Adani Mining Pty Ltd

Carmichael Coal Mine and Rail Project SEIS

Report for Updated Mine Project Description

18 October 2013

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1. Introduction

1.1 Project overview

Adani Mining Pty Ltd (Adani, the Proponent), commenced an Environmental Impact Statement (EIS) process for the Carmichael Coal Mine and Rail Project (the Project) in 2010. On 26 November 2010, the Queensland (Qld) Office of the Coordinator General declared the Project a 'significant project' and the Project was referred to the Commonwealth Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) (referral No. 2010/5736). The Project was assessed to be a controlled action on the 6 January 2011 under section 75 and section 87 of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The controlling provisions for the Project include:

- World Heritage properties (sections 12 & 15A)
- National Heritage places (sections 15B & 15C)
- Wetlands (Ramsar) (sections 16 & 17B)
- Listed threatened species and communities (sections 18 & 18A)
- Listed migratory species (sections 20 & 20A)
- The Great Barrier Reef Marine Park (GBRMP) (sections 24B & 24C)
- Protection of water resources (sections 24D & 24E)

The Qld Government's EIS process has been accredited for the assessment under Part 8 of the EPBC Act in accordance with the bilateral agreement between the Commonwealth of Australia and the State of Queensland.

The Proponent prepared an EIS in accordance with the Terms of Reference (ToR) issued by the Qld Coordinator-General in May 2011 (Qld Government, 2011). The EIS process is managed under section 26(1) (a) of the *State Development and Public Works Act 1971* (SDPWO Act), which is administered by the Qld Government's Department of State Development, Infrastructure and Planning (DSDIP).

The EIS, submitted in December 2012, assessed the environmental, social and economic impacts associated with developing a 60 million tonne (product) per annum (Mtpa) thermal coal mine in the northern Galilee Basin, approximately 160 kilometres (km) north-west of Clermont, Central Queensland, Australia. Coal from the Project will be transported by rail to the existing Goonyella and Newlands rail systems, operated by Aurizon Operations Limited (Aurizon). The coal will be exported via the Port of Hay Point and the Point of Abbot Point over the 60 year (90 years in the EIS) mine life.

Project components are as follows:

- The Project (Mine): a greenfield coal mine over EPC 1690 and the eastern portion of EPC 1080, which includes both open cut and underground mining, on mine infrastructure and associated mine processing facilities (the Mine) and the Mine (offsite) infrastructure including a workers accommodation village and associated facilities, a permanent airport site, an industrial area and water supply infrastructure

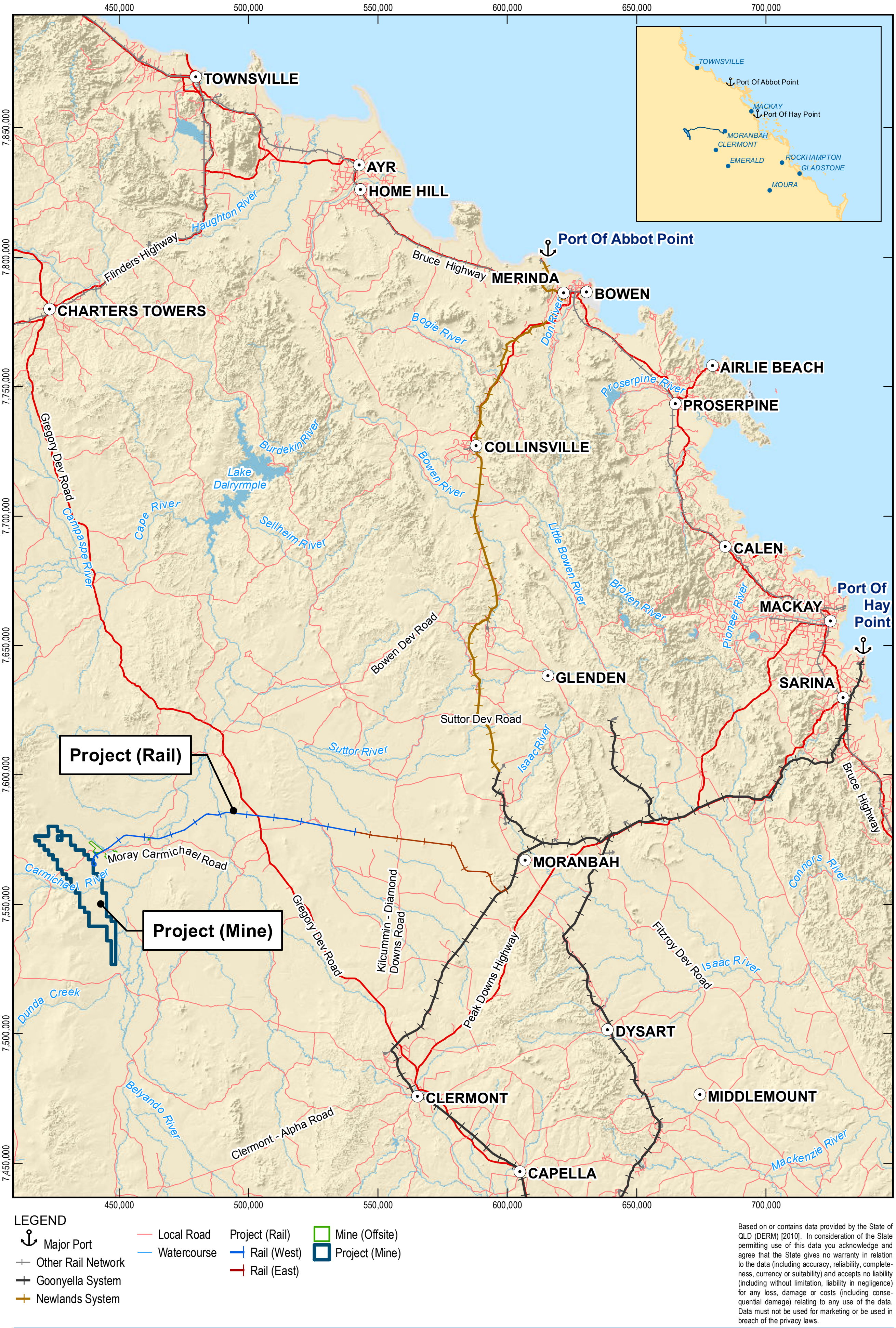
- The Project (Rail): a greenfield rail line connecting to mine to the existing Goonyella and Newlands rail systems to provide for the export of coal via the Port of Hay Point (Dudgeon Point expansion) and the Port of Abbot Point, respectively including:
  - Rail (west): a 120 km dual gauge portion running west from the Mine site east to Diamond Creek
  - Rail (east): a 69 km narrow gauge portion running east from Diamond Creek connecting to the Goonyella rail system south of Moranbah
  - Quarries: five local quarries to extract quarry materials for construction and operational purposes

Figure 1 illustrates the location of the Project.

1.2 Purpose of this report

This report outlines the updated project description for the Project (Mine). The following sections provide details regarding:

- rationale for the mine design and operational features
- the expected capital investment in the Project (Mine)
- the proposed onsite mine infrastructure
- the proposed coal handling process and associate coal handling plant layout and services
- activities associated with the mine pre-construction and construction phases
- activities associated with the mine commissioning and operation
- the proposed offsite infrastructure
- hazardous materials associated with the Project (Mine)
- proposed mine rehabilitation and decommissioning



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Kilometres

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

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Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project SEIS

Job Number	41-26422
Revision	B
Date	14-10-2013

Project Location

Figure 1

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Data Source: © Commonwealth of Australia (Geoscience Australia): Town, Railways, Watercourses (2007); DNRM: LGA, (2011), Hillshade (2009); DMR: State Roads (2008); DME: EPC1690 (2010), EPC1080 (2011); Adani: Mine Offsite, Alignment SP1 Opt11 Rev2, SP2 Opt 9 Rev 3 (2013). Created by: MS

1.3 Mine site details

The Project (Mine) is located in the northern part of the Galilee Basin, Central Queensland. The Mine will be developed over EPC1690 (incorporating Mining Lease Application (MLA) 70441, previously MDLA372) and the eastern and northern portion of EPC1080 (MLA70505 and MLA 70506). The Project is located approximately 160 km north-west of the town of Clermont. The nearest regional centre is Emerald, approximately 350 km south (refer to Figure 1). The Project (Mine) is predominantly within the Local Government Area (LGA) of Isaac Regional Council (IRC), with the exception of 167 ha within the north-western corner of the EPC1690, which is located within the LGA of Charters Towers Regional Council (CTRC). The IRC is located within the Isaac, Mackay and Whitsunday Region while the CTRC is located within the Northern Region of Queensland.

The Mine onsite infrastructure includes all infrastructure located within the boundary of EPC1690 and part of EPC1080. Adani currently holds EPC1690 and has lodged a MLA over EPC 1690) and EPC1080 . EPC1690 runs northwest to southeast, covering approximately 45 km in length and approximately 7 km in width. Adani has obtained consent from Waratah Coal Pty Ltd to lodge a mining lease application over the eastern and northern portion of EPC1080. The eastern and northern portion of EPC1080 is approximately 50 km in length and between 3 and 6 km wide. The offsite infrastructure is located outside EPC1690 and EPC1080, and is not within the proposed mining lease.

1.4 Ongoing evaluation and exploration activities

An ongoing programme of geological and geotechnical investigations is being, and will continue to be, carried out to further define the coal resources and refine the mine plan as the Project (Mine) progresses. This will include coverage across the Mine Area as well as more intense drilling of the sub-crop during early production, covering both the open cut mine areas and underground mine. This drilling program will increase knowledge of the deposit for resource estimation, washability testing as well as hydrogeological and geotechnical evaluation. These investigations will also provide further detail on ground conditions and enable detailed design of all infrastructure and structures associated with the Project (Mine).

Exploration activities will progress in stages aligned to the development of the Project (Mine); these will include:

- resource drilling to improve the level of certainty of the deposit characteristics and elevate the resource category
- geotechnical drilling to acquire knowledge of the appropriate underground working sections and the geotechnical environment affecting open cut slope stability
- Further line of oxidation line drilling to accurately define seam sub-crops for box cut designs
- 3D seismic surveys over the underground mining area to clearly define the structural geology
- hydrology studies to develop models of the subsurface hydrology regime for geotechnical studies, and evaluation of mine drainage and aquifer impacts of both open cut and underground mining

- coal quality drilling to improve knowledge of the coal raw quality and the coal washability characteristics to allow detailed CHPP design in later stages of planning

1.5 Relationship to other projects

The Project has a relationship to third party projects and approvals that will be completed separately to this environmental approval including:

- power transmission system, indicatively between Strathmore (near Collinsville) and the Project (Mine) site
- upgrade to the Moray Carmichael Access Road by Isaac Regional Council
- upgrades to the existing Aurizon rail system
- development of the North Galilee Basin Standard Gauge Rail System
- development of the Terminal 0 Expansion at Abbot Point Coal Terminal
- development of the Dudgeon Point Coal Terminal at Hay Point.

2. Rationale for mine design and operational features

2.1 Overview

The objectives of the Project (Mine) are to:

- produce 100 percent thermal coal product
- achieve a maximum production of 60 Mtpa of product coal sourced from open cut and underground mining
- produce coal with an energy and ash requirement saleable on the international seaborne thermal coal trading market

Adani in conjunction with GHD Pty Ltd, Runge Pty Ltd, Xenith Pty Ltd, Calibre Global Pty Ltd, Hyder Pty Ltd and other expert consultants has completed a detailed mine and supporting infrastructure plan for the development of the Project. The outcomes of these works include:

- development of macro level life of mine designs and associated mine plans
- outlining infrastructure, equipment and plant requirements for life of mine
- development of concept level cost estimates and production schedules
- identification of the mining, infrastructure and environmental constraints
- identification of any major risks or opportunities associated with the Project

Mine planning and design is in the pre-feasibility stage, with the mine plan developed on the basis of:

- an assessment of the general physical characteristics of the deposit based on a geological model built from existing exploration data
- an assessment of the detailed physical characteristics of the first 15 years of mine development deposit based on a geological model built from detailed 2012 exploration data
- the determination of the target coal resource and mine limits based on resource quality and economic considerations
- selection of low risk, high reliability mining methods, and particularly, which parts of the resource to target through open cut and underground methods
- mine waste characteristics and management requirements
- identification of the supporting infrastructure needs including both on-site and offsite infrastructure
- identifying optimal locations for infrastructure including minimisation of sterilisation of resource, location of workers accommodation away from noise and dust sources and overall efficiency of operation

This work has led to the pre-feasibility mine plan presented in this supplementary environmental impact statement (SEIS), which is based on the outcomes of the detailed planning works completed by the Proponent in conjunction with support consultants. While the overall mine concept and mining and infrastructure components are unlikely to change, further geological exploration and geotechnical investigations may result in a number of operational refinements throughout the life of the mine.

2.2 Coal seam physical characteristics

The technical feasibility of the Project (Mine) is dependent on the environmental, geological, geotechnical, hydrological and hydrogeological characteristics of the Project Area. Mine resource characteristics include the geology and location of varying qualities, quantities and depths of coal deposits, the surface water and groundwater features of the site, the location of the coal sub-crop and the geotechnical characteristics of the coal seam strata and overburden. The location and structure of the resource dictates the Project (Mine) layout, however, as the resource is further defined through continued exploration, the Project (Mine) layout may also be reviewed and amended accordingly.

The geological data used to support the mine plan is based on the Galilee Project – in situ JORC Coal Resources Estimate (Xenith Consulting, April 2013). This model has been developed in Mincom's Minescape software, and is underpinned by a total of 416 holes that were used to construct the geological model; 196 chip holes, 165 cored holes and 55 line of oxidation holes. A total of 157 holes were used as JORC points of observation and the topographic surface uses data from a detailed LiDAR survey commissioned by Adani in August 2011 that contains two data points per square metre. Adani has an ongoing exploration programme from which the geological model will be progressively updated.

The coal deposit underlies almost 100 percent of EPC1690. The results of the geological model show the coal seams gradually dip to the west at between 2 degrees and 6 degrees and the seams sub-crop along the eastern boundary of the Project (Mine). Four faults have been interpreted with vertical throws between 20 m and 40 m, trending in a general east - west direction. This orientation is concurrent with the trends seen elsewhere in the Galilee Basin. Mine planning has taken into account the impact and position of these faults through avoiding mine layout across the fault zones.

The overburden thickness to the shallowest coal seams ranges from 50 m of weathered Tertiary and upper Permian material in the east of the tenement, to over 400 m of weathered Triassic age Dunda beds and Rewan formation in the west. The seams are contained within the Permian coal measures, which are overlain across the total area by a poorly consolidated to unconsolidated cover of Tertiary materials, averaging 74 m in thickness but ranging to over 150 m in some areas. Figure 2 shows a generalised mine stratigraphic column.

Figure 2 Carmichael mine stratigraphic column

Age		Lithology	Stratigraphy	Thickness
Tertiary		Clay / Mudstones		40 – 100 m
Triassic		Mudstone / Siltstone	Rewan Formation	
Late Permian		Sandstone	Bandanna Formation	
		COAL – AB Seam		12 – 18 m Resource Seam
		Sandstone / Siltstone		10 m
		COAL – B Splits		1 – 2 m
		Siltstone / Mudstone		60 – 70 m
		COAL – C Seam (carbonaceous)		3 – 4 m
		Siltstone / Sandstone	Colinlea Sandstone	2 – 20 m
		COAL – D1 Seam		4 – 6 m Resource Seam
		Sandstone		5 – 30 m
		COAL D2/D3 Seam		8 – 10 m Resource Seam
		Siltstone / Mudstone		10 – 20 m
		COAL – E Seam		1 – 3 m Resource Seam
		Sandstone / Siltstone		5 – 10 m
		COAL – F Seam		1 – 5 m Resource Seam
Early Permian		Sandstone		

The coal seams occur in five main seam groups AB, C, D, E and F and have a maximum cumulative coal thickness of 50 m including the C seams and 40 m excluding the C seams. The C seams are excluded from the JORC resource estimate as they are not consistent in seam structure or thickness and often have high raw ash percentages of greater than 70 percent, air dried basis (adb). The cumulative coal thickness averages approximately 28 m (excluding C seams). The C seam and B splits have been excluded from the resource calculation because of high ash and inconsistent thicknesses.

The total JORC coal resource estimate within the Project (Mine) is 10.15 billion tonnes (Bt), of which 1.16 Bt is classified as measured resource, 3.24 Bt is classified as indicated resource and 5.74 Bt is classified as inferred resource. This is shown in Table 1.

Table 1 Summary of JORC coal resource estimate

Resource Category	Coal Tonnage (Billion Tonnes / Bt)
Measured	1.16
Indicated	3.24
Inferred	5.74
Total	**10.15**
Source: Xenith, April 2013	

The distribution between the main seam groups and comparison with the tonnage targeted for mining are shown in Table 2. The table also outlines the quality and thickness of the resource.

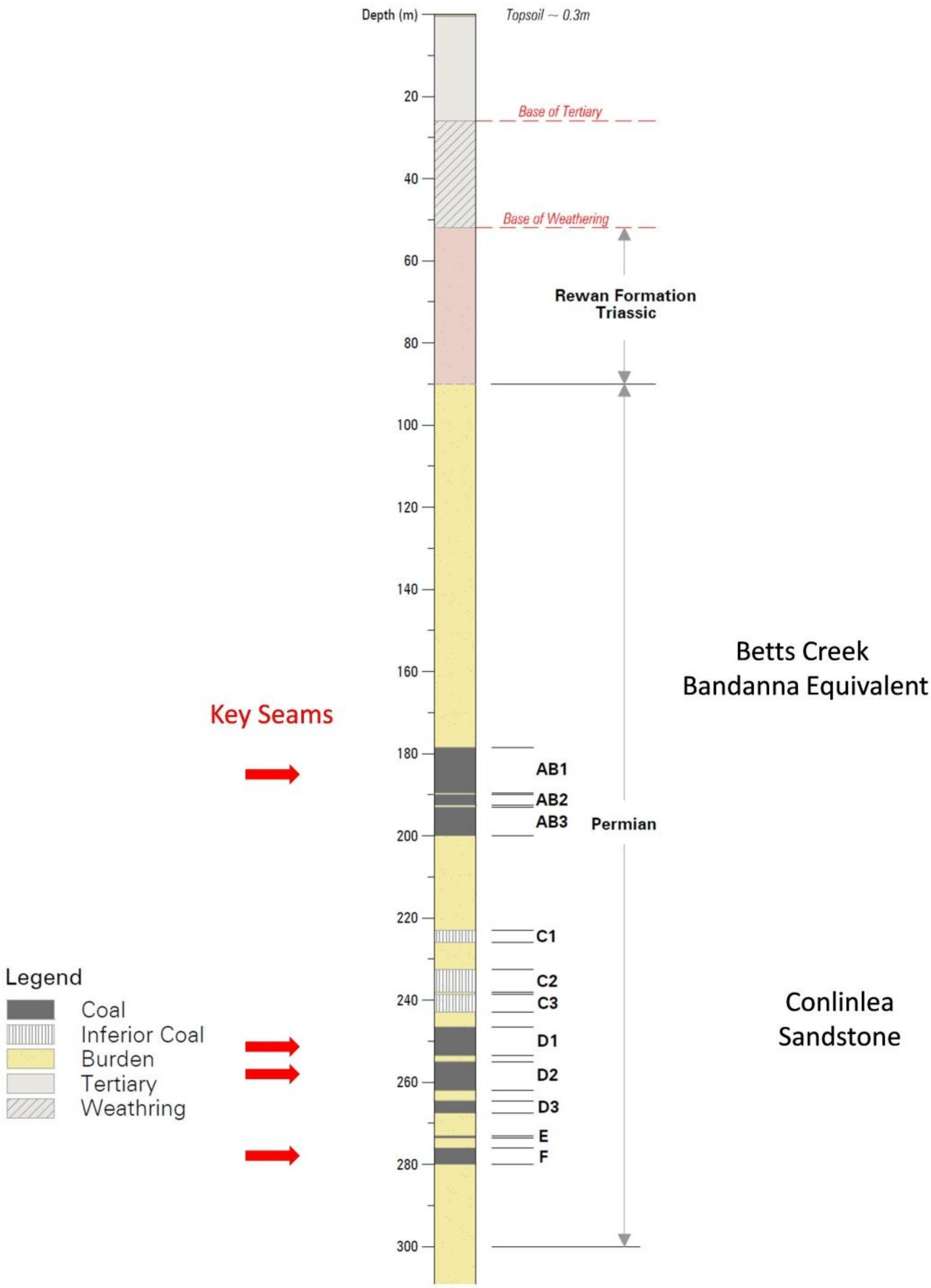
Table 2 Coal resource by seam, thickness and quality

Seam	Coal Tonnage (Bt)	Average Raw Ash (% air dried)	Average Thickness (m)
AB1	1.93	24.3	6.8
AB2	0.57	37.2	2.0
AB3	1.96	35.8	5.6
D1	1.71	23.1	5.7
D2	1.71	24.3	3.6
D3	1.10	20.5	4.0
E	0.21	19.3	1.2
F	0.96	18.9	1.1
Grand Total	**10.15**		**30.1**

The geotechnical evaluation for the Project (Mine) is based on the analysis of samples obtained from eight boreholes during successive annual field exploration drilling campaigns. The analysis was conducted to assess the overburden characteristics of the target coal seams. The geotechnical analysis undertaken has utilised all available data to provide information on appropriate in-pit slope angles, together with in-pit and out-of-pit spoil designs. The geotechnical analysis methods used for the pit design and mine planning for the Project (Mine) are considered commensurate with the industry standard and are supported with empirical assessments from international case studies with comparable ground conditions.

Given the extensive strike length of the coal seams in the Project (Mine), and the variation in geotechnical characteristics across the strike length, the overburden to the target mining seams has been interpreted in terms of geo-mechanical units, and on the basis of definition of geotechnical domains (Figure 3). Slope design parameters are provided for mine planning purposes for each of the identified domains.

Figure 3 Carmichael mine indicative strike length



2.3 Deposit economics

The optimum open cut pit shell and underground mine limits were defined through a cost ranking analysis. Cost ranking is a process that analyses the comparative mining costs of each potential mining block in the deposit to identify economic trends and the potential magnitude of the reserves tonnage that lie within a pre-determined cost cut off. The method defines the likely economic limits of the open cut mine layout and assists in the development of the most cost-effective scheduling sequence.

Cost ranking undertaken as part of the mine planning works was a key determinant in the size and shape of the current mine layout and provided a basic analysis of the possible sequencing of mining in advance of the preparation of the detailed mine plan. The extraction of the target quantity of product to meet demand was considered.

2.4 Mining methods rationale

A combination of both open cut and underground mining methods are proposed to extract the coal. The key factors considered in determining the mining method and the associated open cut mine plan are outlined as follows:

- targeted scale of production
- cost ranking to define the economic limits of the open cut mine
- strike of the coal seams
- geometry of the deposit
- stability of the overburden materials in the deployment of draglines and other mobile equipment
- application of draglines as a more flexible system, particularly to deal with changing geotechnical conditions and large operating cost advantages
- ability to use draglines with truck-shovel pre-strip for the removal of primary overburden for a robust and well proven application
- ability to provide flexible scheduling and access
- ability to develop long, consistent strips for the efficient use of large scale open cut equipment as quickly as possible
- haulage distances for waste once steady-state operations are reached

The key factors considered in determining the underground mining method and the associated underground mine plan include:

- a cost ranking exercise to determine an economic transition boundary between open cut and underground mining areas
- the need for a production output of approximately 20 Mtpa ROM to augment open cut operation to meet target production
- the safety, production rates and recovery rates of the single pass longwall mining method
- the depth ranges of 60 – 500 m of the resource, and productivity levels required to ensure economic extraction

- presence of lower ash AB1 seam and D1 seam which can be blended with higher ash product from open cut pits to achieve an export quality coal with minimised washing
- an assumed initial longwall productivity of approximately 5 Mtpa ROM from each longwall face installed including development
- benchmarking production levels based on comparative productive Australian longwall operations

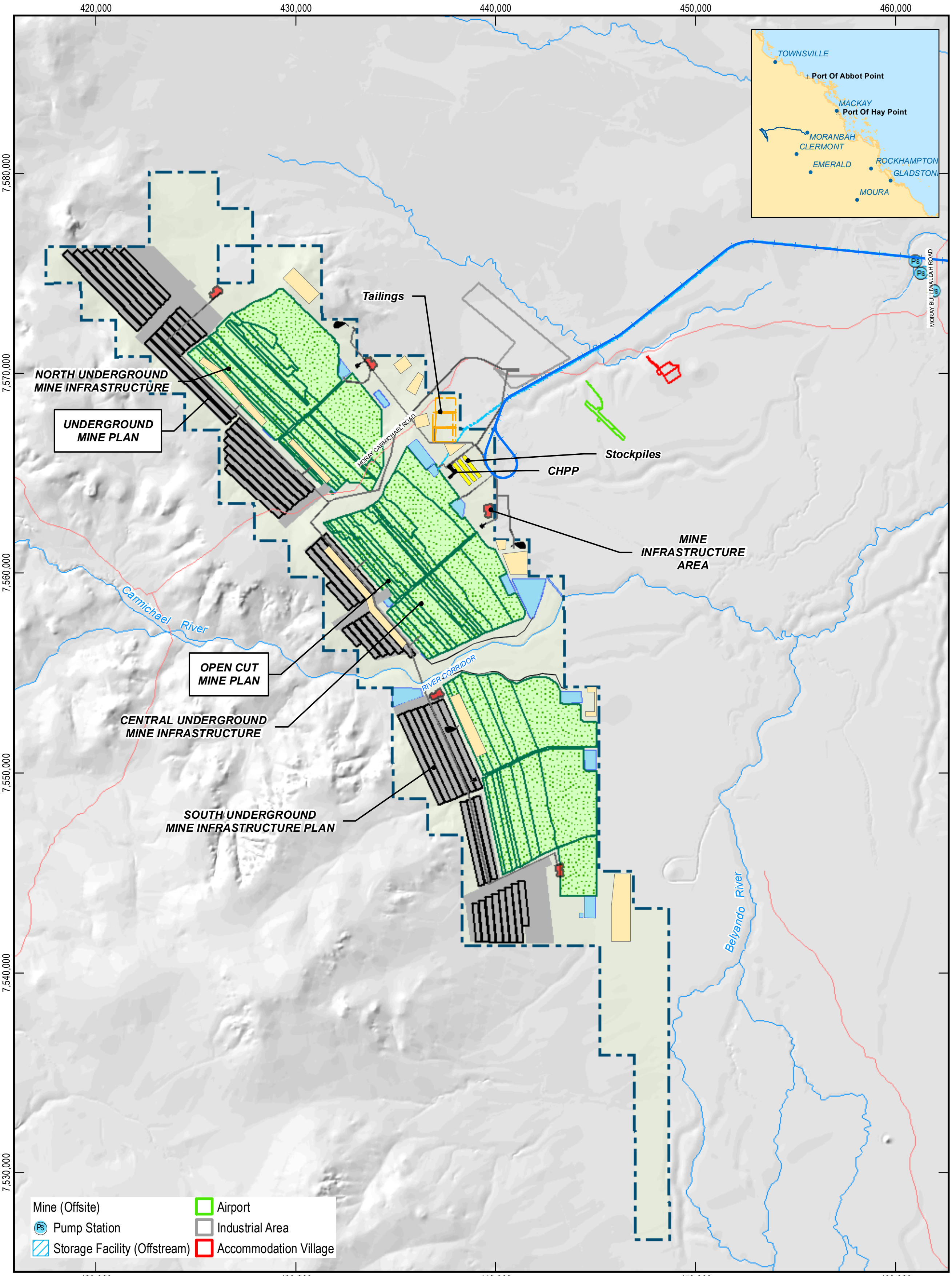
The management of the Carmichael River, which intersects the Project (Mine) in an east-west direction was also considered in the Project (Mine) design. The Carmichael River is an ephemeral tributary of the Belyando River that flows west to east across the lease and bisects the deposit. A minimum corridor of 500 m will be retained either side of the centre line of the Carmichael River to minimise any potential impacts to river and associated riparian zone during mining operations. Mine production is scheduled to commence on the southern side of the Carmichael River around 2021; a bridge or appropriate crossing infrastructure will be developed to allow access to the south of the river.

2.5 Placement of on-site infrastructure and out-of-pit dumps

The geological characteristics of the Project (Mine) define the location of open cut and underground mining operations. This in turn determines the optimal location of mine infrastructure and associated interdependencies including site access, services and other infrastructure required to access offsite infrastructure and third party service providers. If infrastructure is developed over economic coal deposits, those deposits will be difficult or unfeasible to extract. The layout of the infrastructure has subsequently been designed and located to minimise the likelihood of resource sterilisation. In particular, the main infrastructure area is located outside the sub-crop line of the identified economic seams.

The out-of pit dumps are located to minimise handling of material and also to avoid the sterilisation of coal resources. The out-of-pit dumps were initially located over the underground mining areas within EPC1690, however subsequent to the development of the 2011 mine plan, Adani was able to secure the eastern portion of EPC1080, adjacent to the eastern boundary of EPC1690 which allows for more efficient placement of spoil adjacent to the low wall of each open cut. EPC1080 will now be used for the out-of-pit dumps.

Further detail on the key operational activities associated with the mine infrastructure area is in Section 1. Figure 4 illustrates the general mine layout, and location of the mine and offsite infrastructure.



LEGEND

Local Road	Rail (West)	Open Cut Blocks	Mine Infrastructure
River / Watercourse	Mine (Onsite)	Out of Pit Waste Dumps	Stockpiles
Overland Conveyors		Water Management Dams	Tailings Cell
		Mine Infrastructure Area	Top Soil Storage

1:275,000 (at A4)

0 2 4 6 8 10

Kilometres

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

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Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project SEIS

Job Number 41-26422
Revision B
Date 23-10-2013

Onsite and Offsite
Mine Infrastructure

Figure 4

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Level 9, 145 Ann St Brisbane QLD 4000 T +61 7 3316 3000 F +61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data Source: GA: Road, River / Watercourse (2007); DME:EPC1690 (2010), EPC1080 (2011); Adani: Alignment, Offsite(2013), Mine Layout / Infrastructure (2013); Created by: MS

2.6 Equipment and plant selection

The proposed scale of production requires large-scale mining equipment, which will vary in fleet numbers depending on the stage of mine operations. Equipment selection will depend on required production rates, reliability of equipment and suitability to the operating conditions, particularly high summer temperatures.

For the open cut component, truck-and-shovel equipment will be used for the pre-strip of overburden and for coal excavation. Other methods such as bucket wheels, continuous haulage systems and draglines may be used for removal of overburden after further investigation.

The underground mining method will be longwall mining. Longwall mining requires sets of equipment consisting of hydraulic shields to provide roof support during extraction, shearers to cut the coal from the seam and conveyors to transfer the coal to the surface. Underground mining equipment has not yet been selected.

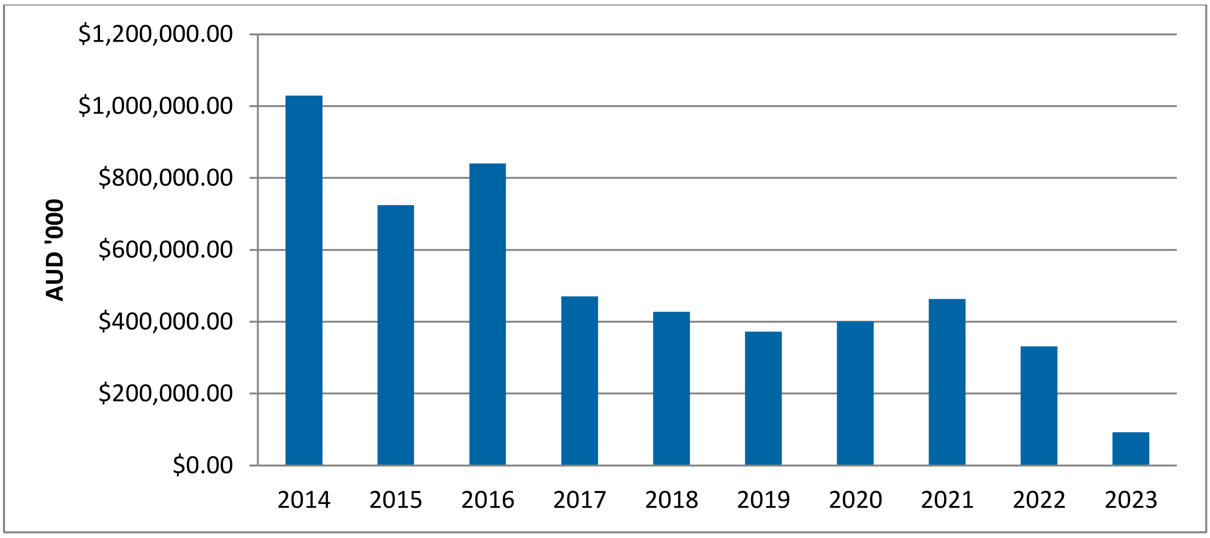
A combination of haul trucks and conveyors will be used to move coal from the extraction location to ROM stockpiles, with the balance yet to be determined. Conveyors generally provide for more efficient transport of coal, but are less flexible and cannot be readily re-routed and hence, an optimal combination of trucks and conveyors is being sought. Further detail on the selection and capacity of the equipment and plant is outlined in Section 8.4.

3. Mine schedule

3.1 Capital investment

Capital investment for the life of the Project (Mine) is expected to total $16.5 billion. It is estimated that $5.1 billion will be spent in the years preceding 2022, with the remaining $11.4 billion being spent over the remaining years of operation. Figure 5 shows capital investment for the life of the Project (Mine).

Figure 5 High level estimate of capital investment – construction phase to full production of the Project (Mine)



3.2 Mine plan

The Mine plan is based on achieving the production objective of 60 Mtpa (product) as quickly as possible and then maintaining a relatively steady rate of production over the life of the mine. Figure 6 outlines the coal production schedule of open cut ROM, underground ROM and total product tonnes for the operational life of 60 years.

Figure 6 Mine (product coal) production

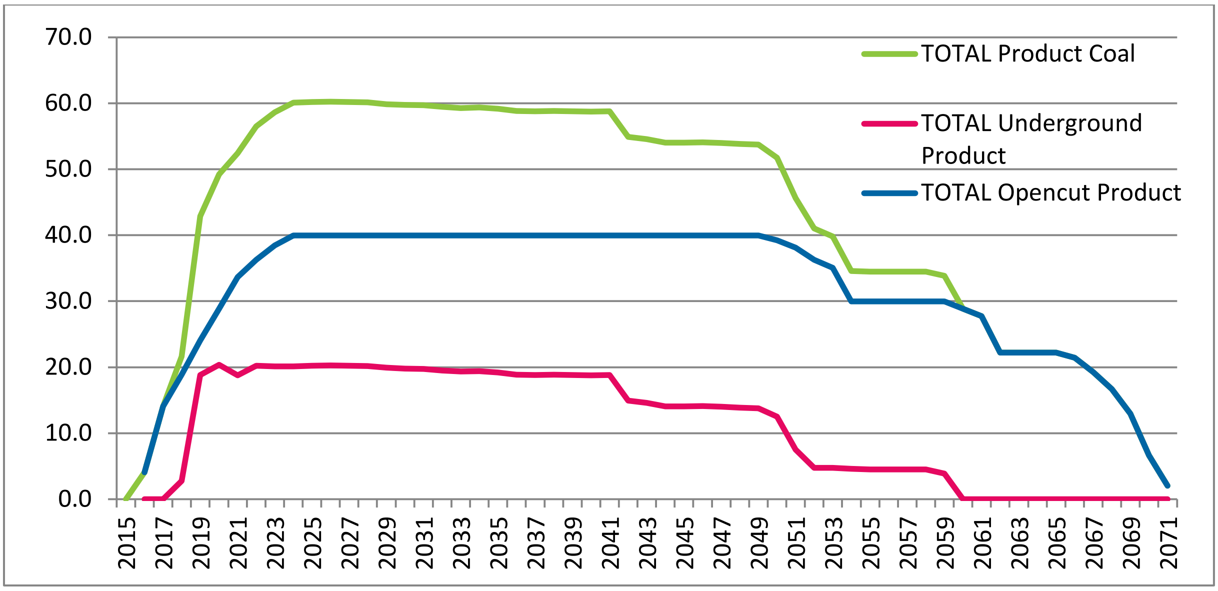


Table 3 outline the quantities of coal and waste that will be moved over the life of the Project (Mine), from the open cut and underground mining respectively. In order to maintain the target throughout the life of the Project (Mine), the annual production levels from the open cut will remain around 40 Mtpa (product).

Table 3 Combined ROM coal and product coal

Period (years)	ROM Coal Mt			Product Coal Mt
	Open Cut	Underground	TOTAL	TOTAL
2015	0	0	0	0
2016	5.5	0	5.5	4.1
2017	19.0	0	19	14.1
2018	25.5	2.8	28.3	21.6
2019	32.5	18.8	51.3	42.9
2020 - 2024	239.5	99.7	339.2	276.9
2025 - 2029	270	100.8	370.8	300.6
2030 - 2034	270	97.7	367.7	297.5
2035 - 2039	270	94.6	364.6	294.4
2040 - 2044	270	81.2	351.2	281.0
2045 - 2049	270	69.9	339.9	269.7
2050 - 2054	241.4	34.2	275.6	212.8
2055 - 2059	162	21.9	183.9	137.9
2060 - 2064	166.5		166.5	123.2
2065 - 2069	134.1		134.1	92.6
2070 - 2074	29.2		29.24	21.6

3.3 Mine staging

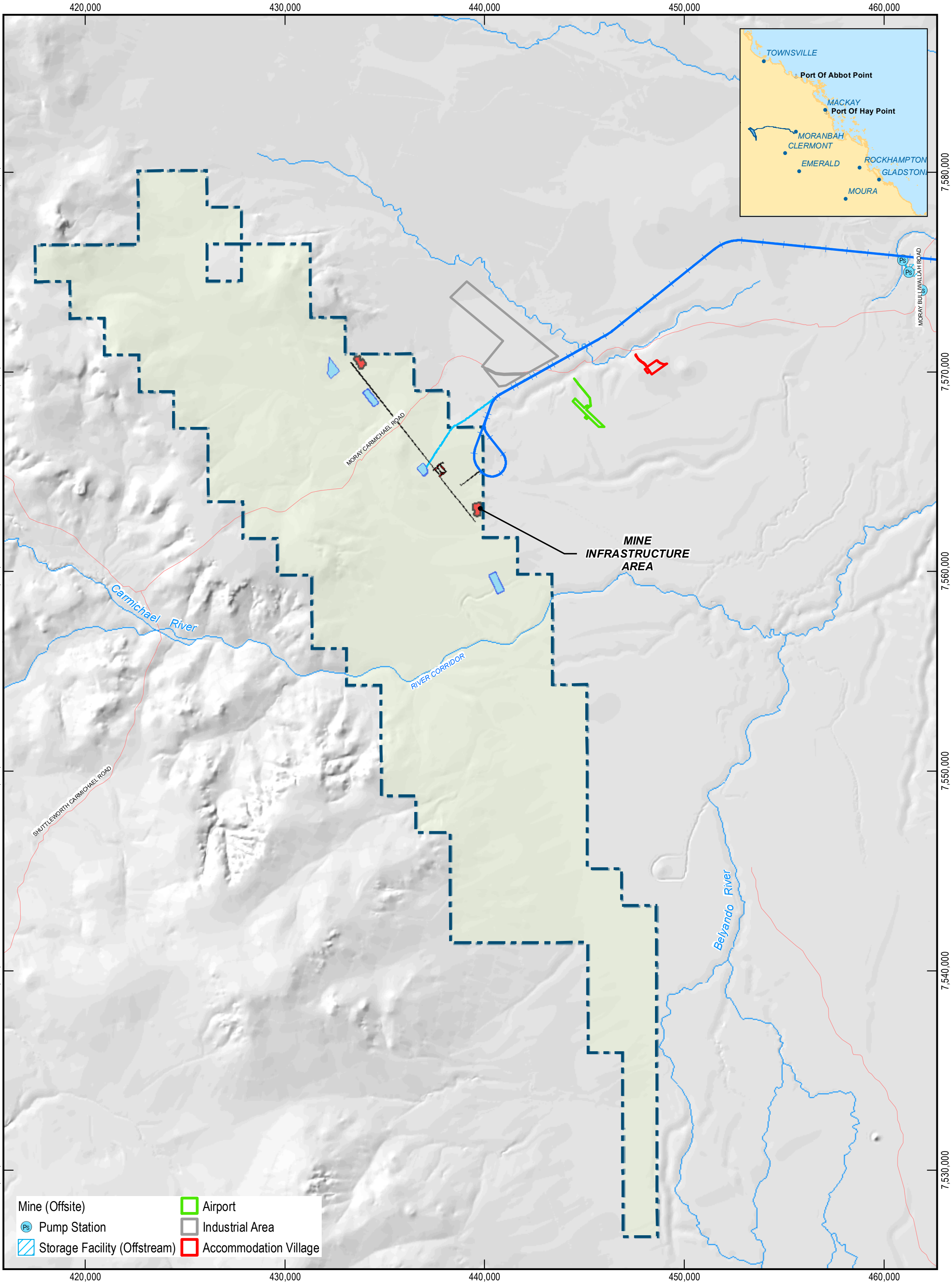
The Project (Mine) life cycle consists of preconstruction, construction, operation and closure and decommissioning. Rehabilitation will occur progressively throughout the mine life. The mine sequencing allows for operational activities to commence prior to the completion of construction of the mine; this facilitates a positive cash flow during early stages of the mine life. Table 4 provides an overview of the Project (mine) stage plan; Figure 7 to Figure 20 show selected stages of the construction and operation stages.

Table 4 Mine stage plan overview

Year(s)	Activities
2014	Commence construction of workers accommodation village stage 1 & 2
	Commence construction of permanent airport
	Commence construction of power, construction water supply and other external services
	Construction of flood harvesting infrastructure
	Commence construction of open cut facilities including Pits B/C and D/E MIA's, Site Fencing, Water Storage Dams and Temporary Roads.
	Refer Figure 7
2015	Commence B ,D & E Pit box-cut
	Complete Pit B Diversion Drains
	Construct Carmichael River Northern Flood Protection Levies
	Commence construction of workers accommodation village stage 3 & 4
	Complete construction of Permanent Airport
	Construct Additional Stages of Flood Harvesting Facilities
	Refer Figure 8
2016	Commence C Pit box cut
	Produce first coal from open cut B, D & E Pits
	Complete open cut facilities for Pit B/C and D/E MIA, ROM and Overland Conveyors
	Complete B,D&E Pits HV Roads and HV Power Distribution
	Complete Coal Handling and Processing Plant Modules 1&2 and Tailings Cell
	Complete Product Handling and Train Load-out Facility
	Commence construction of workers accommodation village stage 5
	Refer Figure 9
2017	First Coal Production from open cut C Pit
	Construct Underground Mine 1 MIA facilities
	Complete C Pit water diversion drain and HV Roads
	Refer Figure 10
2018	Commence development and longwall operations of underground mine UG 1
	Complete Coal Handling and Processing Plant Modules 3 & 4
	Refer Figure 11
2019	Complete development operations in UG1 and commence Longwall operations

Year(s)	Activities
	Construct coal processing plant (CPP) Bypass systems
	Refer Figure 12
2020 – 2024	2021– Construct Carmichael River southern flood protection levee
	2021 – Construct Carmichael River Crossing
	2021 – Commence development of underground mine UG 5
	2021 – Dragline 1 commences in D Pit
	2021 – Commence G Pit
	2021 – Commence minor rehabilitation of out of pit spoil emplacement
	2022 – Commence development of underground mines UG 4 and 5
	2022 – Commence open cut facilities for Pit F/G and UG 4, MIA, ROM and Overland Conveyors
	2023 – Complete open cut facilities for Pit F / G, Water Management
	Refer Figure 13
2025 – 2029	2026 - Commence F Pit
	2026 – Commence longwall operation of underground mine UG 5
	2026 – Complete UG 5 MIA
	2027 – Commence longwall operation of underground mine UG 4
	2027 – Complete UG 4 overland conveyors and facilities
	2028 – Commence development of underground mine UG 3
	2028 – Complete expansion of Pit D/E MIA for UG 3
	2029 – Rehabilitation works on Pits B, C, D, E out of pit spoil emplacement
	Refer Figure 14
2030 – 2034	2030 – Complete UG 5 Infrastructure
	2030 – Complete UG 1 Longwall Operations
	Refer Figure 15
2035 – 2039	2035 – Commence development of underground mine UG 2
	2035 – Commence UG 2 MIA
	2036 – Commence longwall operation of underground mine UG 3
	2036 – Complete UG3 Infrastructure
	Refer Figure 16
2040 – 2044	2040 – Commence longwall operation of underground Mine 2
	2040 – Complete UG2 Infrastructure
	2040 – Complete UG 4 Longwall Operations
	Refer Figure 17
2045 – 2049	No additional Pits Commenced
	2045 – Complete UG 5 Longwall Operations
	Refer Figure 18
2050 – 2060	2051 – Complete UG 3 Longwall Operations
	2051 – Complete mining in C Pit commence final rehabilitation.
	2053 – Complete mining in E Pit commence final rehabilitation.
	2059 – Complete UG 2 Longwall Operations
	Refer Figure 19

Year(s)	Activities
2061 – 2072	2061 – Complete mining in D Pit commence final rehabilitation
	2068 – Complete mining in G Pit commence final rehabilitation
	2069 – Complete mining in F Pit commence final rehabilitation
	2070 – Decommission Southern ROMs
	2071 – Complete mining in B Pit commence final rehabilitation.
	2071 – Decommission Southern ROMs
	2071 + – Rehabilitate mine site
	Refer Figure 20



LEGEND

- Local Road
- River / Watercourse
- Overland Conveyors
- Rail (West)
- Mine (Onsite)
- Water Management Dams
- Mine Infrastructure Area
- Mine Infrastructure

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1:275,000 (at A4)

0 2 4 6 8 10

Kilometres

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

N

Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project SEIS

Job Number 41-26422
Revision B
Date 23-10-2013

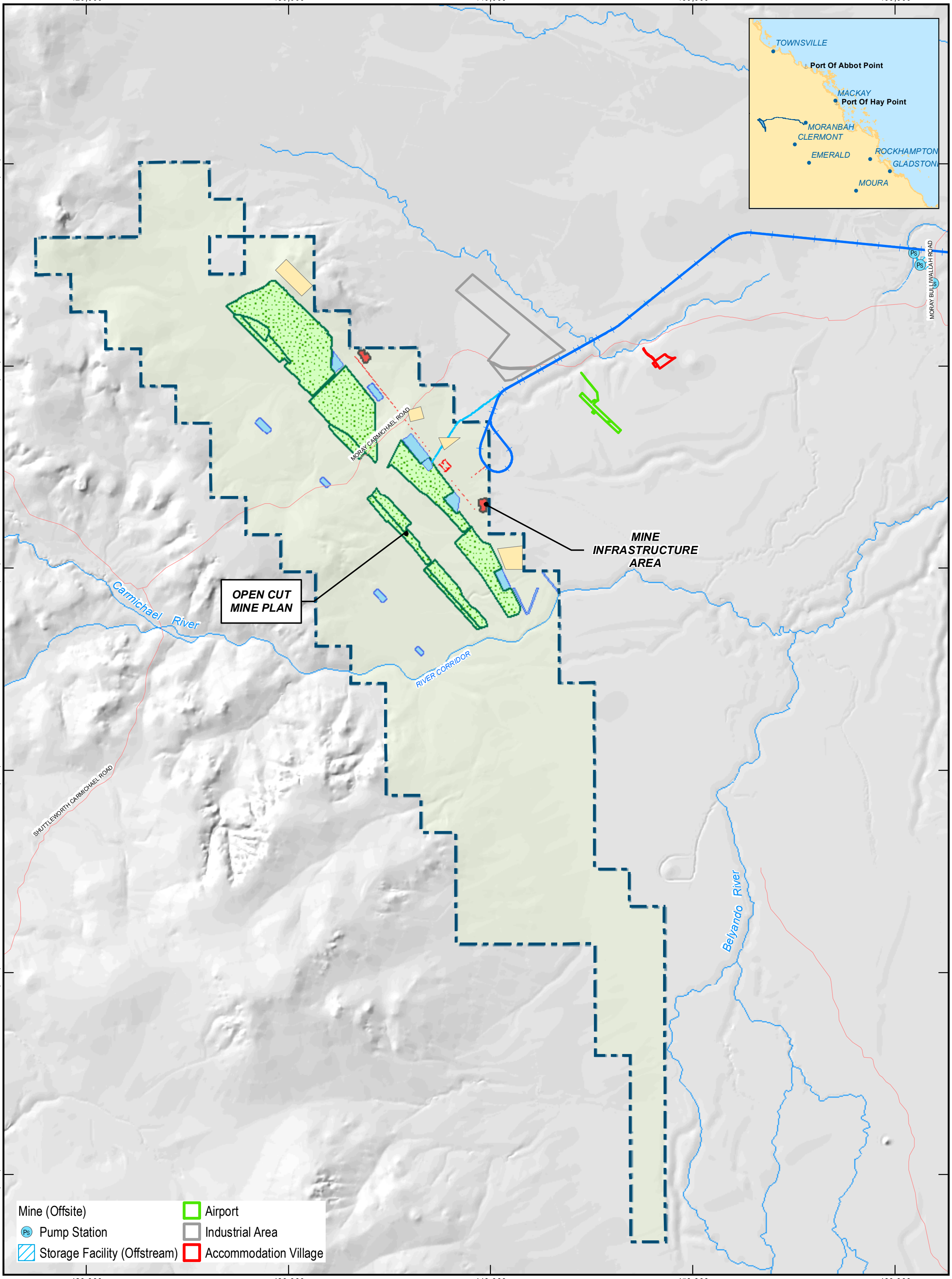
Mine Stage - Year 2014

Figure 7

G:\41\26422\GIS\Maps\MXD\01000_Project_Description\41_26422_01014_rev_b.mxd

Level 9, 145 Ann St Brisbane QLD 4000 T +61 7 3316 3000 F +61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data Source: GA: Road, River / Watercourse (2007); DME:EPC1690 (2010), EPC1080 (2011); Adani: Alignment, Offsite(2013), Mine Layout / Infrastructure (2013); Created by: MS



LEGEND

- Local Road
- River / Watercourse
- Rail (West)
- Mine (Onsite)
- Open Cut Blocks
- Water Management Dams
- Mine Infrastructure Area
- Top Soil Storage

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0 2 4 6 8 10

Kilometres

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

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Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project SEIS

Job Number	41-26422
Revision	B
Date	23-10-2013

Mine Stage - Year 2015

Figure 8

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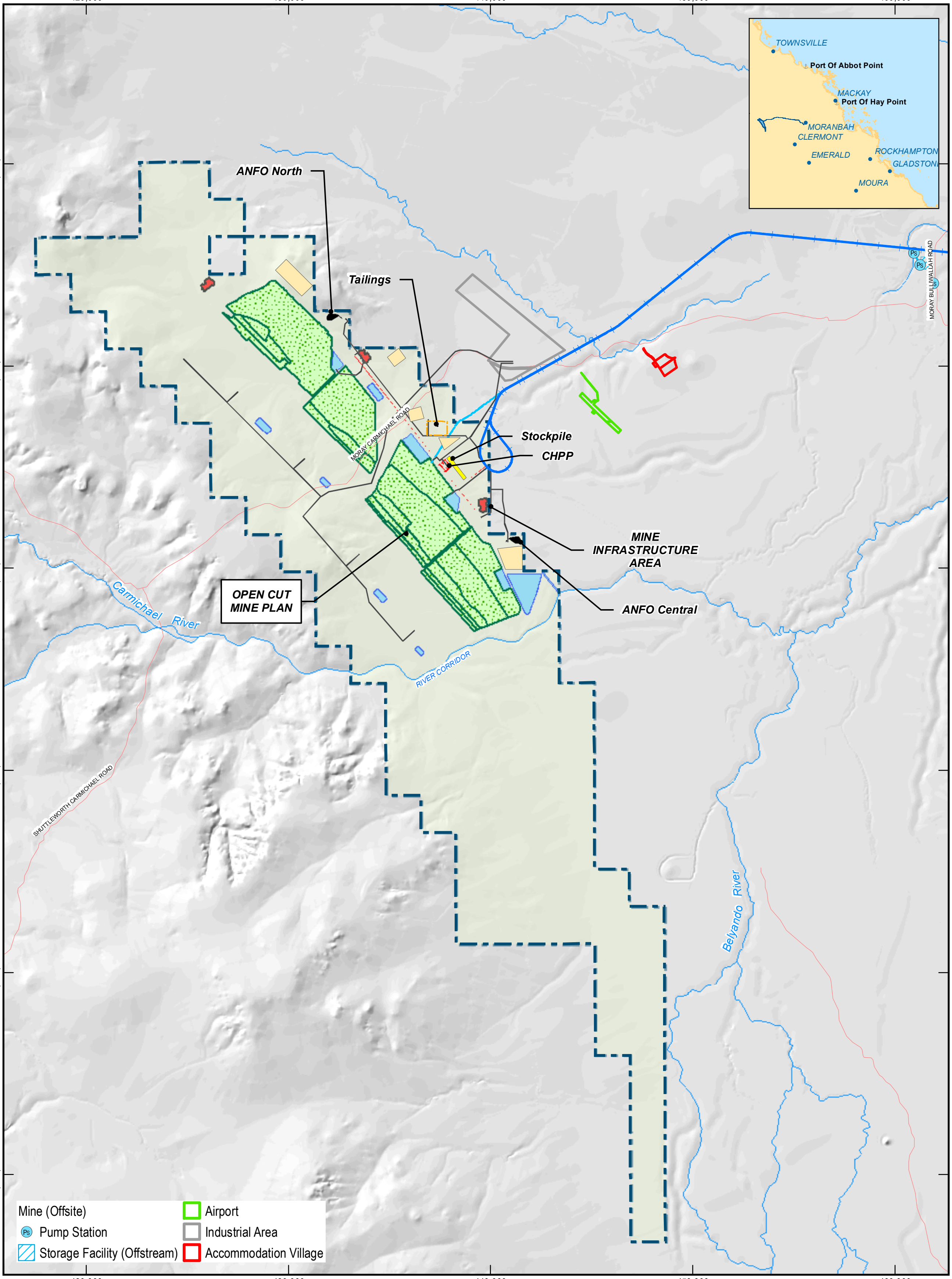
Data Source: GA: Road, River / Watercourse (2007); DME:EPC1690 (2010), EPC1080 (2011); Adani: Alignment, Offsite(2013), Mine Layout / Infrastructure (2013); Created by: MS



LEGEND

- Local Road
- River / Watercourse
- Overland Conveyors
- Rail (West)
- Mine (Onsite)
- Open Cut Blocks
- Water Management Dams
- Mine Infrastructure Area
- Mine Infrastructure
- Stockpiles
- Tailings Cell
- Top Soil Storage

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Kilometres

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

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Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project SEIS

Job Number	41-26422
Revision	B
Date	23-10-2013

Mine Stage - Year 2016

Figure 9

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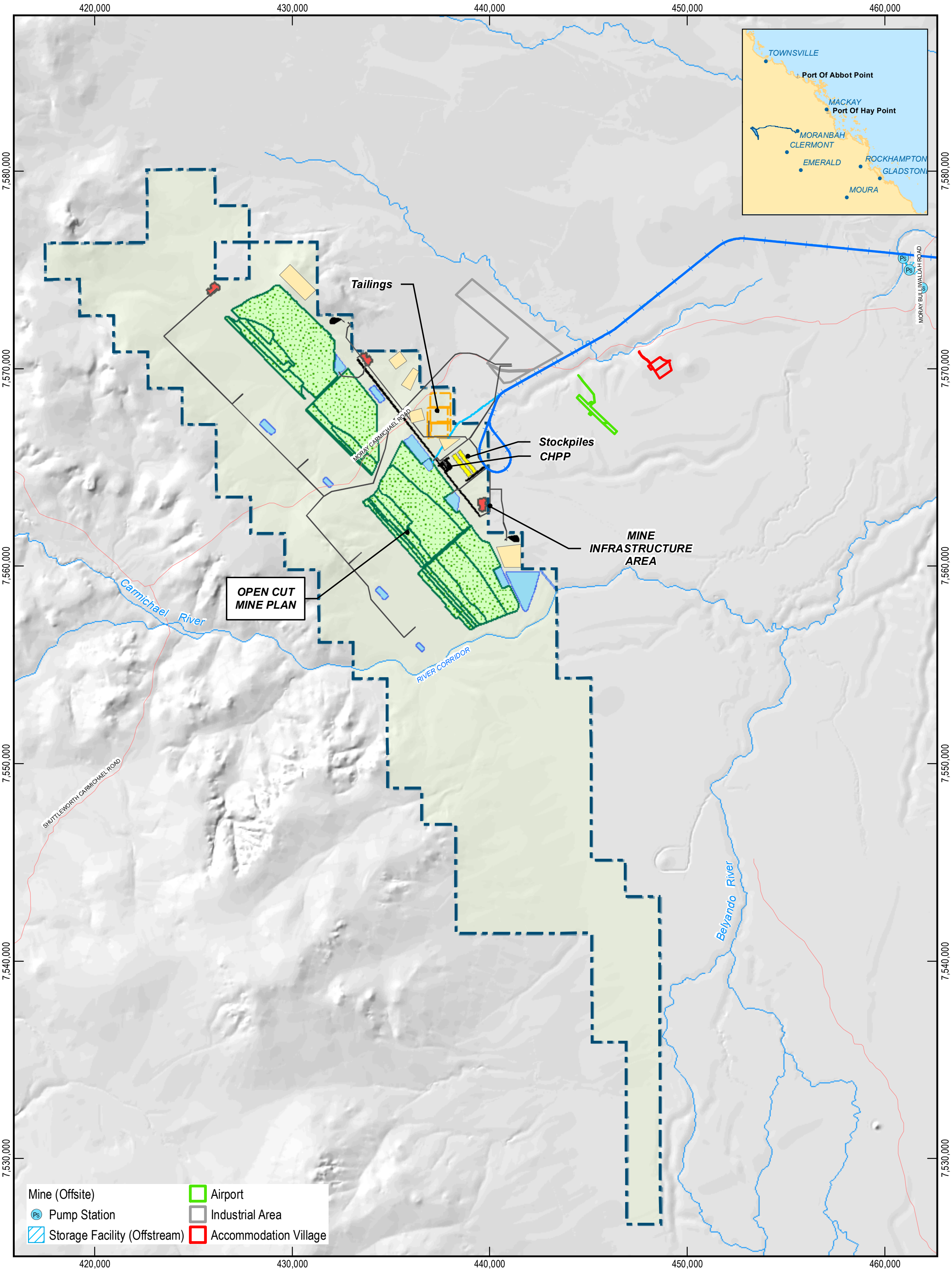
Level 9, 145 Ann St Brisbane QLD 4000 T +61 7 3316 3000 F +61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data Source: GA: Road, River / Watercourse (2007); DME:EPC1690 (2010), EPC1080 (2011); Adani: Alignment, Offsite(2013), Mine Layout / Infrastructure (2013); Created by: MS



LEGEND

Local Road	Rail (West)	Open Cut Blocks	Mine Infrastructure
River / Watercourse	Mine (Onsite)	Water Management Dams	Stockpiles
Overland Conveyors		Mine Infrastructure Area	Tailings Cell
			Top Soil Storage

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1:275,000 (at A4)

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Kilometres

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

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Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project SEIS

Job Number 41-26422
Revision B
Date 23-10-2013

Mine Stage - Year 2017

Figure 10

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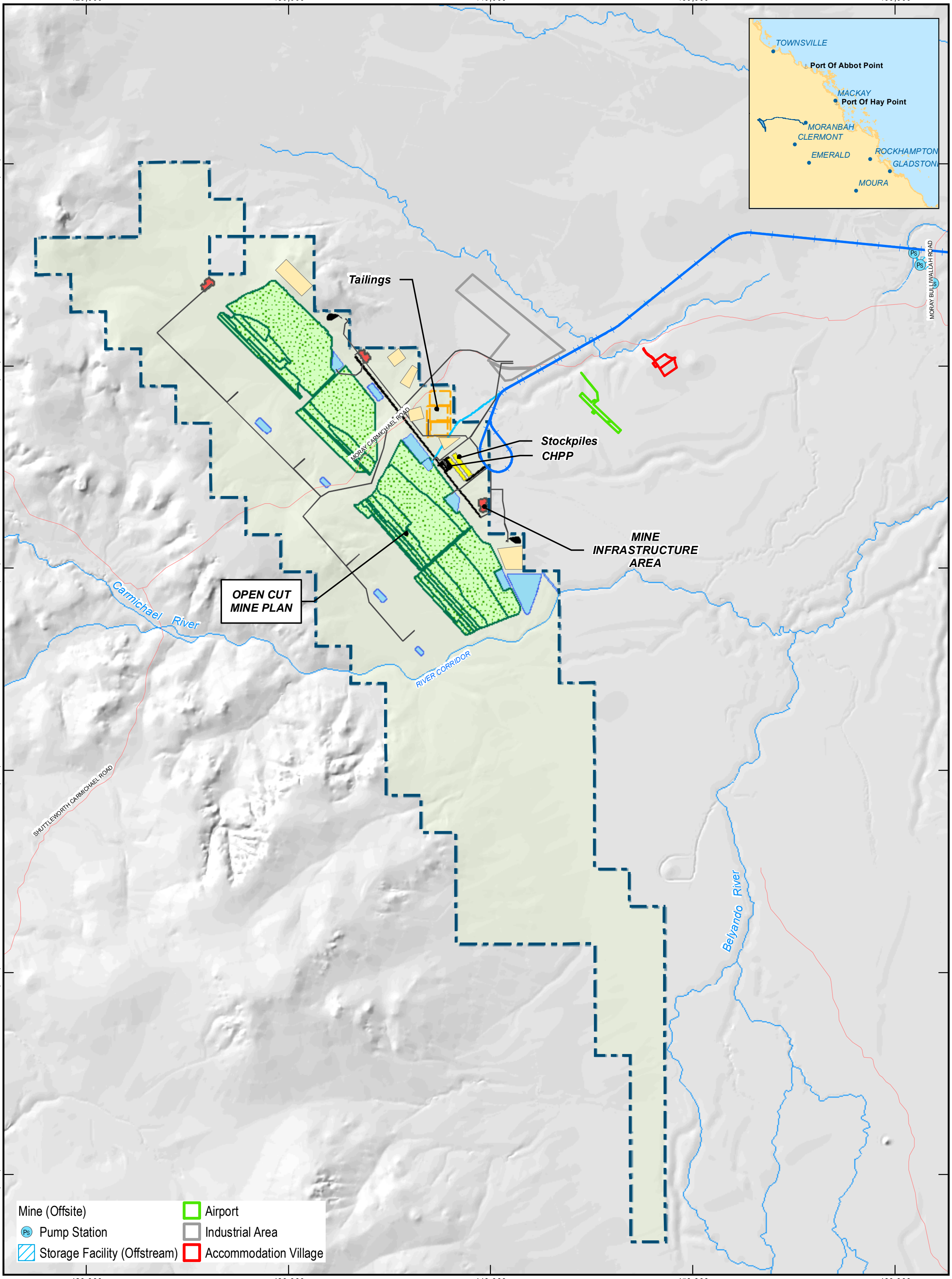
Data Source: GA: Road, River / Watercourse (2007); DME:EPC1690 (2010), EPC1080 (2011); Adani: Alignment, Offsite(2013), Mine Layout / Infrastructure (2013); Created by: MS



LEGEND

Local Road
River / Watercourse
Overland Conveyors
Rail (West)
Mine (Onsite)
Open Cut Blocks
Water Management Dams
Mine Infrastructure Area
Mine Infrastructure
Stockpiles
Tailings Cell
Top Soil Storage

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1:275,000 (at A4)
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Kilometres
Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

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Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project SEIS

Job Number	41-26422
Revision	B
Date	23-10-2013

Mine Stage - Year 2018

Figure 11

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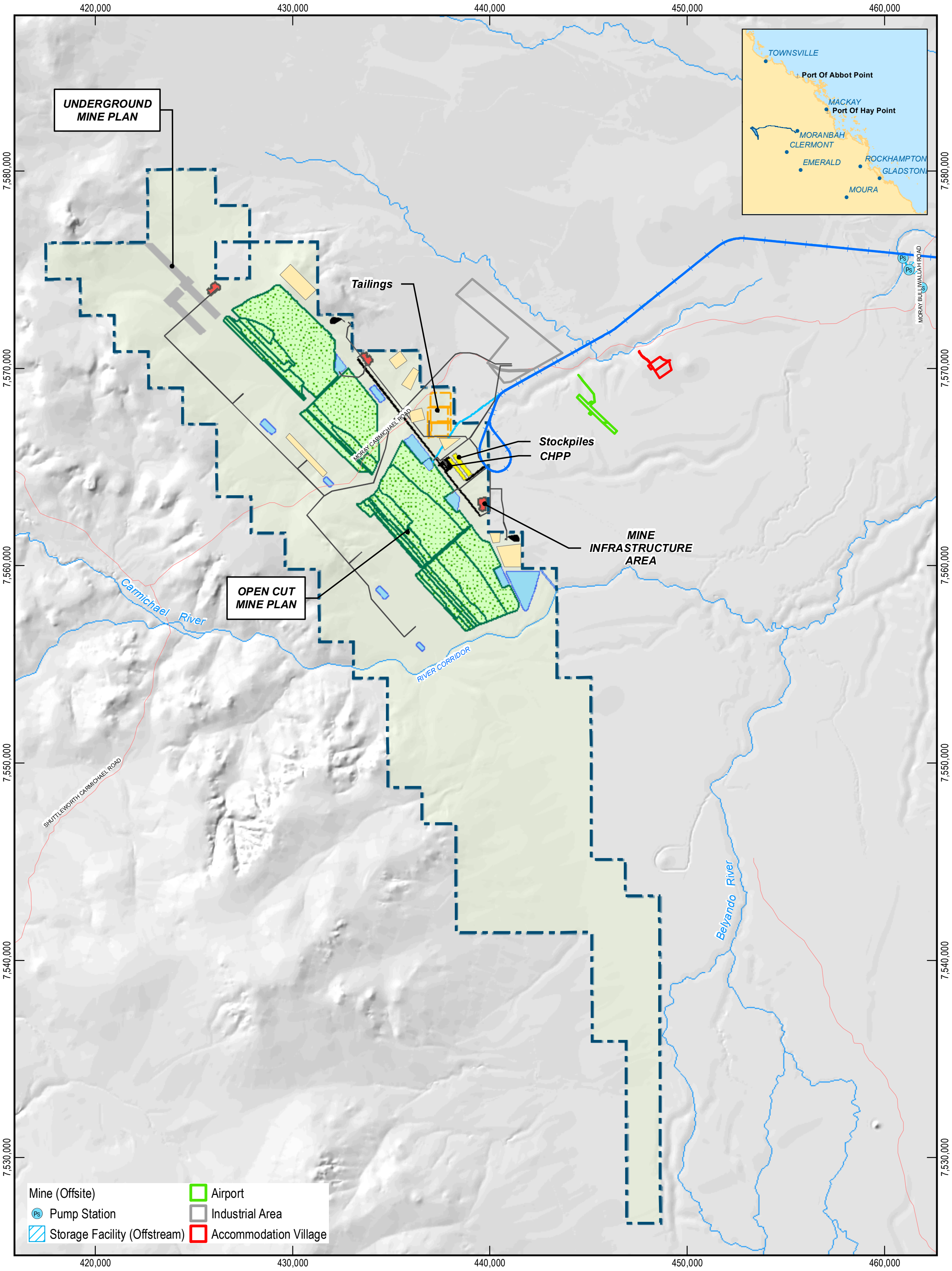
Data Source: GA: Road, River / Watercourse (2007); DME:EPC1690 (2010), EPC1080 (2011); Adani: Alignment, Offsite(2013), Mine Layout / Infrastructure (2013); Created by: MS



LEGEND

- Local Road
- River / Watercourse
- Overland Conveyors
- Rail (West)
- Mine (Onsite)
- Open Cut Blocks
- Water Management Dams
- Mine Infrastructure Area
- Mine Infrastructure
- Stockpiles
- Tailings Cell
- Top Soil Storage

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1:275,000 (at A4)

0 2 4 6 8 10

Kilometres

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

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Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project SEIS

Job Number	41-26422
Revision	B
Date	23-10-2013

Mine Stage - Year 2019

Figure 12

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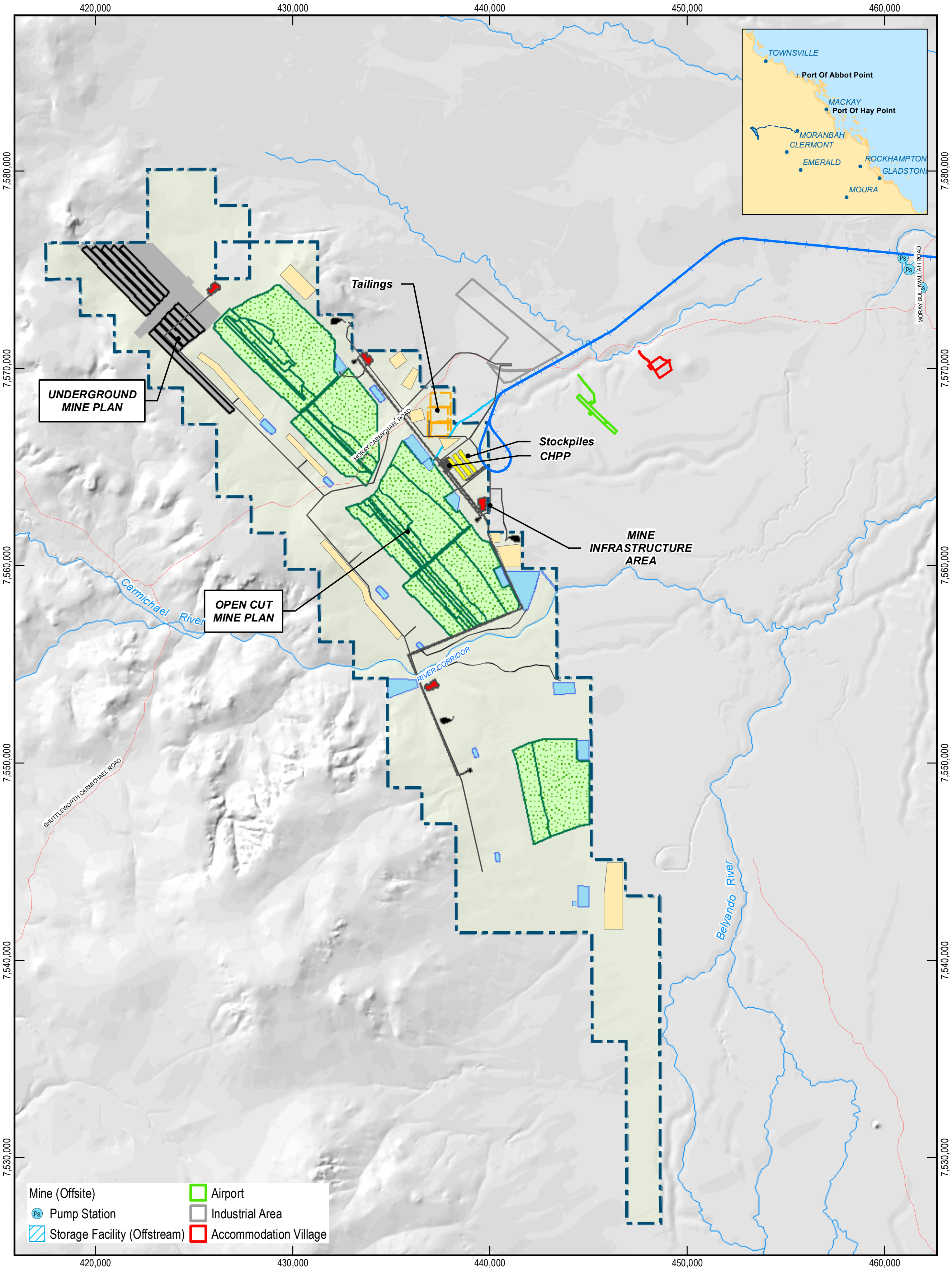
Data Source: GA: Road, River / Watercourse (2007); DME:EPC1690 (2010), EPC1080 (2011); Adani: Alignment, Offsite(2013), Mine Layout / Infrastructure (2013); Created by: MS



LEGEND

- Local Road
- River / Watercourse
- Overland Conveyors
- Rail (West)
- Mine (Onsite)
- Open Cut Blocks
- Water Management Dams
- Mine Infrastructure Area
- Mine Infrastructure
- Stockpiles
- Tailings Cell
- Top Soil Storage

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1:275,000 (at A4)

0 2 4 6 8 10

Kilometres

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

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Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project SEIS

Mine Layout Progress Plot
Year 2020 - 2024

Job Number	41-26422
Revision	B
Date	23-10-2013

Figure 13

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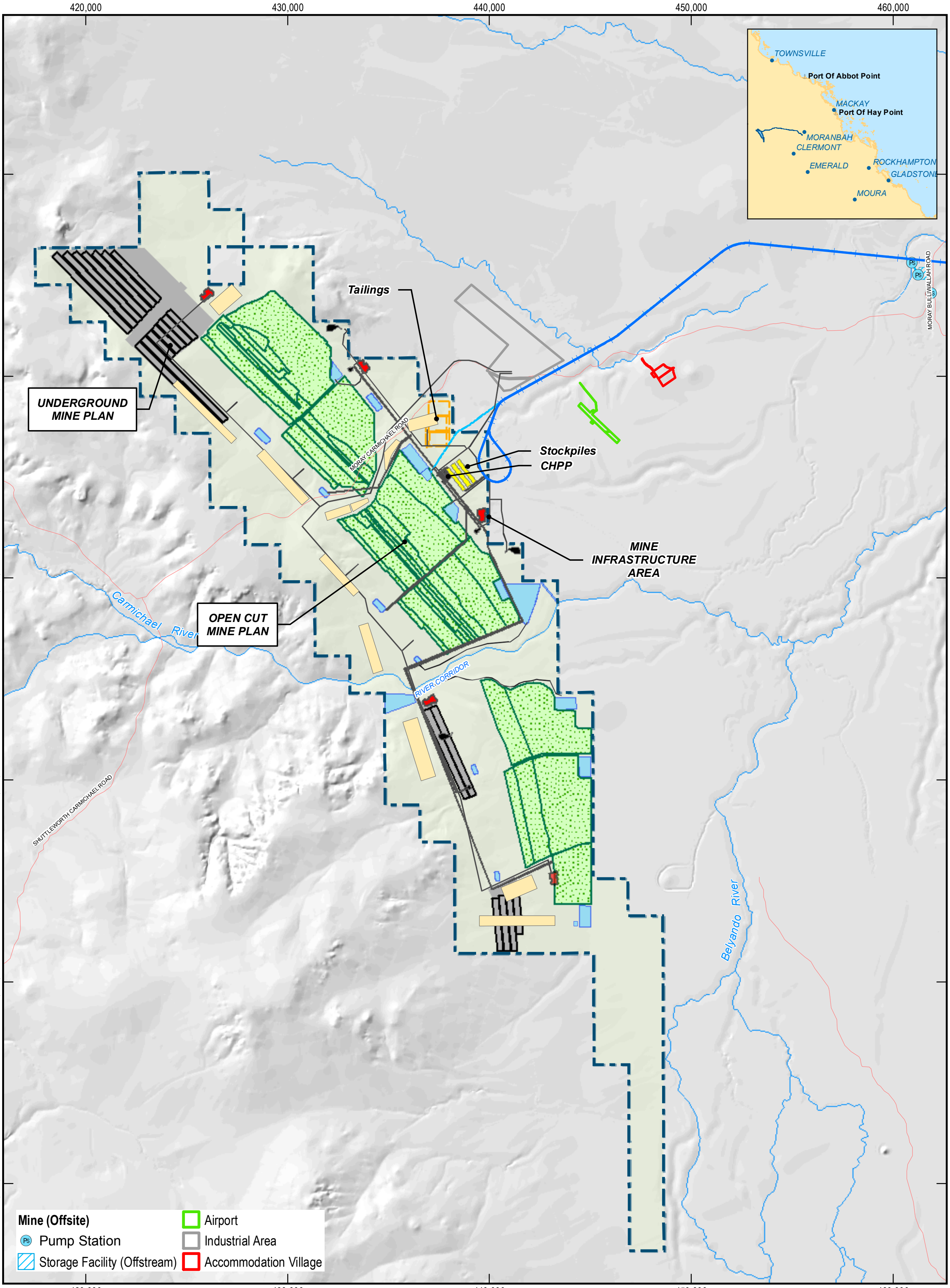

LEGEND

Local Road
River / Watercourse
Overland Conveyors
Rail (West)
Mine (Onsite)
Open Cut Blocks
Water Management Dams
Mine Infrastructure Area
Mine Infrastructure
Stockpiles
Tailings Cell
Top Soil Storage

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1:275,000 (at A4)

0 2 4 6 8 10

Kilometres

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

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Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project SEIS

Mine Layout Progress Plot
Year 2025 - 2029

Job Number 41-26422
Revision C
Date 17-10-2013

Figure 14

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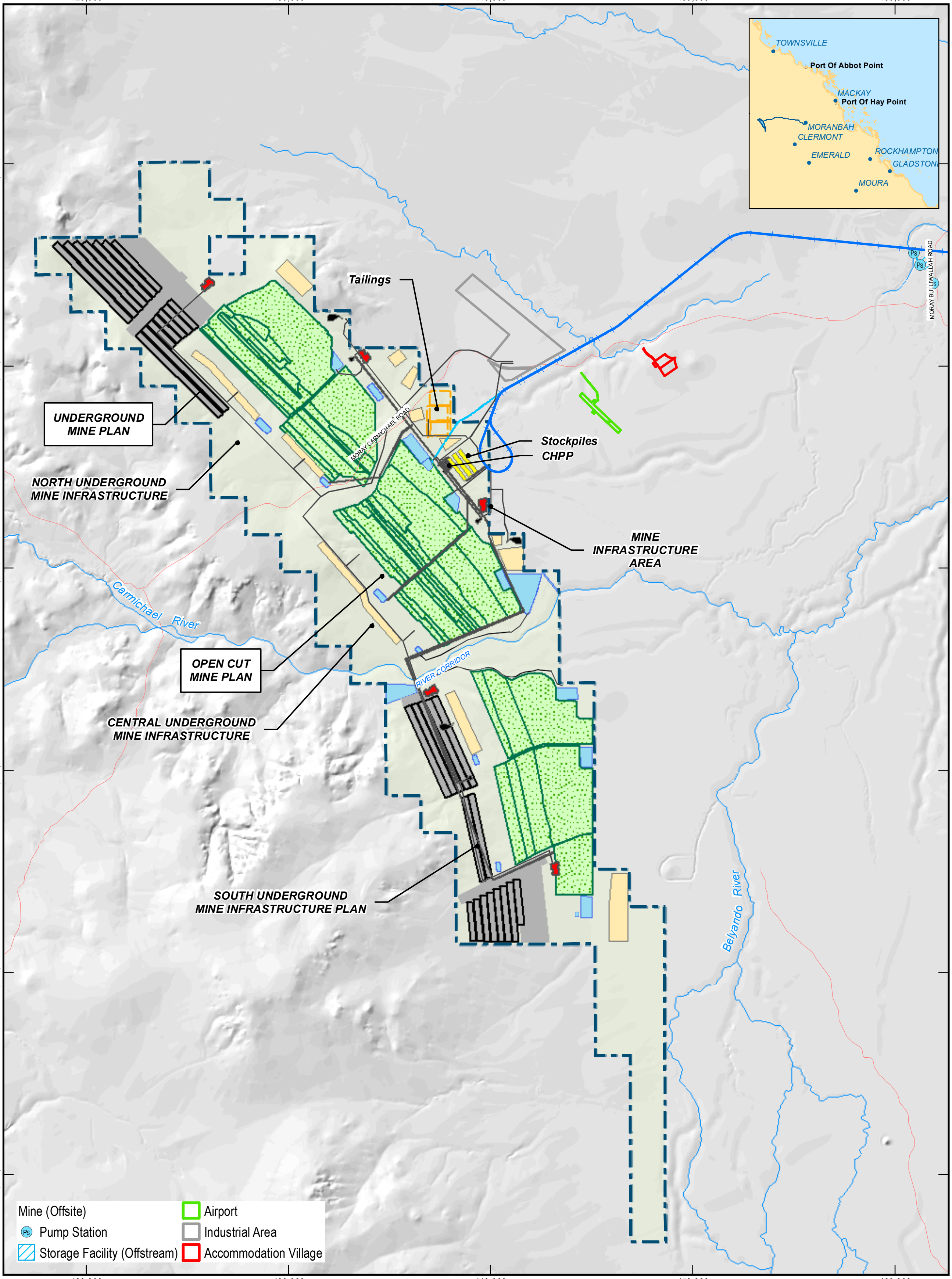
Level 9, 145 Ann St Brisbane QLD 4000 T +61 7 3316 3000 F +61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data Source: GA: Road, River / Watercourse (2007); DME:EPC1690 (2010), EPC1080 (2011); Adani: Alignment, Offsite(2013), Mine Layout / Infrastructure (2013); Created by: MS



LEGEND

- Local Road
- River / Watercourse
- Overland Conveyors
- Rail (West)
- Mine (Onsite)
- Open Cut Blocks
- Water Management Dams
- Mine Infrastructure Area
- Mine Infrastructure
- Stockpiles
- Tailings Cell
- Top Soil Storage

1:275,000 (at A4)

0 2 4 6 8 10

Kilometres

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

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Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project SEIS

Job Number	41-26422
Revision	B
Date	23-10-2013

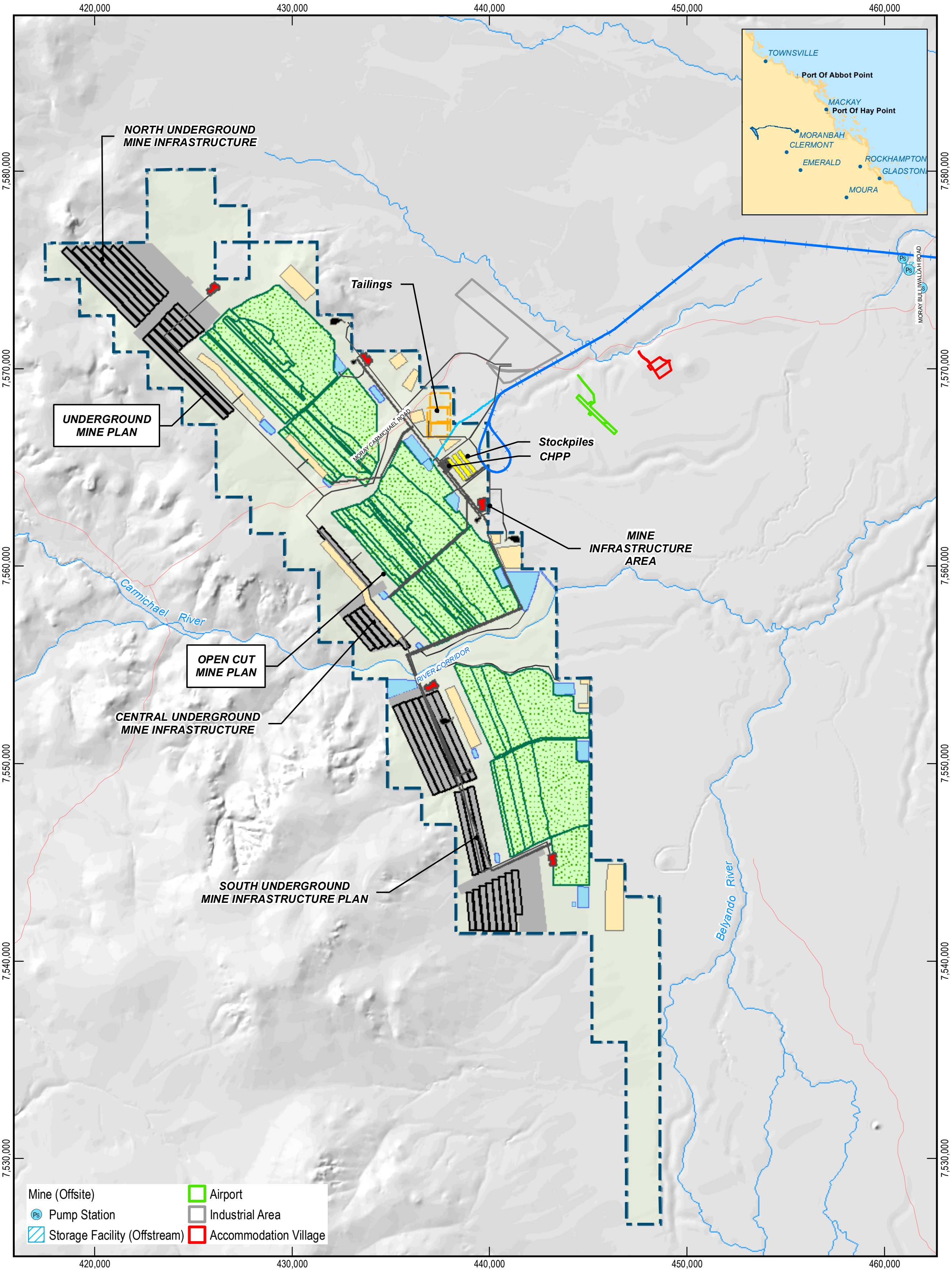
Mine Stage - Year 2030 - 2034

Figure 15

G:\41\26422\GIS\Maps\MXD\01000_Project_Description\41_26422_01006_rev_b.mxd

Level 9, 145 Ann St Brisbane QLD 4000 T +61 7 3316 3000 F +61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data Source: GA: Road, River / Watercourse (2007); DME:EPC1690 (2010), EPC1080 (2011); Adani: Alignment, Offsite(2013), Mine Layout / Infrastructure (2013); Created by: MS



LEGEND

- Local Road
- River / Watercourse
- Overland Conveyors
- Rail (West)
- Mine (Onsite)
- Open Cut Blocks
- Water Management Dams
- Mine Infrastructure Area
- Mine Infrastructure
- Stockpiles
- Tailings Cell
- Top Soil Storage

1:275,000 (at A4)

0 2 4 6 8 10

Kilometres

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

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Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project SEIS

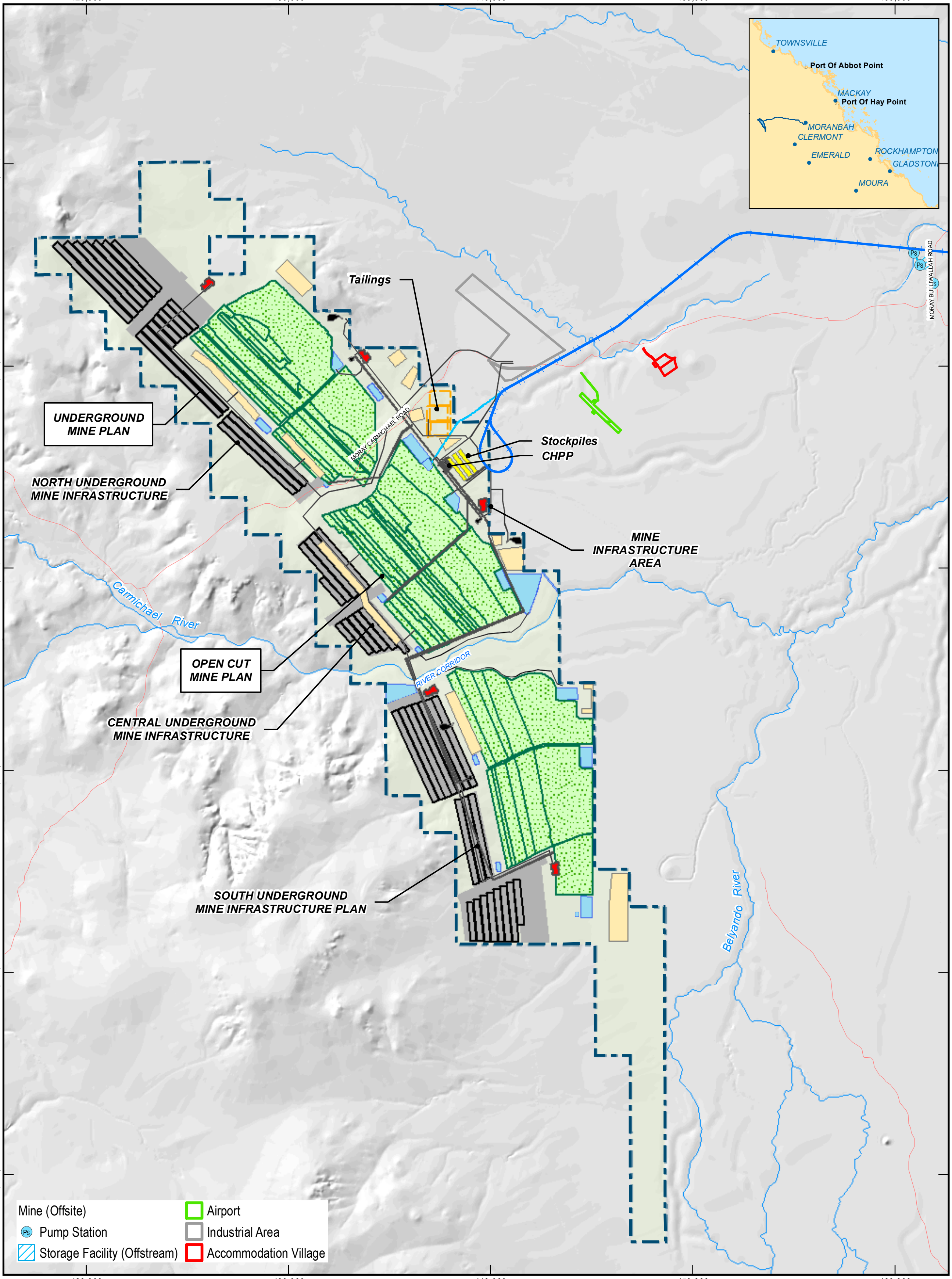
Job Number	41-26422
Revision	B
Date	23-10-2013

Mine Stage - Year 2035 - 2039

Figure 16

Level 9, 145 Ann St Brisbane QLD 4000 T +61 7 3316 3000 F +61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data Source: GA: Road, River / Watercourse (2007); DME:EPC1690 (2010), EPC1080 (2011); Adani: Alignment, Offsite(2013), Mine Layout / Infrastructure (2013); Created by: MS



LEGEND

- Local Road
- River / Watercourse
- Overland Conveyors
- Rail (West)
- Mine (Onsite)
- Open Cut Blocks
- Water Management Dams
- Mine Infrastructure Area
- Mine Infrastructure
- Stockpiles
- Tailings Cell
- Top Soil Storage

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1:275,000 (at A4)

0 2 4 6 8 10

Kilometres

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

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Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project SEIS

Job Number	41-26422
Revision	B
Date	23-10-2013

Mine Stage - Year 2040 - 2044

Figure 17

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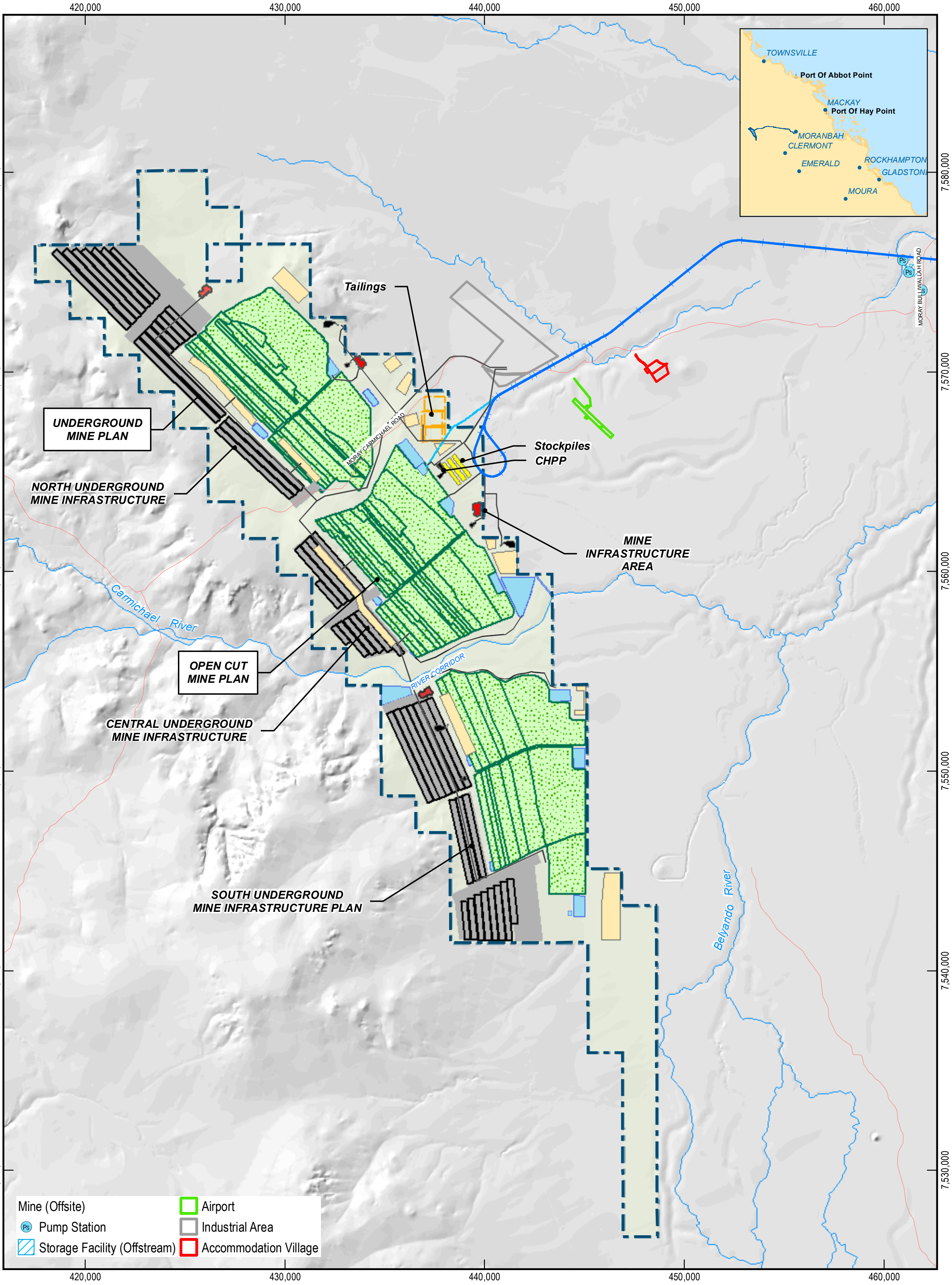
Level 9, 145 Ann St Brisbane QLD 4000 T +61 7 3316 3000 F +61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data Source: GA: Road, River / Watercourse (2007); DME:EPC1690 (2010), EPC1080 (2011); Adani: Alignment, Offsite(2013), Mine Layout / Infrastructure (2013); Created by: MS



LEGEND

Local Road
River / Watercourse
Overland Conveyors
Rail (West)
Mine (Onsite)
Open Cut Blocks
Water Management Dams
Mine Infrastructure Area
Mine Infrastructure
Stockpiles
Tailings Cell
Top Soil Storage

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1:275,000 (at A4)

0 2 4 6 8 10

Kilometres

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

N

GHD adani

Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project SEIS

Job Number 41-26422
Revision B
Date 23-10-2013

Mine Stage - Year 2045 - 2049

Figure 18

G:\41\26422\GIS\Maps\MXD\01000_Project_Description\41_26422_01003_rev_b.mxd

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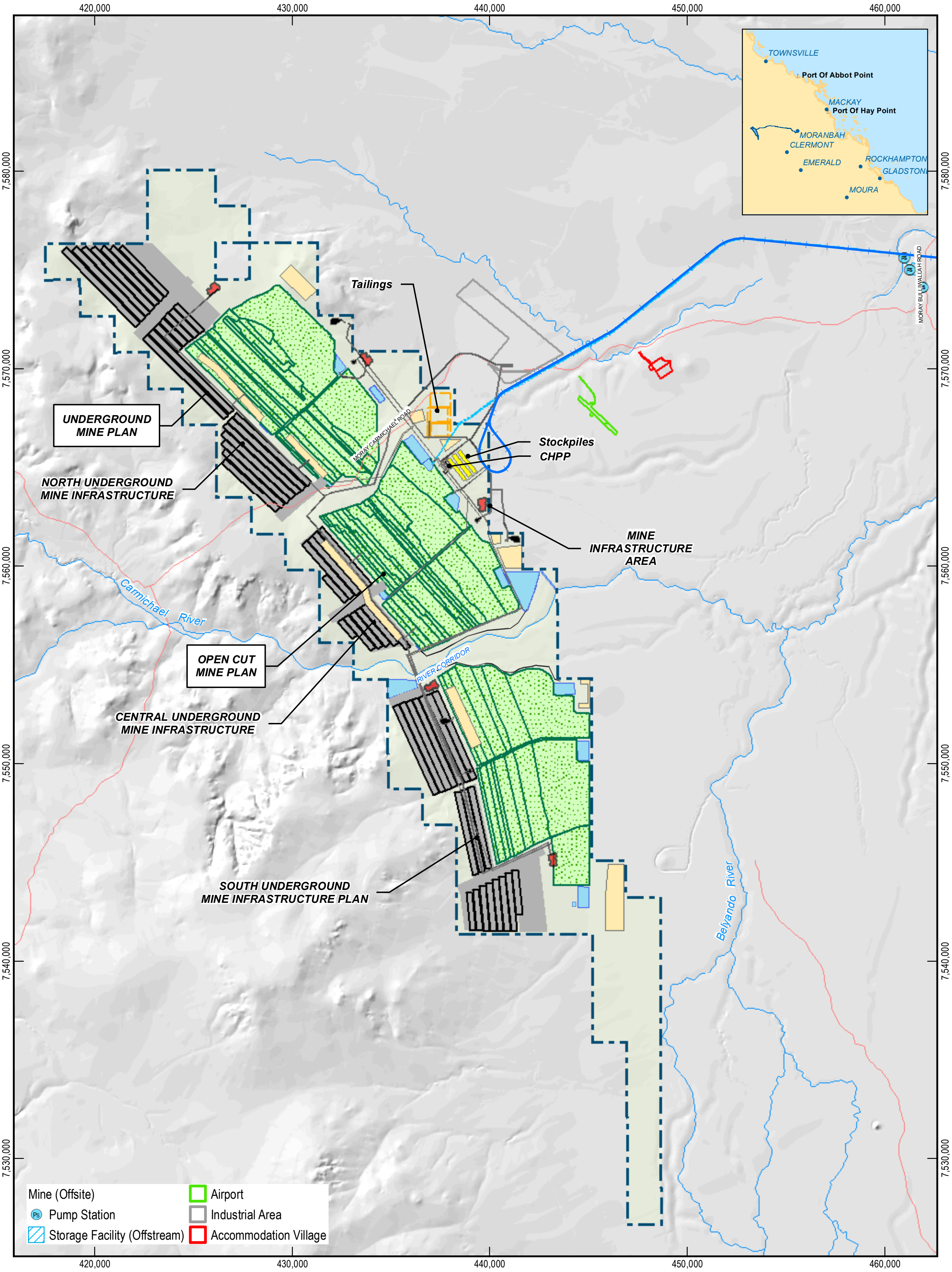
Data Source: GA: Road, River / Watercourse (2007); DME:EPC1690 (2010), EPC1080 (2011); Adani: Alignment, Offsite(2013), Mine Layout / Infrastructure (2013); Created by: MS



LEGEND

Local Road
River / Watercourse
Overland Conveyors
Rail (West)
Mine (Onsite)
Open Cut Blocks
Water Management Dams
Mine Infrastructure Area
Mine Infrastructure
Stockpiles
Tailings Cell
Top Soil Storage

1:275,000 (at A4)

0 2 4 6 8 10

Kilometres

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

N

Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project SEIS

Job Number 41-26422
Revision B
Date 23-10-2013

Mine Stage - Year 2050 - 2060

Figure 19

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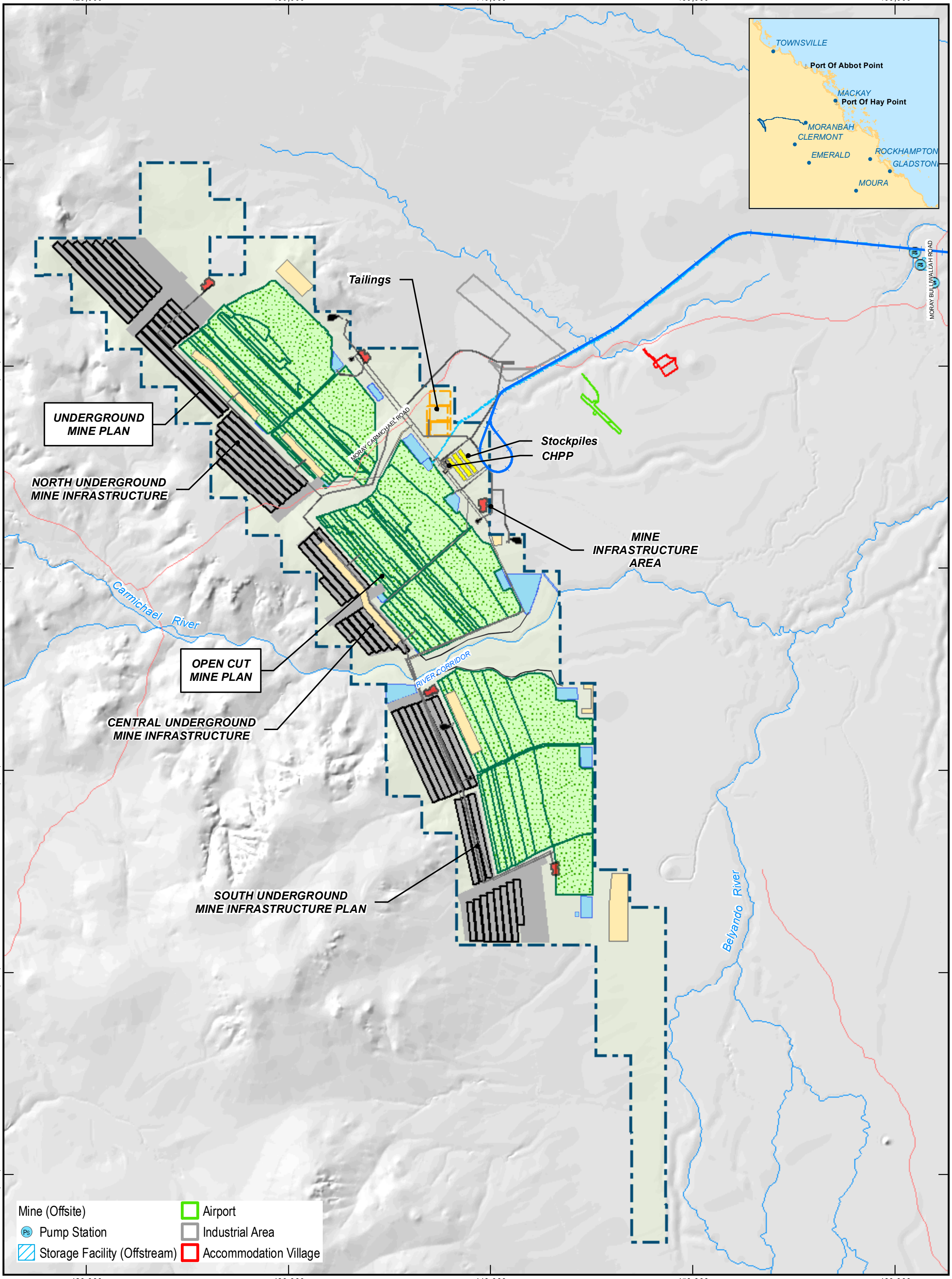
Data Source: GA: Road, River / Watercourse (2007); DME:EPC1690 (2010), EPC1080 (2011); Adani: Alignment, Offsite(2013), Mine Layout / Infrastructure (2013); Created by: MS



LEGEND

- Local Road
- River / Watercourse
- Overland Conveyors
- Rail (West)
- Mine (Onsite)
- Open Cut Blocks
- Water Management Dams
- Mine Infrastructure Area
- Mine Infrastructure
- Stockpiles
- Tailings Cell
- Top Soil Storage

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1:275,000 (at A4)

0 2 4 6 8 10

Kilometres

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

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GHD adani

Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project SEIS

Job Number	41-26422
Revision	B
Date	23-10-2013

Mine Stage - Year 2061 - 2072

Figure 20

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Data Source: GA: Road, River / Watercourse (2007); DME:EPC1690 (2010), EPC1080 (2011); Adani: Alignment, Offsite(2013), Mine Layout / Infrastructure (2013); Created by: MS

4. Mine onsite infrastructure

4.1 Mine infrastructure overview

The onsite mine infrastructure is divided into the following key areas:

- mine service areas
- power supply
- fuel supply and storage
- water supply and management
- mine water management
- roads
- transport facilities
- waste disposal facilities
- communications
- medical facilities
- enabling infrastructure

4.2 Location study

A location study was completed with the aim of coordinating all the site infrastructure requirements to define one site layout that locates all required infrastructure within the known constraints.

The site location study considered the following:

- Carmichael River and existing water courses
- dust and noise
- environmentally sensitive biodiversity
- mine pits and pit ramps
- out-of-pit spoil emplacement
- site drainage infrastructure and flood mitigation structures
- mine infrastructure areas (MIAs)
- internal roads (heavy vehicle and light vehicle)
- public roads
- existing site infrastructure
- coal handling infrastructure
- CPP
- CPP rejects handling

- mine lease
- high voltage infrastructure
- staging of the mine
- mine subsidence areas
- ammonium nitrate/fuel oil (ANFO)
- train loop

The outcome of the location study was to define the layout of all mine infrastructure on the mine site.

4.3 Temporary mine site layout

A temporary mine site layout will include all facilities required to support the first two years of mining activities. This facility will support initial mining operations while permanent facilities are constructed. The facilities included in the temporary mine site layout are as follows:

- Moray Carmichael Boundary Road realignment within the mine lease boundaries
- construction and operational water
- laydown areas/hardstands
- temporary explosive magazines
- temporary operations power
- enabling works fleet construction area
- enabling works MIA North (Pit B and Pit C)
- enabling works MIA Central (Pit D and Pit E)
- fencing and security
- construction roads and access roads
- development haul roads
- local disturbed area sediment and erosion control
- waste transfer station

4.4 Permanent mine site layout

The permanent mine site layout will include all facilities required to support mining operations. The facilities included in the permanent mine site layout area as follows:

- permanent MIA north (Pit B and Pit C)
- permanent MIA central (Pit D and Pit E)
- permanent MIA south (Pit F and Pit G)
- underground Mine MIA’s
- central administration area
- north ANFO (Pit B and Pit C)

- central ANFO (Pit D and Pit E)
- south ANFO (Pit F and Pit G)
- coal handling and processing plant (CHPP)
- tailings and reject disposal
- earthworks and road works
- power
- communications fibre network only
- CHPP controls
- water management inclusive of raw water, mine affected water, sediment affected water and process water
- flood management

4.5 Mine infrastructure area layout

There will be one MIA per major open cut (OC) pit cluster, and one MIA per underground (UG) mine. The mine administration office will be located in close proximity to the main site access road and adjacent to the CHPP area. All other functions associated with the mine operations and maintenance will be located at the MIA areas located near the pit ramps. Each of the MIA areas will service two adjacent pits.

The key drivers for the layout for the MIA is the location of the facilities close to the equipment they are servicing to minimise trip times and therefore operational costs, segregation of traffic classes for safety and flexibility to provide for future requirements.

To achieve this, the MIA layout is divided into the following facilities:

- enabling works fleet construction area
- enabling works MIA North (Pit B and Pit C)
- enabling works MIA Central (Pit D and Pit E)
- permanent MIA North (Pit B and Pit C)
- permanent MIA Central (Pit D and Pit E)
- permanent MIA South (Pit F and Pit G)
- permanent MIA UG Mine 1
- permanent MIA UG Mine 5
- central administration area
- north ANFO (Pit B and Pit C)
- central ANFO (Pit D and Pit E)
- south ANFO (Pit F and Pit G)

Traffic movement areas will be clearly segregated into Heavy Vehicle (HV), Light Vehicle (LV) and pedestrian areas; where required, crossing points will be clearly identified and signed to ensure safe pedestrian / vehicle interactions across the Project site. Additionally, traffic movement across the site will be designed to clearly identify and segregate operational areas; access to these areas will be controlled such that only vehicles involved in operational activities will be granted access. This will aim to minimise vehicle / pedestrian interactions.

4.6 Mine industrial area

4.6.1 Permanent MIA open cut - typical

The permanent MIA’s will support the overburden and coal fleets for duration of the mine life. These areas will be located centrally to clusters of pits. The permanent MIA’s will be constructed by expanding the enabling works MIA’s to include a permanent heavy vehicle workshop and warehouse, a 3.5 ML diesel storage tank, additional lubricant storage and permanent power.

4.6.2 Permanent MIA’s underground - typical

The permanent MIA’s for underground mining will support the underground development of Mines 1-5 and will be progressively developed as the underground mines are constructed.

4.6.3 Central administration area

The central administration will provide the main entry to the mine site and the central administration facilities for the mine. It will be located next to the central MIA on the eastern side of the pits D and E. All visitor access to the mine site will be via the central administration area.

4.6.4 Typical ANFO facility

The ANFO will service the explosive requirements for O/C Pits. It will be constructed a minimum 1.5 km from any other facilities. The facility will cover an area of approximately 180,000m^2. This will provide a sufficient area for delivery, storage and mixing of ANFO.

4.6.5 Earthworks

MIA pads

The MIA pads are an earth platform required for the mine operation facilities and mine fleet facilities. The platform is elevated to provide 1 in 100 year AEP flood immunity to facilities with a cross fall for localised drainage. Longitudinal ‘v- shaped’ drains are required around the outside of the pad to direct localised drainage to mine affected water (MAW) storage. Fill batters have been used, based on geotechnical assumptions of the available general fill embankment materials.

All unsuitable replacement earthworks and subgrade materials are of a general fill quality and will be hauled locally to the areas under construction. All sub-base materials are of a select fill quality. All base and wearing materials required will be hauled from external sources. All general and select materials to be obtained on site from mining pre-strip operations or selective borrowing from drainage excavations. All quarried materials will be sourced from the closest available quarry.

Central administration area pad

The central administration pad is an earth platform required for the mine operation facilities and mine fleet facilities. The platform is elevated to provide 1 in 100 year AEP flood immunity to facilities with a cross fall for localised drainage. Longitudinal ‘v-shaped’ drains are required around the outside of the pad to direct localised drainage to mine affected water (MAW) storage. Fill batters have been used, based on geotechnical assumptions of the available general fill embankment materials.

All unsuitable replacement earthworks and subgrade materials are of a general fill quality and will be hauled locally to the areas under construction. All sub-base materials are of a select fill quality. All base and wearing materials required will be hauled from external sources. All general and select materials to be obtained on site from mining pre-strip operations or selective borrowing from drainage excavations. All quarried materials will be sourced from the closest available quarry.

Gatehouse pads

The gatehouse pads are earth platform required for the gatehouse facilities and medium vehicle road and car park facilities at the ingress from Moray-Carmichael Boundary Road for the MIAs and coal processing plant. The platform is elevated to provide 1 in 100 year AEP flood immunity to facilities with a cross fall for localised drainage. Longitudinal ‘v-shaped’ drains are required around the outside of the pad to direct localised drainage to sediment storage.

All unsuitable replacement earthworks and subgrade materials are of a general fill quality and will hauled locally to the areas under construction. All sub-base materials are of a select fill quality. All base and wearing materials required will be hauled from external sources. All general and select materials to be obtained on site from mining pre-strip operations or selective borrowing from drainage excavations. All quarried materials will be sourced from the closest available quarry.

ANFO facilities pad and medium vehicle access roads

The ANFO facilities pads are an earth platform required for the mine operation facilities and mine fleet facilities. The platform is elevated to provide 1 in 100 year AEP flood immunity to facilities with a cross fall for localised drainage. Longitudinal ‘v-shaped’ drains are required around the outside of the pad to direct localised drainage to mine affected water (MAW) storage. Fill batters have been used, based on geotechnical assumptions of the available general fill embankment materials.

All unsuitable replacement earthworks and subgrade materials are of a general fill quality and will be hauled locally to the areas under construction. All sub-base materials are of a select fill quality. All base and wearing materials required will be hauled from external sources. All general and select materials to be obtained on site from mining pre-strip operations or selective borrowing from drainage excavations. All quarried materials will be sourced from the closest available quarry.

4.7 Servicing facilities

In order to minimise the distance travelled by the haul trucks and other mine vehicles, refuelling areas will be constructed at strategic locations within the pits. These will typically include 1.5 ML of fuel storage per cluster and refuelling bowsers for heavy vehicles and service trucks. Basic maintenance facilities may also be allowed for at these locations.

4.8 Power supply

4.8.1 Introduction

Power will be delivered to the site via a 275 kV transmission line and a 275/66 kV substation the Galilee North Substation (supplied by others). The 275/66 kV substation will be located adjacent to the offsite industrial area about 5 km from the CHPP complex and adjacent to the Moray Carmichael Boundary Road. Power will be reticulated around site via overhead open mesh 66kV transmission line and delivered to local 66/22 kV substations. Reticulation to some areas will be at 22 kV. Some redundancy and security is achieved via the mesh reticulation and 66/22 kV transformers are standardised to allow a spare to be held for the event of transformer failure.

4.8.2 Summary of electrical works

The major elements of the onsite electrical works are as follows:

- Two 66 kV transmission lines from the Carmichael Coal Mine main Galilee north substation 275 kV/ 66 kV; one to the east 66 kV/ 22 kV substation and the other to the west 66 kV substation
- East 66 kV/ 22 kV substation and west 66kV distribution substation
- 22 kV cable/OHL meshes (to be closed in future) for supplying CHP, stacker and reclaimer, dam water pumps, TLO, north, central and south MIAs, CPP, central ROM, south ROM, north ROM, MIA substations and U/G MIA facilities, plus a spare feeder from the east 66 kV/ 22 kV substation
- Three 66 kV feeder bays in the west substation; one supplying pit D, E, F & G loads plus U/G mine 3,4 & 5, another supplying pit B and pit C loads, plus U/G mine 1, 2 & 3, and the other installed as spare
- Three 66 kV/ 22 kV, 25 MVA transformers (two in duty and one in standby) in the east substation where the standby transformer will be installed in the future
- The first ring from the 22 kV bus of the east SUB to supply CHP loads around the product yard conveyor and sediment D Dam water pumps
- One 22k V/3.3k V/415 V transformer to supply the CHP loads around the product yard conveyor
- One 22 k/415 V transformer to supply the sediment D loads
- The second ring of the east substation to supply the loads of the overland conveyors, crushing and the raw water dam substation
- The third ring of the east substation to supply the stacker and reclaimer substation and CPP substation
- The fourth ring of the east substation to supply the TLO, north gatehouse, north ANFO, central MIA and central MIA as well as central ROM substations
- The fifth 22 kV ring of the east substation to supply the tailings water dam, sediment C, north gatehouse, sediment B, north ANFO, north MIA, and north ROM substations
- Two-winding or three-winding transformers in RMU configurations for CHP, stacker and reclaimer, TLO, CPP and ROM substations with their primaries at 22 kV and the

secondaries at 415 V. The tertiary winding (if any) are rated at either 690 V or 3.3 kV depending on the size of the large motors in the MCC and the required cable run to obtain the most cost effective solution

- Two-winding pole mounted 22 kV/415 V transformers for water dam, sediment, ANFO and gatehouse substations and part of MIA
- Two sets of two-winding 22 kV/415 V transformers located in RMU kiosks for the north and south MIA main substations
- 3.3 kV, 690 V or 415 V MCCs (depending on which one can lead to the cost effective solution without exceeding the acceptable voltage drop limits specified in the design criteria for the MCC busbar and motor terminals during the steady state and worst-case scenario motor starting conditions of system)
- 22 kV, 3.3 kV and LV cables
- 3.3 kV, 690 V and 415 V electric motors
- PLC, control system and SCADA
- Instrumentation
- Communications fibre backbone

4.9 Fuel supply

The Project will be a significant consumer of diesel fuel with an estimated annual consumption of around 201 ML.

Fuel deliveries for the Project will generally be made by BAB-triple or quad road train tankers and it is proposed that a maximum of 10 days of diesel will be stored on the mine site at the peak of fuel consumption. The fuel strategy for the Project (Mine) includes refuelling facilities at:

- MIA's
- in-pit Refuelling Area
- offsite refuelling depot adjacent to the rail in the offsite industrial area
- south ROM refuelling area.

Fuel will be delivered by BAB triple or quad road train tankers from off-site storage to each of the fuel storage tanks at the MIAs. Fuel will then be transferred from these storage tanks to the in-pit refuelling areas by mine fuel service vehicle.

4.10 Roads

The Mine site will require a number of on-site roads, pads and dams for expected mine operations. The mine road network will be developed based on the requirement to provide access to critical locations on site for various vehicles and machinery. The pavement of each road will therefore be designed to accommodate the expected quantities and types of vehicles using them with a staged development to account for initial construction traffic and then upgrade them for mining traffic at the completion of construction.

It is expected that there will be limited available general fill materials from the mine overburden, the tailings dam and diversion drain construction and limited low-grade select pavement materials from Diversion Drain A construction. Any high quality pavement materials are expected to be sourced from the nearest quarry to site. Any rock within the overburden is expected to be extremely weathered and unsuitable for pavement materials.

Foundation treatment will be required under site roads to treat unsuitable in-situ materials. This process will require boxing out of the unsuitable materials to depths subject to geotechnical investigation. After box-out, general earthworks materials sourced from site will be used to backfill the box-out.

Select materials for roads are required to be sourced from the nearest available quarry/borrow source.

4.10.1 Access roads

The access road comprises a seven metre wide earth formation with lateral crossfall drainage and will be used to gain access to the mine site for mine vehicles and delivery traffic. The final road design will be based on the mine layout and surface grading will be designed to balance earthwork quantities and meet operational vehicle requirements.

The access road will be designed to achieve 1 in 20 year ARI flood immunity and 1 in 50 year ARI flood immunity where the road will form part of the Project emergency evacuation route. Where required, ‘v-shaped’ drainage will be incorporated along the access road to accommodate 1 in 10 year ARI flood events.

All unsuitable replacement earthworks and subgrade materials are considered to be of a general fill quality and will be hauled on lease. All general and select materials will be obtained on site from pre-stripping operations or selective borrowing from drainage excavations where relevant. All quarried materials will be sourced from the closest available quarry.

4.10.2 Haul roads

The heavy vehicle road comprises a 35 m wide, dual-lane earth formation (lane width is three and a half times the width of an ultra-class mine vehicle as per industry standards) with a single lateral cross-fall. The road will be required for access for heavy mine vehicles.

The final road design will be based on the mine layout and surface grading will be designed to balance earthwork quantities and meet operational vehicle requirements. Safety windrows and side slopes, will be designed as per industry standards (i.e. 1.8 m high, or ½ a heavy vehicle wheel height) where required to protect infrastructure or vehicles. Downstream windrows will be designed d to incorporate a turnout drain at regular intervals to allow for localised drainage and to prevent ponding on the formation surface.

The heavy vehicle formation will be designed to provide 1 in 50 year AEP flood immunity with floodways provided across major drainage paths, as this part of the formation forms part of the mine emergency evacuation route. Longitudinal ‘v-shaped’ drains will be incorporated on the outside of the safety windrows where required to direct localised drainage to MAW storage.

All unsuitable replacement earthworks and subgrade materials are considered to be of a general fill quality and will be hauled on lease. All general and select materials will be obtained from on-site pre-stripping operations or selective borrowing from drainage excavations. All quarried materials will be sourced from the closest available quarry.

4.10.3 Light vehicle roads

The light vehicle road formation comprises a five metre wide earth formation with a lateral cross-fall and will be used for low frequency use service access roads for mine light vehicles. The final road design will be based on the mine layout and surface grading will be designed to balance earthwork quantities and meet operational vehicle requirements.

The formation is designed to provide 1 in 2 year AEP flood immunity with a longitudinal ‘v-shaped’ drainage incorporated where required.

All unsuitable replacement earthworks and subgrade materials are considered to be of a general fill quality and will be hauled on lease. All general and select materials will be obtained from on-site pre-stripping operations or selective borrowing from drainage excavations. All quarried materials will be sourced from the closest available quarry.

4.11 Transport facilities

Traffic management protocols have been developed for the Project to minimise safety risks and provide effective traffic movement to each of the key infrastructure areas within the Project Area. These are outlined as follows:

- Road and security infrastructure has been developed to isolate heavy vehicle mining fleet movements from all other vehicles.
- A bus fleet will be used to transport mining staff between the Project site and relevant accommodation camps in order to minimise interactions between personnel and mine traffic.
- Security infrastructure has been designed to restrict access from the public road to any of the mine areas.
- Speed limits and road infrastructure have been designed to minimise the risk of traffic incidents occurring over the Mine Area.

4.12 Waste disposal facilities

Mine-site waste, including general, green and regulated waste, will be recycled, where possible, and disposed of according to its type. Waste management for general, steel and hazardous waste will be provided at all MIAs and be accessible by waste removal vehicles.

4.13 Sewerage waste

4.13.1 Sewage treatment system

Sewage will be processed at sewage treatment plants (STPs) at the MIAs. Sewage will be collected by an in-pit sewage pump and removed via rising mains to the STPs. Buildings external to the MIAs, such as the security gatehouses, will have a raw sewage tank emptied on a weekly basis by a sewage truck and transported to the STPs for processing.

4.13.2 Sewage treatment plant

STPs with a capacity of 40 kL/day will be provided at MIAs. An appropriate sewerage system will transfer the sewage to the STP which comprises a series of holding tanks for raw sewage, containerised treatment plants and a series of holding tanks for effluent. The effluent from the

STP will be disposed of by spray irrigation through a grid of irrigation, set out and fenced for this purpose.

In the event of failure, the sewage will be trucked to the STP at the mine workers accommodation village for treatment until the system is returned to service.

4.13.3 Sewage storage

Four days' worth of raw sewage and treated effluent storage will be stored at the following locations:

- north MIA – 160 kL raw sewage, 160 kL treated effluent
- north ANFO – 10 kL raw sewage
- north security gatehouse – 10 kL raw sewage
- central MIA – 160 kL raw sewage, 160 kL treated effluent
- central ANFO – 10 kL raw sewage
- central security gatehouse – 10 kL raw sewage
- CHPP security gatehouse – 10 kL raw sewage
- south MIA – 160 kL raw sewage, 160 kL treated effluent
- south ANFO – 10 kL raw sewage
- south Security Gatehouse – 10 kL raw sewage
- U/G Mine 1 MIA – 160 kL raw sewage, 160 kL treated effluent
- U/G Mine 1 Security Gatehouse – 10 kL raw sewage
- U/G Mine 5 MIA – 160 kL raw sewage, 160 kL treated effluent.

4.14 Communications

The scope of work for the Project's communications covers the provision of the fibre optic backbone on the mine lease. The fibre optic backbone is provided by running OPGW wires on the 66 kV overhead power lines on site which links the Galilee North Substation to all major areas of site including the North, South and Central MIA. The fibre optic backbone is further provided by following the conveyor routes linking all motor control centres and control rooms.

This provides a single fibre optic network covering all assets on the mine lease.

4.15 Onsite medical facilities

An emergency response facility will be located at each of the MIAs and will include:

- first aid room complying with Qld coal mining regulations
- emergency building including:
  - parking for one fire truck
  - parking for one paramedic response vehicle
  - store

A helipad for emergency airlift of injured personnel is not required as emergency air transport will be provided from the nearby airport. The helicopter can land in the mine lease at numerous emergency locations such as the pit, HV roads or hardstand area as required.

4.16 Enabling infrastructure

4.16.1 Fencing

Fencing will be provided at the following areas:

- permanent mine lease boundary
- permanent public road boundary

All fencing will be designed to the appropriate industry standards and in accordance with TMR standards.

4.16.2 Existing road improvements and upgrades

Moray Carmichael boundary road upgrade

The Moray-Carmichael Boundary Road comprises a crowned 10 m wide high use earth formation with lateral crossfall required for mine access, delivery traffic and general traffic. The final road design will be based on the mine layout and surface grading will be designed to balance earthwork quantities and meet operational vehicle requirements.

The formation is designed to provide 1 in 10 year AEP flood immunity for major cross drainage with 1 in 50 year AEP flood immunity where these roads form part of the mine emergency evacuation route. Where required, adequate drainage will be incorporated to achieve 1 in 2 year immunity for localised drainage.

All unsuitable replacement earthworks and subgrade materials are considered to be of a general fill quality and will be hauled on lease. All general and select materials will be obtained from on-site pre-stripping operations or selective borrowing from drainage excavations. All quarried materials will be sourced from the closest available quarry.

4.16.3 Enabling works MIA facilities

The Stage 1 MIA facilities will include the following facilities:

- mine fleet assembly area
- enabling works MIA north (pit B and pit C)
- enabling works MIA central (pit D and pit E)

The mine fleet assembly area will be constructed at the existing Labona Airstrip. The hardstand platform for heavy vehicle assembly will cover an area of approximately 95,000 m^2. This will provide a sufficient area for delivery and storage of heavy vehicle parts as well as providing ample space to complete the assembly of eight heavy vehicles at a time.

The platform will be constructed with an all-weather surface, including nominated heavy lift and jacking areas. These heavy load areas will require tightly compacted granular road base material, or alternatively will comprise localised concrete slabs where the required granular fill material not be available.

4.16.4 Power supply

Temporary power will be provided to the enabling works MIA by four Gensets at each MIA. Details of gensets are listed in the following:

- MIA power pack no. one including:
  - two off 850 kVA diesel generators
  - two off 450 kVA generators
  - complete switchboard and protective devices for the set
  - complete control and synchronising system
- MIA power pack no. two including:
  - one off 100 kVA generator
  - complete switchboard and protective devices for the set
  - complete control and synchronising system
- MIA power pack no. three including:
  - three off 250 kVA generators
  - complete switchboard and protective devices for the set
  - complete control and synchronising system
- MIA security hut power pack no. four including:
  - one off 100 kVA generator
  - complete switchboard and protective devices for the set

Each Genset supplies 415 V power to a Distribution board connected to the Genset by either LV cables or LV busducts depending upon the size of total demand. Co-generation of each Genset will be synchronised by the load sharing and control system of the Genset. The synchronism check will be provided by the Genset protection system.

Once permanent 415 V power is available, it will be supplied to the MIA and the Gensets will be used as a backup power station to kick in when the permanent power is interrupted. Also, the design of Genset synchronising, load sharing and control systems and the configuration of distribution boards allow to synchronise the Gensets with a reference voltage from the main grid. This will enable the injection of power to the main grid by MIA Gensets when additional reserve power is available.

5. Coal handling and processing

5.1 Overview

The Project's coal handling and preparation plant (CHPP) has been designed to receive size and process a maximum throughput of 74.5 Mtpa run of mine (ROM) coal, producing 60 Mtpa of product coal. CHPP is an overarching term for coal handling plant (CHP) and coal preparation plant (CPP)

The facility will operate 24 hours per day, seven days a week for a minimum of 7,200 hr/a for the life of the mine. The CPP will consist of four 1,600 tph modules providing a total capacity of 6,400 tph. The facility will be capable of receiving coal from haul trucks and underground ROM and washing 75 percent of the ROM coal. The raw coal surge stockpile has been included to provide minimum buffering between the differences in mining annual hours and processing operating hours.

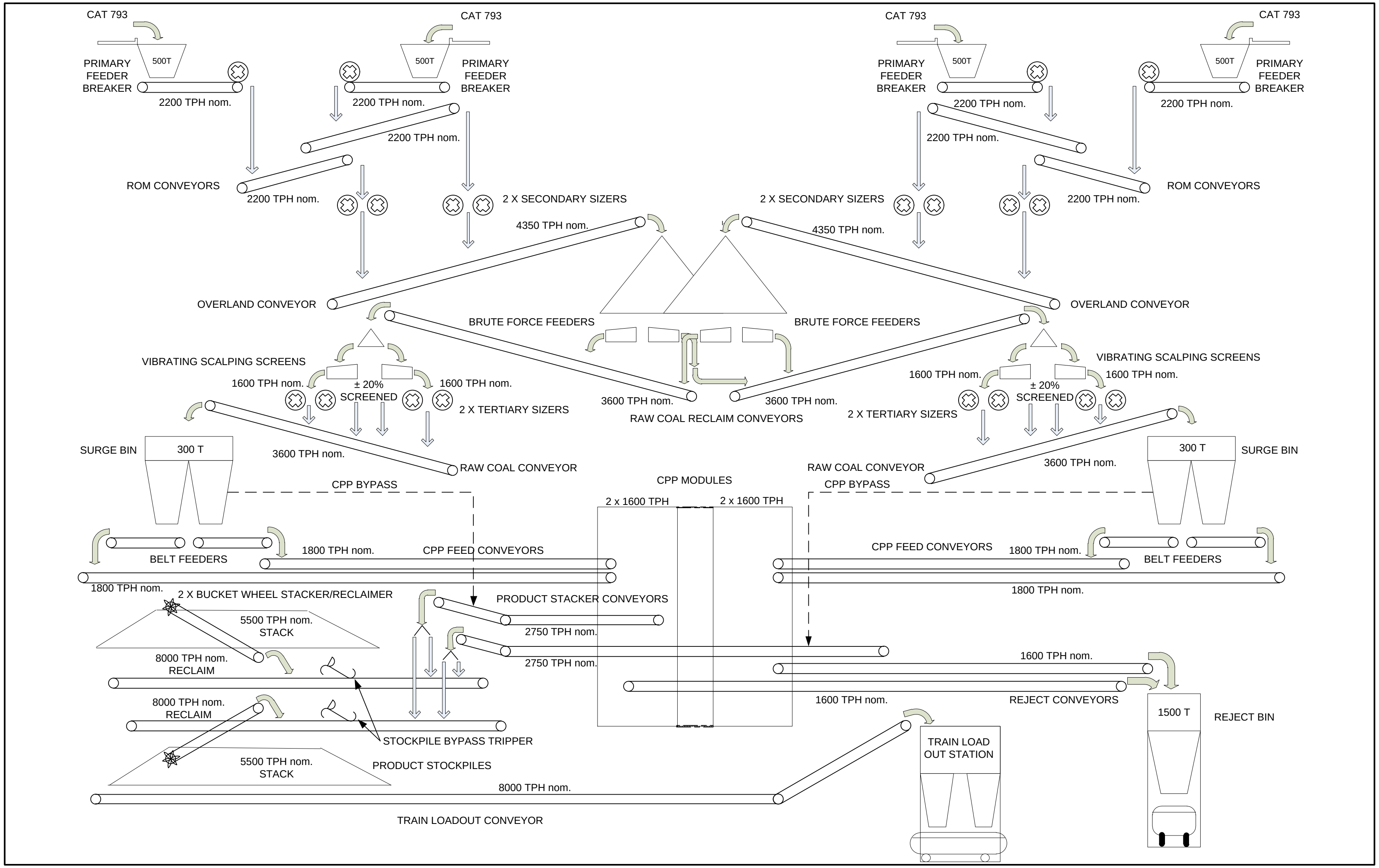
5.2 Summary scope of facilities

The mining operations will operate in up to six open cut pits and two underground mines simultaneously. Coal mined from open cut pits will be dumped into the ROM dump stations. Each ROM dump station will receive raw coal from two pits by rear dump trucks. Each ROM dump station consists of double tip bins equipped with a primary feeder breaker to reduce the raw coal to smaller sizes. The crushed raw coal from the primary sizing station will be transported via ROM conveyors into the secondary sizing station for further size reduction and will be stockpiled via an overland conveyor to a raw coal surge pile. Coal that cannot be received by the CHPP (during downtime or overloading) will be dumped to a ROM stockpile located on ground level from the ROM pad.

The -50 mm raw coal will be fed into the CPP at a throughput of 1,600 tph per module. The raw coal from the two surge piles will be transported via reclaim conveyor into the tertiary sizing station for further size reduction of +50 mm raw coal materials in order to meet the CPP feed size requirement; this process will be undertaken using a screen with 50 mm cut size. The −50 mm CPP feed materials from the tertiary sizing station will then be transported via a raw coal conveyor into the CPP feed bins. The CPP feed bins will each be feeding two CPP modules. The CPP will be constructed in separate building structures; each building consists of two module CPP.

The coarse and fine products from the CPP buildings will be collected by a common product stacker conveyor and will be stockpiled using bucket wheel stacker / reclaimers. The Product Coal stockpile will be designed to provide all the blending capabilities of chevron stacking and bucket wheel reclaiming. The washed coal will be reclaimed from the product stockpile and will be loaded into a train from the train loadout (TLO) station. The product by pass system of the CPP will be utilised for direct feed of underground products.

Figure 21 Coal handling plant flowchart (underground bypass and feed not shown)



5.3 Raw coal system

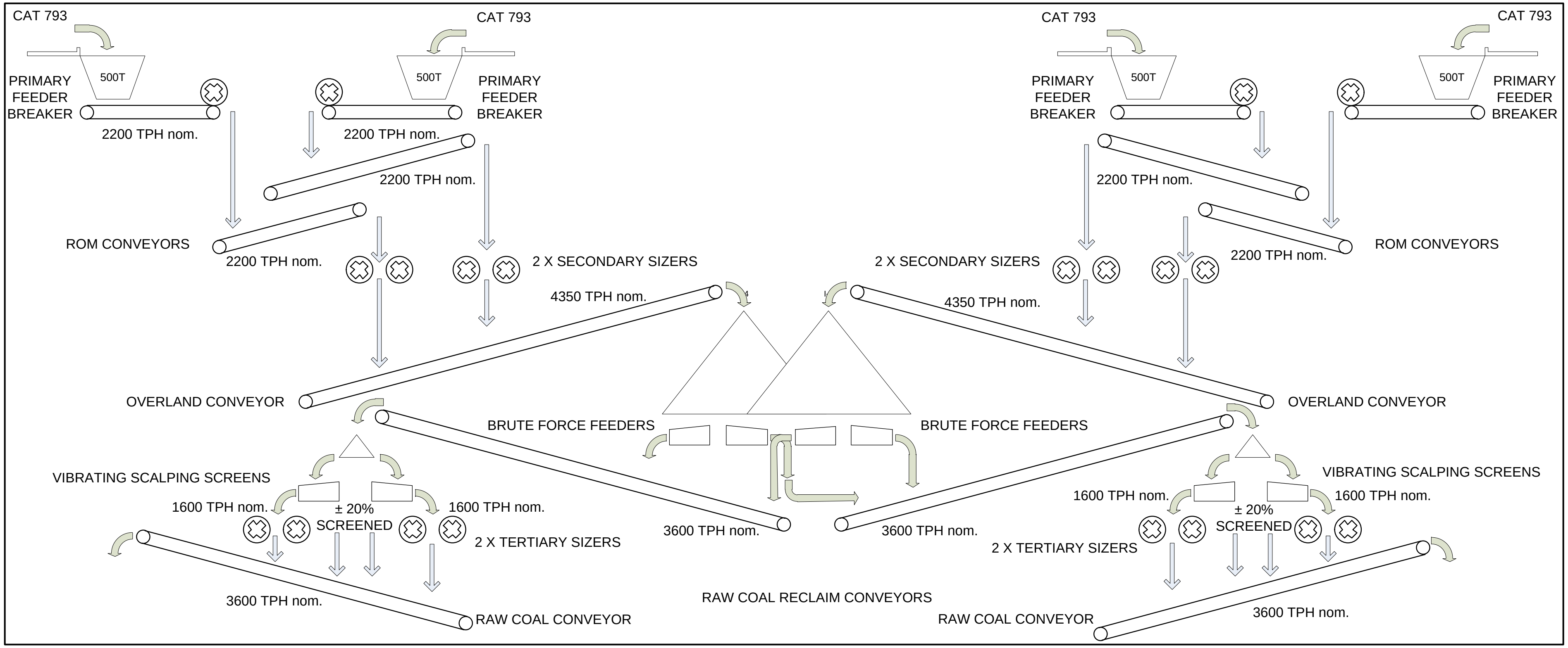
The raw coal system contains infrastructure to service open cut mine pits. The raw coal CHP infrastructure typically comprises of:

- truck dump hoppers
- primary sizing
- secondary crusher feed conveyors
- secondary sizing stations complete with:
  - magnet
  - secondary sizer one
  - secondary sizer two
- overland conveyor
- raw coal surge pile
- raw coal reclaim tunnel and feeders
- tertiary crusher feed conveyor
- tertiary sizing station 1 complete with:
  - bifurcated Splitter chute
  - screens
  - tertiary sizers
- surge bin feed conveyor
- coal analyser
- sampling system
- CPP surge bin dedicated to CPP modules

Similar systems for underground operations will be exclusive of the ROM bins but including a pit head conical stockpile and reclaimer.

Figure 22 shows the typical raw coal handling flowchart.

Figure 22 Raw coal handling flowchart



5.4 Coal preparation plant

Prior to receiving the raw coal in the CPP, the coal is reduced to a top size of 50 mm by three stages of sizing before being delivered to the CPP feed bins to ensure continuous feed to the four modules of the CPP.

Each of the modules will have a capacity of 1,600 tph and will be constructed in pairs that will consist of the following:

- coarse (-50 mm + 1.4 ww mm) beneficiation circuits utilising dense medium cyclones (DMC's)
- fine (-1.4 ww mm + 0.25 mm) fine beneficiation circuits utilising spirals
- one tailings thickener and clarified water circuit per pair of modules
- one set of plant services per pair of modules
- tailings disposal to tailings cells

Each pair of CPP modules will be housed in a common steel framed structure with the two CPP buildings offset along their long axis to allow a reject conveyor and a product conveyor to service each of the two CPP modules. The following description is for one CPP module, with services described in pairs of modules.

The material is discharged from each CPP feed bin by means of a belt feeder onto the plant feed conveyor feeding each module of the CPP. Within each module the feed material is equally divided to the two feed preparation screens by means of a feed hopper and two vibrating feeders. Figure 23 shows a simplified block diagram outlining the overall process.

5.5 Product coal system

The Product coal system comprises:

- product conveyors
- product coal transfer stations
- product yard conveyors
- product stockpiles
- bucket wheel stacker/reclaimers complete with stockpile bypass functionality
- product coal transfer stations (transfer between yard conveyors and TLO conveyor)
- train load out conveyor
- train loading system complete with
  - surge bin
  - batch weighing system
  - rail bunker for cleanout
  - control room
- coal analyser (on TLO conveyor)

Figure 24 shows the product coal handling flowchart

Figure 23 CPP block flow diagram

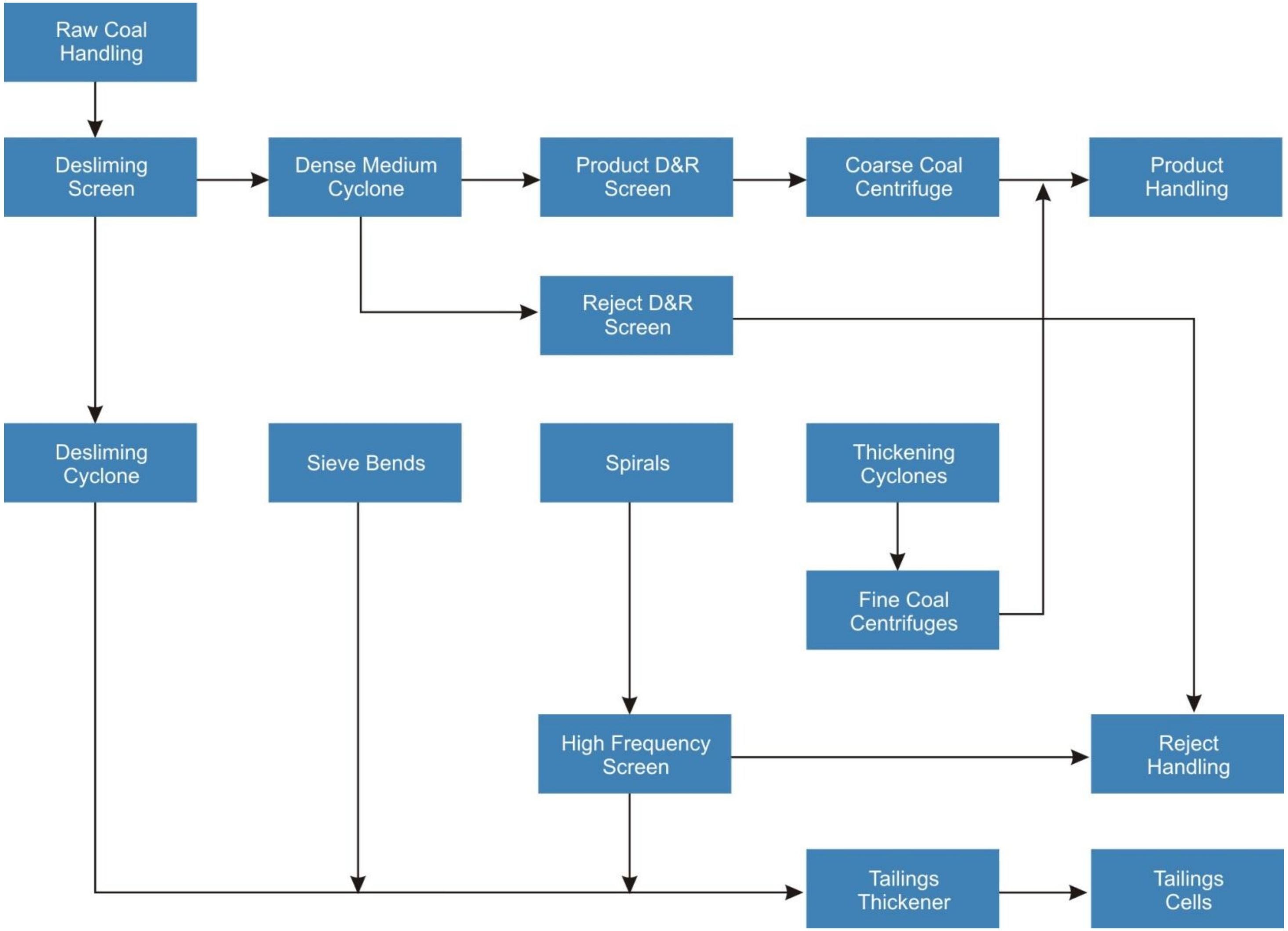
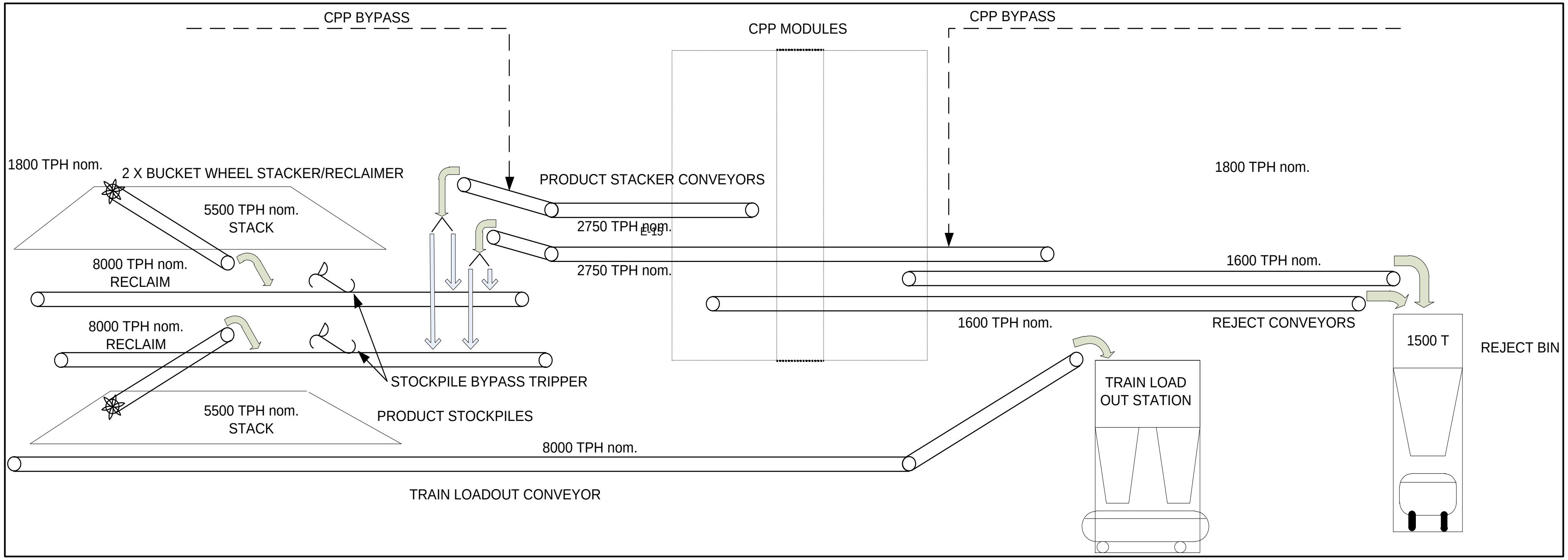


Figure 24 Product coal handling flowchart



5.6 CHPP site layout

5.6.1 Location study

A location study was completed with the aim of coordinating all the site infrastructure requirements to define one site layout that locates the entire required infrastructure within the known constraints.

5.6.2 Spontaneous combustion

Spontaneous combustion may occur for all types of Australian coal with the exception of certain anthracites. This oxidation starts at a slow rate, but doubles for every 10 degrees Celsius increase in temperature. The rate of oxidation increases slowly to the critical point of 70 to 75 degrees Celsius, which may occur within three to four days after stacking of the product. Between 140 to 230 degrees Celsius CO_2 forms until the heating process becomes self-sustaining up to 350 degrees Celsius where the coal starts to burn.

Of all the factors that may influence the spontaneous combustion of coal on large stockpiles the most important is the control of air flow. Although the flow of air may reduce the temperature of heating coal, it provides the oxygen that is essential for spontaneous combustion to occur.

It is most likely that spontaneous combustion will occur within the first one to two meters in depth over the entire surface of the stockpile, but most likely at the outer edges. In these areas the flow of air will be sufficient to provide oxygen for combustion to occur, but the flow will not be adequate to dissipate the heat generated.

To counter spontaneous combustion two approaches may be followed:

- promoting full ventilation to assist with dissipation of heat
- limiting air flow to prevent oxidation

For large stockpiles such as those proposed during the Project, the most feasible option is to limit air flow to prevent oxidation and subsequent combustion.

This can be achieved by aligning the stockpiles with the direction of the prevailing winds which in this case are predominantly south-easterly. Subsequently, it is proposed to align the product stockpiles from south-east to north-west to limit oxidation that may lead to spontaneous combustion.

5.6.3 CHPP – Civil design

The CHPP pad (earth platform) or conveyor corridors are required for the coal handling, process and wash facilities. Typically these will comprise elevated platforms to achieve 1 in 100 year AEP flood immunity to facilities with a cross fall of two percent for localised drainage. Longitudinal ‘v-shaped’ drains are required around the outside of the pads or conveyor alignments to direct localised drainage to MAW or SAW storage. Areas with a high potential for contamination from coal such as the central CHPP, ROM and stockpile areas will incorporate dedicated sediment traps and sumps as well as MAW dams.

Sediment control structures will be used to manage the run-off from infrastructure determined to have a low spill risk (i.e. overland conveyors etc.). Geological conditions at the Project site require the replacement of a 0.2 –1.0 m box of unsuitable foundation material prior to the construction of the pad embankments. All earthworks materials used for the pad construction will be obtained on-site from pre-stripping operations and are dependent on the location of suitable fill materials. Where suitable material is not available on-site, it will be imported from the closest project based or commercial quarry.

5.6.4 Tailings disposal

The proposed method of tailings disposal must be developed considering the following constraints:

- The limited physical space within the mining lease to accommodate the volume of tailings produced during the life of mine
- It must minimise impact to the environment, surface water, and groundwater
- It must maximise water recovery from the tailings for beneficial reuse in future coal washing operations on site

Strategy overview

Adani propose that the tailings be managed by:

- Approximately 35 percent of the tailings would be dewatered by passing them through a belt / filter press; and
- Approximately 65 percent of the tailings will be pumped as slurry and sub-aerially deposited into out of pit earth embankment tailings dams.

The tailings deposited into these dams would be placed in thin layers of a nominal maximum of approximately 150 mm to assist with the bleeding and consolidation of the tailings.

The bleed water will be decanted off into adjacent storage ponds for reuse in the plant. Once the tailings have sufficiently dried out and consolidated, the consolidated tailings would be excavated from the tailings dams and transported to pre-constructed containment cells located within the out of pit storage emplacements at Pits D and E. Dried tailings ‘cake’ generated from the belt / filter press would also be placed into the pre-constructed containment cells located within out of pit storage emplacements at Pits D and E.

The containment cells located within out of pit storage emplacements at Pits D and E would be constructed with a suitably designed and engineered clay liner at the base and sides. When at capacity, the cells would be clay capped. This should effectively fully contain the tailings and minimise the risk of any contaminants entering the surrounding environment.

Design parameters, assumptions and limitations

Table 5 provides a summary of the design parameters used to calculate:

- The size of the tailings drying ponds;
- The number of tailings drying ponds; and
- The size and number of permanent tailings containment cells in the out of pit storage emplacements.

The design parameters listed in Table 5 have been derived from best available information at the time of writing and will be refined during the preliminary and final design stages. Further details in relation to tailing management are provided in SEIS Volume 4 Appendix O2 Waste Management Strategy.

Table 5 Design parameters for tailings disposal

Parameter	Value
Discharge solids content (wt/wt)	30%
After bleed solids content (wt/wt)	50%
Settled solids content (wt/wt)	70%
Specific gravity, Gs	2.0 t/m^3
Settled dry density, rb	1.0 t/m^3
Settled bulk density, rd	1.37 t/m^3
Initial bleed water per dry tonne	1.33 m^3/t
Bleed water after settling	0.57 m^3/t
Annual loading rate	34,000 t/ha/annum
Beach slope for tailings deposition	1V:200H for 600m then 1V:1000H to decant structure

Tailings slurry management

The 65 percent of tailings not passing through the belt / filter press would be mixed with water to achieve a slurry of 30 percent solids by weight, and pumped to the tailings dams. The tailings dams would be constructed as above ground 'turkey's nest' earth embankment structures using selected and compacted earth fill excavated from within the basin of the dams. The size and number the dams required would be dependent upon the rate at which water will bleed from the slurry deposited into the dams, thereby allowing the tailings to consolidate sufficiently for them to be excavated and transported to the containment cells located within out of pit storage emplacements Pits D and E.

For concept purposes, a two to three year rotation of the dams has been made such that sufficient operational contingency is built into the system for them to be filled, for the tailings to dry, and for tailings removal. The estimated drying and tailings removal period would be refined during final design.

To further maximise the tailings slurry, it is proposed that each of the three tailings dams be divided into a number of individual cells. The tailings would be deposited into each cell on a rotational basis via a feed pipeline placed along the basin edge of the embankment crest. Flow controlled spigot tee off's, placed at approximately 25 m intervals along the pipeline would allow the tailings to be deposited in the thin, uniform layers required within the cells.

The deposited tailings would form a natural beach sloping towards the end of each cell where a suitably constructed decant structure would collect the bleed water, together with any rainfall sourced run-off during the wet season. The decant water would then be pumped back to the CHPP for reuse, or be stored in decant water dams constructed proximal to the tailings dams.

The floor of each individual cell would be gently graded towards the decant structure. Further, a series of slotted 'ag-pipes' would be laid in shallow sand filled trenches across the topographically lowest 200 m area of cell floor, to assist with maximising vertical drainage of bleed water.

Filter cake tailings management

The tailings filter cake removed from the belt / filter press, together with the dried tailings from the individual cells within the conventional tailings dams, would be permanently stored in the engineered containment cells constructed within the out of pit storage emplacements at Pits D and E.

To minimise the risk of any leachate migrating from the engineered containment cells, tailings would be emplaced within clay lined cells. The rectilinear cells would be constructed within selected over and interburden material in the out of pit storage emplacements.

5.7 CHP services

5.7.1 Raw water requirements

The CHP will require the use of raw water for the following components:

- conveyor belt cleaners on the head end of each conveyor
- ROM bin dust suppression nozzles
- conveyor tail and head end dust suppression nozzles
- raw coal surge pile dust suppression water cannons
- product coal stockpile dust suppression water cannons
- washdown hoses at head and tail end of each conveyor only
- fire hydrants
- fire hose reels

The significant differences in pumping requirements to operate these components resulted in the design of two separate raw water systems:

- CHP process water networks (utilises the low flow, high pressure and continuous use type devices)
- CHP fire water network (utilises the high pressure, low flow and intermittent use type devices)

5.7.2 Raw water supply

A dedicated fire water supply will provide a flooded suction arrangement to both the process water pump and fire water pump. This raw water reserve will be supplied with water from the clean water dam. It is anticipated this water will be of a high enough quality to service both process water and fire water networks.

5.7.3 Dust suppression

Dust suppression is provided as part of the process water system. The process water network is a shared piping network servicing both the belt cleaners and dust suppression nozzles. Dust suppression is proposed at the following locations:

- ROM bins
- tail end of the conveyor feeding the secondary sizing stations
- tail end of the overland conveyors
- tail end of the RC reclaim conveyors

- head end of overland conveyors
- tail end of CPP feed conveyors
- tail end of CPP surge bin feed conveyors

High pressure full cone nozzles are proposed to be used in dust suppression; these do not require compressed air to operate.

5.7.4 Fire water and wash down area

A dedicated firewater circuit has been included as part of the CHP. The CHP fire water network comprises of:

- sufficiently sized panel tank/s
- electric pump and standby diesel tank (with associated appurtenances)
- hydrant – North ROM
- hydrant – Central ROM
- hydrant – South ROM
- hose reels on all elevated gantries
- hydrant – tertiary sizing stations (covers CPP area as well)
- hydrant – Train loadout
- raw coal surge pile water cannons for dust suppression
- product coal stockpile water cannons for dust suppression

5.7.5 Compressed air

Compressed air has not been included to service dust suppression nozzles. The reclaim feeders included do not required compressed air to operate. Solenoid valves or manual valves will be utilised to control the water networks. As such the CHP has no compressed air requirements.

5.7.6 Potable water

The potable water network at the MIA's and CPP will service the CHP areas.

Safety showers or dedicated amenity blocks are not required as part of the CHP, as such a dedicated potable water circuit for the CHP has been excluded.

5.8 Mine waste

Approximately 13.1 billion bank cubic metres (bcm) of over and interburden will be generated from the open cut section of the Carmichael mine during the mine life. Initially this material will be stored in out of pit waste rock structures on the eastern side of the mine area. Subsequently, the balance of the material will be placed into mine voids as these become available.

Test results for 92 samples indicate that the clays, weathered rocks (including mudstone, claystone, carbonaceous mudstone and siltstone) may have dispersive behaviour. Slightly weathered siltstone may show very slight potential for dispersivity. The weathered sandstone did not show any indication of dispersive behaviour. Soil samples showed completely non-dispersive results due to the presence of calcite.

The fresh rocks were generally non-dispersive, although some claystones and siltstones may have a very low potential for dispersion. There was variability in dispersion results within each group.

Weathered rock, siltstone and sandstone showed potential for deterioration and breakdown after exposure to water. The siltstone showed moderate rate deterioration, and sandstone slow deterioration. This may indicate that although the fresh rock units are not dispersive, they are not durable, and with time may degrade to sand, silt or clay. The degraded material may be more prone to physical erosion than the original fresh rock.

Chromium reducible sulfur (CRS) tests indicated that not all acid generating capacity determined from total sulfur may be available to generate acid. Similarly, acid buffering characteristic curve (ABCC) testing indicated that not all acid neutralising capacity determined from ANC testing may be available to neutralise acid. Thus, there is expected to be some uncertainty on the accuracy of the NPR and AMIRA classifications of the samples.

Based on the available results the majority of the overburden and interburden materials (not immediately adjacent to the coal seams) and roof and floor wastes are not likely to be a source of acid immediately after mining. Nor would most of these materials be expected to be an immediate source of salinity; however, some portion could be a source of salinity. The clay materials of the overburden and interburden could have a markedly higher potential to release salts and metals to contact water even though the pH may remain alkaline. Typically however, the concentrations of metals in water contacting the waste would be expected to be low while waters remain circumneutral.

The majority of the overburden and interburden waste from all lithological groups is likely to be non-acid forming in the longer term. Some carbonaceous mudstone, carbonaceous sandstone, carbonaceous siltstone, clay, claystone, mudstone, sandstone, sandy clay, siltstone and tuff may be acid forming in the long term and there may be a requirement to manage these materials to prevent or limit the longer-term development of AMD.

Some portion of the roof, floor and coal could be expected to be acid forming in the long term. Washed coal wastes were not available for testing.

Kinetic testing of 10 samples to estimate rates of acid production and neutralisation and rates of metals release commenced in May 2013.

Details of the tailing management strategy are included in SEIS Volume 4 Appendix O2. Ultimately, 100 percent of the tailings and coarse rejects generated in the CHPP would report to the engineered co-disposal cells located within out of pit storage emplacements at Pits D and E. It is proposed that the tailings be managed by:

- approximately 26 percent of the tailings being dewatered by passing them through a belt / filter press
- approximately 74 percent of the tailings being pumped as slurry and sub-aerially deposited into out of pit earth embankment tailings dams to dry. The tailings deposited into these dams would be placed in thin layers of a nominal maximum of approximately 150 mm to assist with the bleeding and consolidation of the tailings

The bleed water will be decanted off into adjacent storage ponds for reuse in the plant. Once the tailings have sufficiently dried out and consolidated, the consolidated tailings would be excavated from the tailings dams and transported to pre-constructed containment cells located within the out of pit storage emplacements at Pits D and E. Dried tailings 'cake' generated from the belt / filter press would also be placed into the pre-constructed containment cells located within out of pit storage emplacements at Pits D and E.

The containment cells located within out of pit storage emplacements at Pits D and E would be constructed with a suitably designed and engineered clay liner at the base and sides. When at capacity, the cells would be clay capped. This should effectively fully contain the tailings and minimise the risk of any contaminants entering the surrounding environment

6. Mine pre-construction

This section describes the activities that will be undertaken on the mine site prior to commencement of production. During the pre-construction phase the Proponent will undertake a major realignment and upgrade works of the Moray Carmichael Road within the mine lease area, in accordance with the standard agreed between the Proponent and IRC and contained within the road maintenance and upgrade agreements. The workers accommodation village and permanent airport will be developed during this phase, to provide accommodation for the construction workforce and associated air transport.

The site clearing includes removal of vegetation and general debris, any structures and diversion of any existing infrastructure or services. Due to the rural nature of the region, the number of existing structures and services requiring relocation or removal will be minimal. While the terrain in these areas is relatively level, some earthworks will be required to:

- level, grade and compact the building footprint for any on mine or off site structures or platforms
- level and grade the access road to the Mine and the offsite infrastructure
- level and grade the airstrip at the permanent airport to engineering requirements
- provide stormwater management

All additional approvals required for the construction of the Project (Mine) will include Environmental Management Plans, and Safety Management Plans as approved by the relevant Federal, State and local authorities. Relevant environmental licences will also be applied for or attained for the purpose of the Project (Mine). The execution of the mining lease over EPC1690 and EPC1080 is also required before commencement of construction.

7. Mine construction

7.1 Overview

Construction will commence as soon as approval requirements are in place and, for activities within the MLA, once the Mining Lease has been granted.

Construction scheduling will focus on allowing production to commence as soon as possible and, as discussed in Section 7.2, there is an overlap between construction and operation phases. The majority of the construction works will take place over a 36-48 month period, however, the construction phases will continue until the mine reaches full production.

As the mine progresses south, additional construction works will be required to construct the bridge and infrastructure crossing of the Carmichael River and mine support facilities south of the river.

Construction activities will generally occur seven days per week and 24 hours per day and will be carried out by one or more contractors.

7.2 Main construction phase

The following off-site components are required to be constructed during the main construction period:

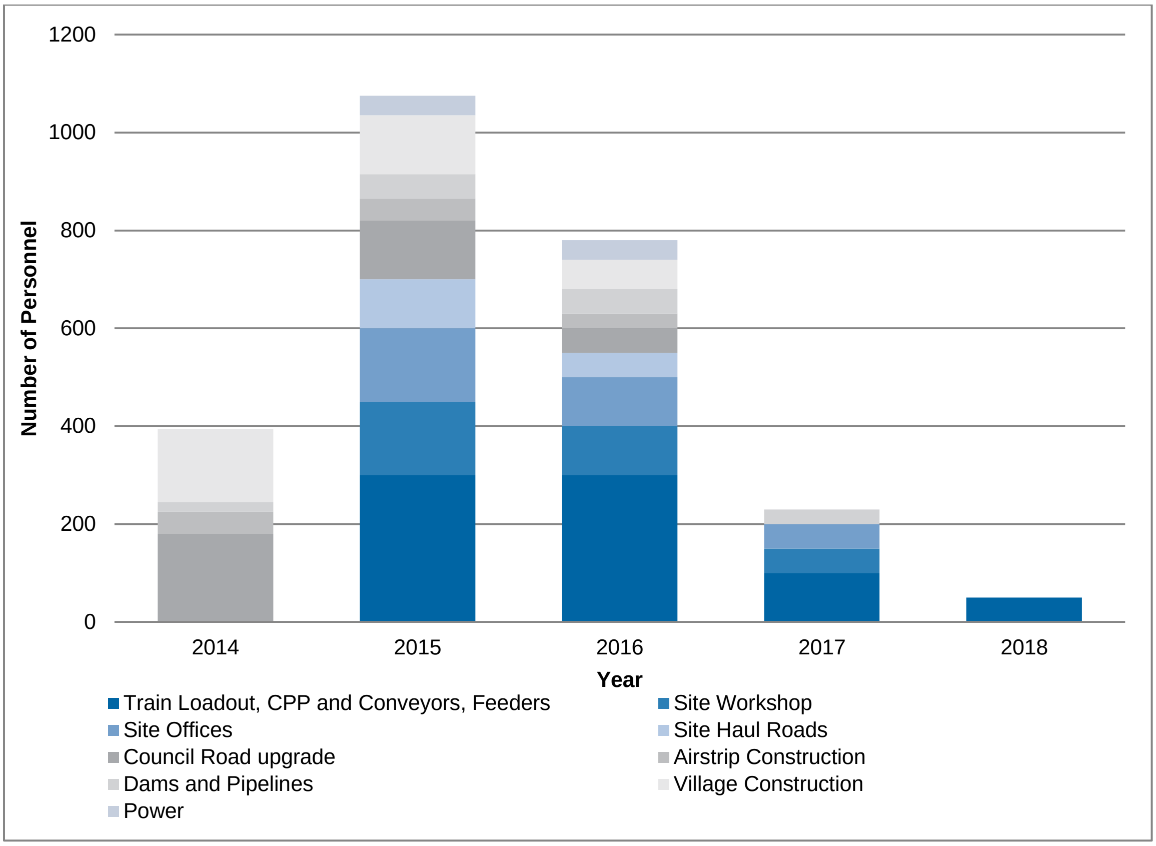
- Construction of access roads from Moray-Carmichael Road to the workers accommodation village, airstrip and industrial area. These will ultimately be bitumen sealed and provide year round access.
- Construction of the workers accommodation village. The village will be constructed in a number of stages.
- Installation of sewage treatment systems and water treatment systems at the workers accommodation village and also the industrial area and airport.
- Construction of the airstrip and terminal facilities.
- Construction of the industrial area including fuel storage and refuelling areas, maintenance facilities, vehicle wash areas and office and administration facilities.
- Construction of off-site water supply components. This will include:
  - construction of an off-stream storage near the Belyando River; including a “turkey nest” style dam
  - installation of pipelines connecting the water supply sources to the off-site infrastructure area and demand points within the proposed mine

Long term water supply infrastructure requirements in the form of a regional pipeline have not yet been determined but it is expected that, if required, offsite components of pipeline will be constructed by the relevant authorised supply authority.

7.3 Construction workforce

Construction of the Project is scheduled to commence in 2014. An initial workforce of 395 persons is anticipated for the pre-construction phase. Figure 25 shows the workforce numbers for the construction period with details of the number of personnel required for each different component of construction (onsite and offsite infrastructure).

Figure 25 Mine construction workforce by year



7.4 Moray Carmichael Road

As the Moray Carmichael Road passes through the proposed mine footprint, it will need to be realigned. It is proposed to temporarily realign the road while mining takes place in the central part of the proposed mine, and then, once rehabilitation in this area is complete, establish a permanent road alignment as close as possible to the existing alignment.

The temporary and final roads will meet the relevant rural road design standards that are in place at the time from Isaac Regional Council and Department of Transport and Main Roads.

7.5 Ongoing construction works

As mining progresses, a range of additional construction works will be required including:

- Underground mining ROM stockpile and infrastructure areas for each of the underground mines. These will have worker amenities, sewage treatment systems, raw and mine water storages, stormwater containment systems, minor vehicle maintenance facilities and fuel and other consumable storage.
- Extension of conveyor and haul road networks to the north and then to the south as mining progresses
- Construction of a bridge and infrastructure crossing of the Carmichael River

- Construction of levee banks along the north and south of the Carmichael River/Cabbage Tree Creek. Levees will be built a minimum of 500 m away from the river channel and will need to be in place before open cut mining extends into the Carmichael River floodplain. Design and construction will comply with *Manual for Assessing Hazard Categories and Hydraulic Performance of Dams* (DERM 2012)
- Diversions of streams away from open cut areas. Stream diversions will comply with guidelines in place at the time, with current relevant guidelines DERM 2011 *Watercourse Diversions – Central Queensland Mining Industry version 5.0*
- Construction of additional mine water storage dams.

7.6 Construction methods

7.6.1 Vegetation clearing

Vegetation clearing will be staged to minimise areas of disturbance prior to construction. Timber will be harvested, with scrub and stumps being grubbed utilising a bulldozer. Pre-clearing surveys will be conducted in areas where conservation significant flora and fauna may be present, including along vegetated creeks and drainage lines.

Depending on the type of vegetation and level of weed infestation, cleared timber will be mulched utilising a tub grinder, or similar, for use as soil conditioner or alternately cleared vegetation will be piled into windrows and left to decompose naturally.

7.6.2 Erosion and sediment controls

During wet periods, erosion and sediment controls will be installed immediately after vegetation clearing and prior to any other surface disturbance.

7.6.3 Bulk earthworks

While areas within the construction footprint are relatively flat, civil earthworks will be required for the installation of structural foundations, lay down areas and hardstand. Topsoil will be stripped ahead of earthworks and stockpiled for reuse in rehabilitation of areas no longer required for construction, or in rehabilitation trials.

The requirement for piling will be determined during the detailed design phase and where required, piling rigs will brought to site. It is not anticipated to generate excess spoil during this phase. If excess spoil is generated, this will be stockpiled for disposal with mine waste at a later date.

7.6.4 Buried infrastructure

Water supply pipelines will be buried and the requirement for other linear infrastructure to be buried will be determined during detailed design. Final alignments will seek to minimise clearing of remnant native vegetation.

For buried infrastructure, the construction method will consist of:

- Clearing vegetation along the proposed alignment, with clearing widths held to the minimal width required for safe construction. Larger trees will be felled and root systems grubbed, but where possible, root structures of smaller plants and grasses will be left intact in topsoil.

- installation of erosion and sediment controls
- removal of topsoil which will be set aside in windrows parallel to the proposed alignment for reuse in rehabilitation of the alignment
- excavation of a trench, with spoil material placed in windrows along the alignment
- installation of the pipeline or other buried infrastructure component, with quality control to ensure that there are no leaks or other faults
- Backfilling of the trench with spoil material. Excess spoil will be removed for use as fill in other construction areas or stockpiled for later disposal in mine waste stockpiles.
- Replacement of topsoil and stabilisation. Rehabilitation trials will be required to determine whether to utilise native or introduced grass species to attain the best ground cover.

Construction scheduling will focus on minimising the time between initial vegetation clearing and reinstatement to minimise risk of erosion and soil loss. Erosion and sediment control measures will remain in place until the disturbed surfaces are stabilised.

Water supply pipelines will be required to cross several ephemeral streams and drainage lines. Stream crossings will be performed in dry conditions wherever possible, with forward planning to minimise the length of time that there are disturbed areas within the bed and banks of streams and thus, the likelihood of flow conditions occurring during construction. The construction method will be similar to that outlined above for underground infrastructure, however in addition the following measures will be undertaken:

- Clearing of vegetation and particularly tall trees in the riparian zone and bed and banks of watercourses will be minimised as far as possible without compromising safety
- The bed level of the stream or drainage line will be restored so that there is no disruption to flows
- The bed and banks of the stream will be stabilised such that native vegetation can be re-established and scouring does not occur.

Codes and guidelines that will be incorporated into design, construction and rehabilitation of watercourse crossings are listed in Section 7.6.5. Laydown areas will be required for pipes and bedding material and will be located in areas already cleared of native vegetation.

7.6.5 General requirements for works in watercourses

Works in watercourses will need to be undertaken both on and off the proposed mining lease, including for access road crossings, water supply infrastructure and underground infrastructure. The regulatory requirements in relation to works in watercourses are different depending whether the works are on or off the proposed mining lease and hence, self-assessable codes and guidelines are not necessarily applicable in all instances. However, codes and guidelines still provide guidance in terms of standards and practices for design, construction and rehabilitation of works in watercourses and will be referenced as such for all works in watercourses.

Applicable codes in place at the time of proposed works will be utilised to inform design and development.

7.6.6 Mine raw water storage

While detailed design has not been commenced for the mine raw water storage, it is anticipated that in-situ materials will be used for construction of the embankments for this storage.

7.6.7 Belyando River pump station and storage dam

The Belyando River storage dam is an off-stream storage and will be located on the footprint of an old quarry. It is anticipated that the dam will be constructed by a combination of excavation into the ground and construction of embankment walls from in-situ material.

A channel will be installed into the bank of the Belyando River leading to a pump station. The construction area for the pump station will be approximately 2,500 m^2. This includes the pump station and channel area, and all laydown, spoil and stockpile areas.

The pump station structure will be cast in situ during non-flood periods. The excavation of the channel and pump station invert river level will be done in phases, with connection to the river made late in the construction period as the river level is higher in this area due to the retarding effect of the downstream causeway. The concrete structure will support a steel or concrete platform above to house the electrical infrastructure. Concrete will be likely obtained from a batching plant on site. Reinforcement, other steelwork, electrical and mechanical equipment will be delivered to site.

7.6.8 Boreholes

The Carmichael Coal Mine and Rail EIS proposed the development of an offsite bore field for water extraction. That bore field is no longer a component of the proposed project. Should external bore water be required, separate approvals and assessments would be required for this post the EIS and SEIS process. In that event, any bore would be constructed in accordance with the *Minimum Construction Requirements for Water Bores in Australia* (National Uniform Drillers Licensing Committee 2011) – the standard for constructing, maintaining, rehabilitating and decommissioning water bores in Australia.

7.6.9 Access roads and tracks

Both temporary and permanent access roads will be required for the off-site infrastructure and within the mining lease. Access road alignments have not yet been determined but will take into consideration utilisation of existing tracks where possible to minimise vegetation clearing. Permanent, long-term and/or high volume access roads will be constructed from bitumen or gravel and will have drainage provided to prevent concentration of flows across or along road alignments. Minor or temporary access tracks will generally be single lane dirt tracks with minimal earthworks.

Access roads and tracks will be required to cross ephemeral watercourses. Wherever possible, crossing locations will be selected to minimise the need to clear riparian or in-stream vegetation. For permanent, long-term and/or high volume access roads, culverts will be used with flood immunity design criteria as specified. Codes and guidelines listed in Section 7.6.5 will be followed as closely as possible, particularly in relation to minimising damage to the bed and banks of watercourses and maintaining flows and fish passage. If construction occurs in the wet periods, a sediment check dam or similar device will be installed downstream of the construction area to capture sediment released during construction.

For minor access roads, crossings will either be at bed level, or with a low flow pipe installed under a slightly elevated crossing. Again, locations will be selected to minimise clearing of riparian vegetation or in-stream vegetation and codes and guidelines listed in Section 7.6.5 will be followed as far as practicable. Crossing locations will be stabilised such that erosion and scouring does not occur.

7.6.10 Carmichael River Bridge

A bridge will be required across the Carmichael River in 2033 to access the southern part of the proposed mine. The bridge will be designed to minimise afflux impacts and to meet flood immunity criteria. The bridge will span the main channel of the Carmichael River, with no pylons or supports within the low flow channel.

During construction, it will be necessary to install a low level crossing across the Carmichael River to allow construction vehicles, equipment and materials to be transported to the south side of the River. This will consist of a compacted dirt roadway, with low flow pipes laid underneath. On completion of construction, this will be removed and the bed and banks rehabilitated.

7.6.11 Flood levees

Flood levees will be constructed to protect the open cut pits and underground mine portals from flooding from the Carmichael River and possibly Eight Mile Creek. While geotechnical investigations are yet to be undertaken, it is expected that levees will be able to be constructed from locally available materials. Flood levees will meet hydraulic design criteria.

7.7 Construction traffic and transport

The Project area encompasses several transport corridors of national, state, regional, district and local significance. These types of roads are either under the management and control of either the State road authority, Department of Transport and Main Roads (DTMR), or in the local road authority, the IRC. Table 6 provides the classification of each road within the study area and identifies the road authority that manages each road. The traffic volumes generated by the construction of the Mine will vary and will depend on the construction timetable. The main traffic generated through the construction phase will be from plant, equipment and material deliveries.

Table 6 Roads within vicinity of Project (Mine)

Road Name	Road Authority	Classification
Flinders Highway (Charters Towers to Townsville)	DTMR	State Strategic Road
Gregory Developmental Road (Charters Towers to Clermont)	DTMR	State Strategic Road
Gregory Developmental Road (Clermont to Emerald)	DTMR	State Strategic Road
Bowen Developmental Road (Bowen-Collinsville)	DTMR	District
Bowen Developmental Road (Collinsville – Belyando Crossing)	DTMR	District
Suttor Developmental Road (Nebo-Mount Coolon)	DTMR	Regional Road
Peak Downs Highway (Clermont – Nebo)	DTMR	State Strategic Road
Peak Downs Highway (Nebo – Mackay)	DTMR	State Strategic Road
Moray Carmichael Boundary Road	Isaac Regional council	Local Road

Road Name	Road Authority	Classification
Moray Bulliwallah Road	Isaac Regional council	Local Road
Elgin Moray Road	Isaac Regional council	Local Road

7.8 Construction water requirements

Water will be required for construction over the period of 2014 – 2022. This water will be used for purposes such as construction of roads, dam embankments and levees, as well as batching of concrete. The amount of water needed on a yearly basis is shown in Table 7. Construction water has been excluded from the water balance as a large part of the construction water requirements is required for dust suppression, which has been accounted for in the water balance.

Table 7 Construction water demands

Year	ML/year	ML/day
2014	1,000	2.74
2015	1,500	4.11
2016	2,000	5.48
2017	2,000	5.48
2018	1,000	2.74
2019	1,000	2.74
2020	500	1.37
2021	500	1.37
2022	500	1.37
Source: Adani		

7.9 Rehabilitation of temporary construction sites

For mine infrastructure temporary construction and laydown areas have been located in areas that will be required for mine operations to minimise the overall disturbance footprint. Hence, rehabilitation of these areas will not be required. Areas that are not to be used immediately will be stabilised by placement of gravel or seeding with grass if necessary to minimise erosion risk.

For the off-site infrastructure, temporary construction and laydown areas have been located in areas already cleared of native vegetation. If any areas are not required once construction is completed these will be ripped, topsoil replaced, and grass sown to provide ground cover. Erosion and sediment controls will be left in place until 70 percent ground cover is achieved.

7.10 Construction equipment

The types of heavy vehicles and equipment required for the construction include:

- three, five and seven axle trucks, flatbed semitrailers, extendable trailers, B-double tankers, road trains to transport plant and material to the site
- low loaders for construction equipment
- tipper trucks, to transport bedding sand on-site and excavated burden off-site
- excavation machinery

- dozers, backhoes, scrapers, graders, rollers and water carts
- buses for workers

8. Mine commissioning and operation

8.1 Commissioning

8.1.1 CHPP and coal handling systems

Commissioning of the CHPP and coal handling systems involves operating the systems under close supervision and monitoring quality of outputs until a satisfactory level of performance is achieved. Only normal coal fines and rejects waste will be produced during commissioning and there is no potential for hazardous wastes to be generated.

8.1.2 Plant and equipment

There are no specific commissioning requirements for plant and equipment.

8.1.3 Dams, pipes and pump stations

While there are no specific commissioning requirements for dams without mechanical gates, there are a number of surveillance requirements during design and construction, both under the *Manual for Assessing Hazard Categories and Hydraulic Performance of Dams* (DERM 2012) (dams within the mining lease) and *Queensland Dam Safety Management Guidelines* (NRM, 2002). Prior to allowing any dams to fill, a review will be undertaken to check that all design and construction requirements have been met.

Pipes and pump stations must be tested for hydraulic performance as part of commissioning. This is to check that all components are fully sealed and that the required capacity has been achieved. Pipelines also need to be cleaned of any debris that may be within the pipeline after construction. This is done by pressure testing pipes and pumps with water. Pipes are filled with water and pressurised and then monitored for drops in pressure that may indicate leaks. Pumps are also tested by monitoring pressure and checking for leaks.

Water from hydro-testing will either be discharged to land (irrigation) or surface waterways or transferred to water storage dams for reuse. It is not currently anticipated that any additives will be required, but water is likely to have collected debris from within the pipes and pumps and will need to be screened to remove this debris if it is to be discharged to surface waterways. Any discharge to surface waterways or land irrigation will be done in a manner that does not cause scouring or erosion.

8.2 Operations

The Project (Mine) includes the:

- open cut mine
- underground mine
- mine infrastructure area and CHPP
- out-of-pit dumps
- associated raw water and waste water management infrastructure

The open cut mine has a capacity of 40 Mtpa (product) and will be located along the eastern portion of Mine. The open cut mine will be predominantly truck/shovel/excavator operation. Six open cut pits will be mined over the life of the proposed mine, designated pits B to G. Pits B to E are located north of the Carmichael River and Pits F and G are south of the river.

During the early stage of development of each pit, overburden will be transported to out-of-pit dumps on EPC 1080 and on east side of sub-crop in EPC 1690, which will be profiled and rehabilitated as operations progress. Thereafter, backfilling of the pit will be maximised during operations and eventually a proportion of the waste used to re-profile the high-wall of the final voids.

Five underground longwall coal mines will be developed, designated as the Mine 1 to Mine 5 underground mines. The Mine 1 to Mine 3 underground mines are located to the north of the Carmichael River, with Mine 4 and 5 underground mines to the south of the river. The underground mines will produce 20 Mtpa (product) of lower ash coal over 42 years of the overall mine life. The lower ash coal will be blended with higher ash coal from the open cut mines, to minimise the overall need for coal processing and washing to meet the target ash content.

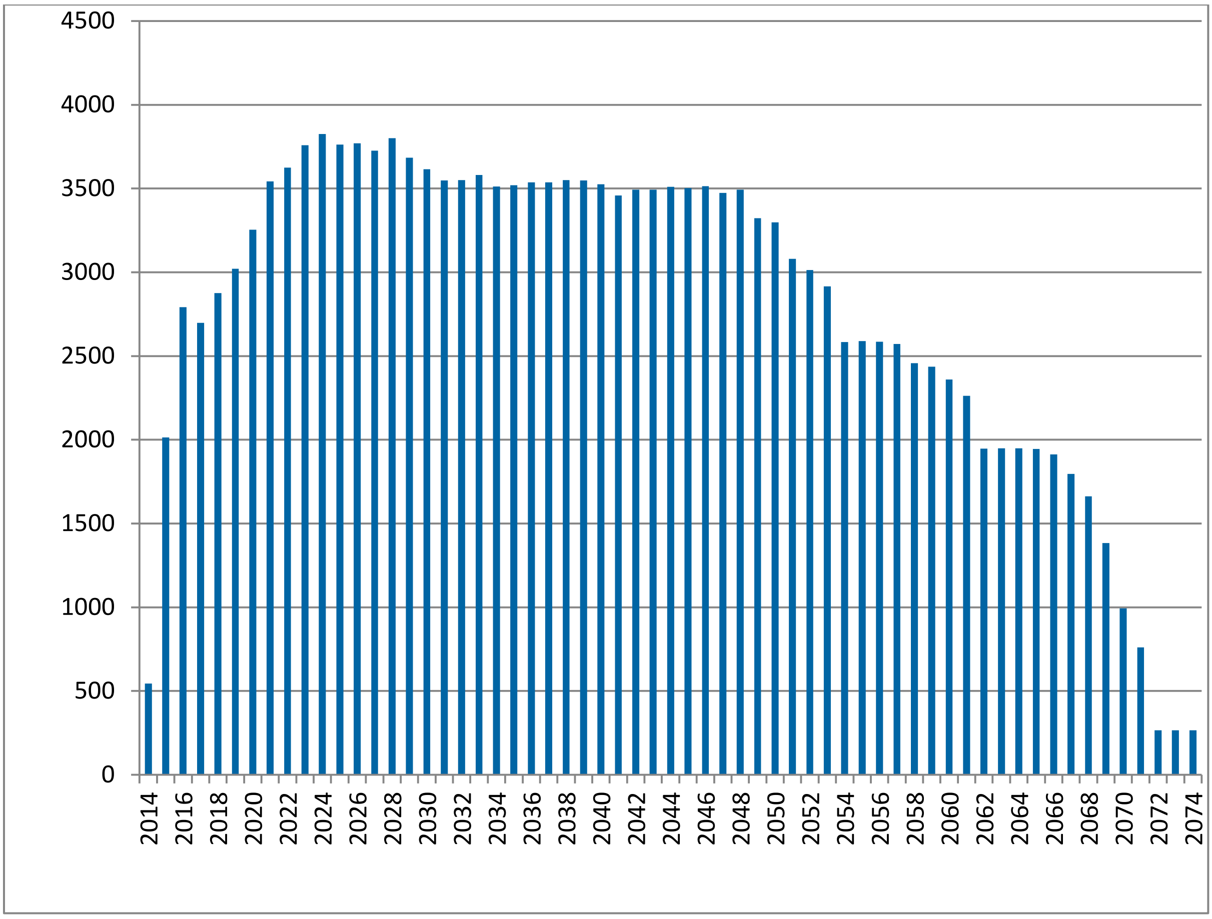
A north-south surface corridor will separate the underground mines from the open cut pits. This is used to locate the underground drift access and surface coal haulage access and provide a barrier pillar for safe concurrent working of the underground and open cut operations. Coal from both the underground and open cut mines will be conveyed by truck and overland conveyor to the centralised CHPP within the mine infrastructure area, where the high-ash portion will be processed and then blended with lower ash coal, which will bypass the CHPP.

8.3 Operational workforce

First coal production from the Project (Mine) is expected in 2016. However, preliminary operational activities will commence in 2015. The operations workforce will ramp up from 789 in 2015 to a peak of approximately 3,800 by 2024. It is expected that the workforce will remain above 3,400 from 2022 til 2048 (see Figure 26).

The workforce will drop to over 2,400 when underground mining ceases production by 2059, and will gradually reduce from year 2062 as the production slows and the Project (Mine) ceases production.

Figure 26 Total workforce for life of mine



8.4 Open cut mine operations

8.4.1 Mining method

The following outlines the nature and description of all key operations associated with the open cut mine. The open cut mining method includes:

- overburden removal
- overburden disposal
- drilling and blasting
- coal mining
- co-disposal of rejects and tailings

Figure 27 and Figure 28 provide schematics of open cut mine operations.

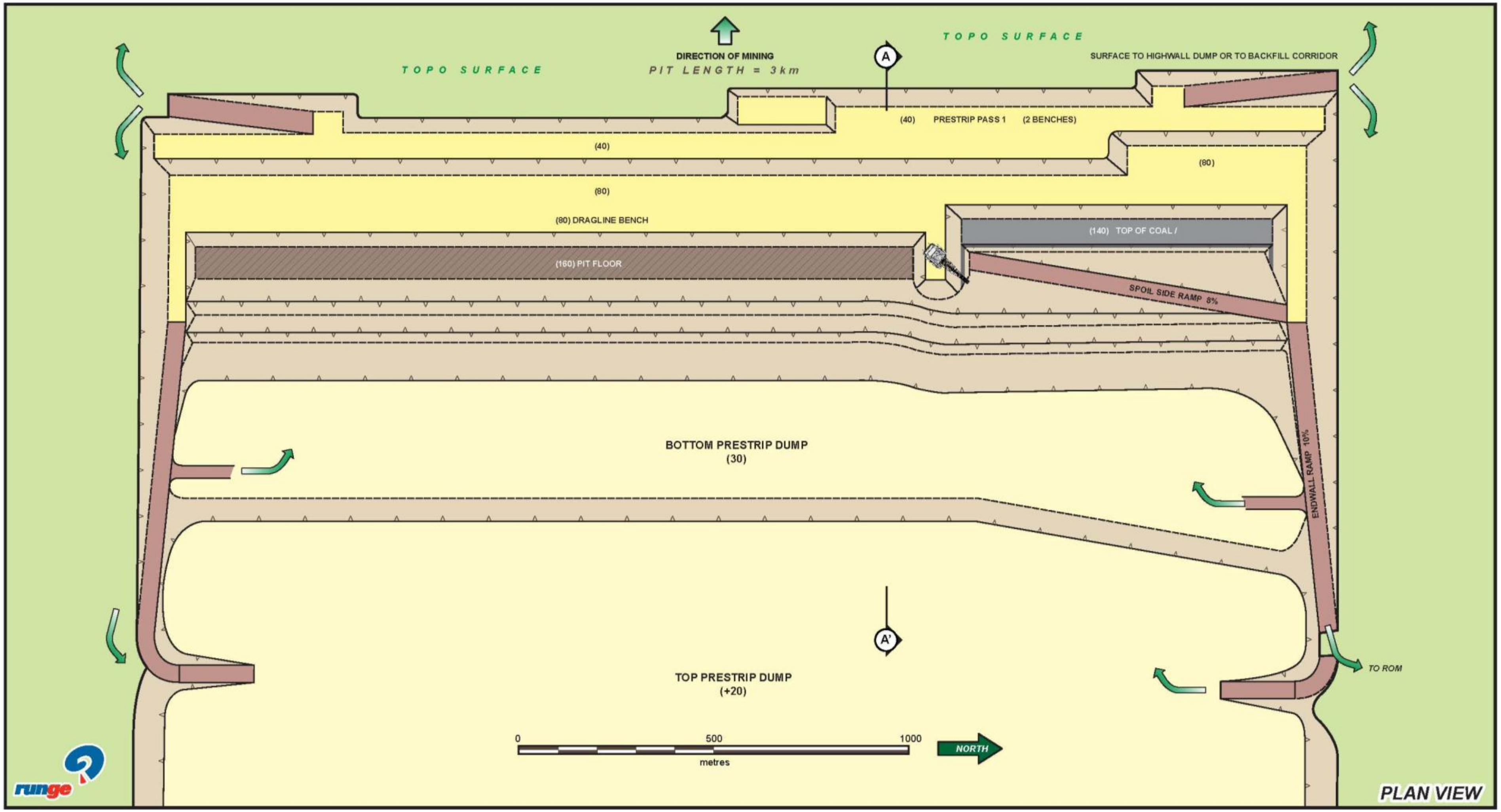
Vegetation clearing will be undertaken using bulldozers or similar equipment. In areas of high ecological value, pre-clearing surveys will be undertaken to identify conservation significant flora and fauna and determine appropriate methods to avoid or minimise harm. The clearing method and whether vegetation is stockpiled, mulched or otherwise treated will depend on the type of vegetation in a particular area, and the level of weed infestation.

Topsoil will be stripped prior to mining or dumping in each area by a combination of scrapers, dozers and excavators. Topsoil stripping depth will be determined prior to stripping as will the need for single or two phase stripping. The topsoil will be stockpiled until it is required for rehabilitation, or hauled directly for respreading on the completed and re-profiled mining areas. Depending on requirements to be specified in the rehabilitation management plan, some amelioration of topsoil may be required prior to or at the time of stripping and replacement. A topsoil register will be retained to track the origin, interim storage and final destination of topsoil.

An initial box cut will be constructed on the eastern side of each open cut to provide access for removal of overburden. The Tertiary layer overburden, consisting of an average 80 m thick layer will be removed using excavators loading material into rear dump trucks, as will the uppermost layers of the Permian formation. This will expose the AB seam, which will be mined.

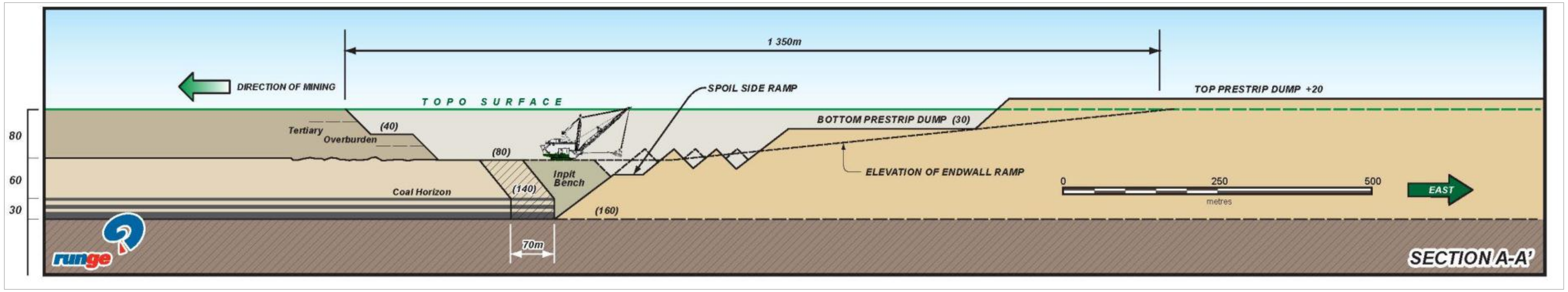
Mining will occur in an east to west direction, leaving a low wall of mined out material to the east with coal being removed from a high wall which will progress westwards. Because of the geometry of the Project (Mine) and limited access on the low wall side of the mine, backfilling of each pit cannot commence until the box-cut and several overburden strips have been completed. The waste associated with this phase of mining will be hauled to out-of-pit dumps located east of the pits, within EPC1080. After that time, all pre-strip material will be hauled to backfill dumps, using a series of endwall and in pit ramps.

Figure 27 Open cut mine concept – plan view



Source: Runge Limited 2011

Figure 28 Open cut mine concept – section A-A



Source: Runge Limited 2011

Much of the Tertiary and weathered Permian overburden is likely to be able to be dug with excavators and shovels but some light blasting will be used to speed up excavation. Thin inter-burden and coal will be ripped with bulldozers as and pushed into windrows for loading onto trucks by front-end loaders. All blasting will be undertaken using ANFO and emulsion explosives. The maximum tonnage of explosives required per year is approximately 165,000 t. All ANFO and emulsion explosives will be stored in a dedicated secure bulk explosives facilities with an associated high explosives magazine, located approximately 10 km from the mine infrastructure areas.

Trucks and equipment will access the open cut by ramps which will progress with depth and westward movement of mining, with a maximum length of approximately 5 km.

During the life of the Project (Mine), there will be approximately 1 billion m^3 of out-of-pit waste. The maximum height above the natural surface of the out-of-pit dumps is estimated to be up to 140 m. The outer face of the dumps will be profiled to a final rehabilitation gradient of 10 percent / (6.3 degrees). The inner face will be dumped to angle of repose, and later re-profiled between 10 and 20 percent (12 to 14 degrees) to assist in rehabilitation of the final landform and mining voids.

Figure 7 to Figure 20 provides an outline of the mine progress over the life of mine.

8.4.2 Equipment associated with open cut mining method

The open cut mine will initially consist of a conventional dragline and truck-shovel pre-strip operation, with coal haulage by rear-dump haul truck to one of three ROM dump stations. In steady-state operations, draglines may expose the coal in a single seam 2-pass operation on the D seam in selected pits or conventional truck shovel/excavator method will be employed. Once the upper D1 seam is exposed and mined, the underlying D2 and D3 seams will be exposed by the interburden in pit fleet and mined separately. Where the E and F seams are included in the block, these will also be exposed by the interburden fleet or dozed in pit.

In the pre-strip horizon, the overburden will be excavated ahead of the dragline by backhoe excavators (up to 800 t) and / or electric rope shovels, and hauled to out-of-pit dumps beyond the high-wall with RDT (up to ultra-class or 400 t). Much of the Tertiary and weathered Permian overburden is likely to be free-dig material, but it is planned that light blasting may be used to maintain productivity of digging.

The upper AB seams will be exposed by pre-strip as it descends to the fresh Permian horizon. Once the box-cuts have been completed and sufficient room has been created to commence backfill dumping, the waste trucks will haul the waste into backfill via a series of end-wall ramps, in-pit bridges or via the highwall ramp and an out-of-pit haul road located in the adjacent pit area. Due to the depth of the box-cuts, backfill dumping of the pits cannot commence until pre-stripping is around five strips in advance of the box-cut. Over the life of the project, up to a total of two draglines may be required. These will be staged from 2020 on an individual basis as required, with both being deployed prior to 2027. The draglines will be constructed on a dragline construction area located adjacent to the scheduled point of first deployment. The first dragline pad will be located within the footprint of D pit, and will be utilised until the end of the pit.

Large excavators and rear dump trucks will be used in the pre-strip to allow flexibility of mine sequencing and gain access to the deep box-cut. There may be opportunities in the future to optimise equipment sizes or incorporate continuous handling systems such as conveyors for waste haulage, and thereby minimise equipment numbers, labour and diesel consumption. In general, the complexity and depth of the operation restrict the application of large continuous systems over most areas of the mine.

The CAT 8750 dragline or equivalent with other manufacturers has been selected because it is the largest capacity dragline in common use in the Australian coal industry. The objective has been to minimise the size of the excavation required and to limit the volume of truck-shovel pre-strip and minimise the number of draglines consistent with the planned rate of coal exposure.

Mid-size rear dump trucks have been selected for mining the coal and inter-burden so that they can negotiate the deep ramps and match the scale of the coal and inter-burden benches. The fleet size has been limited by providing overland conveyor haulage for the long flat hauls back to the CHPP.

In some areas, the mix of equipment sizes is not optimised because of competing needs. This is particularly the case with the coal fleet, where medium sized rear dump trucks have been selected, loaded by either mid-size backhoe excavators or large front-end-loaders, depending on face height. These have been selected in order to match the excavator size on the smaller coal benches (79 percent of the coal is less than 3 m bench height) and to negotiate the spoil-side ramps. Bottom dump trucks have not been selected because of poor grade-ability and the possible poor pit conditions.

8.4.3 Major equipment – open cut

Table 8 outlines an overview of the major equipment list, the unit type, make/model, capacity and application as selected during the conceptual design phase. The make and model is given to illustrate size of the machine. Final equipment types and capacities will be determined as mine planning and design progresses; however the equipment types listed in Table 8 are unlikely to change significantly.

Table 8 Indicative major equipment list

Unit Type	Typical Make / Model	Capacity	Application
Main Waste			
Overburden drill	Pit Viper 250	270 mm diam.	Main waste drilling
Electric Shovel	P&H 4100 XPC	42 m^3	Main waste removal
Hydraulic Excavator	Liebherr R9800	800 t/42 m^3	Main waste loading
Hydraulic Excavator	CAT 6060	550t/34 m^3	Main waste loading
Hydraulic Excavator	Hitachi EX5600	550t/34 m^3	Main waste loading
Rear-dump truck	Caterpillar 797F	370 t	Main waste haulage
Rear-dump truck	Caterpillar 793F	230 t	Main water haulage
Secondary waste and coal			
Overburden drill	Sandvik D45KS	150-210 mm diam	Secondary waste drilling
Hydraulic Excavator	Liebherr 9400BH	300 t/ 17 m^3	Secondary waste loading
Front end loader	Caterpillar 994D	19 m^3	Backup and thin waste loading

Unit Type	Typical Make / Model	Capacity	Application
Rear-dump truck	Caterpillar 789C	140 t	Secondary waste haulage
Coal Mining			
Coal drill	Sandvik D45KS	150 diam.	Coal drilling (if required)
Front end loader	Caterpillar 994D	31 m^3	Coal handling – thin seams
Hydraulic Excavator	Liebherr 9400BH	300 t/20 m^3	Coal loading – thick seams
Rear-dump truck	Caterpillar 789C	140 t	Coal haulage
Reject Haulage			
Rear-dump truck	Caterpillar 789C	140 t	Reject haulage, coal and inter-burden back up
Major ancillaries			
Tracked Dozer	Caterpillar D11T	634 kW	Waste face clean-up, dragline dozer, spoil dump maintenance, misc. construction, thin waste ripping
Tracked Dozer	Caterpillar D10T	433 kW	Coal face clean-up, road maintenance, misc. construction, thin coal and waste ripping
Rubber tyred dozer	Caterpillar 854G	597 kW	Coal and waste face clean-up, road maintenance, misc. construction
Grader	Caterpillar 24M	373 kW	Coal and waste face clean-up, road maintenance, misc. construction
Water truck	Caterpillar 789C	170 kl	Road maintenance, misc. construction
Service truck	Caterpillar 789C	170 kl	Inpit servicing including fuel and lubes
Note: Model name is illustrative only to indicate size and type			

8.5 Underground mine operations

Underground mining will augment production from the open cut operations. Three multi-seam underground mines will be developed progressively in the deeper areas of the deposit to the west of the open cut highwall. The underground mines will target the lower ash AB1 and D1 seams. Although the D2 and D3 seams present attractive underground working sections, their close proximity to the D1 seam may present technical problems. There may be opportunities to mine these seams as well as the thinner underlying E and F seams at a later time.

The objective of these mines is to increase resource recovery beyond the economic open cut mining limit and produce a low ash coal to improve the blend from the open cut without washing, or reduce the amount of washing required.

The underground mine consists of:

- Mine 1 underground mine: installed with up to four longwall units
- Mine 2 underground mine: installed with up to four longwall units
- Mine 3 underground mine: installed with up to four longwall units
- Mine 4 underground mine: installed with two longwall units
- Mine 5 underground mine: installed with two longwall units

The longwall mining method will be used because of its ability to deliver a safe, high production rate and high resource recovery. Longwalls will be approximately three m to 4.5 m high.

Figure 29 and Figure 30 provide a schematic of underground longwall mine operations. Longwall mining involves the use of a longwall shearer, which is a coal cutting machine with a rotating drums. The shearer moves back and forth across a wide part of the coal seam called the longwall face. The cut coal falls and is loaded onto the chain conveyor by the shearer. The chain conveyor then transports the coal to the conveyor belt for removal from the work area. Longwall systems have in-built hydraulic roof supports, which advance as mining progresses. The supports make possible high levels of production and ensure the safety of the operators. As the longwall mining equipment moves forward, overlying rock that is no longer supported by coal/hydraulic roof supports is allowed to fall behind the operation in a controlled manner. This is known as goaf.

The underground mines will be developed as separate operations, operating independently of the open cut pits. The proposed conceptual layout is based around longwall panels extending out on both sides of a centrally located set of main headings.

Access to three underground mines will be located beyond the final highwall for the open cut, and each will have separate drift entry to both seams, and separate surface facilities (see Section 1. All coal from the underground mines will be transported from the pithead to the central coal handling plant (CHPP) by overland conveyor. Seam access for each mine will be via two inclined drifts, one providing drive in-drive out diesel vehicle access for personnel and materials and the other housing the conveyor coal clearance system.

Figure 29 Underground longwall mine operations – plan view

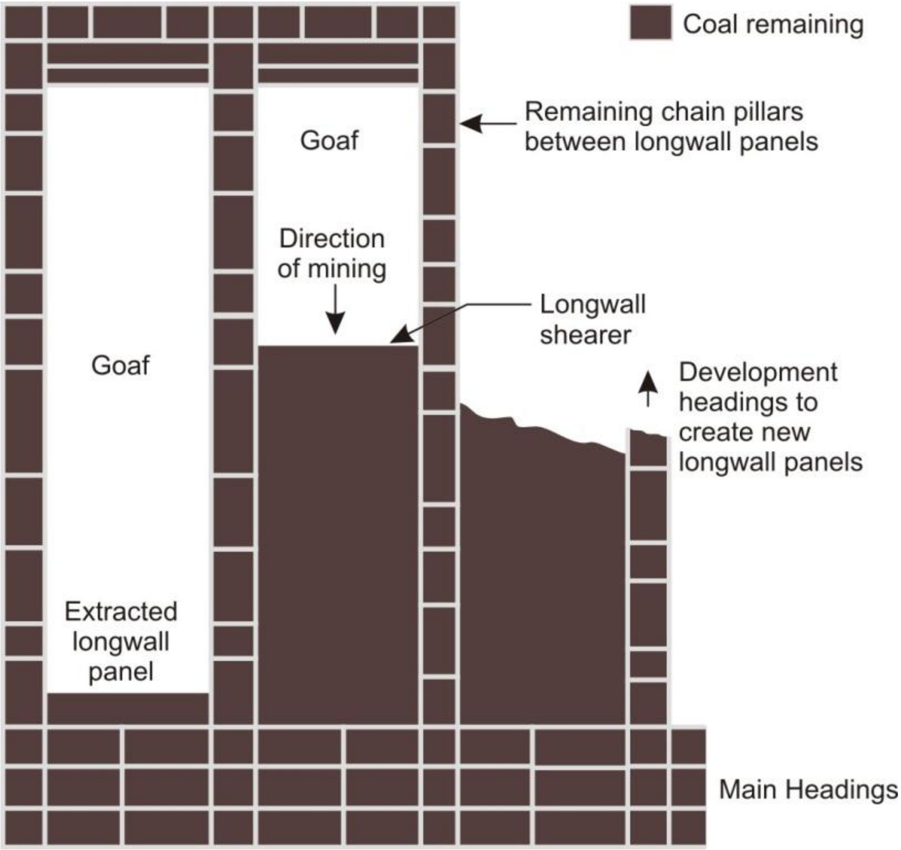
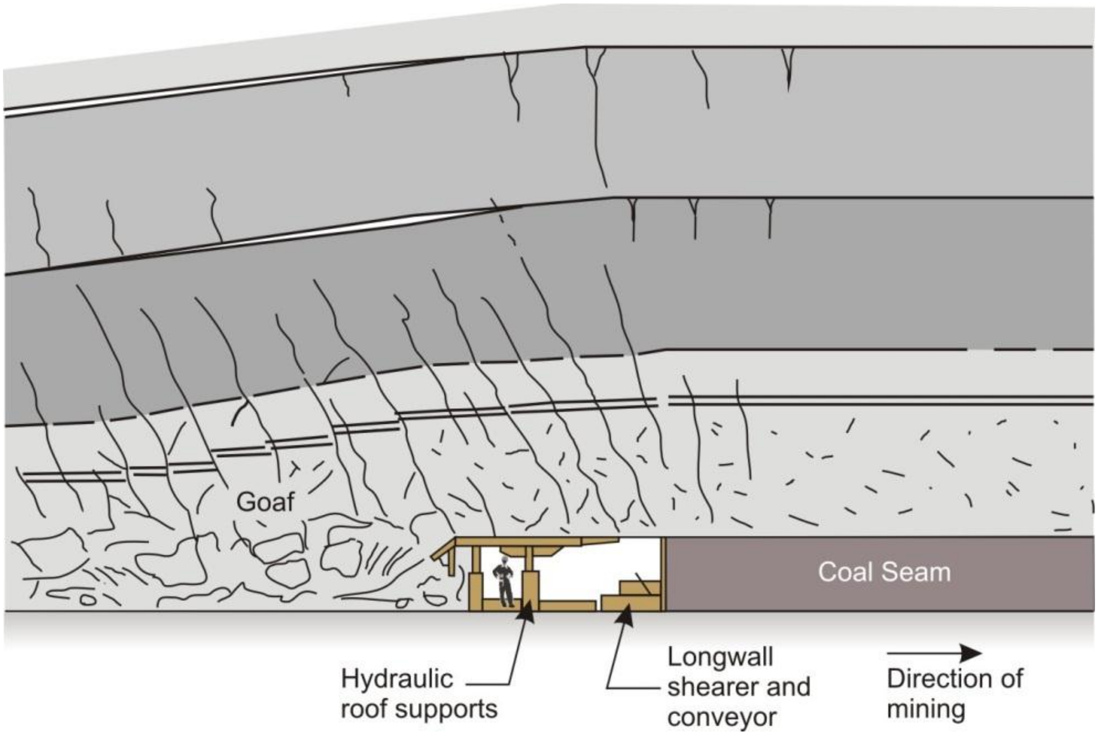


Figure 30 Underground longwall mine operations – section view



Initial development of the mine involves the construction of a tunnel, known as a drift from the surface to intersect the target seams. Once the target depth has been reached, the main entrance to the mine, known as pit bottom, will be established and transportation and ventilation systems installed. Conveyors will be installed in the drift to bring coal to the surface, and roadways and other infrastructure requirements will also be established.

The main heading will then be driven in a north-east to south-west direction, following the seam and thus becoming deeper as it progresses.

The longwall panels are then developed progressively by driving parallel headings perpendicular to the main heading. These headings allow mining equipment to be introduced and the ventilation and conveyor systems to be installed. Mining of the longwall panels then progresses from the furthest extremity, back towards the main heading.

As two seams are targeted by underground mining, the upper AB1 seam will be targeted first and then a second layer of headings and longwall panels will be developed about two to three years after the upper layer has been mined to target the D1 seam. This will allow for subsidence from mining of the AB1 seam to have occurred and settled adequately.

The north underground mine will be developed first, with development of the southern mines (Mine 5 and 4) to follow immediately.

The underground mines will each have a separate pit-head ROM stockpile, where the coal will be reclaimed, sized and conveyed on an overland conveyor to an independent product coal handling stockpile adjacent to the central CHPP facility.

The initial underground mine design parameters include:

- longwall face length of 300 m
- planned longwall panel block length of 5,000 m
- development face width of 5.2 – 5.8 m
- two headings per gateroad panel
- gateroad pillar dimensions (centre to centre) of 100 x 35 m
- 9 Headings mains panel
- mains pillar dimension (centre to centre) of 70 x 50 m

Figure 7 to Figure 20 provide an outline of the mine progress over the life of Project (Mine).

8.6 Water supply and management

8.6.1 Introduction

Water supply and management for the Project involves the supply and distribution of raw water, mine affected water (MAW), sediment affected water (SAW), clean water, process water and treated water throughout the site for both construction and operation requirements. A water balance for the Project (Mine) is included in SEIS Volume 4 Appendix K2 Water Balance.

Water inputs to the Project (Mine) are further defined as:

- Raw water is water that is received from an external water supply, is considered clean and has not been used in a task. Raw water is used for fire water and other high quality water requirements such as concrete batching and potable water. Raw water will predominantly be sourced from pit dewatering (groundwater) and flood water harvesting (surface water).

- MAW (also called worked water) is that which has been through a task and is potentially contaminated by exposure to mining activities and areas
- SAW contains a higher sediment load but has not been contaminated by direct mine activities
- Clean water is runoff from undisturbed catchments and will be diverted around the Project. As such clean water will not be part of the water balance for the Project
- Process water is that which is used on site to complete a task
- Treated water is water that has been treated on site to achieve a particular water quality objective. Raw water, MAW, SAW and process water can be treated as required to allow further use or release as a controlled discharge from a designated outlet.

Mine affected water

MAW is generated in active mining areas. Sources of MAW are:

- Dewatering of six open cut pits (four north of the Carmichael River and two south of the Carmichael River)
- Dewatering of five underground mines (three north of the Carmichael River and two south of the Carmichael River)
- Dewatering of three boxcut areas – underground mines 1, 4 and 5 (from north to south)
- Dewatering of two high wall access areas – Pit D and Pit C
- CHPP tailings decant dam
- Runoff from industrial working areas including the MIA, the ROM coal area, CHPP and the TLO facility
- Runoff from overburden sumps associated with open cut Pits D and E.

Sediment affected water

SAW is generated from disturbed areas; areas where runoff will not be contaminated with coal or other mining associated contaminants, but are likely to be disturbed due to vehicle movements or for example pre-stripping. Runoff from these areas typically has higher sediment loads than runoff from undisturbed areas. Runoff from overburden areas is also considered SAW (with the exception noted above).

8.6.2 Water management principles

The following general water management principles are proposed for the Project:

- Raw water will be delivered and temporarily stored in a raw water dam
- MAW is to be retained on site and stored in the MAW storages (dams) that will be designed and managed in accordance with the Manual for Assessing Hazard Categories and Hydraulic Performance of Dams (DERM, 2012)

- MAW will, when necessary, be discharged into receiving waterways from the centrally located MAW collection storages (central MAW dams) one for north and the other for south of the Carmichael River. Discharges will be in accordance with relevant licence conditions under the Environmental Authority. The aim is not to discharge into the Carmichael River except during extreme climatic circumstances in which the AEP of the storm event exceeds the design parameters adopted
- Runoff from disturbed catchments (SAW) has to be treated to achieve minimum reductions in key pollutant levels before being reused or released into the natural environment
- Clean water runoff from undisturbed catchments is diverted around any mine workings or disturbed areas and released downstream into the same waterway where possible
- Mine workings are protected from local stormwater runoff and regional flooding
- Any controlled discharges are in accordance with Environmental Authorities licence conditions
- Acid Mine Drainage (AMD) water needs to be treated through neutralisation processes in the sediment basins or the MAW storages. The nature of treatment will depend upon the water quality

8.6.3 Water demand requirements

To support the mine, a constant and secure water supply is needed throughout the life of the Project. The required water supply and demand was developed during the project feasibility. A further review of this assessment based on other coal mine operations, industry standard practices, and new information regarding coal washing and dust suppression, has been completed and a summary is included in this section. Detailed analysis of water demand is provided in SEIS Volume 4 Appendix K2 Water Balance Report.

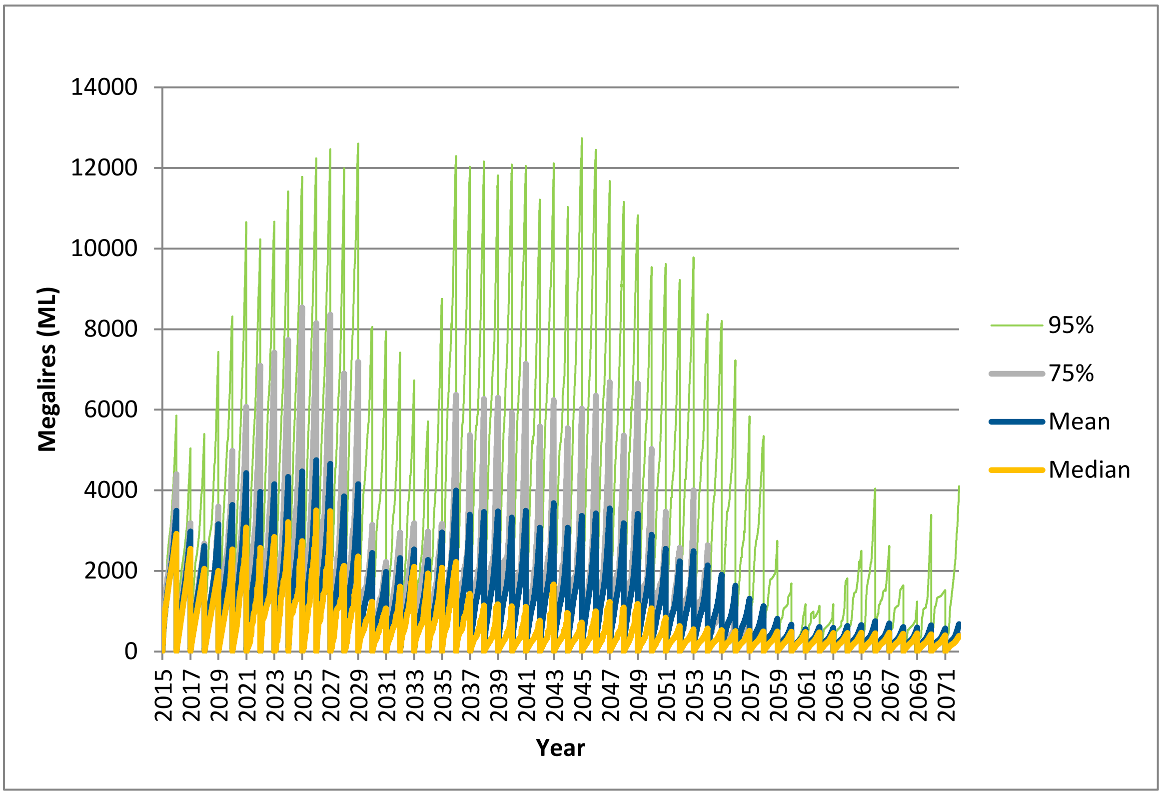
Water is required for:

- Water for potable use will be required for use at the on-site (mine) facilities and at offsite (mine workers accommodation village and airfield) facilities. A combined demand of 300 L/person/day (for both on-site and offsite facilities) has been used to calculate the potable demand with reference to the expected number of staff to be present on site.
- Dust suppression will be required on areas that would otherwise produce excessive volumes of dust as a result of the mining activities. These areas predominantly include the haul roads and the active mining areas.
- Process water is required for the CHPP and the longwall mining equipment.

Figure 31 shows the total estimates of external water demand for the mine site from 2015 to 2071. The mean water demand for the mine site and all associated operations is in the order of 12 GL/yr. This will occur during the majority of the mine’s life with lower demands during the start-up and close down phases.

Water demand is presented for the 95th percentile as this is an industry standard for the required reliability of water supply for a mine.

Figure 31 Estimated water demand



8.6.4 On-site water balance

The water balance for the Project has been developed using GoldSim software. One of the objectives for the water balance is to determine the requirements of controlled discharge from the Project to the environment. Within the mine plan, the central MAW storages on both sides of the Carmichael River have been identified as the two potential discharge locations. Hence input and output information is frequently provided separately for the parts of the mine on both sides of the Carmichael River. Within GoldSim there are two approaches available for modelling a site water balance:

1. A deterministic approach where modelling of crucial mine stage snapshots and running the entire historical climate data for this single mine stage
2. A probabilistic approach where a number of climate sequences are run through the water balance of the mine to produce a statistical distribution of results from which a measure of risk can be extracted.

The probabilistic option has been applied for the following reasons:

- It provides a robust indication of water requirements over the life of the mine
- It represents a more robust estimation of storage volumes and the associated carry over storage between different mine phases.

Inflows to the water balance included:

- External water supplies
- Rainfall

- Runoff
- Groundwater inflows

Outflows included:

- Evaporation
- Dust suppression
- Process water requirements
- Seepage
- Potable water
- Tailing facilities

8.6.5 Water storage dams

Design criteria for dams

The methodology for the preliminary sizing of the diverse water management storages for the Project differs per type of storage:

- Central MAW dams
- Central process water dams
- MAW transfer dams
- Overburden MAW dams
- Sediment dams
- Raw water dams.

Central MAW dams

Required volumes for both of the MAW dams have been extracted from GoldSim. Conceptual designs have been generated for these volumes to accommodate the calculated volumes, with the dams having 0.5 m freeboard and an eight m crest width to the embankments. Batters for the dams have been based on 1 in 3 slopes to all sides. The dams have also been fitted within the allocated dam areas provided in the mine plans. For the Central MAW storages a non-rectangular area is available. Storage curves were developed to provide the relationship between volume of water in the dam and the associated area. This allows for a more accurate prediction of evaporation losses in the dams.

Table 9 provides the maximum volume and baseline dimensions of the Central MAW dams. Within GoldSim a sensitivity analysis has been carried out to verify the proposed maximum volumes against potential discharges. At this stage no detail cognisance has been given to ground water levels or balancing cut to fill.

Table 9 Central MAW dams

Dam	Required volume (m^3)	Footprint area (m^2)	Storage depth (m)	Water surface area (m^2)
Central MAW - North	8,000,000	695,810	15.9	574,709
Central MAW - South	7,000,000	680,917	13.9	571,861

* Dams have a triangular shape

Central process water dams

Required volumes for both of the central process water dams have been extracted from GoldSim. Conceptual designs have been generated for these volumes to accommodate the calculated volumes, with the dams having 0.5 m freeboard and an 8 m crest width to the embankments. Batters for the dams have been based on 1 in 3 slopes to all sides. The dams have also been fitted within the allocated dam areas provided in the mine plans. Storage curves were developed to provide the relationship between volume of water in the dam and the associated area. Table 10 provides the maximum volume and baseline dimensions of the central process water dams.

Table 10 Central process water dams

	Required volume (m^3)	Footprint length (m)	Footprint width (m)	Footprint area (m2)	Storage depth (m)	Water surface area (m^2)
PWD –North	3,000,000	593	413	244,909	27.5	172,525
PWD –South	2,000,000	861	311	267,771	11.0	217,056

MAW transfer dams

The MAW transfer dams have been sized in accordance with expected pump rates of the two input sources (open cut pits and underground mine dewatering). The size of the dams equals a 7 day pumping volume, disregarding evaporation and seepage losses. Table 11 provides the maximum volume and baseline dimensions of the central process water dams.

Table 11 MAW transfer dams

	Required volume (m^3)	Footprint length (m)	Footprint width (m)	Footprint area (m2)	Storage depth (m)	Water surface area (m^2)
MAW-B	200,000	191	191	36,481	13.4	25,728
MAW-C	350,000	240	220	52,800	17.0	36,764
MAW-D	600,000	335	235	78,725	18.4	55,292
MAW-E	900,000	415	255	105,825	20.6	74,029
MAW-F	650,000	356	236	84,016	18.4	59,100
MAW-G	450,000	285	225	64,125	17.3	44,810

Overburden MAW dams

The overburden MAW dams have been sized equal to the DSA. As these dams will need to collect runoff they will be constructed as in-ground basins.

Table 12 provides the maximum volume and baseline dimensions of the central process water dams.

Table 12 Overburden MAW basins

	Required volume (m3)	Footprint length (m)	Footprint width (m)	Footprint area (m2)	Storage depth (m)	Water surface area (m2)

MAW Pit - D	13,660,000	1035	600	621,000	20	621,000
MAW Pit - E	11,250,000	1500	400	600,000	20	600,000

Sediment dams

Sediment dams can be found in both the overburden areas and the disturbed areas for each pit. For both situations the sediment dams are sized outside of GoldSim with help of Excel. The size of the catchment areas for the overburden dams and the disturbed area dams change over time with the disturbed areas decreasing over time and the overburden areas increasing over time. The width of disturbed soil adjacent to each pit at the mine site regresses over the life of the mine at a rate of approximately 50 linear metres per year. As such, the area of disturbed soil adjacent to each pit is systematically reduced over the life of the mine.

The following assumptions were used to calculate a total required storage volume for the sediment basins, in 1 year increments for the disturbed areas and 5 year increments for the overburden areas. This approach is expected to reflect actual mine operations as the sediment dams for the disturbed areas need frequent relocating due to pit progress, while the overburden sediment dams are fixed in location.

- Design rainfall event: 1 in 20 year ARI, 24 event
- Design rainfall depth: 6.77 mm/hr (over 24 hours)
- Runoff coefficient: 0.2 (20 percent of all rainfall reflecting relatively large catchment areas)
- Maximum basin width (disturbed area sediment basins): 80 m.

The width of disturbed soil adjacent to each pit at the mine site regresses over the life of the mine at a rate of approximately 50 linear metres per year. As such, the area of disturbed soil adjacent to each pit is systematically reduced over the life of the mine.

The following assumptions were used to calculate a total required storage volume for the sediment basins, in one year increments for the disturbed areas and five year increments for the overburden areas. This approach is expected to reflect actual mine operations as the sediment dams for the disturbed areas need frequent relocating due to pit progress, while the overburden sediment dams are fixed in location.

- Design rainfall event: 1 in 20 year ARI, 24 events
- Design rainfall depth: 6.77 mm/hr (over 24 hours)
- Runoff coefficient: 0.2 (20 per cent of all rainfall reflecting relatively large catchment areas)
- Maximum basin width (disturbed area sediment basins): 80 m.

The calculated volumes (sizes) of the storages are incorporated within GoldSim. Actual runoff from those areas has been calculated within GoldSim with the AWBM model. Refer to Section 4.3.3. Runoff for the runoff coefficients applied within the AWBM model. Table 13 shows the maximum basin sizes for the disturbed areas.

Table 13 Disturbed area maximum basin sizes

	Area (ha)	Storage Volume (ML)
Pit B	6.3	1,258

Pit C	3.0	602
Pit D	5.0	1,002
Pit E	4.4	883
Pit F	3.4	671
Pit G	3.4	670

Table 14 shows the maximum basin sizes for the overburden sediment basins.

Table 14 Overburden sediment basins

	Required storage volume (m^3)	Footprint length (m)	Footprint width (m)	Footprint area (m^2)	Storage depth (m)	Water surface area (m^2)
SAW Pit-B	744,505	626	200	125,121	10	125,121
SAW Pit-C	411,735	359	200	71,878	10	71,878
SAW Pit-F	565,468	346	400	138,241	5	138,241
SAW Pit-G	867,022	512	400	204,791	5	204,791

Raw water dams

Both raw water dams (north and south) have been sized based on the mine planning requirements at 1 GL each. Table 15 shows the dimensions for the raw water dams.

Table 15 Raw water dams

	Required volume (m3)	Footprint length (m)	Footprint width (m)	Footprint area (m2)	Storage depth (m)	Water surface area (m2)
RWD - North	1,000,000	341	321	109,461	24.0	74,976
RWD- South	1,000,000	404	379	152,959	10.4	122,274

Design storage allowance

The DSA is associated with the hazard category of a particular dam. The *Manual for Assessing Hazard Categories and Hydraulic Performance of Dams* (DERM, 2012) informs how to establish the hazard category. A preliminary hazard assessment in accordance with the Manual has been performed for the following dams:

- The central MAW dams where all MAW from the site will be collected
- The dams that capture the runoff in the overburden dams of pits D and E as it is understood that tailings and rejects are likely to be placed within these overburden areas.

The preliminary hazard assessment for the central MAW dams assumes that each dam will maintain a hazard category of high and thus need to be designed to withhold a 1 in 100 year AEP event. Section 2.2.2 of the Manual states that two approaches are available for the assessment of DSA. These comprise the ‘Method of Deciles’ and the ‘Method of Operational Simulation for Performance Based Containment’ as detailed in Appendix A of the Manual. The ‘Method of Operational Simulation …’ is a water balance approach based on a series of historical rainfall data (in excess of 100 years) which is assumed to be representative of the extremes in climate that could occur at the site. This approach accommodates the occurrence of a range of individual storm event magnitudes and storm sequences together with operational variations in storage prior to and during storm events. It therefore allows a more detailed representation of the operational performance of the system compared to the alternative approach based on the ‘Method of Deciles’. This methodology has been applied for the central MAW dams, i.e. DSA is included in the presented dam dimensions.

The ‘Method of Deciles’ provides a more conservative estimate of the DSA given its reliance on the total volume of a wet season rainfall without losses and a disregard of system operation during the course of the wet season rainfall. This methodology has been applied for the overburden MAW dams as these are not sized within GoldSim.

Both overburden MAW dams have been assumed to have a significant hazard category. This assumption is solely based on the understanding tailings and rejects materials will be placed in the overburden areas for these two pits. While this material is placed it will be exposed to rainfall events meaning that runoff potentially contains contaminants associated with the mining activities. The dam itself will be built as a sump, hence the risk of a dam break failure is considered minimal. The Manual specifies for a significant hazard category a 1:20 AEP event (5 percent AEP)

Model (operational) rules allow for the MAW in the overburden MAW dams to be pumped, when available, directly into the north central MAW dam, henceforth ensuring that the allocated DSA volume is available within in each dam on the 1 November each year. A hazard assessment for all dams on site will be required during future design stages. Note that for dams without an actual catchment, like the MAW transfer dams, allowing for the DSA will be a matter of increasing the storage depth.

8.7 Flood management

8.7.1 Hydraulic modelling

Hydraulic modelling to determine water levels resulting from flood flows has been undertaken for the existing (pre-development) and post-development condition using one-dimensional (HEC-RAS) hydraulic modelling software to simulate minor waterways and two-dimensional (TUFLOW) hydraulic modelling software to model the more complex Carmichael River floodplain. Both of these packages are recognised as industry standard within Australia and are appropriate for modelling flood extents for this study.

Hydraulic modelling was undertaken for the 10, 50, 100 and 1,000 year ARI design events with a model time step of five seconds. The modelling determined that there would be:

- Change in local flood levels (higher in some regions, lower in others) as a result of watercourse diversions or temporarily restricted flows during construction. This would be a localised effect and not expected to impact outside of the construction area
- Confinement of the Carmichael River to the corridor between the flood levees during Project operation. The contraction of the floodplain would cause an insignificant increase in flood extent upstream of the MLA for any of the simulated flood events. This outcome reflects the relative distance of the contraction from the western MLA boundary.

A detailed description of flood management is provided in SEIS Volume 4 Appendix K4 Flooding and Diversion Drain Assessment.

8.7.2 Flood management

To manage flood impacts from the Project (Mine), the following are measures are proposed:

- Levee banks are proposed in various locations to reduce the risk of flood waters entering pits and to assist with the separation of mine affected areas. These controls will reduce the amount of MAW and SAW produced
- Design criteria have been established for diversion drains required to redirect surface water away from mine affected areas. The purpose of these diversion drains is to both provide flood immunity to the site and to minimise the volume of mine-affected water requiring treatment before discharge
- The Project (Mine) design includes provision for a haul road and conveyor crossing of the Carmichael River. This crossing links the southern parts of the mine to the mine infrastructure in the northern area. Given that the crossing of the Carmichael River has the potential to have a large impact on the existing flood regime, particularly flood levels, a preliminary design of the crossing was undertaken using a hydraulic model to inform the design and demonstrate that potential hydraulic impacts could be addressed through design

Carmichael River levee design criteria

The following criteria were adopted for the Carmichael River levees at this stage of the design:

- The alignment of the flood protection levees along the northern and southern sides of the Carmichael River corridor has been based on the available corridor provided in the mine plan
- The flood protection levees along the northern and southern sides of the Carmichael River corridor, and the levees along the northern and southern external diversion drains, have been designed with crest levels set at the 1,000 year ARI flood level, with an additional 600 mm of freeboard
- For the purposes of this design stage, the batter slopes on the levees have been set at one vertical to five horizontal, and a 6 m top width of levee. Further assessment and consideration of the geotechnical engineering issues and design refinement will be required at a later stage

Diversion drains

Diversion drains are categorised as follows:

- External diversions drains - These are located outside of the mine affected area (but within the MLA) and are constructed in phases depending upon mining activity and to last for the life of the mining activity in that area. They will also be maintained and integrated into the rehabilitation plan for the mine site. A case study design for one of these external diversion drains is described below in order to demonstrate indicative sizing. Sizing of the remainder of the proposed external diversion drains will be required in further stages of design
- Internal diversion drains and bunds - These are located within the MLA and are constructed as required to provide required flood mitigation. These will require relocation or replacement as the mine plan advances to allow for the progression of the open cut

mining footprint and to ultimately ensure alignment and compliance with final landform and drainage requirements. The diversion drains are expected to remain after the mine operations have ceased. Due to the open cut pits and waste rock stockpiles the natural waterways cannot be restored. It is also expected that the diversion drains will develop their own environmental values during the many years they will be required that would be destroyed by reinstating the previous natural waterway.

External diversion drain design criteria

The external diversion drains are to be designed in accordance with the following drainage design criteria:

- The design must accommodate the 100 year ARI flow with an additional 600 mm freeboard; no allowance for climate change (higher rainfall intensities) as derived using the hydraulic models previously described
- The design considers expected subsidence (MSEC, 2013)
- The maximum flow velocity in the diversion drains to be no greater than 2.5 m/s velocity for the 50 year ARI event (DERM, 2011)
- No greater than 80 N/m^2 shear stress for the 50 year ARI event (DERM, 2011)
- No greater than 220 watt/ m^2 stream power for the 50 year ARI event (DERM, 2011)
- Drain banks to have 1:5 slope
- Where the mine pits are potentially at risk of inundation from the diversion drains, diversion bunds will be constructed along the eastern side of the drain to provide for 1,000 year ARI flood immunity for the pit from flood waters originating from the diversions drains. These are sized according to the 1,000 year ARI peak flood level, plus 600 mm freeboard.

Haul roads and conveyor crossing

The Project (Mine) design includes provision for a haul road and conveyor crossing of the Carmichael River. This crossing links the southern parts of the mine to the mine infrastructure in the northern area. Given that the crossing of the Carmichael River has the potential to have a large impact on the existing flood regime, particularly flood levels, a preliminary design of the crossing was undertaken using the hydraulic model to inform the design and demonstrate that potential hydraulic impacts could be addressed through design.

The mine plan indicates that the crossing would take the form of a causeway, thus having a low flood immunity standard and would be overtopped by large floods. Preliminary analysis of a causeway, suggests a large number of culverts would be required to provide 50 year ARI flood immunity and that providing a bridge instead may prove to be an appropriate alternative.

River crossing design criteria

The haul road and conveyor crossing has been designed in accordance with the following design criteria:

- 50 year ARI flood immunity for the haul road and conveyor crossing, with 600 mm freeboard for the haul road
- Haul road width of 40 m

- Conveyor/s to be located on the same structure as the haul road crossing therefore not requiring separate hydraulic analysis
- Velocity of flows under bridge less than 5 m/s
- Allowance for passage of flow through natural minor channels on the flood plain, where possible
- Assumptions adopted for the preliminary design including:
  – Piers to support the bridge have a pile cap base of 2 m diameter and are 1 m in diameter above the pile cap
  – The soffit level of the bridge will be approximately 0.5 m above the 50 year ARI flood to allow for debris passage
  – In the absence of a defined limit to afflux, it has been assumed that 600 mm at the upstream side of the crossing is acceptable.

9. Offsite infrastructure

9.1 Offsite infrastructure

The offsite infrastructure comprises (see Figure 32):

- Workers accommodation village
- Airport
- Industrial development area
- Water supply infrastructure

9.2 Mine Workers accommodation village

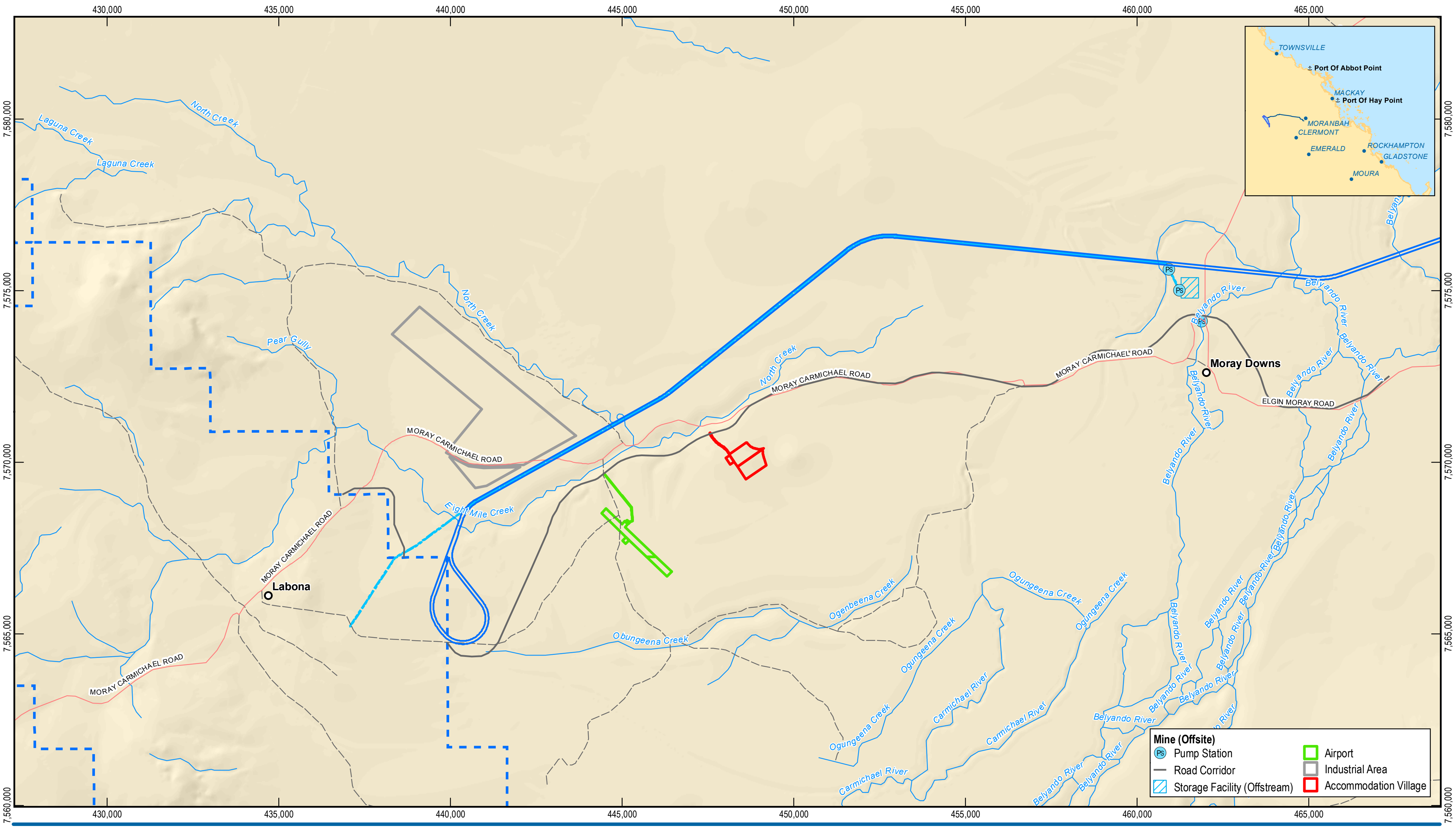
The workers accommodation village will be purpose built to accommodate the workforce for the construction and operation of the Project. The design has been developed in a staged manner where the accommodation can grow in accordance with demand, whilst ensuring that each stage is appropriately serviced in terms of facilities and infrastructure. For full details, please refer to Volume 1 Chapter 4 (Approvals) and Volume 4 Appendices C1 and C4 (Offsite Infrastructure).

The workers accommodation village design is based on the utilisation of a ‘module unit’ that provides 48 bedrooms in a three sided two storey low-set format. There are to be in total 49 modules wrapped around a central spine of communal facilities for the exclusive use of future residents. The central spine communal facilities are to be of more traditional construction materials, whereas the modules are to be lightweight and relocatable. The workers accommodation village has also been designed such that in can be constructed in a number a stages, whilst ensuring key services and facilities are appropriately provided in sequence and in accordance with the scale and anticipated demand of future residents.

The design philosophy and key aspects of the planned workers accommodation village can be characterised as follows:

- Reception / site management offices;
- Medical clinic
- Kitchen / dining room;
- 3,500 accommodation rooms;
- Laundries associated with each accommodation cluster
- Informal recreation facilities such as barbeques / shelters associated with each accommodation cluster
- Bulk linen stores
- Amenities rooms
- Recreation facilities
- Gymnasiums

- Commercial laundry
- Maintenance shed
- Hazardous materials & chemical storage
- Car parking
- Sewerage infrastructure
- Power infrastructure



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Kilometres

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

N

LEGEND

- Homestead
- Local Road
- Track
- Watercourse
- Rail Corridor
- Water Supply Pipeline
- Mine (Onsite)

Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project SEIS

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Offsite Infrastructure

Figure 32

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Data source: DME: EPC1690 (2010)/EPC1080 (2011); DNRM: Bioregion Boundary (2011); © Commonwealth of Australia (Geoscience Australia): Watercourse, Tracks (2007); Adani: Alignment Opt11 Rev 2 (SP1 and 2)(2013), Offsite Infrastructure (2013). Created by: AJ

9.3 Airport

A dedicated airport will support the Project to facilitate FIFO operation and general access to other regional and national centres.

In the Environmental Impact Statement (December 2012), the siting of the airport was located to the north of the rail line and close to the boundary of the mining tenure. Further studies since that time have been undertaken, and a number of factors have led to the change in location to the south of the rail line, nearer to the worker accommodation village. The factors leading to the revised location are:

- Responding to submissions from stakeholders, such as the Isaac Regional Council who expressed concerns regarding potential bird strike as a result of the location of the airport;
- Further ecological studies of offsite infrastructure which has shown that the southern location requires less clearing and is further away from sensitive fauna habitat, such as the Black-throated finch;
- Safer operating conditions through improved connectivity between the airstrip and the worker accommodation village
- Improved immunity from flooding

Airport has been strategically selected to ensure that it is conveniently located in relation to both the accommodation village and mine, whilst ensuring that take-off and landing approach paths are offset from the accommodation village to minimise potential noise disturbance and disruption.

The design philosophy of key aspects of the planned airport can be characterised as follows:

- A 2,250 m x 30 m asphalt runway strip
- Apron of dimension 100 m x 70 m
- Multi-function terminal building (circa 800 m^2) providing security, amenities, café and departure lounge functions
- Security fencing and stock proof fencing
- Inclusion of appropriate visual, navigation and lighting aids
- Car and bus parking for up to 62 cars and 4 buses
- Passenger set down and pick up area
- Ancillary emergency fuel storage of up to 500 m
- Aerodrome Rescue and Fire Fighting Services (AFRRS) facilities

When operational, the airport has been designed and planned to accommodate aircraft with a maximum capacity of 150 persons. Flights are programmed to occur on Tuesdays, Wednesdays and Sundays.

Currently it is planned that during the early and mid-phases of the mine, between 10 and 13 flights per week will occur. In the latter part of the mines operation (post 2060), flights are generally expected to decline from eight (8) to one (1) flight per week. When operating at maximum capacity (in the early-mid phases) it is envisaged that up to 701 flights per annum could be processed through the airport.

Importantly, all aspects in relation to certification and aeronautical industry compliance of the proposed airport fall outside the scope of this current material change of use and operational works application and are to be dealt with separately.

9.4 Industrial development area

An industrial area will be established as part of the off-site infrastructure to provide for servicing and maintenance of the mine, offsite infrastructure and rail construction and operation. Facilities may include, but not limited to:

- vehicle and equipment fabrication and maintenance workshops
- concrete batching plant
- hot mix bituminous plant
- bulk fuel storage
- vehicle wash areas
- warehouse and storage
- office and administration buildings

The industrial area will be located on a land parcel approximately 4 km to the east of the EPC 1080 lease directly to the north of the proposed rail alignment. The industrial area is located in this position to allow access to a rail siding for use in supply logistics to the mine development.

The proposed rail siding area is situated at the western end of the Project (Rail) alignment. As the Project (Rail) alignment is a single line with a rail siding area for multiple trains, the intent of the rail siding is to improve the functioning and operation of the new rail line proposed to service the planned mine. The rail line will be used for a number of ancillary purposes such as fuel delivery. The rail line is envisaged as a single line with rail sidings as an effective mechanism to enable a number of trains to utilise the line without impacting on each other at the western end of the line.

Given the large length of the coal trains that could be ultimately utilising this proposed rail line, a siding of minimum dimension 2.5 – 3 km was highlighted as being required. Further, it was also advised that the best location for any such siding (apart from being adjacent to the proposed rail line) would be interlocked with the above-mentioned industrial area such that the full potential of the proposed rail line could be achieved and managed in a coordinated manner.

9.5 Offsite water infrastructure

9.5.1 Extraction

A key source of water supply to the mine will be a flood water harvester on the Belyando River. The extraction system will pump water from the river into an off-site storage then supply water to the mine via a trunk main pipeline. The extraction from the Belyando will be triggered by flood events over 200 ML/d, stored in an off-stream storage and used to meet mine water demands when onsite and groundwater (off and onsite) supplies are exhausted. The amount of water sought, and operation of the water harvester, is presented in Table 16. The location of the water harvester will be directly downstream of the confluence of the Belyando River with the

Carmichael River (approximately 70 km Adopted Middle Thread Distance (AMTD) Belyando River).

Table 16 Proposed water harvesting extraction

Extraction location	Max. volumetric limit per annum	Average volumetric extraction per annum	Pump size	Trigger (start and cease to pump)
Approximately 70 km AMTD Belyando River	12,500 ML/a	10,000 ML/a	400 ML/day	200 ML/day

9.5.2 Required infrastructure

To support the proposed water extractions, a number of pump stations, storages and pipelines will need to be constructed. As mentioned earlier, the water is proposed to be extracted from the Belyando River which at the proposed extraction point, runs through the property (Lot 662 on PH1491) on which Adani own the property leases. All associated infrastructure will be located within the bounds of the property. Appendix B in this submission provides an overall layout plan of the infrastructure, and concept for several of the pump stations. The recommended infrastructure design was described in the EIS, with the key changes since then being the removal of the pump stations and in stream storage extractions on North and Obungeena Creeks.

Belyando River pump station

The pump station will be located on the western bank of the existing storage formed by the causeway for the Moray Carmichael Road entering the Moray Downs Property from the east, within the Belyando Creek. The pump station will consist of 5 No. centrifugal, wet well submersible pumps, with one pump on standby. The pumps will be located within a three sided reinforced concrete structure, which will protect the pumps from flood flows and debris. The pumps will also be protected by a bar screen on the open face and roof of the wet well. This bar screen will be removed when maintenance is required. A channel will be dug perpendicularly to the river at invert level to provide a pump sump.

The pipe fittings within the pump station will be ductile iron, with a gate valve, check valve and dismantling joint on each pump discharge pipeline. Once underground, the discharge pipeline will transition to HDPE via a stub flange and backing ring, before splitting to twin pipelines to the storage dam. Both pipelines will contain a gate valve to allow for isolation for maintenance.

The electrical infrastructure will be housed on a steel platform supported on the pump station walls, above the defined floodplain level. Gate valve spindles will also extend to the platform to allow for operation during flood conditions. Access to the platform will be via a steel staircase, for which the design is to be confirmed.

Due to the size of the pumps and the location within the flood plain, no permanent pump lifting equipment will be provided at the pump station site. Lifting arrangements for maintenance and replacement will need to be made on site.

Offsite storage

Flow will be extracted from the storage via a dry well with submersible pumps located adjacent to the storage at ground level. The suction pipes will pass through the storage wall. The storage will be both above and below existing ground levels.

10. Mine decommissioning and rehabilitation

The operational life of the Project (Mine) is over 60 years, therefore a general overview of decommissioning and rehabilitation is provided based on current legislative requirements, noting that such requirements may be different at the time of decommission and rehabilitation.

The general objective required for the rehabilitation of areas disturbed by mining is that the final land form is:

- safe to humans and wildlife
- non-polluting
- stable
- able to sustain an agreed post-mining land use

Details of rehabilitation approaches are provided in SEIS Volume 4 Appendix R1 and R2.

11. References

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