figure 34-2 | **Byerwen Coal Project**

Date: *31/01/2013*
Author: emma.lewis
Map Scale: 1:400,000
Revision: R1
Coordinate System: GCS GDA 1994

G:\CLIENTS\A-TO-D\BYEGEN - Byerwen EIS\GIS\Maps\EIS Chapters\EIS_Chpt_34_CumulativeImp\BYEGEN_fig34-2 BYE Project area.mxd

QCOAL GROUP

environmental and licensing professionals pty ltd

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21°40'0"S

22°0'0"S

22°20'0"S

SUTTOR RIVER

SUTTOR CREEK

EAGLEFIELD CREEK

ANNA CREEK

ISAAC RIVER

HAIL CREEK

BEE CREEK

DIAMOND CREEK

LOGAN CREEK

CHERWELL CREEK

HARRYBRANDT CREEK

DEVLIN CREEK

BOOMERANG CREEK

PEAK DOWNS HIGHWAY

Moranbah

N

CAIRNS

TOWNSVILLE

MACKAY

Queensland

GLADSTONE

BRISBANE

0 5 10 15 20

Kilometres (A3)

1:350,000

Legend

- Moranbah Airport, Power & Ammoniun Nitrate Projects (Approximate Locations)
- Bow Energy Gas Pipeline (Approximate Location)
- Arrow Bowen Pipeline Project (Approximate Location)
- Northern Missing Link
- Central Queensland Integrated Rail Project (Approximate Location)
- Central Queensland Gas Pipeline
- Goonyella to Abbot Point Rail Project
- Connors River Pipeline (Approximate Location)
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- Suttor Creek East Project
- Lancewood Project
- Ellensfield Coal Mine Project
- Carborough Downs Mine Expansion Project
- Cordilla Coal Mine Project
- Eagle Downs Coal Project
- Eagle Field Expansion Project
- Grosvenor Coal Project
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- Bowen Basin Coal Growth - Caval Ridge
- Caval Ridge Mine Project - Change 5
- Goonyella Riverside Mine
- Bowen Basin Coal Growth - Daunia Mine
- New Lenton Project
- Burton Project
- Wards Well Underground
- Saraji East
- PL 224
- Moranbah CSG Operation
- Moranbah South
- Olive Downs North
- Winchestor South
- Willunga Project
- Major Watercourses
- 15 km extent
- 50 km extent
- 150 km extent
- Main Towns
- Local Government Boundaries
- Highway
- Byerwen Project Area

Cumulative Impacts - Moranbah Area

QCOAL GROUP

Figure 34-3

Byerwen Coal Project

environmental and licensing professionals pty ltd

Date: *31/01/2013*

Author: emma.lewis

Map Scale: 1:350,000

Revision: R1

Coordinate System: GCS GDA 1994

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Table 34-1 Projects Considered in Cumulative Impact Assessments

Project title	Proponent	Status	Timing	Brief description
Drake Coal Project	Drake Coal Pty Ltd	EIS and SEIS submitted (SEIS in response to EIS submissions)	Proposed start up 2013. 30 year mine life.	The green-field open-cut mine would use conventional open-cut truck and excavator methods to produce up to 10 Mtpa of ROM coal per year. Washed product coal would be transported by train via the Collinsville-Newlands rail line to the Abbot Point Coal Terminal near Bowen for export using existing port facilities.
Ellensfield Coal Mine Project	Ellensfield Coal Management Pty Ltd	Proponent responds to submissions on the EIS	Proposed start up 2013. Mine life of up to 20 years.	The project involves the development of a greenfield underground coal mine producing up to 5.5 Mtpa of coking coal and thermal coal for export. Product coal would be transported to port via rail for export. Prior to the proposed CHPP being fully operational in 2012, all raw coal would be crushed, sized and washed using the existing Carborough Downs Coal Mine CHPP, and coal product transported via rail to the Dalrymple Bay Coal Terminal (DBCT) for export. After 2012, product coal would be either transported to DBCT or to Abbot Point Coal Terminal via the yet to be completed Goonyella Abbot Point rail line.
Sarsfield Expansion Project	Carpentaria Gold Pty	Public notification of draft TOR	Extension of mine life by 10 years.	The project would involve the expansion of the current open-cut gold mining operation by recommencing mining in the Sarsfield pit and extending the Nolans Pit floor. The existing processing plant would treat ore from Nolans and Sarsfield pits and the Mt Wright underground operations at a rate of 5 Mtpa peaking at 6 Mtpa for six months.
Arrow Bowen Pipeline Project	Arrow Bowen Pipeline Pty Ltd	Final TOR issued, EIS in preparation	Construction 2015 with the first gas supplied to an LNG plant in Gladstone in 2017.	The project would involve the construction of a 600 km long point-to-point, 107 cm diameter transmission pipeline consisting of a main pipeline and several lateral pipelines. The pipeline would commence at Red Hill, approximately 90 km north of Moranbah in central Queensland, and terminate at Gladstone. Its purpose would be to convey coal seam gas (CSG) from Arrow Energy's gas fields in the Bowen Basin for eventual export as liquefied natural gas (LNG).
Carborough Downs Mine Expansion Project	The Carborough Downs Joint Venture	EIS completed	not available	The project involves the expansion of the existing Carborough Downs underground coal mine to the increase the approved production rate of 1.9 Mtpa ROM coal to approximately 5 Mtpa ROM. The planned increase in production would be achieved either through a continuation of the existing "cut and flit" method using additional continuous miners or the introduction of the longwall mining method. The project would involve duplication of the CHPP adjacent to the existing facility and increase in the number of product stockpiles.

Project title	Proponent	Status	Timing	Brief description
Codrilla Coal Mine Project	The Coppabella and Moorvale Joint Venture	EIS assessment report	Proposed start up 2013. Expected life of the project 13.5 years.	The proposed project involves development an open cut coal mine producing an average of approximately 4 Mtpa of ROM coal which following processing would produce an average of 3.2 Mtpa of pulverised coal injection product for export. Product coal would be transported approximately 31 km to the existing Moorvale Mine train loading facility using road trains on a purpose built private haul road. Coal would then be railed to Dalrymple Bay Coal Terminal for export.
Eagle Downs Coal project	Bowen Central Coal Joint Venture Parties	EIS completed	Proposed start up 2015. 50 year plus mine life.	The project would involve the development of a greenfield underground coal mine producing up to 7 Mtpa of coking coal and thermal coal for export. A rail loop and train loading facilities would be located adjacent to the CHPP and connected to the existing Norwich Park Branch railway. Product coal would be transported to port via rail for export.
Eaglefield Expansion Project	Peabody Energy Australia Coal Pty Ltd	EIS assessment report	Proposed start up 2014. 22 year mine life.	The project would extend the current Eaglefield Coal Mine operations and increase production from 5 to 10.2 Mtpa of ROM coal. An in-pit crushing and conveying system will be used with haul trucks to produce coking coal for the export market. Coal would be transported approximately 200 km by existing rail infrastructure, for export from the Dalrymple Bay Coal Terminal (DBCT). The EEP would utilise some of the existing Eaglefield Coal Mine infrastructure, such as power supply, sewage treatment facility and wastewater management infrastructure. Existing site offices and industrial areas also would be utilised.
Grosvenor Coal Project	Anglo Coal (Grosvenor) Pty Ltd	EIS assessment report	Proposed start up 2013. 30 year mine life.	The project would involve the development of a Greenfield underground coal mine will have a production rate of up to 5 Mtpa of high quality coking coal for the export market. ROM coal from the Grosvenor Mine will be transported via an overland conveyor to the CHPP facilities at the existing Moranbah North Mine. The Moranbah North CHPP. Product coal will be transported by train via the existing Moranbah North rail loading facilities to the Abbot Point Coal Terminal for export.
Integrated Isaac Plains Project	IP Coal Pty Ltd and Vale Australia (IP) Pty Ltd	EIS completed	Proposed start up 2012. 15 year mine life.	The project would involve the extension of the existing Isaac Plains open-cut coal mine involving expanding current mining operations from 2 Mtpa of ROM coal to up to 4Mtpa of ROM coal. ROM coal from the expansion area will be hauled by truck to the Isaac Plains CHPP. Processed and washed coal from the Integrated Isaac Plains Project will be railed to Dalrymple Bay Coal Terminal at Mackay for export.

Project title	Proponent	Status	Timing	Brief description
Millennium Expansion Project	Millennium Coal Pty Limited	EIS completed	Proposed start up 2012. Extension of mine life by 17 years.	The proposed expansion project includes increasing production of the current open-cut, hard coking coal Millennium mine from 1.9 Mtpa ROM coal to 5.5 Mtpa. This will produce up to 3.6 Mtpa of product coal for export. Coal processing would occur at the currently utilised off-site facility at the Red Mountain Joint Venture immediately adjacent to the site. The size of the current ROM and product stockpile areas will be increased to meet the additional throughput. Product coal will be railed to the Dalrymple Bay Coal Terminal for export to international markets.
Moorvale Coal Project	Australian Premium Coals Pty Ltd	EIS completed	14 year mine life. Construction was expected to commence in late 2002.	The general project objective is to mine and export a high grade pulverised coal injection (PCI) product at a rate of 2 Mtpa. Mining infrastructure will include mine pit and out-of-pit spoil, rail loop, run-of-mine stockpiles, coal preparation plant, product stockpiles, water management dams, workshop and administration facilities
Newlands Coal Extension Project	Xstrata Coal Queensland Pty Ltd (Xstrata Coal)	Final TOR issued, EIS in preparation	2016 for open cut mining, with a proposed mine life of 22 years. 2013 for underground mining with a proposed mine life of 13 years.	Mining would be by open cut and underground mining operations. Open cut mining would produce 5Mtpa ROM coal per annum. The underground mining activities would involve an extension of existing longwall activities at the Northern Underground mine and would produce up to 6 Mtpa ROM coal. All coal mined from the project would be hauled by truck or transferred by conveyor for processing at the existing coal handling and processing plant in the current Newlands main deposit area.
Newlands Coal Project (Suttor Creek and Wollombi)	Xstrata Coal Queensland Pty Ltd, Itochu Coal Resources Australia Pty Ltd, ICRA NCA Pty Limited and Sumisho Coal Australia Pty Limited	EIS completed	15 year mine life. EIS assessment report issued 2006.	The project involves extension to the existing Newlands Coal Project through extension of the existing Suttor Creek operations into the western portion of the mining lease (the proposed Wollombi area). The proposal includes open cut mining of the area, clearing of vegetation (including endangered regional ecosystems), topsoil removal/replacement, overburden stockpiling, coal extraction and final rehabilitation of disturbed areas. The mine would produce up to 2.5 Mtpa of ROM coal for a nominal annual average of 1.9 Mtpa product coal.
Sonoma Coal Project	QCoal Sonoma Pty Ltd	Currently operating under approved ML and Environmental Authority conditions	15 year mine life.	Open cut mining operations will extract, using truck and shovel method, approximately 3 Mtpa of coal for processing through a coal preparation plant. The coal output from the plant, expected to be approximately 2 Mtpa, will be railed to Abbot Point coal terminal for export.

Project title	Proponent	Status	Timing	Brief description
Vermont Coal Project	Bowen Basin Coal Pty Ltd	EIS completed	Proposed start up 2013. 15 year mine life.	The project involves the development of a contractor operated open cut mine producing approximately 2.65 Mtpa coking coal and 1.25 Mtpa pulverised coal injection coal. Products are to be transported directly from the mine site 235km to the coal exporting facility at Dalrymple Bay Coal terminal within the Port of Hay Point.
Bowen Basin Coal Growth - Caval Ridge	BHP Billiton Mitsubishi Alliance (BMA) Coal Operations	EIS Complete. Recommended project proceed subject to conditions and recommendations	Proposed start up 2014. 30 year mine life.	The project forms part of the BMA Bowen Basin Coal Growth project and would involve development of an open-cut coal mine with a yield of 5.5 Mtpa and associated infrastructure, including a CHPP. The CHPP will also process an additional 2.5 Mtpa of product coal from the expansion of the neighbouring Peak Downs Mine, which will be transported via conveyor. Coal will initially be railed to BMA's Hay Point Coal Terminal.
Caval Ridge Mine Project Change 5	BHP Billiton Mitsubishi Alliance (BMA) Coal Operations	EIS Complete. Recommended project proceed subject to conditions and recommendations	Construction proposed start date 2011, finish date 2014. 30 year mine life.	Change relating to rail alignment.
Goonyella Riverside Mine	BHP Billiton Mitsubishi Alliance (BMA) Coal Operations	EIS active - EIS being prepared by proponent	Proposed start up 2013.	The project forms part of the BMA Bowen Basin Coal Growth project and would involve an expansion of the existing Goonyella Riverside open cut and the underground operations at Broadmeadow to increase the capacity from 16Mtpa to 24 Mtpa. Mining and processing will yield a Hard Coking Coal product for the export market. The open cut expansion and underground expansions will result in an additional 5 Mtpa and 3 Mtpa of product coal respectively.
Moranbah Airport	BHP Billiton Mitsubishi Alliance (BMA) Coal Operations	EIS active - EIS being prepared by the proponent	not available	The project forms part of the BMA Bowen Basin Coal Growth project and involves the development of a new airport, to replace the existing Moranbah airport.
Central Queensland Integrated Rail Project	QR limited	EIS active - Draft terms of reference being prepared	Construction proposed start date 2013, finish date 2015	The project would involve the development of an Integrated, heavy-haul rail system that will link coal mines in the Galilee and Bowen basins to eastern Queensland ports. The line will run from the Galilee Basin, north of Alpha, before linking with existing lines taking coal to the Port of Abbot Point near Bowen, or the Hay Point or Dalrymple Bay ports near Mackay

Project title	Proponent	Status	Timing	Brief description
Dudgeon Point Coal Terminals Project	North Queensland Bulk Ports Corporation Ltd	EIS active - Draft terms of reference being prepared	Expected completion 2015 - 2016	The project would involve the development of two new coal export terminals with a combined capacity of up to 180 million tonnes per annum; and associated infrastructure at Dudgeon Point, in the Port of Hay Point.
Goonyella to Abbot Point Rail Project	BHP Billiton MetCoal Holdings Pty Ltd	EIS active - Draft terms of reference public consultation from Feb to March 2012	Construction proposed start date 2015, finish date 2016	A dedicated rail line, approximately 260 km in length, to transport up to 60 million tonnes per annum of coal. The line would service a number of potential new and expanded coal mines. The line would run from the Goonyella Riverside Mine in the Bowen Basin, approximately 24 kilometres north-west of Moranbah, to the Port of Abbot Point, near Bowen
Moranbah and Nebo Power Stations	Transfield Services Limited	Proponent has placed project on hold	not available	The project would involve the development of 120 MW gas-fired, intermediate power station near Moranbah and a 300 MW gas-fired, peaking power station near Nebo. A 97 kilometre gas pipeline will connect these two locations in the northern Bowen Basin west of Mackay. The power stations would use locally sourced coal seam gas and each would be linked via an overhead electricity feeder line to a substation located near each power station
Water for Bowen Project	Sunwater Ltd	EIS active - supplementary EIS being prepared by proponent	not available	The project would involve the development of a 150 km water transport scheme featuring a channel and network of pipelines from the Burdekin River south across the coastal plain to Bowen and surrounding areas, with the potential to supply 60,000 ML of water a year to the Bowen region.
Abbot Point Coal Terminal Expansion - Stage 3	Ports Corporation of Queensland Limited	EIS completed. Recommended project proceed subject to conditions and recommendations	not available	Duplication of the existing terminal infrastructure, which will double the Port of Abbot Point's capacity from 25 million tonnes per annum to 50 mtpa.
Bowen Basin Coal Growth - Daunia Mine	BHP Billiton Mitsubishi Alliance (BMA) Coal Operations.	EIS completed. Recommended project proceed subject to conditions and recommendations	Proposed start up 2013. 21 year mine life.	The project forms part of the BMA Bowen Basin Coal Growth project and would involve development of an open-cut coal mine with a yield of 4 mtpa and associated infrastructure including a CHPP and associated loading facilities for ROM coal. The product coal will be railed approximately 160 km to the Hay Point and/or Dalrymple Bay coal terminals for shipment to the international market.

Project title	Proponent	Status	Timing	Brief description
Central Queensland Gas Pipeline	Enertrade	EIS complete	Proposed start up 2014	The project will involve the development of an 440 km high pressure gas transmission pipeline in Central Queensland from Moranbah to Gladstone. The pipeline would provide a strategic link for gas supply between the North Bowen Basin and Gladstone and provides scope for future interconnection to South East Queensland markets such as Brisbane. Construction of the project would provide interconnection of the North Queensland Gas Pipeline to the state gas transmission network. This would enable alternative sources of gas to the industrial centre of Gladstone as well as into Townsville.
Clermont Coal Mine	The Clermont Joint Venture	EIS complete	Construction commenced 2006. 20 year expected mine life.	The project will involve the development and operation of an open cut mine to produce 12.2 Mtpa of thermal coal for the export through Dalrymple Bay. Development was scheduled to coincide with wind-down of Blair Athol in 2009-10. The project planned to utilise existing load-out facilities and rail spur line at Blair Athol, with product being transported from the Clermont mine to Blair Athol via overland conveyor.
Connors River Dam and Pipelines*	Sunwater Ltd	EIS complete. Recommended project proceed subject to conditions and recommendations	Estimated completion 2015	The project will involve the construction of a 373,662 ML dam, water from which will be transported via a 133 km pipeline to Moranbah and will primarily service coal mines (and associated communities) in Central Queensland's coal basins.
Jilalan Rail Yard	Queensland Rail	EIS complete	not available	The project will involve the expansion of the existing Jilalan Rail Yard (located near the town of Sarina). The proposed expansion of the yard will incorporate two new bypass tracks with room for a third, two provisioning tracks, a provisioning facility, a wagon maintenance facility, and modifications to the existing yard and maintenance tracks. The development will complement the expansion of Dalrymple Bay/Hay Point.
Moranbah Ammonium Nitrate	Dyno Nobel Asia Pacific Limited	EIS complete	Proposed start up 2012	The project will involve the development of the Moranbah plant which will produce ammonia gas and nitric acid as inputs to the plant outputs of ammonium nitrate emulsion (viscous liquid) and prill (solid) to service the rapidly expanding demand for explosives from mining throughout Queensland and New South Wales. The Moranbah facility will have a production capacity of approximately 330 000 tonnes annually. The project will use locally sourced coal seam gas

Project title	Proponent	Status	Timing	Brief description
Northern missing link	Queensland Rail	EIS complete	not available	The project will involve the construction and operation of a 69 km rail link between the North Goonyella and Newlands rail systems in the northern Bowen Basin coalfields. The rail link will connect the existing mines of North Goonyella and Newlands and allow coal trains originating in Central Queensland to be directed to the port of Abbot Point, near Bowen.
Port of Hay Point capital dredging	The Ports Corporation of Queensland	EIS complete	not available	The project will involve undertaking of apron area and departure path capital dredging to increase the allowable draft of departing vessels from the Port of Hay Point, south of Mackay. The project will involve increasing existing ship manoeuvring apron areas and creating a 9.5 km long, 300—500 m wide departure path from the apron areas to the open ocean. Approximately 14 million cubic metres of capital and maintenance dredged material will require disposal over a five year period
Jax Project	Jax Coal Pty Ltd	Currently operating a bulk sample operation under approved MDL and Environmental Authority conditions	Proposed start up 2012	The project will involve the development of an open cut coal mine producing 1.8 Mtpa (ROM) coking coal.
Sarum Project	Xstrata Coal Ltd	New project, EIS & pre- feasibility study underway	Proposed start up 2014	The project would involve the development of a new open cut and underground coal mine with the production capacity of 5Mtpa coking and thermal
New Lenton Project	New Hope Corp. Ltd	New project, Pre-feasibility study completed	Proposed start up 2014	The project would involve the development of a new open cut coal mine with the production capacity of 3.5Mtpa coking and thermal
Burton Project	Peabody Energy Ltd	Expansion, under construction	Proposed start up 2012	The project would involve the expansion of an existing open cut coal mine with a new production capacity of 4Mtpa coking
Wards Well Underground	BHP Billiton Mitsubishi Alliance	New project, pre-feasibility study underway	Proposed start up 2016	The project would involve the development of a new underground coal mine with a production capacity of 5Mtpa hard coking

Project title	Proponent	Status	Timing	Brief description
Moranbah CSG operation	Arrow Energy Ltd / AGL Energy Ltd	Expansion, in progress	Proposed start up 2014	The project would involve the expansion of existing Moranbah coal seam gas operation with the new capacity of 160 Pjpa
Moranbah South	Anglo Amer. Met Coal / Exxaro Australia	New project, pre-feasibility study underway	Proposed start up 2017	The project would involve the development of a new underground coal mine with the production capacity of up to 4.5 Mtpa coking
Olive Downs North	MacArthur Coal Ltd	New project, on hold	Proposed start up 2013	The project would involve the development of a new open cut coal mine with the production capacity of 1 Mtpa coking and PCI
Willunga Project	MacArthur Coal Ltd	New project, pre-feasibility study completed	Proposed start up 2015	The project would involve the development of a new open cut coal mine with a production capacity of 3 Mtpa PCI and thermal
Winchestor South	Rio Tinto Ltd	New project, pre-feasibility study to start: Q2 2012	Proposed start up 2016	The project would involve the development of a new open cut coal mine with a production capacity of 4 Mt coking & thermal
Saraji East	BHP Billiton Mitsubishi Alliance	New project, pre-feasibility study underway	Proposed start up 2016	The project would involve the development a of new open-cut and underground coal mine with the production capacity of 5 Mtpa hard coking
Talwood Project	Aquila Resources Ltd	New project, Pre-feasibility study underway	Proposed start up 2015	The project would involve the development of a new underground coal mine with a production capacity of 3.6 Mt coking and thermal
Dysart East	Bengal Coal Ltd	New project, pre-feasibility study underway	Proposed start up 2013	The project would involve the development of a new open cut and underground coal mine with the mining capacity of 4 Mtpa (ROM) coking
Twin Hills	Evolution Mining Ltd	Redevelopment, on hold	Proposed start up 2012	The project would involve the redevelopment of a gold-silver underground mine with the production capacity of 30,000 oz pa
Anthony Project	Zamia Metals Ltd	New project, scoping study in progress	Proposed start up 2015	The project would involve the production of a new molybdenum open cut mine with a production capacity of 5 Mtpa molybdenum ore

Project title	Proponent	Status	Timing	Brief description
Blackwater to Norwich Park CSG fields	Bow Energy Ltd	New project, EIS commenced	Proposed start up 2014	The projects new capacity will be a minimum 30 Pjpa
Bow Energy Gas Pipeline	Bow Energy Ltd	New project, EIS commenced	Proposed start up 2015	The project includes Blackwater to Gladstone and Blackwater to Norwich Park gas pipelines
Collinsville Project	Xstrata Coal Ltd	Proposed start up 2015	Expansion, pre-feasibility study underway	Production rate of 6 Mtpa coking and thermal.
PL 224	Principal holder CH4 Pty Ltd, joint holders AGL Energy Limited and Arrow CSG Pty Ltd	EA issued 2011	not available	Petroleum lease.
North Queensland Gas Pipeline	North Queensland Pipeline No. 1 Pty Ltd	EA issued 2008	not available	Petroleum Pipeline Licence. Pipeline from Moranbah to Townsville.
Dalrymple Bay Coal Terminal Expansion	North Queensland Bulk Ports Corporation	not available	estimated completion 2018	
Cows Coal Project	Bowen River Coal Pty Ltd	Currently operating operation under approved ML and Environmental Authority conditions	construction to commence in 2012	The Cows Coal Project is located approximately 7km south of Collinsville in Queensland's north Bowen Basin

* This project has since been announced as no longer proceeding (SunWater 2012)

34.4 Landholders

There are 7 leasehold (lands lease) properties that are intersected by the project MLAs (see **Table 34-2**).

Table 34-2 Real Property Tenure – Byerwen Project

Lot	Plan	Tenure	Description and land use
1	CP905226	Lands Lease	Tenure: Grazing Homestead Perpetual Lease (GHPL) 30/4120. Lessee: Private Individual - Grazing
3	SP171922	Lands Lease	Tenure: TL 0/235865 Lessee: Collinta Holdings. Pty. Ltd. - Grazing
4	SP171921	Lands Lease	Tenure: GHPL 5/2123 Lessee: Private Individual - Grazing
14	SP225054	Lands Lease	Tenure: Term Lease (TL) 0/35642 Lessee: Collinta Holdings Pty. Ltd. - Grazing
667	PH1321	Lands Lease	Tenure: Lands Lease (Mount Lookout Holding) Lessees: Private individuals. - Grazing Tenure Reference Pastoral Holding (PH) 5/667.
682	CP906890	Lands Lease	Tenure: Lands Lease (Suttor Creek Holding). Lessees: Private individuals - Grazing Tenure Reference TL 0/235783.
689	SP251696	Lands Lease	Tenure: Lands Lease Lessee: Leichhardt Pastoral Pty. Ltd. - Grazing Tenure Reference TL 0/235359

Cumulative impacts on landholders may occur where those properties intersected by the project MLAs are also intersected by other projects. It is noted that Lot 689 SP251696 is owned by a wholly owned subsidiary of Byerwen Coal Pty Ltd.

Properties intersected by the Byerwen Project are also intersected by the potential project area for a number of other projects including:

- Northern Missing Link
- Goonyella to Abbot Point Rail project
- North Queensland Gas Pipeline
- Suttor Creek Project

- Suttor Creek East Project
- Central Queensland Integrated Rail Project
- Newlands and Newlands Extension projects
- Arrow Bowen Pipeline Project
- Sonoma Coal Project

The proponent will mitigate the project's contribution to landholder impacts by way of compensation agreements, which will be negotiated with landholders for those properties intersected by the project MLAs.

It is expected that other third party projects which intersect these properties will also enter into compensation agreements with relevant landholders. As such the compensation agreements between landholders and the project proponents will inherently consider cumulative impacts, by way of landholder's considering potential cumulative impacts during compensation agreement negotiations.

Cumulative impacts on landholders are therefore considered as being mitigated.

34.5 Soils and Land Use

The majority of planned development in the region relates to coal mining projects and to a lesser extent development of infrastructure to support this development (e.g. rail and pipeline infrastructure). The most relevant impact to be considered, with respect to soils and land, is the change in the amount of land available for agricultural activities and the types of agriculture that can be supported. Cumulative land impacts were therefore assessed by quantifying the area of good quality agricultural land (GQAL) and strategic cropping land (SCL) for each project considered relevant to cumulative impacts and for which reliable information could be sourced.

The potential impact area for each project considered was based on the project's mining leases (MLs), project boundary or, for linear features, buffered lines. The areas of each land type potentially disturbed were added across all projects and the contribution of the Byerwen project to the total potential disturbance of GQAL and SCL was determined.

Potential disturbance areas were restricted to the MLs, distinct project boundaries and buffers. At the scale of this cumulative impact assessment, these are considered to provide a suitable indication of potential areas to be disturbed by each project.

The projects for which spatial information was available only in the form of exploration permits for coal (EPCs), exploration permits for minerals (EPMs) or mineral development licences (MDLs), have not been included. This is because those stated EPC, EPM and MDL boundary areas are significantly disproportionate to actual disturbance areas generated by those projects, once they commence. As a consequence, projects consisting of EPCs, EPMs, MDLs have been excluded from the assessment for soil and land use.

The Connors River Dam and Pipeline Projects have also been excluded from this assessment due to the project's cancellation in July 2012 (SunWater, 2012).

In many cases the areas of different projects considered for cumulative impacts overlapped. To obtain an accurate account of GQAL and SCL potentially affected by the projects, overlapping areas were accounted for within one project only.

Appendix 14 contains a tabulation of:

- the area of each relevant project (excluding areas of overlap)
- the area of potential SCL (DEHP Trigger Map for Strategic Cropping Land in Queensland v1.0) within each project area
- the area of GQAL Class A, B, C and D (based on interpretation various publically available data sets) within each project area

Table 34-3 shows the area of SCL and GQAL class in other projects and the Byerwen project and the percentage of total area of SCL or GQAL class in the Byerwen project.

Table 34-3 Cumulative SCL and GQAL Impacts

SCL / GQAL	Area within other projects (ha)	Area within Byerwen project footprint (ha)	Total area – other projects plus Byerwen project (ha)	Percentage within Byerwen project
Potential SCL				
Potential SCL	21,473	1,430	22,903	6.2%
Not SCL	182,150	5,570	187,720	
Total	**203,623**	**7,000**	**210,623**	
GQAL				
GQAL Class A	39,691	1,638	41,329	4.0%
GQAL Class B	353	0	353	0.0%
GQAL Class C	100,970	2,615	103,585	2.5%
GQAL Class D	57,688	2,771	60,459	4.6%
Water body or outside the extent of GQAL mapping	4,921			
Total	**203,623**	**7,024**	**210,646***	

* differs to SCL total of 210,623 by 23 ha as an artefact of GIS mapping

The total footprint of all projects considered in the GQAL and SCL cumulative impact assessment is 203,623 ha. The Byerwen project footprint is approximately 7,000 ha, resulting in a total for all projects of 210,623 ha.

Approximately 22,903 ha or 10.9% of the total area of all projects contains potential SCL. It is expected that conditions of approval for each project will require mitigation measures to avoid, minimise or compensate for impacts to SCL. Within the region containing the identified projects, potential SCL is scattered and fragmented and represents a very small percentage of the total potential SCL in Queensland (less than 0.5%). With the implementation of mitigation measures for all projects it is expected that the cumulative impact on SCL from identified projects will be minor. The Byerwen project's contribution to cumulative impacts on potential SCL is 1,430 ha or 6.2% of the impact from all

projects and is therefore considered to be a minor contribution to a minor cumulative impact to potential SCL.

Approximately 41,682 ha or 19.8% of the total area of all projects contains GQAL Class A and B. It is expected that conditions of approval for each project will require mitigation measures to avoid or minimise impacts to soils. Within the region containing the identified projects, GQAL Class A and B represents a very small percentage of the total GQAL Class A and B in Queensland. With the implementation of mitigation measures for all projects it is expected that the cumulative impact on GQAL Class A and B from identified projects will be minor. The Byerwen project's contribution to cumulative impacts on GQAL Class A and B is 1,638 ha or 3.9% of the impact from all projects and is therefore considered to be a minor contribution to a minor cumulative impact to GQAL Class A and B.

The majority of soils within the area of identified projects (75.3%) are GQAL Class C and D, which are generally only suitable for grazing or not suitable for any pastoral or agricultural activities and due to their limited value from a land use perspective, are not considered further for cumulative impacts.

34.6 Surface Water Quality

Local and regional mining projects considered as part of a review of potential cumulative impacts are presented, according to their respective catchments, within **Table 34-4**.

Table 34-4 Local and Regional Projects in the Same Catchments as the Byerwen Project

Bowen River catchment	Suttor River catchment
Drake Coal Project	Goonyella Riverside Mine
Sarum Project	Wards Well Underground
Jax Project	Newlands Coal Project (Wollombi and Suttor Creek pits)
Newlands Mine (existing)	
Newlands Coal Extension Project	
Eastern Creek Project	
Northern Underground Project	
Sonoma Coal Project	

As described in **Chapter 15** and **Chapter 16** impacts on the Suttor River and Kangaroo Creek resulting from sediment and contaminant mobilisation, changes in hydrology and hydraulics and changes in salt loads are expected to be minor. This is due to the proposed management and mitigation strategies which include a mine water management system, sediment dams, restrictions to site water discharges, progressive rehabilitation and water quality monitoring. Therefore the Byerwen project's contribution to cumulative impacts on surface water quality will be minor.

At a local level, the Suttor River and Kangaroo Creek (part of the Bowen River catchment) may be impacted to a degree by potential increases in salt loads and sediment resulting from other mines in the catchments.

At a regional level, activities associated with other coal mining projects within the Bowen and Suttor Catchments (refer to **Table 34-4**) may have also have a degree of cumulative impact on these

catchments and wider Burdekin Basin. It is noted that EHP are currently undertaking investigations within the Fitzroy Catchment to quantify the cumulative impacts of mining on water resources, which will provide an analogous study for comparative purposes.

A degree of cumulative impact may therefore occur at a local and regional level, however, given that these projects are required to implement similar management and mitigation strategies to the Byerwen project, impacts from these other projects are also anticipated to be minor. Cumulative impacts on the Bowen River and Suttor River catchments are therefore expected to be minor.

34.7 Hydrology, Hydraulics and Final Voids

There are existing and future projects within the same catchment as the Byerwen project. These include Xstrata Coal's neighbouring mines and other projects identified in **Section 34.6**. All projects, other than Xstrata Coal's mines, are located downstream of the Byerwen project.

The operation of the Byerwen project water management system in accordance with the planned release strategy will have negligible impact on the hydrology of the Suttor River and Kangaroo Creek (refer **Chapter 16**). As the Byerwen project's impact on the hydrology of surrounding watercourses is predicted to be negligible, the Byerwen project's contribution to cumulative changes in the hydrology of surrounding watercourses is predicted to be negligible.

Chapter 16 describes the change in the modelled peak flood level (afflux) and flood velocities between the pre and post-development scenarios. For the 100 year and 1,000 year ARI flood events, the change in peak flood level associated with the Byerwen project development is generally less than 0.02 m, with a localised maximum of no more than 0.2 m, which is considered negligible. The change in average velocity between the pre and post-development scenario for the 100 year and 1,000 year ARI flood events is generally negligible with a few localised areas where velocities increase by about 0.1 m/s. The minor changes that are predicted are attributable to available floodplain storage and flow paths in the pre-development scenario being modified by the waste rock dumps and diversion channels. As the Byerwen project's impact on changes in flood levels and velocities is predicted to be negligible, the Byerwen project's contribution to cumulative changes in flood levels and velocities is predicted to be negligible.

Chapter 16 models the impact that the Byerwen project will have on flood levels along the GAP rail line. The GAP rail line is not overtopped in the pre-development Suttor River 100 year ARI flood event and this flood immunity is not affected by the Byerwen project.

Chapter 11 describes that there are no modelled scenarios where the lake levels within the final void pits reached the ground level (void rim). In addition **Chapter 16** describes that there are no modelled scenarios where the regional probable maximum flood (PMF) event, reaches the levels of final voids of South Pit 1, West Pit 3, East Pit 2 or North Pit. The Byerwen project is not predicted to impact surface water through release of final void water and therefore, the Byerwen project is not predicted to contribute to cumulative impacts on water quality from releases of final void water.

34.8 Groundwater

There is potential for cumulative groundwater drawdown to impact on private groundwater bores from the Byerwen project and Xstrata Coal's nearby mining projects (existing Newlands, Suttor Creek and Wollombi mines and proposed Newlands Extension Project) to the east and south, due to location of

those bores. The private bores with the potential to be impacted due to their location are RN 60458, RN 60459, RN100092, RN 100274 and RN 25686. Details of these bores are provided in **Chapter 17**.

As demonstrated in **Chapter 17** the maximum expected radius of drawdown from South Pit 1 is 2,300 m. Other Byerwen project pits are expected to have a lesser radius of drawdown. All bores with the exception of RN 25686, are beyond 2,300 m of any of the Byerwen project open pits and are therefore unlikely to experience a reaction to any Byerwen related groundwater drawdown. RN 25686 is approximately 1,950 m east of East Pit 2 at Year 35 of mining; however this bore has a cased depth of 6.4 m and as such does not intersect any of the targeted coal seam groundwater units and as such is also unlikely to experience a reaction to any Byerwen related groundwater drawdown.

RN 100092 and RN 100274 are located about 5 km to the east of the proposed East Pits and 4 km north of RN 25686. Their use status is not known. They were formerly mineral exploration bores. They are also located very close to each other and would likely interfere with each other as a function of overlapping localised bore drawdown cones when pumping simultaneously, if they are equipped.

There is potential for RN 25686, RN 100092 and RN 100274 to be impacted by regional water table depressurisation that may already have occurred as a result of the Newlands mine (to the north) and Suttor Creek / Wollombi mine pits (to the south). Groundwater monitoring bore BYGW06 is ideally located to assess potential for groundwater level and groundwater quality impacts on these bores.

RN 60458 is located on the eastern boundary of the Byerwen project. Its use status is not known. It was formerly a mineral exploration bore. It is located approximately 5 km to the east-north-east of proposed West Pit 3. This bore could be impacted by depression on the regional water table as it is mid way between the Newlands mine pits to its east and proposed Byerwen project West Pit 3. The use status of the bore will be confirmed and groundwater levels will be measured in RN 60458 before mining at West Pit 3 commences (approximately Year 25). Groundwater monitoring bore BYWWB02 is well located to monitor groundwater level and groundwater quality impacts on RN 60458.

RN 60459 is located well to the east of the Byerwen project. Its use status is not known. It was formerly a mineral exploration bore. It is located east of the Newlands mine pits (i.e. the Newlands mine pits are between the Byerwen project and RN 60459). Any impacts on that bore would result from the Newlands mine and not from the Byerwen project.

A groundwater monitoring strategy will be implemented, comprising the existing dedicated groundwater monitoring bores. Groundwater levels will be measured and recorded in all the groundwater monitoring bores at quarterly intervals. The monitoring data will be reviewed at minimum six-monthly intervals. In the unlikely event of regional depressurisation of the water table, the dedicated Byerwen project groundwater monitoring bores are well located to measure those impacts.

Water level monitoring data will be reported to the relevant authority on a quarterly basis only if a change of >2 m (higher or lower than the previous quarterly monitoring event) to the standing water level is detected; however, all groundwater level monitoring results will be reported as part of the annual return.

34.9 Terrestrial Ecology

The most relevant impact to be considered, with respect to terrestrial ecology, is the area of terrestrial remnant vegetation (which also provides an indication of fauna habitat) and the extent of sensitive vegetation communities. Cumulative impacts were therefore assessed by considering impacts of current and planned projects within the Brigalow Belt North bioregion, on endangered and of concern regional ecosystem (RE) types and threatened ecological communities (TECs) associated with these projects.

Quantification for consistent comparisons across all of these projects is not considered practical or accurate due to:

- the varying availability of associated ecological assessment reports
- the quality and manner in which impact data is expressed
- the dynamic nature of development footprints which remain in the planning phase.

For this reason, the cumulative impacts assessment for terrestrial ecology has adopted the highly conservative approach of assuming that all vegetation within the broader project area of each project (normally a mining lease) will be removed. This clearly results in a significant overestimation of vegetation which is likely to be affected, particularly for TECs and endangered REs, which proponents preferentially avoid compared to the more common vegetation types. It is very important to keep this approach in mind when considering the following analysis.

The potential impact area for each project was based on the project MLs, project boundary or, for linear features, buffered lines.

The areas covered by EPCs, EPMs or MDLs have not been included as their areas are disproportionate to the likely disturbance generated by the project. As a consequence, projects consisting of EPCs, EPMs and MDLs have been excluded from the assessment.

The Connors River Dam and Pipeline Projects have also been excluded from this assessment due to the project's cancellation in July 2012 (SunWater 2012). Projects located outside the Brigalow Belt North Bioregion were also excluded from this assessment. In many cases the cumulative impact project areas overlapped. To avoid additional overestimation of terrestrial vegetation potentially affected by the projects, beyond the necessary highly conservative method adopted, overlapping areas were accounted for within one project only (usually within the project of the larger extent). The areas of project overlay are shown in **Appendix 19.**

The area of each value type potentially disturbed was summed across all projects and the contribution of the Byerwen project to the total potential disturbance of endangered and of concern REs and TECs calculated.

The area of endangered and of concern REs affected by the projects has been derived from certified RE mapping (Version 6.1). This data maps vegetation types according to their status under the *Vegetation Management Act 1999* (VM Act). Potential disturbance areas for TECs have been defined in accordance with Commonwealth listing advice as described in **Table 34-5**.

Table 34-5 Definition of TECs for Cumulative Impact Assessment

TEC	Definitions
Brigalow	All brigalow RE types within the Brigalow Belt North bioregion (REs 11.3.1, 11.4.3, 11.4.7, 11.4.8, 11.4.9, 11.4.10, 11.5.16, 11.9.1, 11.9.5, 11.9.6, 11.11.14, 11.12.21)
Semi-evergreen vine thickets (SEVT)	All SEVT RE types within the Brigalow Belt North bioregion (REs 11.2.3, 11.3.11, 11.4.1, 11.5.15, 11.8.3, 11.8.6,11.8.13, 11.9.4, 11.9.8, 11.11.18)

TEC	Definitions
Natural grasslands	Natural grassland REs (REs 11.3.21, 11.4.4, 11.4.11, 11.8.11, 11.9.3, 11.9.12, 11.11.17) within the following subregions of the Brigalow Belt North bioregion: ▪ BBN6 Northern Bowen Basin ▪ BBN9 Anakie Inlier ▪ BBN10 Basalt Downs ▪ BBN11 Isaac-Comet Downs ▪ BBN12 Nebo-Connors Range ▪ BBN13 South Drummond Basin

Table 34-6 shows the areas of impact from identified projects on endangered and of concern REs including the Byerwen project and the percentage of Byerwen project's impact within the total cumulative impact and the Bioregion.

Table 34-7 shows the areas of impact from identified projects on TECs including the Byerwen project and the percentage of Byerwen project's impact within the total cumulative impact and the Bioregion.

Table 34-6 Cumulative Impacts on Endangered and Of Concern REs

Projects	Endangered REs						Of concern REs					
	11.3.1	11.4.8	11.4.9	11.5.16	11.8.13	Total	11.3.4	11.3.25	11.4.2	11.7.1 / 11.7.1 x 1	11.8.11	Total
Byerwen Coal Project	8.7	34.6	62.2	190.4	18.0	313.9	1.6	8.7	156.4	214.1	84.4	465.2
Abbot Point Coal Terminal	-	-	-	-	-	0	-	-	-	-	-	0
Arrow Bowen Pipeline Project	3.2	1.6	4.4	-	1.1	10.3	10.0	22.5	0.2	-	12.2	44.9
Bow Energy Gas Pipeline	3.8	1.4	-	-	-	5.2	0.1	5.6	-	-	-	5.7
Bowen basin Coal Growth Caval Ridge	58.1	247.9	417.9	-	-	723.9	-	229.8	41.6	-	148.2	419.6
Bowen Basin Coal Growth Daunia Mine	29.8	-	77.5	-	-	107.3	-	7.5	-	-	-	7.5
Burton Project	-	-	-	-	-	0	167.2	276.4	-	-	24.9	468.5
Central Queensland Gas Pipeline	13.4	4.0	0.8	-	-	18.2	0.2	8.4	2.6	1.0	-	12.2
Central Queensland Integrated Rail	7.2	10.6	2.1	-	-	19.9	3.9	18.2	-	-	0.1	22.2
Clermont Coal Mine	-	-	186.8	-	-	186.8	-	-	-	-	77.6	77.6
Cows Coal	-	-	-	-	-	0	-	-	-	-	-	0
Drake Coal Project	-	-	-	-	-	0	52.1	-	-	-	-	52.1
Eagle Downs Coal Terminal	0.2	-	56.8	-	2.7	59.7	-	0.2	-	-	397.0	397.2
Eaglefield Expansion	-	10.5	24.2	-	52.9	87.6	-	22.9	-	-	435.1	458
Ellenfield Coal Mine	-	-	31.9	-	-	31.9	-	261.9	-	-	-	261.9
Goonyella Riverside Mine ML	-	31.9	665.4	-	-	697.3	19.5	165.6	-	-	-	185.1

Projects	Endangered REs						Of concern REs					
	11.3.1	11.4.8	11.4.9	11.5.16	11.8.13	Total	11.3.4	11.3.25	11.4.2	11.7.1 / 11.7.1 x 1	11.8.11	Total
Grosvenor Coal	-	-	0.8	-	-	0.8	0.9	11.0	4.1	-	-	16
Integrated Issac Plains ML	5.7	-	2.8	-	-	8.5	0.0	30.1	-	-	-	30.1
Jax Project	11.4	-	-	-	-	11.4	42.7	2.8	-	-	-	45.5
Millenium Expansion Project	-	-	162.1	-	-	162.1	-	-	-	-	-	0
Moorvale Coal	17.1	-	17.4	-	-	34.5	-	26.1	-	-	-	26.1
Moranbah CSG Operation	63.0	65.7	555.1	-	155.3	839.1	58.1	1756.3	633.8	60.5	1539.6	4048.3
Nebo Moranbah Power Stations	-	-	-	-	-	0	-	8.2	-	-	-	8.2
New Lenton	-	-	-	-	-	0	118.9	459.3	-	-	776.9	1355.1
Newlands Coal	14.7	-	277.2	-	21.2	313.1	-	240.9	-	-	636.9	877.8
Newlands Coal Extension	21.3	-	-	10.3	12.6	44.2	14.9	259.6	-	-	38.9	313.4
Northern Missing Link	0.1	0.5	5.5	-	6.0	12.1	1.1	1.0	0.5	-	4.8	7.4
NQ gas Pipeline	2.8	2.2	6.1	-	1.0	12.1	5.4	3.1	0.3	-	0.3	9.1
Olive Downs	7.2	-	1.8	-	-	9	-	10.2	-	-	-	10.2
PL224	-	127.7	7.2	-	-	134.9	-	174.5	-	4.3	88.3	267.1
Saraji East	61.0	109.3	165.8	-	-	336.1	-	342.1	-	-	-	342.1
Twin Hills	-	3.6	-	-	-	3.6	-	-	-	-	-	0
Vermont Coal	-	49.0	49.0	-	-	98	-	-	-	-	-	0
Wards Well Underground	-	-	-	-	81.8	81.8	-	86.7	-	-	1640.6	1727.3

Projects	Endangered REs						Of concern REs					
	11.3.1	11.4.8	11.4.9	11.5.16	11.8.13	Total	11.3.4	11.3.25	11.4.2	11.7.1 / 11.7.1 x 1	11.8.11	Total
Water For Bowen Project	-	-	-	-	-	0	0.1	18.7	-	-	-	18.8
Total cumulative impact of projects	**328.7**	**700.3**	**2,780.6**	**200.7**	**352.7**	**4,363.0**	**496.8**	**4,458.2**	**839.5**	**279.9**	**5,905.9**	**11,980.3**
Total area within Bioregion	**80,877.0**	**71,162.0**	**95,498.0**	**3,178.0**	**6,623.0**	**257,338.0**	**183,756.0**	**514,852.0**	**34,532.0**	**78,579.0**	**178,562.0**	**990,281.0**
% of Byerwen project impact within total cumulative impact	**2.6**	**4.9**	**2.2**	**94.9**	**5.1**	**7.2**	**0.3**	**0.2**	**18.6**	**76.5**	**1.4**	**3.9**
% of Byerwen project impact within Bioregion	**<0.1**	**<0.1**	**0.1**	**6.0**	**0.3**	**0.1**	**<0.1**	**<0.1**	**0.5**	**0.3**	**<0.1**	**0.0**
% of cumulative impacts of projects within Bioregion	**0.4**	**1.0**	**2.9**	**6.3**	**5.3**	**1.7**	**0.3**	**0.9**	**2.4**	**0.4**	**3.3**	**1.2**

Table 34-7 Cumulative Impacts on TECs

Projects	Brigalow TEC	Natural grasslands TEC	SEVT TEC
Byerwen Coal Project	316.3	84.4	18.0
Abbot Point Coal Terminal	-	-	41.9
Arrow Bowen Pipeline Project	15.9	13.1	1.1
Bow Energy Gas Pipeline	6.2	0.3	-
Bowen basin Coal Growth Caval Ridge	723.9	148.2	-
Bowen Basin Coal Growth Daunia Mine	111.3	8.6	-
Burton Project	65.9	24.9	-
Central Queensland Gas Pipeline	25.8	-	0.3
Central Queensland Integrated Rail	26.2	8.2	5.8
Clermont Coal Mine	186.8	77.6	-
Cows Coal	-		-
Dalrymple Bay Coal Terminal	-	-	-
Drake Coal Project	-	104.5	-
Dudgeon Point Coal terminal	-	-	-
Eagle Downs Coal Terminal	127.6	518.0	2.7
Eaglefield Expansion	34.7	435.1	11.6
Ellensfield Coal Mine	114.3	-	0.7
Goonyella Riverside Mine ML	697.3	1.2	-
Grosvenor Coal	0.8	-	-
Integrated Issac Plains ML	8.5	-	-
Jax Project	11.4	-	-
Jilalan Rail Yard	-	-	-
Millenium Expansion Project	185.5	36.4	-
Moorvale Coal	69.5	-	-
Moranbah CSG Operation	945.5	1886.3	155.3
Nebo Moranbah Power Stations	-	-	-
New Lenton	11.5	776.9	-
Newlands Coal	514.8	636.9	21.2
Newlands Coal Extension	1440.3	90.1	14.7
Northern Missing Link	6.3	4.8	13.7
NQ gas Pipeline	11.2	0.3	4.5
Olive Downs	22.0	-	-
PL224	134.9	88.3	-
Saraji East	336.0	1.4	-
Sarsfield Project	-	-	-
Twin Hills	3.6	-	-

Projects	Brigalow TEC	Natural grasslands TEC	SEVT TEC
Vermont Coal	98.0	-	-
Wards Well Underground	4.3	1640.6	405.7
Water For Bowen Project	-	-	-
Total cumulative impact of projects	**6,256.3**	**6,586.3**	**697.4**
Total area within Bioregion	**579,883.0**	**35,606.0**	**12,042.0**
% of Byerwen project impact within total cumulative impact	**5.1**	**1.3**	**2.6**
% of Byerwen project impact within Bioregion	**0.1**	**0.2**	**0.1**
% of cumulative impact of projects within Bioregion	**1.1**	**18.5**	**5.8**

The total cumulative impact of all projects on endangered REs is 4,363.0 ha, or 1.7% of the 257,338.0 ha of endangered REs within the Bioregion. The Byerwen project's contribution to cumulative impacts on endangered REs is 313.9 ha, or approximately 7.2% of the impact from all projects and is therefore considered to be a minor contribution to a minor cumulative impact on endangered REs. The Byerwen project will have the greatest impact on endangered RE 11.5.16, with the Byerwen project contributing to approximately 94.9% of the impact from all projects. The total cumulative impact of all projects on this RE is 200.7 ha, or 6.3% of the 3,178.0 ha of RE 11.5.16 within the Bioregion. As such the Byerwen project's contribution to cumulative impacts on endangered RE 11.5.16 is considered to be a major contribution to a minor cumulative impact to RE 11.5.16.

The total cumulative impact of projects on of concern REs is 11,980.3 ha, or 1.2% of the 990,281.0 ha of of concern REs within the Bioregion. The Byerwen project's contribution to cumulative impacts on of concern REs is 465.2 ha, or approximately 3.9% of the impact from all projects and is therefore considered to be a minor contribution to a minor cumulative impact to of concern REs. The Byerwen project will have the greatest impact on of concern RE 11.7.1/11.7.1x1, with the Byerwen project contributing to approximately 76.5% of the impacts from all projects. The total cumulative impact of projects on this RE is 279.9 ha, or 0.4% of the 78,579.0 ha of RE 11.7.1/11.7.1x1 within the Bioregion. As such the Byerwen project's contribution to cumulative impacts on of concern RE 11.7.1/11.7.1x1 is considered to be a major contribution to a minor cumulative impact to RE 11.5.16.

The total cumulative impact of projects on Brigalow TEC is 6,256.3 ha, or 1.1% of the 579,883.0 ha of Brigalow TEC within the Bioregion. The Byerwen project's contribution to cumulative impacts on Brigalow TEC is 316.3 ha, or approximately 5.1% of the impact from all projects and is therefore considered to be a minor contribution to a minor cumulative impact to Brigalow TEC.

The total cumulative impact of projects on natural grasslands TEC is 6,586.3 ha, or 18.5% of the 35,606.0 ha of natural grasslands TEC within the Bioregion. The Byerwen project's contribution to cumulative impacts on natural grasslands TEC is 84.4 ha, or approximately 1.3% of the impact from all projects and is therefore considered to be a minor contribution to a moderate cumulative impact to natural grasslands TEC.

The total cumulative impact of projects on SEVT TEC is 697.4 ha, or 5.8% of the 12,042.0 ha of SEVT TEC within the Bioregion. The Byerwen project's contribution to cumulative impacts on SEVT TEC is 18.0 ha, or approximately 2.6% of the impact from all projects and is therefore considered to be a minor contribution to a minor cumulative impact to SEVT TEC.

It is expected that other projects that contribute to cumulative impacts will implement mitigation measures and that the residual cumulative impacts in the region will be managed at an acceptable level.

34.9.1 Connectivity and Wildlife Corridors

There is potential for cumulative terrestrial ecology impacts associated with connectivity and wildlife corridors, particularly east – west fauna movement due to the linear nature of projects throughout the Bowen Basin.

Bioregional corridors of State and regional significance are provided in BPA mapping. These corridors and projects considered as part of the cumulative impact assessment are shown in **Figure 34-4**.

Areas to the south and north of the project form part of large bioregional corridors listed as having state significance in accordance with BPA mapping. A section of the corridor to the north is mapped within the project boundary but does not occur within the project footprint.

Another bioregional corridor is mapped along the Suttor River in proximity to the project and is listed as having State and regional significance which are mapped at difference widths. This corridor intersects the western project boundary.

The placement of out of pit waste rock dumps associated with South Pit 1 will encroach on the bioregional corridor associated with Suttor River. Connectivity for this corridor will be retained. Therefore the project is expected to have minor impacts on the value of bioregional corridors of State and regional significance.

As other projects in the region appear to have the potential to far more greatly impact on connectivity and the values of bioregional corridors of State and regional significance, the contribution of the Byerwen Project to cumulative impacts associated with connectivity and wildlife corridors is expected to be minor.

146°20'0"E 146°40'0"E 147°0'0"E 147°20'0"E 147°40'0"E 148°0'0"E 148°20'0"E 148°40'0"E 149°0'0"E 149°20'0"E

19°40'0"S 20°0'0"S 20°20'0"S 20°40'0"S 21°0'0"S 21°20'0"S 21°40'0"S 22°0'0"S 22°20'0"S 22°40'0"S 23°0'0"S

BURDEKIN SHIRE COUNCIL

Home hill

Abbot Point Coal Terminal Expansion Stage 3 (Approximate Location)

BOWEN

Whitsunday

Proserpine

CHARTERS TOWERS REGIONAL COUNCIL

Collinsville

Calen

MACKAY REGIONAL COUNCIL

MACKAY

Dudgeon Point Coal Terminal Project (Approximate Location)

Jilalan Rail Yard

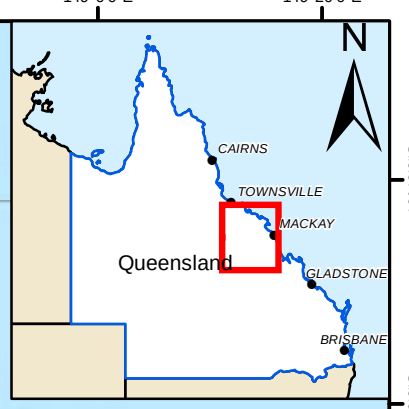
Moranbah

Dysart

Clermont

0 5 10 15 20
Kilometres (A3)

1:1,250,000



Legend

- Clermont Coal Mine
- Sarsfield Expansion Project
- Drake Coal Project
- Ellensfield Coal Mine Project
- Carborough Downs Mine Expansion Project
- Cordilla Coal Mine Project
- Eagle Downs Coal Project
- Eagle Field Expansion Project
- Grosvenor Coal Project
- Integrated Issac Plains Project
- Millenium Expansion Project
- Moorvale Coal Project
- Suttor Creek Project
- Newlands & Newlands Extension Projects
- Talwood Project
- Dysart East
- Twin Hills
- Sonoma Coal Project
- Vermont Coal Project
- Caval Ridge Mine Project - Change 5
- Bowen Basin Coal Growth - Caval Ridge
- Bowen Basin Coal Growth - Daunia Mine
- Goonyella Riverside Mine
- Jax Project
- Sarum Project
- New Lenton Project
- Burton Project
- Wards Well Underground
- Anthony Project
- Saraji East
- PL 224
- Moranbah CSG Operation
- Moranbah South
- Olive Downs North
- Winchestor South
- Willunga Project
- Arrow Bowen Pipeline Project (Approximate Location)
- Bow Energy Gas Pipeline (Approximate Location)
- Water for Bowen Project (Approximate Location)
- Northern Missing Link
- Central Queensland Integrated Rail Project (Approximate Location)
- Central Queensland Gas Pipeline
- Goonyella to Abbot Point Rail Project
- Connors River Pipeline (Approximate Location)
- North Queensland Gas Pipeline
- Moranbah Airport, Power & Ammoniun Nitrate Projects (Approximate Locations)
- Nebo Power Station
- Connors River Dam (Approximate Location)
- Collinsville Project (Approximate Location)
- Cows Coal Project (Approximate Location)
- Dalrymple Bay Coal Terminal Expansion
- Byerwen Project Area
- Local Government Boundaries
- 15 km extent
- 50 km extent
- 150 km extent

BPA Corridor

- State
- Regional

Cumulative Impacts - Bioregional Corridors

QCOAL GROUP

Figure 34-4

Byerwen Coal Project

Date: *14/03/2013*

Author: samuel.ferguson

Map Scale: 1:1,250,000

Revision: R1

Coordinate System: GCS GDA 1994

environmental and licensing professionals pty ltd

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34.10 Aquatic Ecology

Table 34-8 considers the different sources of cumulative environmental impacts and how they may relate to aquatic ecosystems impacted by the Byerwen project (Canter and Kamath 1995; Sadar 1994; as cited in Elliott and Thomas 2009).

Table 34-8 Sources of Cumulative Environmental Impact Relating to Aquatic Ecosystems

Issue type*	Main characteristics*	Potential impacts on aquatic ecosystems	Mitigation measures to avoid project contributing to cumulative impacts
Time Crowding	Frequent and repetitive impacts on a single environmental medium	• Wastes sequentially discharged into waterways, wetlands or catchments.	• Proper management of fuels, oils and hazardous substances. • Runoff control – implementation of location -specific sediment and erosion control plans. • Discharge criteria to meet EA conditions.
Space Crowding	High density of impacts on a single environmental medium	• Habitat fragmentation in waterways. • Removal of lacustrine wetland habitat. • Removal of gilgai wetland habitat.	• Aquatic and riparian habitat reinstated in diversion channels. • Alternative lacustrine wetland habitat created, resulting in an overall increase in lacustrine wetland area. • Discharge criteria to meet EA conditions.
Compounding Effects	Synergistic effects due to multiple sources on a single environmental medium	• Downstream effects of several projects in the Suttor and Belyando sub-catchments and broader Burdekin catchment, including impacts on the Great Barrier Reef.	• Management of fuels, oils and hazardous substances. • Runoff control – implementation of location-specific sediment and erosion control plans. • Discharge criteria to meet EA conditions.
Time Lags	Long delays in experiencing impacts	• Accumulation of contaminants in sediments. • Bioaccumulation of contaminants in aquatic flora, fauna or terrestrial predators.	• Management of fuels, oils and hazardous substances. • Mitigation measures for dusts and other gaseous emissions • Runoff control -implementation of location-specific sediment and erosion control plans. • Discharge criteria to meet EA conditions.
Space Lags	Impacts resulting some distance from their sources (e.g., gaseous emissions into the atmosphere)	• Alteration of water and sediment chemistry in the broader catchment or neighbouring catchments.	• Implement mitigation measures for dust and other gaseous emissions.

Issue type*	Main characteristics*	Potential impacts on aquatic ecosystems	Mitigation measures to avoid project contributing to cumulative impacts
Triggers and Thresholds	Impacts to biological systems that fundamentally change system behaviour (e.g., effects in changes in forest age on forest fauna)	• Altered runoff volumes, velocities and patterns (flow regimes) impacting fish movement and spawning cues in aquatic fauna. • Flow alteration resulting in scouring and habitat loss for aquatic flora and fauna.	• Diversion channels designed to mimic: gradient, meander, substrate composition, in-stream habitat and vegetation of natural waterways. • Discharge to waterways to follow EA conditions, including meeting appropriate discharge quality and only discharging when high flow is encountered in receiving waters.

Note *: After Sadar (1994) as cited by Elliot and Thomas (2009).

In order for impacts to be considered cumulative, they must:

- not occur in isolation (i.e., not be an impact unique to one project only)
- occur within relevant spatial and temporal scales.

Local and regional mining projects which have the potential to contribute to those sources of cumulative environmental impacts to aquatic ecology outlined in **Table 34-8** are presented, according to their respective catchments, within **Table 34-4**. It is expected that all projects will implement mitigation measures to minimise impacts to aquatic ecology and that residual impacts will be broadly similar to the Byerwen project as these other projects are related to coal mining.

As outlined in **Chapter 19**, with the implementation of proposed mitigation measures, the Byerwen project is expected to result in minor impacts on threatened or Priority aquatic species, aquatic ecological communities or their habitats. The impact to the ecological integrity of the Suttor River, Kangaroo Creek or their downstream receiving environs as well as the impacts on aquatic fauna from removal of mapped lacustrine dam is also expected to be minor. Therefore should the Byerwen project occur within relevant spatial and temporal scales, its contribution to cumulative impacts of projects on these aquatic ecology values will be minor.

Impacts to the aquatic ecology of the palustrine wetland, during the period when the hydrology of the wetland is altered, will be minor to moderate. Once the wetland catchment is rehabilitated to a similar pre-development hydrological profile, impacts on the aquatic ecology of the wetland will be negligible. There are no other projects expected to contribute to cumulative impacts on the palustrine wetland, as its catchment is only impacted by the Byerwen project.

34.11 Stygofauna

Consideration has been given to potential cumulative effects on stygofauna arising from the following:

- the compound effects of a single mining or processing operation
- interference effects between multiple mining and processing operations
- interaction between mining and non-mining activities.

The cumulative effects of mining on the regions groundwater levels are considered in **Section 34.8. Chapter 17** describes the Byerwen project's potential impacts on groundwater including:

- groundwater quantity (i.e. alteration to groundwater levels)

- groundwater quality
- groundwater – surface water interaction
- physical disruption to aquifers.

All of the above have the potential to impact on groundwater quantity and quality therefore ultimately on obligate groundwater dependent fauna (stygofauna including hyporheic fauna).

A study of the local hydrogeology considered the adjacent Xstrata Coal's mines (immediately to the east of the Byerwen project area) (see **Appendix 21)**. This study concludes that with respect to stygofauna habitat, the Byerwen project and Xstrata Coalmine groundwater units are common across the projects. This has allowed the Xstrata Coal mine stygofauna dataset to be included as part of a combined dataset which has been used to inform the Byerwen project stygofauna assessment.

Order/Family level taxonomic analysis was undertaken as this is the prescribed level of taxonomic resolution required by the Queensland Coordinator General in the Byerwen project's Terms of Reference (ToR). Furthermore in Queensland, to satisfy the ToR endemism must be disproved at the Family or Order level for stygofauna. A description of stygofauna identified in the project area and from Xstrata Coal's mine data is provided in **Chapter 20**.

The Order/Family level stygofauna taxa identified across the combined dataset, shows that taxa collected from bore BYGW02 (in November/December 2011) were identified as belonging to the Orders Amphipoda and Copepoda (Family Cyclopoida). They are not endemic, because the Order/Family they belong to (i.e. Amphipoda and Cyclopoida) occur in all Australian States (Serov, 2002).

Given the limited number of Order/Family taxa described within the Byerwen project area and their non endemicity, it is concluded that any proposed mining activities associated with the Byerwen project area and Xstrata Coal's surrounding mining projects will not threaten or put at risk the survival of the amphipod and copepod taxa at the Order/Family level of taxonomic resolution.

34.12 Air Quality

Monitoring of ambient air quality in the Byerwen project area demonstrates that ambient air quality meets air quality objectives. Ambient air quality inherently includes any impacts related to Xstrata Coal's existing operational mine sites; accordingly the results of the Byerwen project air quality assessment already quantify the cumulative impact of Xstrata Coal's adjacent mines. As such all cumulative impacts of the Byerwen project and Xstrata Coal's existing mines on air quality can be mitigated to meet air quality objectives.

However, as details on the air emissions from future projects are not available, quantitative air quality modelling, inclusive of future projects with the potential for cumulative impacts with the Byerwen project, was not undertaken. Therefore a qualitative assessment of cumulative air quality impacts was conducted.

The modelling of the long-term air quality exposure, expressed in terms of the TSP (annual average) and the $PM_{2.5}$ (annual average) (refer **Chapter 22**) may be used to address cumulative impacts since it incorporates all the prevailing wind directions. The contours from the operations show that the west of the Byerwen project area is more likely to experience a greater increase in dust levels than to the east of the Byerwen project area. A similar outcome would be expected for any future mines, i.e. greatest impacts to the west of any proposed mining operation.

There is one receptor (R5) to the west of the Byerwen project. Although both the TSP (annual average) and the $PM_{2.5}$ (annual average) air quality objectives are readily met, this receptor is likely to experience at most a 20% increase in $PM_{2.5}$ (annual average) and a 60% increase TSP (annual average). There is one proposed mine to the east of R5 (i.e. predominantly upwind) beyond the Byerwen project; namely

Xstrata Coal's proposed Newlands Mine Extension Project. Since the proposed mine is much further from R5 than the Byerwen project the likelihood of dusts from this proposed mine causing a further increase in the annual average dust levels at R5 is considered unlikely.

There are four receptors to the east of the Byerwen project. Since these sensitive receptors (R2, R3, R6 and R7) are mostly upwind, the impact from the Byerwen project is much lower than for the sensitive receptor to the west (R5). Both the TSP (annual average) and the $PM_{2.5}$ (annual average) air quality objectives are readily met at the eastern receptors and they are likely to experience <1% increase in $PM_{2.5}$ (annual average) and at most a 4% increase TSP (annual average). These sensitive receptors are closer and generally to the east of the Newlands Mine Extension Project. Thus receptors R2, R3, R6 and R7 are more likely to be adversely affected by the Newlands Mine Extension Project than the Byerwen project.

Short-term impacts are typically assessed by the 24 hour averaging period, i.e. the PM_{10} (24 hour). The high dust levels at a large distance from the Byerwen project (refer **Chapter 22**) are the result of a constant and consistent wind direction continuing for an extended long period, 24 hours or longer. Apart from a consistent wind direction, the meteorology conditions do not assist dispersion of particulates (low wind speed and a stable atmosphere). Typically a narrow dust plume is formed and in some instance, depending on the wind direction, it may pass and accumulate with dusts from several Byerwen project sources. However it is unlikely that these short-term, narrow meandering dust plumes will accumulate with dusts from other mines since the plumes do not pass through any other proposed mining projects. The dusts from other mines will travel on an entirely different path and are unlikely to combine and cause cumulative impacts.

34.13 Greenhouse Gas

This EIS does not provide a quantified assessment of cumulative greenhouse gas emissions from other projects, as all projects worldwide, have the potential to contribute to greenhouse gas emissions.

The 2012 National Greenhouse Gas Inventory is the most up to date account of Australia's greenhouse gas emissions (DCCEE, 2012). Australia's net greenhouse gas emissions for the year to end June 2012 across all sectors totalled 551 Mt CO_2-e. The energy sector, which includes coal mining sources, contributed the vast majority of the total emissions, with 416 Mt CO_2-e. Within the total emissions by the energy sector, fugitive emissions from fuel accounted for 40.9 Mt CO_2-e.

The maximum annual emissions for the Byerwen project, including an estimate for vegetation clearing based on annualising life of project emissions, is approximately 568 kt CO_2-e. This is approximately 0.1% of the national GHG inventory for 2012. This is considered to be a minor contribution to Australia's annual GHG emissions.

34.14 Noise and Vibration

Noise and vibration impacts from the Byerwen project will only be cumulative with other projects in the local area (e.g. within 10 km of the Byerwen project noise sources). Only Xstrata Coal's mining projects have the potential for ongoing cumulative noise and vibration impacts. Other projects involving linear infrastructure construction in the vicinity of the Byerwen project may result in temporary cumulative noise impacts during construction periods.

Existing noise levels were measured at several homesteads surrounding the Byerwen project. The noise levels at all the homesteads are low and industrial or commercial noise is not currently a feature of the existing noise levels at the homesteads, including noise from Xstrata Coal's nearby mines.

The Environmental Protection (Noise) Policy 2008 (EPP (Noise)) was reviewed for applicability and the acoustic quality objectives were considered relevant. These objectives are designed to preserve the

health and wellbeing of sensitive receptors, which in the case of the Byerwen project, are the occupants of the homesteads. The EPP (Noise) noise goals for background creep are more stringent than the acoustic quality objectives (refer **Chapter 24**) and these goals, particularly at the homesteads, are the most stringent noise level goals possible in Queensland.

One of the background creep objectives is that the acoustic environment not be permitted to deteriorate. This implies that, should another mine or other development undertake a noise assessment at any of the sensitive receptors identified for the Byerwen project then the noise level goal developed for that study would be the same or very similar to that developed for the Byerwen project.

Noise modelling described in **Chapter 24** demonstrates that no sensitive receptors in the vicinity of the Byerwen project will experience noise and vibration levels above noise and vibration objectives, including noise level goals to avoid background creep for all time periods.

The only receptor with the potential for cumulative noise and vibration impacts is R2, which is to the east of Xstrata Coal's Suttor Creek mine and the Byerwen project's East Pits. Other receptors are located in areas where it is considered that noise and vibration may be experienced from either one or the other project, but not cumulatively from both projects. Modelled noise levels at R2 range between 22 dB(A) and 27 dB(A) across various periods of the Byerwen project's life, which is lower than the objective to prevent background creep of 28 dB(A). Objectives for blast overpressure and vibration from the Byerwen project's activities are also met at R2.

With the adoption of similar acoustic objectives to limit background creep, and the adoption of similar vibration goals, at other projects, future cumulative impacts are not expected at sensitive receptors.

34.15 Visual Amenity and Landscape

The assessment of cumulative visual and landscape character impacts focuses on existing and planned future mines and other planned infrastructure projects within 15 km of the Byerwen project (shown in **Figure 34-1)**. The key projects considered as relevant to the landscape and visual assessment are described below.

The existing Xstrata Coal mining operations covering 11 mining leases covering an area of approximately 20,166 hectares. Existing mining activities within 15 km of the Byerwen project are:

- Newlands mine to the east of the Byerwen project comprising existing mining operations, coal handling and preparation plant, airstrip, coal loader, run-of-mine and product stockpiles, mine voids, waste rock dumps and main administration and warehouse complex
- Suttor Creek and Wollombi pits (immediately south-east of the Byerwen project) comprising active open cut mining area, temporary infrastructure, mine stockpiles, extensive waste rock dumps
- Newlands South comprising open cut mining area undergoing rehabilitation and tailings storage area
- Eastern Creek South comprising active open cut mining area with ROM stockpiles, waste rock dump and voids

Planned mine projects within 15 km include:

- Newlands Coal Extension Project (a substantial extension to the existing mining operations east of the main deposit and around the existing Eastern Creek Pit (over approximately the next 26 years)).

Three other future planned linear infrastructure projects are within 15 km of the Byerwen project area.

Areas of active and rehabilitated high and extensive waste rock dumps associated with the Suttor Creek and Wollombi mines are visible from parts of the Collinsville-Elphinstone Road. These are a visually

dominant feature in the south of the Byerwen project area. Some waste rock dumps are yet to be rehabilitated, are grey in colour, and are the most visible element. This visual contrast will reduce with revegetation over time, with completion due in approximately 15 years.

There are currently no outside views of any other parts of Xstrata Coal's mines within 15 km of the Byerwen project area, apart from those along Collinsville-Elphinstone Road (i.e. the main entry gates and the road overpass near the intersection with Wollombi Road).

The addition of the Byerwen project would increase the number of industrial-like structures in the general area and overall would change the relatively undisturbed rural and vegetated landscape character to a more disturbed active mining area.

Other potential linear infrastructure projects would have a lesser impact, but would nevertheless add to the overall cumulative loss of scenic quality and further detract from the rural character.

Overall, the area most affected by cumulative impact would be the views from the Collinsville-Elphinstone Road, in the area where the road crosses the central portion of the Byerwen project area. Within this area there would be cumulative visual impact primarily due to the combined views of the existing Newlands, Suttor Creek and Wollombi mines and the Byerwen project.

The two main mitigating factors taken into account when considering this impact are as follows:

- There would be no sensitive receptors already affected by the existing and planned mines that appear to be also affected by the Byerwen project.
- Although there would be an additional loss of scenic quality and rural landscape character, the scenic quality of the overall landscape has been assessed as low or moderate, and of a type that is relatively widespread and common.

Potential mitigation measures for the Byerwen project include the retention of a 25 m vegetated buffer where practicable along Collinsville-Elphinstone Road. This will reduce impacts associated with the Newlands, Suttor Creek and Wollombi mines by continuing to screen views of the existing and future waste rock dumps of both projects.

34.16 Waste

This section describes cumulative impacts from management of non-mining waste, as described in **Chapter 26**. With appropriate management of non-mining waste, as described in **Chapter 26**, it is not expected that the Byerwen project will result in the release of pollutants. Therefore the Byerwen project will not contribute to cumulative impacts from the uncontrolled release of non-mining wastes.

The majority of waste described in **Chapter 26** will be reused, recycled or, in limited circumstances (i.e. used tyres), disposed of on site. Byerwen Coal proposes to use Isaac Regional Council's (IRC's) Glenden Waste Facility for disposal of general wastes other than:

- wastes that are reused or recycled, either on-site or at a designated facility
- wastes planned for on-site disposal
- regulated wastes or other wastes that cannot be accepted by the Glenden Waste Facility.

It is estimated that the quantity of general wastes (e.g. putrescibles and plastics) would be approximately 170 tpa during operations. Other regulated wastes such as oils, chemicals and batteries are likely to be transferred to specialist waste disposal facilities in the region or state for recycling or disposal. Treated effluent from the onsite sewage treatment plant will be re-used on site or used for irrigation. Biosolids may be disposed of at Glenden Waste Facility.

Other projects in the local area (e.g. Xstrata Coal's mines) are also likely to use Glenden Waste Facility for disposal of general waste and biosolids. All projects in the region may use regional or state wide waste disposal facilities for recycling or disposal of regulated waste. This will result in cumulative impacts to waste facilities. The proponent will work closely with regional councils and waste contractors to ensure that waste disposal facilities have the required capacity to meet the needs of the Byerwen project and other projects.

34.17 Traffic and Transport

Chapter 27 describes the roads that will be impacted by the Byerwen project, the current traffic volumes on those roads, the traffic volumes generated by the Byerwen project and the predicted growth in traffic volumes from all projects in the region that may use those roads. This information has been used to estimate the Byerwen project's contribution to cumulative growth in traffic volumes.

Annual growth rates in traffic volumes were sourced from the Department of Transport and Main Roads (TMR). **Table 34-9** summarises the information gathered from historic growth rates and the growth rates agreed with TMR to be utilised in the traffic assessment.

Table 34-9 Traffic Growth Rate Summary

TMR Road No.	Road Description	5 year growth			Exponential Growth Rate (Yr 19)	TMR Agreed rate
		G	A	B	AADT	B
33B	Peak Down Highway	5.58%	5.24%	5.41%	5.74%	5.50%
88A	Bowen Developmental Road - north of Collinsville	8.75%	8.28%	8.51%	8.71%	8.50%
88B	Bowen Developmental Road - south of Collinsville	22.62%	19.16%	20.92%	24.88%	8.50%
5307	Collinsville-Elphinstone Road	11.74%*	7.78%*	9.78%*	NA	10.00%
10H	Bruce Highway - Mackay to Proserpine	2.89%	3.20%	3.04%	3.36%	3.00%
10J	Bruce Highway - Proserpine to Bowen	3.45%	3.36%	3.41%	3.67%	3.00%
10K	Bruce Highway - Bowen to Ayr	2.98%	2.27%	2.63%	3.00%	3.00%
33B	Peak Down Highway	5.58%	5.24%	5.41%	5.74%	5.50%
82A	Suttor Developmental Road	9.60%	6.62%	8.10%	5.78%	6.00%

*Segment growth rate for 1 year only
G Gazettal direction
A Against gazettal direction
B Both directions

As described in **Chapter 27**, the only link in the road network where the Byerwen project contributes greater than 5% (modelled increase of 10.5% in 2014 for heavy vehicles) to the cumulative increase in annual average daily traffic (AADT), is Collinsville-Elphinstone Road south of the Byerwen project to Glenden.

As described in **Chapter 27**, the Byerwen project is not expected to have significant impact on the road link performance based on the level of service measurement criteria for roads described in **Table 34-9**.

The Byerwen project's contribution to cumulative impacts on traffic volumes and the level of service on roads in the region is likely to be minor impact.

There are four sections of road where the Byerwen project's pavement impacts (measured as equivalent standard axels (ESAs)) increased the expected cumulative growth in background traffic ESAs by more than 5% including:

- Collinsville-Elphinstone Road north of the Byerwen project site to Bowen Developmental Road (5.7%)
- Collinsville Elphinstone Road between the Byerwen project site and Glenden (15.1%)
- Collinsville-Elphinstone Road between Glenden and Suttor Developmental Road (9.1%)
- Suttor Developmental Road between Elphinstone and the Peak Down Highway (5.7%).

The Byerwen project's pavement impact will be mitigated by contributions to maintenance costs. It is expected that other projects in the region will also contribute to maintenance costs. With the increased contributions to maintenance costs, the Byerwen project's contribution to cumulative pavement impacts on regional roads is likely to be minor.

34.17.1 Interaction of the Byerwen Project's Roads with Rail Lines and Linear Infrastructure

The Byerwen project's ROM coal and waste rock haul roads will cross the following linear infrastructure:

- the GAP rail line and Alpha Coal Project rail line between the Byerwen project's South Pits and their associated out of pit waste rock dumps
- Xstrata Coal's mining lease for transport.

The central infrastructure corridor (containing the Byerwen project site access road to the northern area) will cross GAP rail line, Alpha Coal Project rail line and the Collinsville-Elphinstone Road.

The crossing of the GAP rail line will be designed in accordance with the relevant standards and guidelines. Any assessment including an Australian Level Crossing Assessment Model will be undertaken as part of the permit requirements for the level crossing through Queensland Rail.

The intersection of the haul roads with Xstrata Coal's mining lease for transport will be designed in accordance with the relevant design guidelines and standards including turn paths/swept path of the appropriate vehicles and ensure that appropriate sight lines and distances are provided to ensure safe operation of the intersection.

34.18 Historical Cultural Heritage

As described in **Chapter 29**, the historical cultural heritage values that may be impacted by the Byerwen project are camp sites and homestead complexes. The potential for cumulative impacts on these values is considered below.

The cumulative impacts of the Byerwen project on camp sites cannot be accurately assessed as there is no way to determine the total number of such camps at a state or regional level or to determine the proportion of such camps being impacted by other projects in the region. However, only one such camp site has the potential to be impacted directly by the Byerwen project and it is likely that any impact on this heritage value would be a very small proportion of the total cumulative impact on sites of this type across the region.

There is some evidence for homestead complexes throughout the region, and many of these exist in areas near other projects. The cumulative impacts on homesteads as a heritage category across the

region is difficult to accurately assess as there is limited information on the location, condition, and significance of these homesteads relative to the areas of impact from other projects. For the Byerwen project to contribute to cumulative impacts on homesteads in the region it must itself cause an impact on individual homesteads. The Byerwen project's potential to impact homesteads is low.

The Byerwen project's contribution to cumulative impacts on historical cultural heritage values is considered to be negligible.

34.19 Indigenous Cultural Heritage

Approximately 100 known heritage values were identified within the Byerwen project area, of which approximately 40 are within the Byerwen project footprint. It is likely that other indigenous cultural heritage values exist within the Byerwen project area and project footprint and these will be managed in accordance with the approved Cultural Heritage Management Plans developed with the Birriah and Jangga Peoples.

It is expected that the Aboriginal cultural heritage landscape of the region may be affected by the cumulative impact of the projects in the region. Impacts to Aboriginal cultural heritage will be considered as part of assessment and management processes specific to each individual project's CHMP, and will also be considered as part of inspection and assessment processes conducted at each project site, where ground disturbance is contemplated.

The Byerwen project's contribution to cumulative impacts on indigenous cultural heritage is considered to be minor.

34.20 Economics

Appendix 30 provides an assessment of cumulative economic impacts, with a focus on the cumulative economic impacts of coal projects in the region. The cumulative impact of the coal projects equates to additional production of approximately 140 Mtpa of coal. This increases to 150 Mtpa when combined with the Byerwen project's 10 Mtpa. Noting recent market events and recent announcements by major mining companies to delay projects, this additional production is unlikely to be realised to the full extent. **Table 34-10** provides a qualitative assessment of the cumulative positive and negative economic impacts in the region under three scenarios of additional coal production.

Table 34-10 Cumulative Economic Impacts under Varying Scenarios for Coal Production

Scenario	Positive impacts	Negative impacts	Overall summary
Upper - Additional 150 Mtpa (100% of proposed projects)	Significant increase in economic activity across the region. Greater employment opportunities with likely flow-on effects to wages and household income. Potential increase in royalties and taxes payable to government (dependent on the value of $A, demand and coal prices).	Potential for significant pressure to be placed on accommodation and housing. Likely to be impacts on supporting infrastructures (i.e. water, power, sewerage etc) ability to cope with such development. Possible significant differential in local economy as businesses and councils try to compete for labour in increased wages and lower unemployment.	Overall the potential positive impacts on local, regional, state and national economies would outweigh negative impacts. Priority would need to be given to mitigation strategies to appropriately treat negative impacts.
Middle - Additional 105 Mtpa (70% of proposed projects)	Increased economic activity across the Region. Low unemployment with likely flow-on effects to increased wages and household income. Potential increase in royalties and taxes payable to government (dependent on the value of $A and coal prices).	Potential for pressure on accommodation, housing and supporting infrastructure. Possible differential in local economic and businesses and councils ability to compete for labour.	Overall the potential positive impacts on local, regional, state and national economies would outweigh negative impacts. Mitigation strategies would need to be developed to appropriately treat negative impacts.
Lower Additional 45Mtpa (30% of proposed projects)	More sustainable level of economic growth across the region. Impacts likely to be more localised where development is occurring. Moderate effects on employment, wages and household income. Manageable effects on accommodation, housing and supporting infrastructure.	Lower level of investment reducing anticipated revenues, taxes, fees etc payable to government.	Overall the potential positive impacts on the local, regional, state and national economies would outweigh the negatives. Development is likely to be sustainable across the region.

Under all scenarios, the overall cumulative economic impact to the region is positive. Depending on the number of projects reaching maturity the cumulative positive economic impact is moderate or major. The Byerwen project's contribution to cumulative economic impacts in region may range between 5% and 20%, depending on the number of projects that proceed. This is considered to be a moderate to major contribution to the cumulative economic impacts in the region.

34.21 Social

The social cumulative impacts considered for the Byerwen project relate to the increase in residence and the associated impact on housing and community infrastructure, facilities and services in Glenden.

The Byerwen project is expected to contribute to a 43.5% increase in the existing population in Glenden (1,793 at 2011) when the workforce peaks at 780 personnel (including construction and operation) at year 16 of the mine life. A summary of the assessment of impacts on housing and community infrastructure, facilities and services in Glenden from the Byerwen project is provided in **Table 34-11** below

Table 34-11 Summary of Potential Social Impacts

Potential impact	Phase	Positive/ negative	Impact significance without mitigation	Residual impact significance
Housing and Accommodation				
Increased temporary accommodation requirements.	Construction	Negative	Moderate	Low
Increased permanent accommodation requirements.	Operation	Negative	High	Low
Employment, Education and Training				
Generation of construction employment.	Construction	Positive	Moderate	-
Generation of operations employment.	Operation	Positive	High	-
Stimulation of training and skill development opportunities.	Construction Operation	Positive	Moderate	-
Contribution to regional skills shortage	Construction Operation	Negative	Moderate	Low
Health and Community Infrastructure				
Increased demand on health services.	Construction Operation	Negative	High	Moderate
Increased demand on essential services.	Construction Operation	Negative	Moderate	Low
Increased demand on education services.	Operation	Positive	High	-
Increased demand on emergency services.	Construction Operation	Negative	High	Moderate
Increased usage of recreational facilities and services.	Operation	Positive	Moderate	-
Increased usage of general community infrastructure (halls, meeting spaces etc.)	Operation	Positive & Negative	Moderate	-
Lack of land allocation for provision of social and commercial services.	Operation	Negative	Moderate	Low

Projects which are considered to potentially contribute to cumulative impacts on housing and community infrastructure, facilities and services in Glenden include:

- Newlands Coal Project (Suttor Creek and Wollombi mines)

- Newlands Coal Extension Project
- Eaglefield Expansion Project

The Newlands Coal Project involves extension of the existing Xstrata Coal's Suttor Creek operations into the Wollombi area. The extension will provide an additional 125 operational and 60 construction positions to the existing workforce (estimated to be 1,227), based in Glenden. Assuming the additional 185 person workforce associated with the project will reside in Glenden, Newlands Coal Project will contribute to a 10.3% increase in the existing population in Glenden (1,793 at 2011). The Newlands Coal Project's contribution to the increase in population for Glenden is approximately 25% of the Byerwen project's contribution. As shown in **Table 34-11**, following mitigation measures the Byerwen project's impacts on housing and community infrastructure, facilities and services in Glenden are assessed as a combination of low to moderate negative impacts and moderate to high positive impacts. Newlands Coal Project's impacts on housing and community infrastructure, facilities and services in Glenden are expected to be less than the Byerwen Coal project's contribution to these impacts, with mitigation of negative impacts. The cumulative impact from the Newlands Coal Project and Byerwen project on housing and community infrastructure, facilities and services in Glenden is expected to be broadly similar to the Byerwen project.

The proposed extensions associated with the Newlands Coal Extension Project would enable the existing workforce and equipment to move into new areas as coal reserves in existing parts of Newlands mine are depleted. Subsequently, it is not anticipated that the extension will result in any additional workforce requirement. As such the Newlands Coal Extension Project's contribution to cumulative impacts on housing and community infrastructure, facilities and services in Glenden would be negligible.

The Eagle Field Mine is approximately 35 km in a direct line to the south west of Glenden. Current operations support a workforce of 220 employees. Peabody Energy is currently advancing the Eagle Field Expansion Project with the EIS approved in October 2011 pending the submittal of an adequate EM Plan. The Eagle Field Expansion Project will require a predicted 650 construction employees and 700 operations employees. If no accommodation options are available in Moranbah there is the potential for the workforce associated with the Eagle Field Expansion Project to look to Glenden for housing accommodation. If housing accommodation is provided in Glenden, the Eagle Field Expansion Project would contribute to cumulative impacts associated with demand on housing and community infrastructure, facilities and services in Glenden. Assuming the additional 1,350 person workforce associated with the Eagle Field Expansion Project will reside in Glenden, the project will contribute to a 75.3% increase in the existing population in Glenden (1,793 at 2011). This contribution to the increase in population for Glenden would be greater than the contribution of the Byerwen project. The cumulative impact on housing and community infrastructure, facilities and services in Glenden from the Byerwen Project and the Eagle Field Expansion Project would be equal to or greater than the Byerwen project's contribution to these impacts, potentially resulting in moderate to high negative impacts and moderate to high positive impacts.

It is expected that other projects that contribute to negative cumulative impacts will implement mitigation measures and that the residual cumulative impacts in the region will be managed at an acceptable level.

34.22 Hazard and Risk

Chapter 32 (Section 32.6.8) presents a cumulative risk assessment for the interaction of Byerwen project activities with third party infrastructure.

High risks were identified resulting from the interaction with third parties, namely:

- Goonyella to Abbot Point rail line

- Alpha Coal Project railway line
- Access road / heavy vehicle road intersection with Collinsville-Elphinstone Road
- Xstrata Coal's mine vehicles along the transport route from mines south of the project (Suttor Creek and Wollombi) to the Newlands mine that bisects Byerwen tenements
- SunWater Pipeline (Burdekin to Moranbah)
- North Queensland Gas Pipeline

These risks related to the potential for vehicle accidents, fly rock from blasting and explosion from the gas pipeline. The risks has been assessed as high as the consequence could result in a fatality, however likelihood of the event was 'unlikely' or 'rare'.

The Byerwen project's activities may interact with other project's activities in the region, however this interaction is unlikely to increase the cumulative risk level, assuming the mitigation measures recommended are implemented and working effectively.

34.23 Health and Safety

Potential health and safety impacts associated with the Byerwen project activities have been identified and assessed, with mitigation measures proposed. Cumulative impacts were assessed for all potential health and safety impacts identified (e.g. from air emissions, noise or impacts to water quality) and detailed in in this chapter. It is expected that with the adoption of proposed mitigation measures for the Byerwen project and similar measures at other projects, cumulative health and safety impacts will be minor.

34.24 MNES

A cumulative impact assessment for MNES is provided in **Chapter 35**.

34.25 Conclusion

Over 50 proposed projects and existing projects with the potential for cumulative impacts with the Byerwen project in the region were identified and a methodology presented for the assessment of cumulative impacts. Cumulative impacts can occur on a spatial and temporal level. Depending on the environmental, social or economic values being considered, cumulative impacts may occur at a local, catchment or regional level. Therefore not every project considered contributes to cumulative impacts for each environmental and social value.

Overall the cumulative impacts in the region were assessed for all environmental social and economic considerations as being negligible or minor, with the exception of impact on natural grassland TEC. The cumulative impact on natural grassland TEC is considered moderate for the regional projects considered; however, the Byerwen project's contribution to cumulative impacts is assessed as being minor.

The project will implement a range of mitigation measures for residual ecological impacts (e.g. offsets). It is expected that other projects that contribute to cumulative impacts will implement comparable mitigation measures.

In addition it should be noted that the below potential contributions to cumulative impacts in the region are not minor but are of notable benefit and have a positive impact:

- The Byerwen project's impact on economic benefits assessed as a moderate to major positive contribution to regional cumulative impacts.

- The Byerwen project's impact on social values was assessed as a moderate to high positive and negative contribution to cumulative impacts, depending on the values assessed and the potential projects proceeding in the region.