Waratah Coal
THE NEW ENERGY IN COAL

Waratah Coal

DRAFT Environmental Management Plan (EM Plan) Mine

China First Coal Project – Galilee Basin

December 2012

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ABBREVIATIONS

(EPP (Air)) - Environmental Protection (Air) Policy 2008

(EPP (Noise)) - Environmental Protection (Noise) Policy 2008

(EPP (Waste)) - Environment Protection (Waste Management) Policy 2000

AADT - Average Annual Daily Traffic

ARI - Average Recurrence Interval

AST - Above Ground Storage Tank

BAM - beta attenuation monitor

BMP - Biosecurity Management Plan

BNR - Bimblebox Nature Refuge

BRC - Barcaldine Regional Council

CCCC - Communications Construction Company First Harbour Engineering Co. Ltd

CEC - cation-exchange capacity

CHMPs - Cultural Heritage Management Plans

CHPP - Coal Handling and Preparation Plant

CO - carbon monoxide

CP - Cleaner Production

CREC - China Railway Group

DEHP - Department of Environment and Heritage Protection

DSA - Design Storage Allowance

DIDO - Drive in Drive out

DTMR - Department of Transport and Main Roads

EA – Environmental Authority

EC - Electrical Conductivity

EIL - Environmental Investigation Levels

EIS - Environmental Impact Statement

EM - electromagnetic

EMP – Environmental Management Plan

EMR - Environmental Management Register

EMS - Environmental Management System

EoP - End-of-pipe

EP Act - *Environmental Protection Act 1994*

EPBC Act - *Environment Protection and Biodiversity Conservation Act 1999*

EPC - Exploration Permit for Coal

EPCM - Engineering, Procurement, and Construction Management

ERAs - Environmentally Relevant Activities

ESA - Environmentally Sensitive Areas

ESCP - Erosion and Sediment and Control Plan

ESP - Exchangeable Sodium Percentage

FIFO - Fly In Fly Out

FMP - Fauna Management Plan

FVP - Final Void Plan

GAB – Great Artesian Basin

GED - General Environmental Duty

GQAL - Good Quality Agricultural Land

h - Hours

HVAS - high volume air samplers

HSEC - Health, Safety, Environment and Community

JORC - Joint Ore Reserves Committee

KPIs - key performance indicators

LP Act - *Land Protection Pest and Stock Route Management Act 2002*

LOS - Level of Service

m - Metre

MCC - Metallurgical Corporation of China Ltd

MCP - Mine Closure Plan

MIA - Mine Infrastructure Area

MLA - Mining Lease application

mm - millimetre

MRL - mandatory reporting level

MSDS - Material Safety Data Sheets

Mt - Million tonnes

Mtpa - Million Tonnes per Annum

NAF - Non Acid Forming

NC Act - *Nature Conservation Act 1992*

NO_x - oxides of nitrogen

OMC - optimum moisture content

PAF – Potentially Acid Forming

$PM_{2.5}$ - particulate matter with an aerodynamic diameter less than two and half microns

PM_{10} - particulate matter with an aerodynamic diameter less than ten microns

PNL - Planning Noise Level

PoO - Plan of Operation

PSI - Preliminary Site Investigation

RAP - remediation action plan

RBLs - Rating Background Levels

RE - Regional Ecosystem

ROM - Run-of-Mine

SAR Sodium Absorption Ratio

SCIEG - Sino-Coal International Engineering Design & Research Institute China

SCL - Strategic Cropping Land

SEIS - Supplementary Environmental Impact Statement

SEO - Site Environmental Officer

SMP – Species Management Plan

SMP - Subsidence Management Plan

SO_2 - sulfur dioxide

SOPs - Standard Operating Procedures

SP Act - *Sustainable Planing Act 2009*

SMP - Species Management Plan

STF - sewage treatment facilities

TAPM - The Air Pollution Model

TDS - Total Dissolved Solids

TEOM - tapered element oscillating microbalance

tph - tonnes per hour

TSF - Tailings Storage Facility

TSP - Total Suspended Particulate

VM Act - *Vegetation Management Act 1999*

VOCs - volatile organic compounds

vpd - vehicles per day

WMP - Waste Management Plan

WMP - Weed Management Plan

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1. Introduction

1.1 Purpose and Structure

This draft Environmental Management Plan (EM Plan) has been prepared for the mine component of the Galilee Coal Project (Northern Export Facility) (also known as, and hereafter referred to as, the China First Project). This draft EM Plan supports the application for draft Environmental Authority for the Project.

An EM Plan is required under *Section 201* of the *Environmental Protection Act 1994* (EP Act) as part of the application for an Environmental Authority (mining activities) process. *Section 202* of the EP Act states that the purpose of an EM Plan is to propose environmental protection commitments to assist the administering authority prepare the draft Environmental Authority.

In accordance with *Section 203* of the EP Act, this draft EM Plan contains the following sections.

- **Section 1** – Introduction, provides background on the proponent, describes each of the relevant mining leases and land tenure, and identifies the relevant stakeholders.
- **Section 2** – Project Description, describes the relevant mining activities and the land on which the mining activities are to be carried out.
- **Section 3** – Environmental Values, Impacts, Commitments, and Draft Conditions describes:
    - environmental values likely to be affected by the mining activities
    - potential adverse and beneficial impacts of the mining activities on the environmental values,
    - environmental protection objectives,
    - control strategies adopted to achieve the environmental protection objectives,
    - environmental protection commitments
    - proposed Environmental Authority (EA) conditions.
- **Section 4** – Environmental Management describes details of the Project's systems for monitoring, reporting, research, training and auditing.

The structure and content of this draft EM Plan addresses the Department of Environment and Heritage Protection's (DEHP) Guideline No. 8, 'Preparing an Environmental Management Overview Strategy for non-standard Mining Projects'. The commitments provided in the EM Plan are measurable and auditable; they set objectives and outline control strategies to achieve the objectives.

A separate stand alone draft Environmental Management Plan (EMP) specific to the rail component of the Project has been prepared. That draft EMP establishes the environmental management and monitoring obligations associated with the construction and operation of the rail starting at the balloon loops adjacent to the mine site and ending at the boundary of the Abbot Point State Development Area.

1.2 The Project

The China First Project comprises a new coal mine located in the Galilee Basin, Queensland, approximately 30 km to the north of Alpha; and a new rail line connecting the mine to coal terminal facilities at the Abbot Point State Development Area. This is shown in **Figure 1.** The project proposes to use future or existing coal terminal, stockpiling and loading facilities within the Port of Abbot Point and the Abbot Point State Development Area, however, these facilities are the subject of other approvals processes and, as such, are not considered as part of the project. Waratah Coal proposes to mine 1.4 billion tonnes of raw coal from its existing tenements, Exploration Permit for Coal (EPC) 1040 and EPC 1079, with the mine component covered by Mining Lease application (MLA) 70454, as shown in **Figure 2**.

The mine development will involve the construction of four nine Million Tonnes Per Annum (Mtpa) underground long-wall coal mines, two 10 Mtpa open cut pits (each with a north and south component) , two coal preparation plants with raw washing capacity of 28 Mtpa. The Project area arrangement and the Mine Infrastructure Area (MIA) is shown in **Figure 3** .

An annual Run-of-Mine (ROM) coal production of 56 Mtpa will produce 40 Mtpa of saleable export highly volatile, low sulphur, steaming coal to international markets. At this scale of operation, the capital expense of constructing the required rail and port infrastructure is economically viable over the life of the project. Processed coal will be transported by a new railway system approximately 453 km in length that runs from the Galilee Basin to the existing Port of Abbot Point.

The mine development is located approximately 30 km to the northwest of the township of Alpha in central Queensland, and falls within the Barcaldine Regional Council (BRC) administrative area. Access to the mine site will be via a new road exiting the Capricorn Highway to the west of the existing Saltbush Road intersection.

1.3 Project Proponent

Waratah Coal is the proponent of the China First Project. Waratah Coal was established on May 5th 2006 as an exploration and development company of coal projects in Australia, listed originally on the Toronto Stock Exchange Venture and then jointly listed on the Australian Securities Exchange. On May 26th 2009, Mineralogy Pty Ltd acquired Waratah Coal, and the company is now a privately owned Australian Coal Exploration and Coal development company that is a fully owned subsidiary of Mineralogy Pty Limited (Mineralogy). The Mineralogy corporate structure is shown in **Figure 4**.

Waratah Coal has been granted eighteen Exploration Permits for Coal (EPC's), seven Exploration Permits for Minerals, one Mineral Development License. Waratah Coal also has two Mineral Development Licence Applications, one Mining Lease Application and one EPC application over the Galilee Basin. Waratah Coal's EPC's cover a total area of 16,930 km^2 which contain a prospective exploration target of 467,030 million tonnes of high quality thermal coal.

Waratah Coal has Joint Ore Reserves Committee (JORC) resources of 3,684 Million tonnes (Mt) within their EPC's 1040 and 1079 and a further 3,480 Mt within their EPC's 1053, 1039 and 1079. Waratah Coal has further proven up reserves of 1,100 Mt within EPC's 1040 and 1079 for the 'China First Project'.

The China First Project will be jointly developed and operated by both Chinese and Australian constituents. The Project will be managed on behalf of Waratah Coal by ECPM contractors Metallurgical Corporation of China Ltd (MCC), who will manage a syndicated group of several highly experienced Chinese construction companies including Sino-Coal International Engineering Design and Research Institute China (SCIEG), China Railway Group (CREC) and Communications Construction Company First Harbour Engineering Co. Ltd (CCCC).

Figure 1. Project location

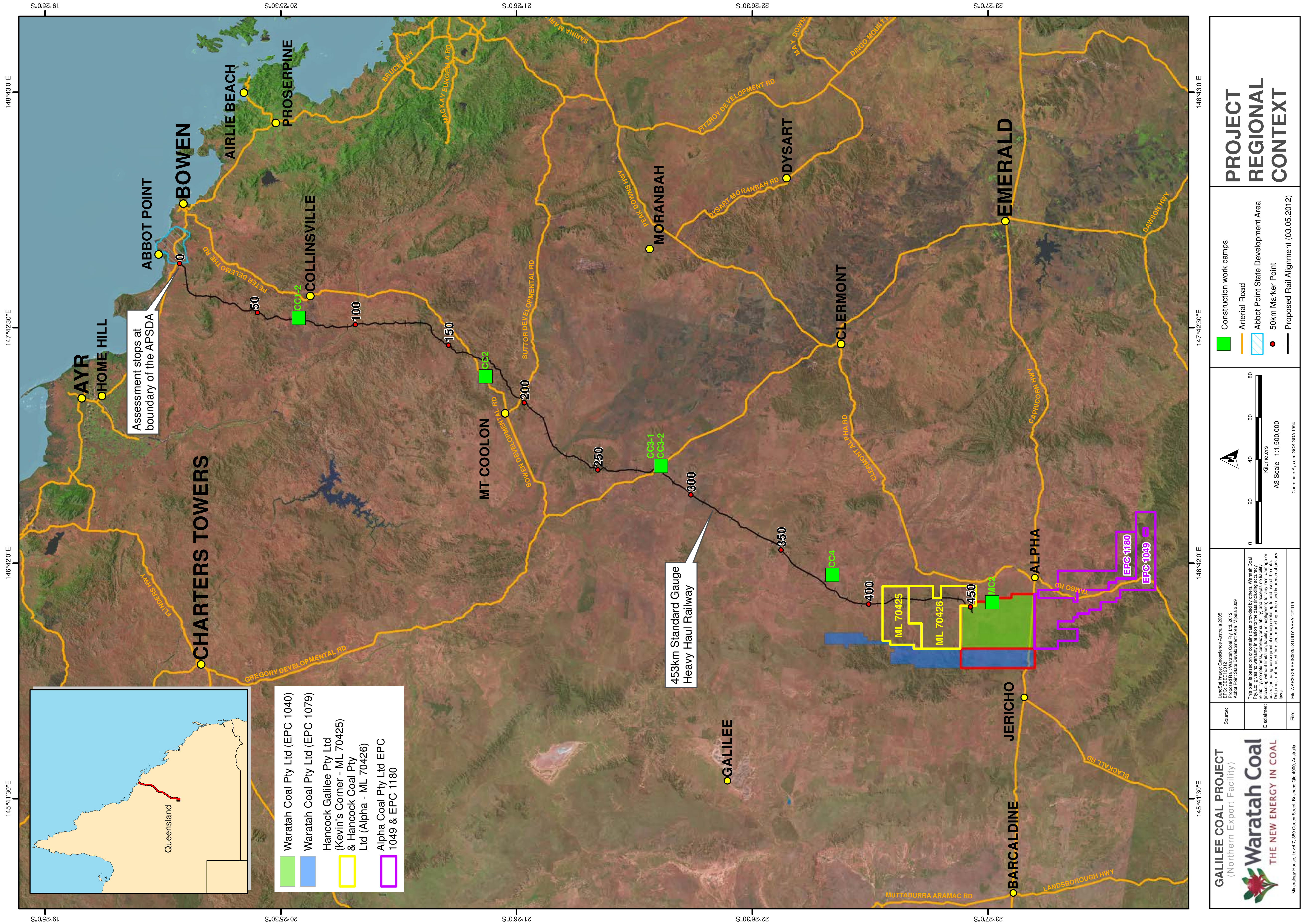


Figure 2. China First Mine Lease Application Area 70454

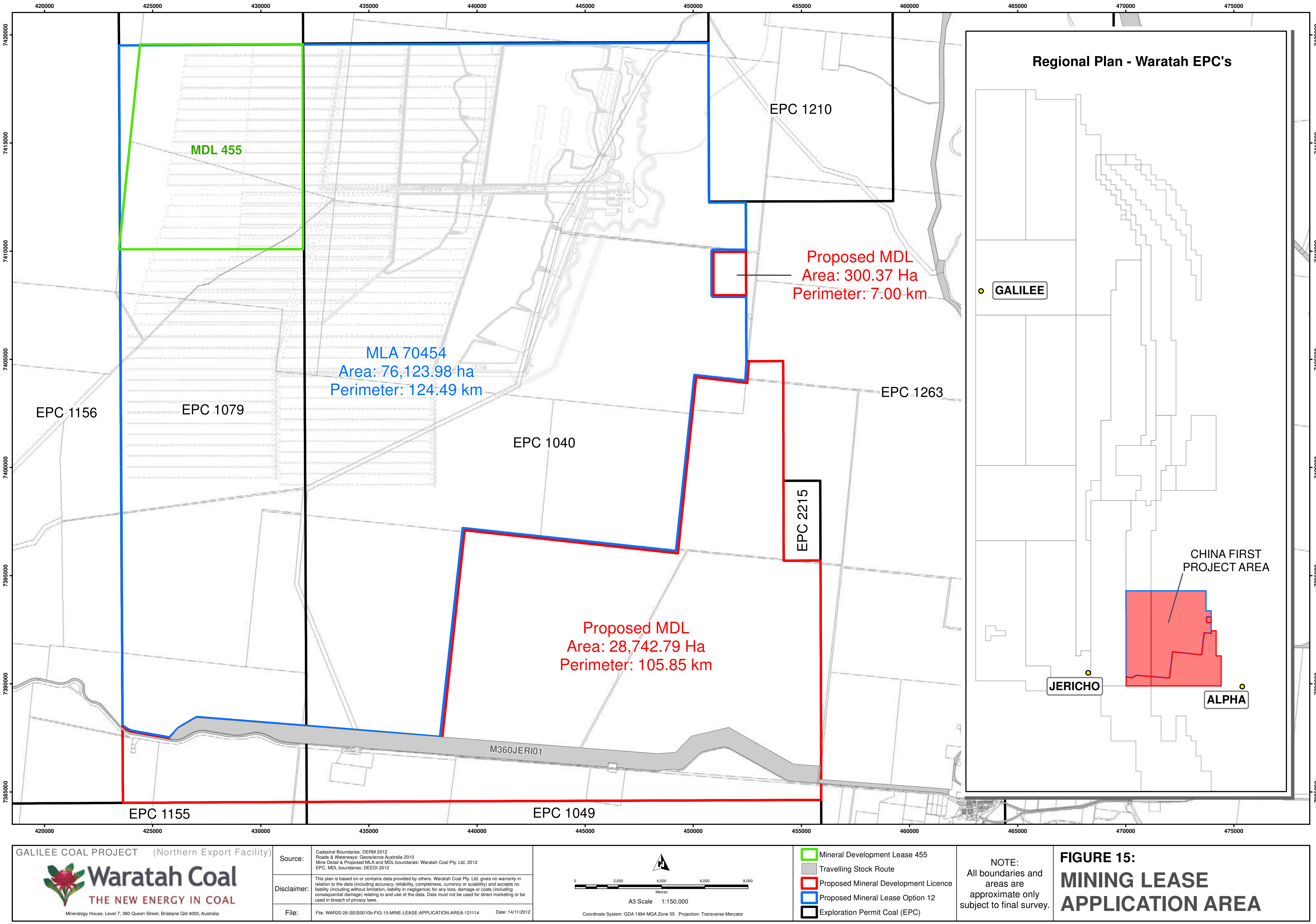
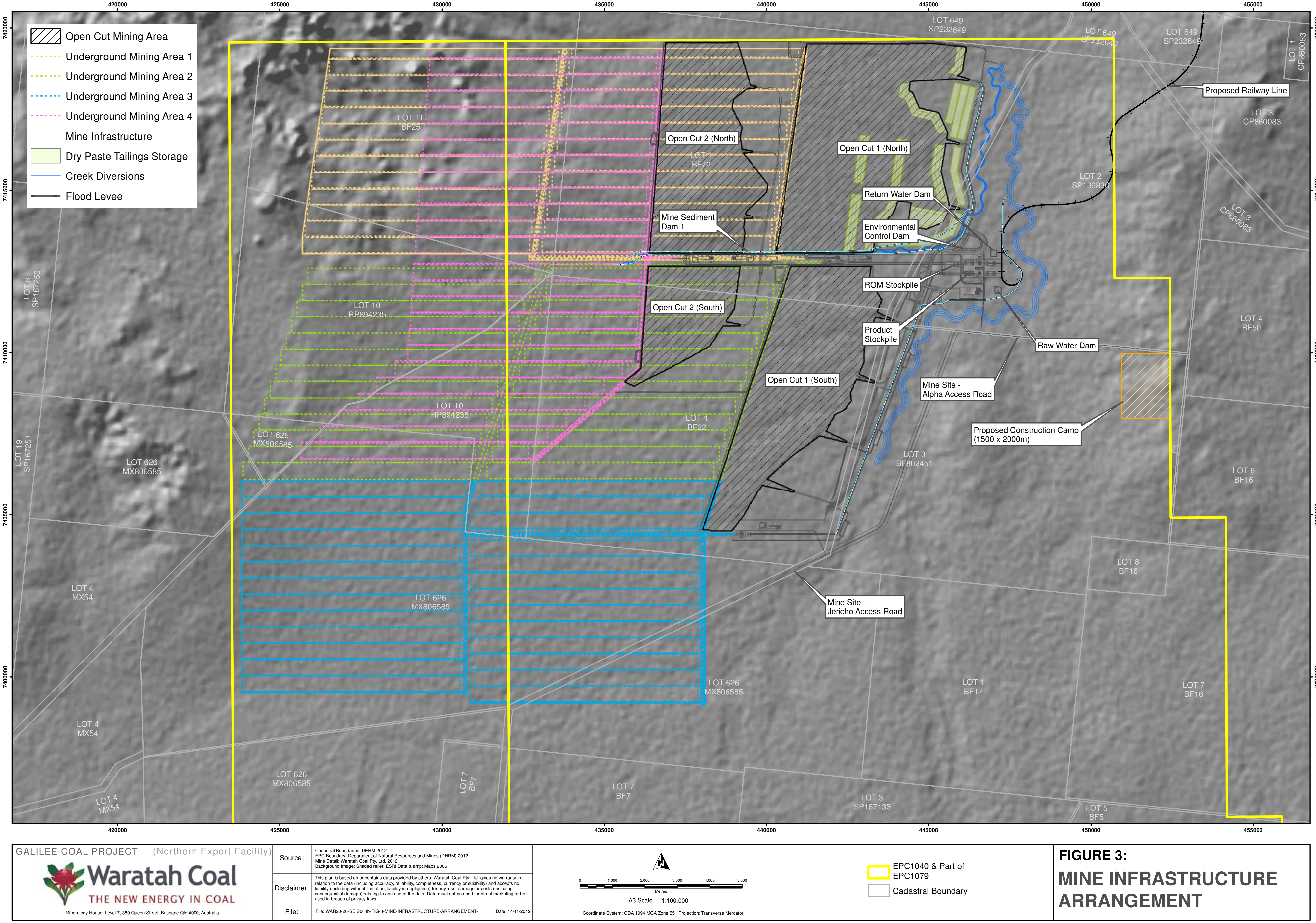


Figure 3. Mine site arrangement



An internationally recognised Australian engineering consultant with strong local experience in delivering successful infrastructure projects of this size will be engaged to assist the proponent with the development of the Project. As owners engineers they will be responsible for ensuring the design and construction phases of the Project are to Australian Standards and in line with the relevant legislative requirements. Waratah Coal is currently finalizing the shortlist of companies to undertake this role.

The Project management structure is shown in **Figure 5**.

Figure 4. Mineralogy Structure

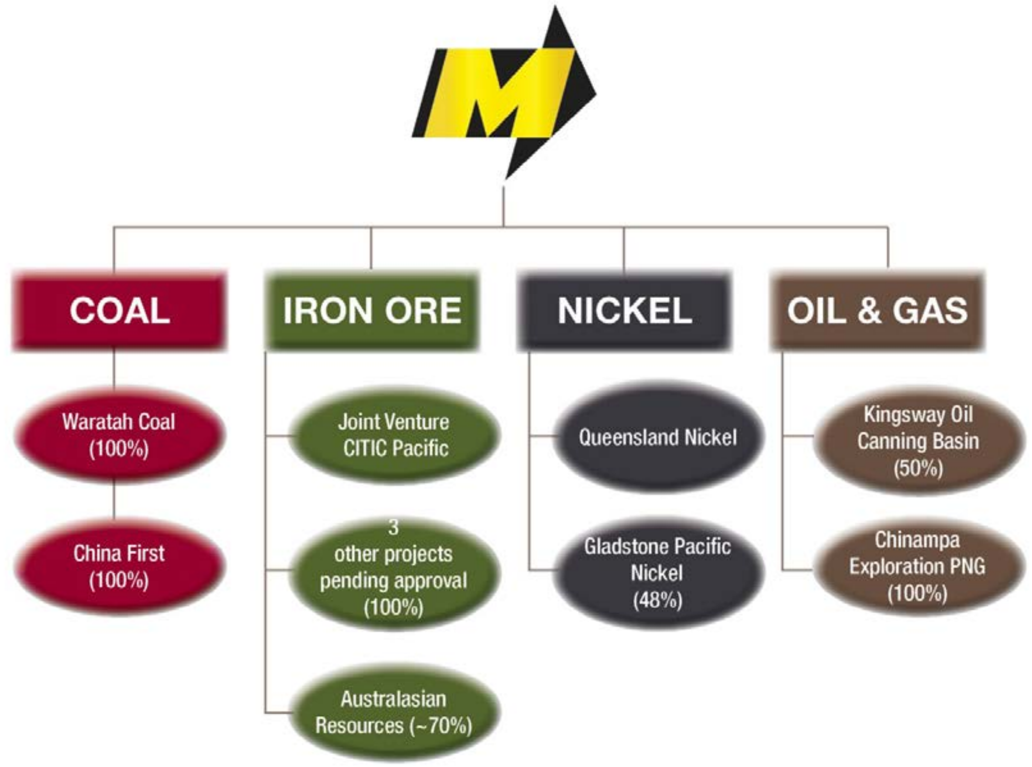
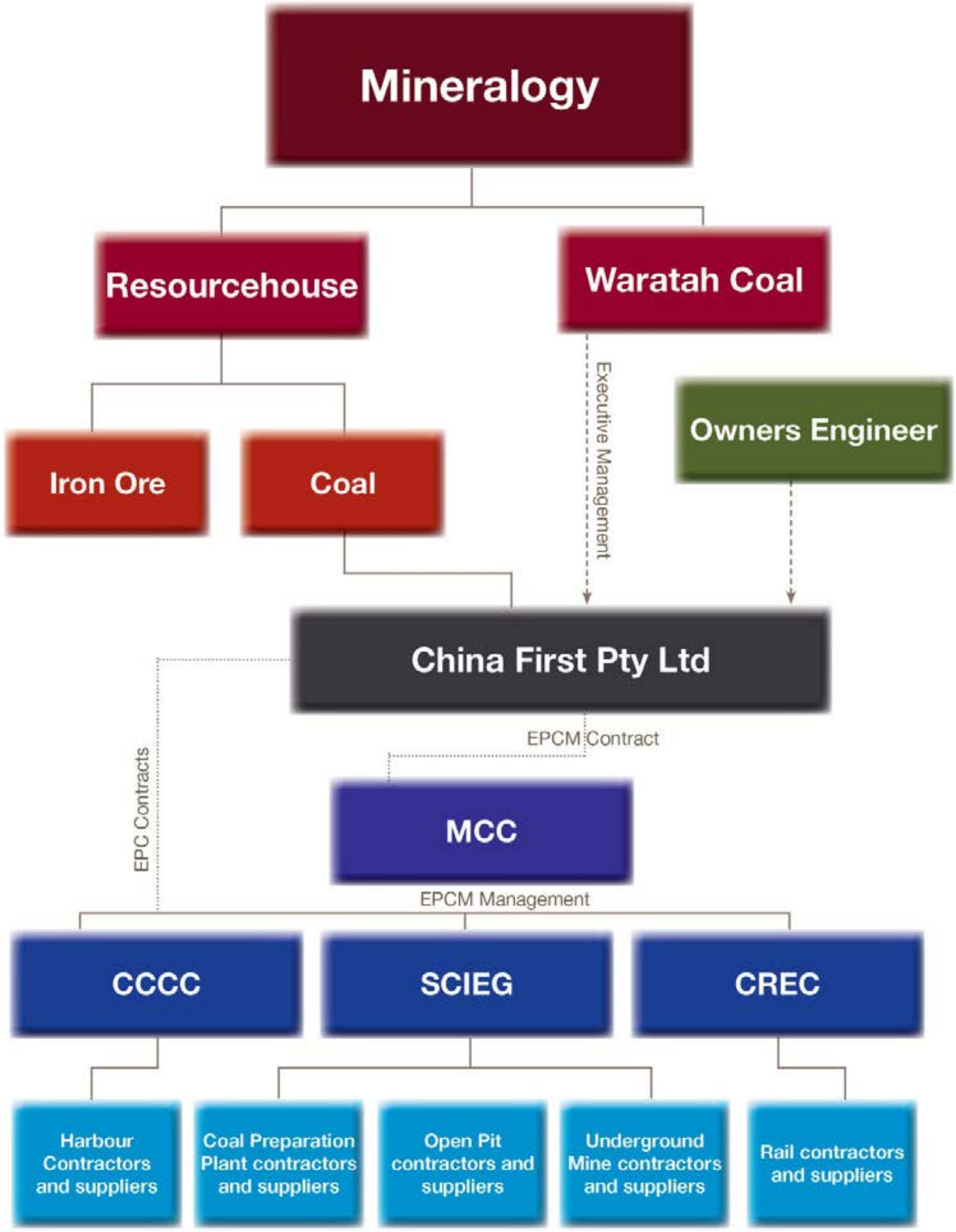


Figure 5. Project management structure



1.4 Land Use and Tenure

The current land tenure within the mine site is listed at **Table 1** and shown in **Figure 6**. A total of fifty-two separate allotments intersect EPC 1040 and EPC 1079. Of these, 11 separate allotments intersect MLA 70454 (as identified in **Table 1**). The predominant land tenure type is leasehold which comprises approximately 60% of existing tenure types. Freehold land comprises approximately 25% of tenure type with the remaining 15% held as either forest reserve or easements. Four distinct parcels of freehold land exist within the mine footprint, while an additional three parcels of freehold land are located just south-west of the footprint, but within the proposed Mining Lease boundary.

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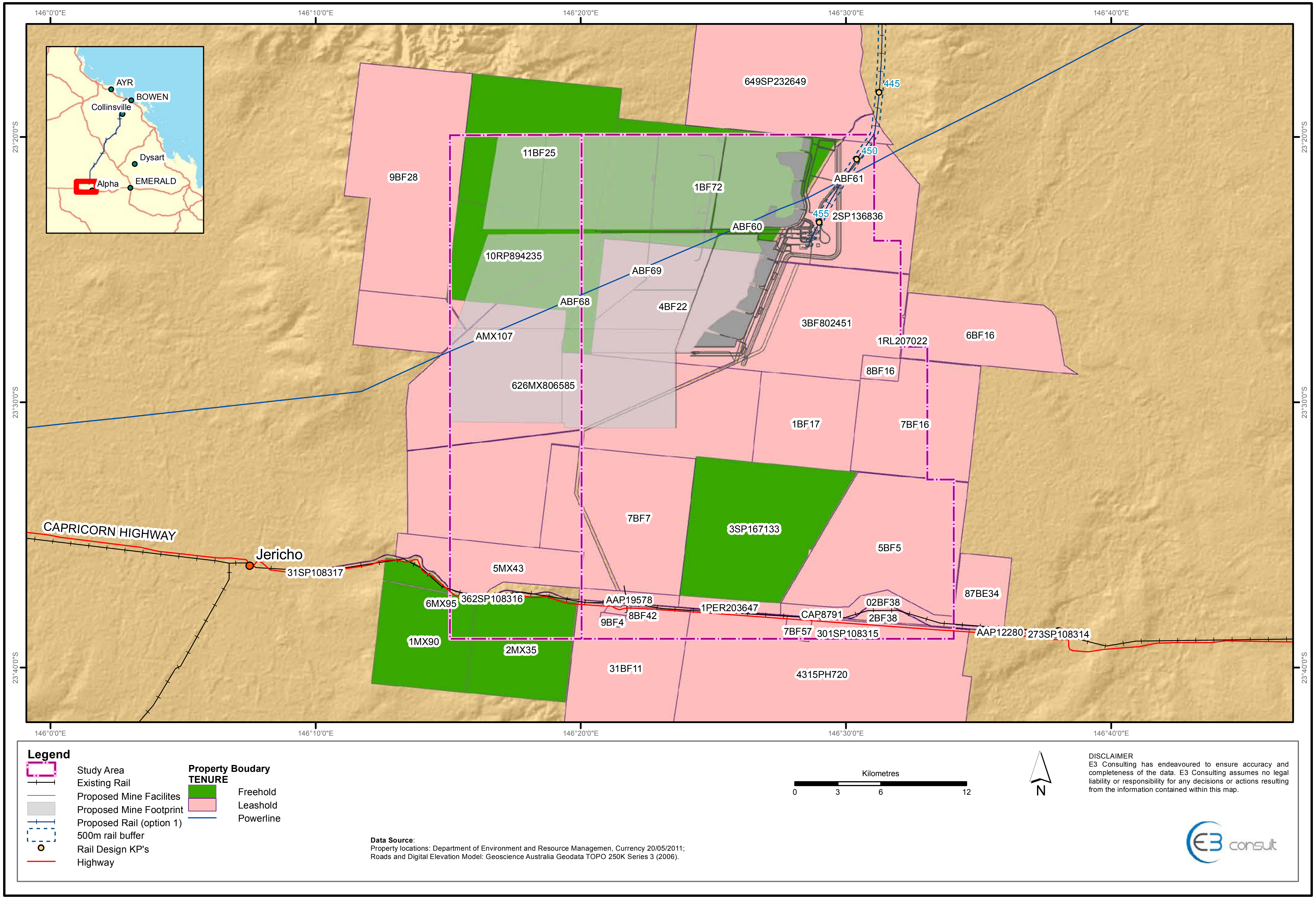
Table 1. Land tenure – Mine site

Lot and Plan Number	Tenure	Lot and Plan Number	Tenure
Lots intersecting MLA 70454 and EPCs (1030 and/or 1079)			
Lot 1 on BF17	Leasehold	Lot 5 on MX43	Leasehold
Lot 4 on BF22	Leasehold	Lot 626 on MX806585	Leasehold
Lot 11 on BF25	Freehold	Lot 10 on RP894235	Freehold
Lot 9 on BF28	Leasehold	Lot 1 on BF72	Freehold
Lot 7 on BF7	Leasehold	Lot 2 on SP136836	Leasehold
Lot 3 on BF802451	Leasehold		
Lots intersecting EPCs only (1030 and/or 1079)			
Lot A on AP12280	Leasehold	Lot A on MX107	Easement
Lot C on AP8791	Leasehold	Lot 2 on MX35	Freehold
Lot 87 on BE34	Leasehold	Lot 1 on MX90	Freehold
Lot 31 on BF11	Leasehold	Lot 6 on MX95	Freehold
Lot 6 on BF16	Leasehold	Lot 1 on PER203647	Leasehold
Lot 8 on BF16	Leasehold	Lot 649 on PH1981	Leasehold
Lot 7 on BF16	Leasehold	Lot 4315 on PH720	Leasehold
Lot 2 on BF38	Forest Reserve	Lot 1 on RL207022	Leasehold
Lot 2 on BF38	Leasehold	Lot A on RP612290	Easement
Lot 9 on BF4	Leasehold	Lot 273 on SP108314	Leasehold
Lot 8 on BF42	Forest Reserve	Lot 302 on SP108315	Forest Reserve
Lot 8 on BF42	Leasehold	Lot 303 on SP108315	Forest Reserve
Lot 5 on BF5	Leasehold	Lot 301 on SP108315	Leasehold
Lot 7 on BF57	Leasehold	Lot 362 on SP108316	Leasehold
Lot A on BF60	Easement	Lot 363 on SP108316	Forest Reserve
Lot A on BF61	Easement	Lot 361 on SP108316	Leasehold
Lot A on BF68	Easement	3Lot 64 on SP108316	Forest Reserve
Lot A on BF69	Easement	Lot 2 on SP136836	Leasehold
Lot 365 on SP108316	Forest Reserve	Lot 3 on SP167133	Freehold
Lot 31 on SP108317	Leasehold		

Figure 6. Land Tenure



1.5 Stakeholders

Waratah Coal has undertaken an extensive community consultation, public notification and stakeholder engagement process for the mine, which has identified a number of key project stakeholders. In addition to private and surrounding landowners and property managers, key stakeholders for the China First Project are listed in **Table 2** below.

Although not listed, an extensive range of industry, community and NGO Groups are also key stakeholders for the project and will continue to be consulted during the different stages of the Project.

Table 2. Key Stakeholders

Commonwealth and State Government
Department of Agriculture, Fisheries and Forestry
Department of Education, Employment and Workplace Relations
Department of Families, Housing, Community Services and Indigenous Affairs
Department of Human Services
Department of Industry, Innovation, Science, Research and Tertiary Education
Department of Infrastructure and Transport
Department of Resources, Energy and Tourism
Department of Sustainability, Environment, Water, Population and Communities
State Government
Department of Premier and Cabinet
Department of State Development, Infrastructure and Planning
Department of Treasury and Trade
Department of Health
Department of Education, Training and Employment
Department of Police and Department of Community Safety
Department of Transport and Main Roads
Department of Environment and Heritage Protection
Department of Natural Resources and Mines
Department of Energy and Water Supply
Department of Communities, Child Safety and Disability Services
Department of Aboriginal and Torres Strait Islander and Multicultural Affairs
Local Government
Barcaldine Regional Council
Isaac Regional Council
Whitsunday Regional Council
Central Highlands Regional Council
Blackall-Tambo Regional Council

Commonwealth and State Government
Mackay Regional Council
Central Highlands Development Corporation Ltd
Elected Federal and State Members
Member for Maranoa (Federal Government)
Member for Flynn (Federal Government)
Member for Capricornia (Federal Government)
Member for Gregory (State Government)
Indigenous representatives
Wangan and Jagalingou People

1.6 Standard Environmental Conditions

The mining activity will be subject to the conditions of an Environmental Authority (mining activities) and the conditions of a Mining Lease.

2. Project Description

The China First Project comprises an open cut and underground mining operation in the Galilee Basin, a new rail line connecting the mine to coal terminal facilities and use of coal terminal and port loading facilities in the Abbot Point State Development Area (APSDA) and the Port of Abbot Point.

The surface and underground mines will be supported by a purpose built Mine Infrastructure Area (MIA).

2.1 Coal Mine and Mine Infrastructure

The mine development will involve the mining of 20 Mtpa from open cut operations and 36 Mtpa from underground operations for a total Run-of-Mine (ROM) coal extraction of 56 Mtpa. The annual coal production of 56 Mtpa ROM will be washed in two coal handling and preparation plants (CHPP) for the export market with an overall product yield of 72% to produce 40 Mtpa of highly volatile, low sulphur, steaming coal to international markets. Processed coal will be transported by a new railway system that runs from the mine to the existing Port of Abbot Point and the APSDA. Due to uncertainty regarding the location of the future stockpiling and loading facilities, the limit of the assessment is the boundary of the Abbot Point State Development Area. As such, the length of the rail alignment is 453 km. The overall mine arrangement will incorporate the following operations producing raw coal:

- one open cut mine comprising two surface mining pits (North and South) in the B seam producing 10 Mtpa total:
- one open cut mine comprising two surface mining pits (North and South) in the C and D seam resources producing 10 Mtpa totalone long wall underground mine in the B seam producing 9 Mtpa
- three long wall underground mines in the C and D seam resources producing 27 Mtpa total
- raw coal stockpiles at the location of the underground mines
- haulage roads to deliver raw coal from the surface mines to crushing and stockpile facilities
- three overland conveyor systems to transport raw coal to the coal processing plants
- three raw coal stockpiles to feed the coal preparation plants while providing blending capability
- two coal preparation plants with a raw washing capacity of 28 Mtpa
- two product coal stockpiles handling product coal to rail load out facilities
- topsoil stockpiles and out of pit overburden spoil sites to create initial surface mining pit space
- water management structures including raw water and environmental dams, creek diversions, levee banks/bunds, drainage channels and sediment traps
- Tailings Storage Facilities (TSF) and coarse spoil disposal areas integrated into the mine spoil pile areas
- refuelling and maintenance facilities
- access roads, power lines and other services located in a central services corridor transgressing the entire resource area

- a Mine Industrial Area (MIA) incorporating mine support activities such as, rail freight unloading and bunkering, welding shops, light vehicle servicing, specialist maintenance contractors' workshops and offices, warehousing, bulk fuel and other mine consumables storage, tyre fitting and repair, training and conference centres
- facilities including: main workshop, stores, administration buildings, a mine office, communications, security building, emergency services building, tyre bay, ancillary mining vehicle workshop, vehicle wash facilities and associated amenities
- accommodation village
- fuel, oil, and explosives storage facilities.

The surface mining method will be a combination of walking draglines for overburden removal in conjunction with truck and shovel fleets for partings removal and coal recovery.

An additional overburden removal system utilising large electric rope shovels loading onto overburden conveyors will also be used in conjunction with the draglines. This configuration offers the flexibility to create additional pit space by moving overburden over longer distances rather than through the use of walking draglines without the expense of truck and shovel fleets to achieve this.

The underground mining system is based on large scale long wall mining with each mine accessing the underground resource at 120 m depth through two cross measure drifts and a ventilation shaft.

The benign structural geology of the Galilee Basin offers an opportunity to mine 7 km long blocks with a 450 m wide long wall face. Extraction height of the long wall faces will vary from 1.8 m to 2.5 m depending on the constraints of seam geology.

2.2 Mining Sequence

2.2.1 Open Cut Mining Development Sequence

Mining operations will commence with vegetation clearing and topsoil removal using scrapers and other earthmoving machinery. Topsoil will be placed on dedicated topsoil stockpiles dumps or placed directly onto reshaped final landforms if available.

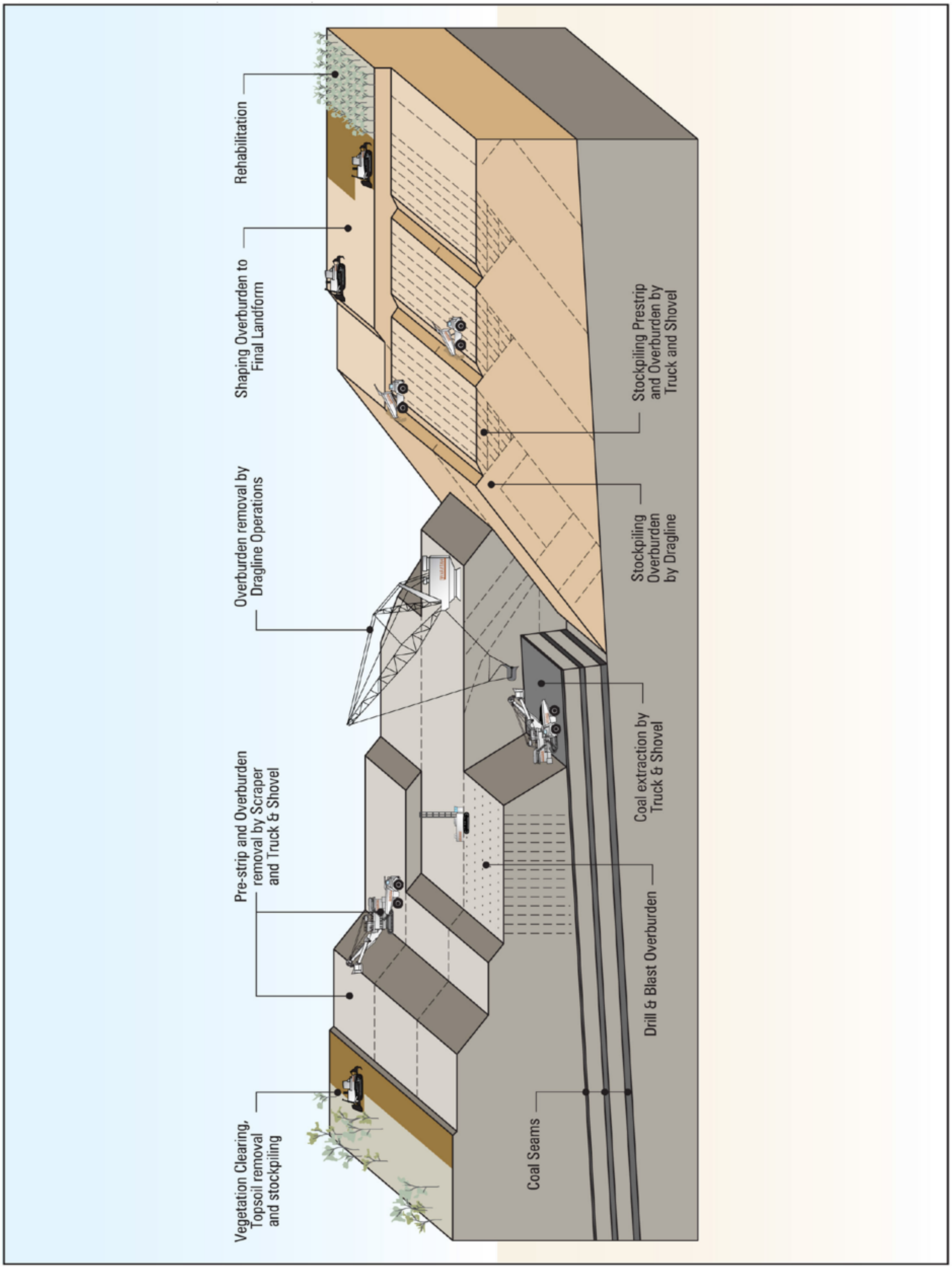
The upper portion of the Tertiary overburden (where available) will be free dug and removed with a scraper and dozer and a truck and shovel fleet. Where Tertiary capping rock and Permian materials become competent and digging operations cease, a drill and blast operation will be utilized to fracture strata. The blast operation optimizes overburden removal by throw blasting prime material into the previous open cut void. The blasted Permian material thrown into the previous open cut void provides a substantial founding base for overburden spoil to be safely sited and anchored.

The dragline will then enter the strip, with the material used to extend the initial dragline bench. Any tertiary material will be kept high in the bench and therefore will not result in a weak spoil pile floor. The dragline will begin to remove the main Permian waste from above the coal seams, with the remainder of the material above the top coal seam removed and used to build the spoil pile. The final material to be removed from the dragline block will be from the low wall and coal seam edge, as is shown in **Figure 7.** The dragline will then move back to the high wall area to begin excavation of the next mining block.

The coal mining fleet consisting of excavators, front end loaders and trucks will then mine the coal seams, with the coal hauled to the CHPP for washing. Inter-burden waste between the main coal seams will be blasted and the waste mined by the excavators and hauled by trucks to spoil dumps in the previous strips. The next coal seam will be mined in the block, with the coal mining and parting operation planned to be performed in a series of sections up to 200 m in length along the pit.

The completed pit will then be available for the next strip's overburden activities to begin the mining sequence again as described above. Progressive rehabilitation can be undertaken once the overburden stockpiles are reshaped by bulldozers and scrapers and the topsoil has been spread.

Figure 7. Initial Mine Concept Plan for the Open Cut Activities



2.2.2 Opencut Mine Development Schedule

A 25-year production schedule has been developed to produce 20 Mtpa ROM. Initially this is achieved by allocating two draglines to the D North pit, one dragline in the D South pit and one in the B North pit. Each dragline is scheduled to uncover five Mtpa. In the latter years, the draglines will be moved around to balance the ratio of coal from the D and B pits.

Not all the mining blocks will be extracted in the B north and B south pits during the 25 year mine plan. Coal access ramps will be opened up as required, with the two most southerly ramps in the D south pit not required until year 14 and 15.

The mining sequence is shown in **Figure 8.**

Open cut stage plans have been developed to show the progress of the mine and the spoil dumps for milestone years – 1, 5, 10 and 20. Stage plans are shown in **Figure 9** to **Figure 12**

Out of pit spoil dumps have been designed with sufficient capacity for the initial ramp, boxcut strips and the tertiary unit of the second strip after the boxcut, and a maximum height of 40 m above ground level. After the out of pit spoil dumps are filled up, the spoil then progresses into mined out strips with a maximum height of 40 m above ground level. It is envisaged that most progressing spoil dumps will be at heights between natural ground level and the 40 m above ground, depending on the split of dragline spoil or truck shovel spoil.

The main coal access ramps will be regraded regularly with the inter-burden spoil between the coal seams. It is anticipated that final voids with depths up to 120 m will remain in each of the four open cut pits at the completion of mining.

Figure 8. Opencut Mining Sequence

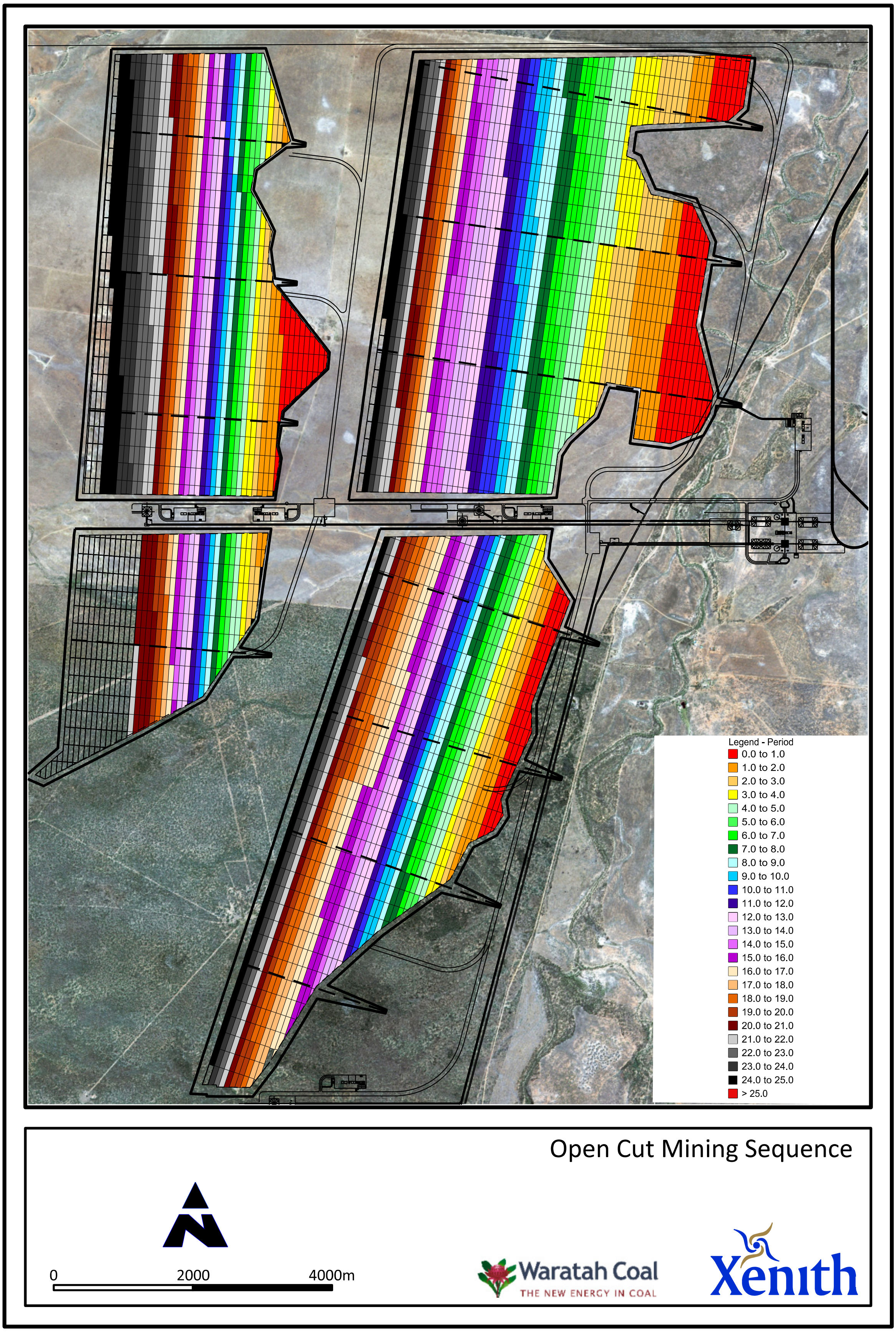


Figure 9. Opencut Year 1 Stage Plan

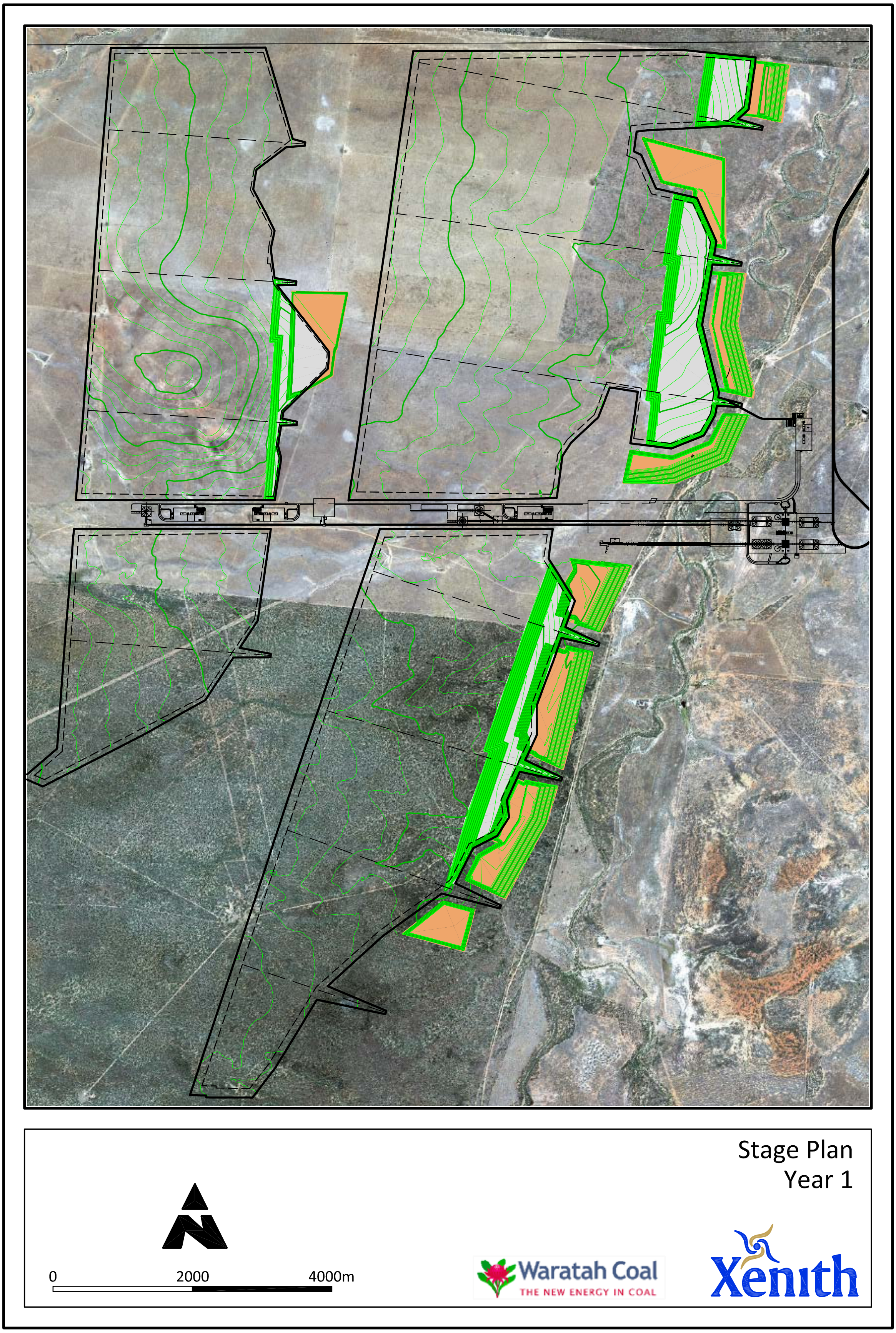


Figure 10. Opencut Year 5 Stage Plan

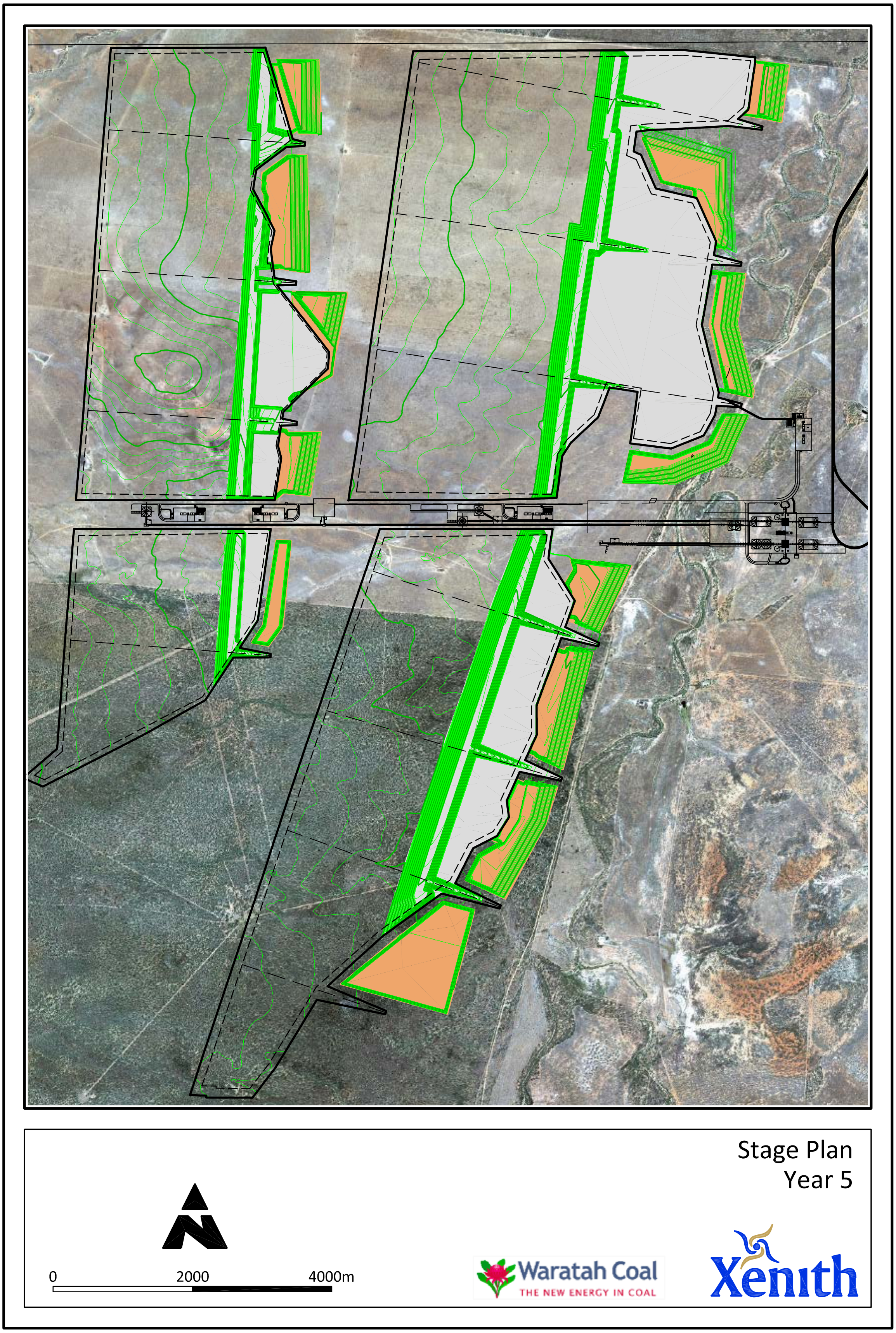


Figure 11. Opencut Year 10 Stage Plan

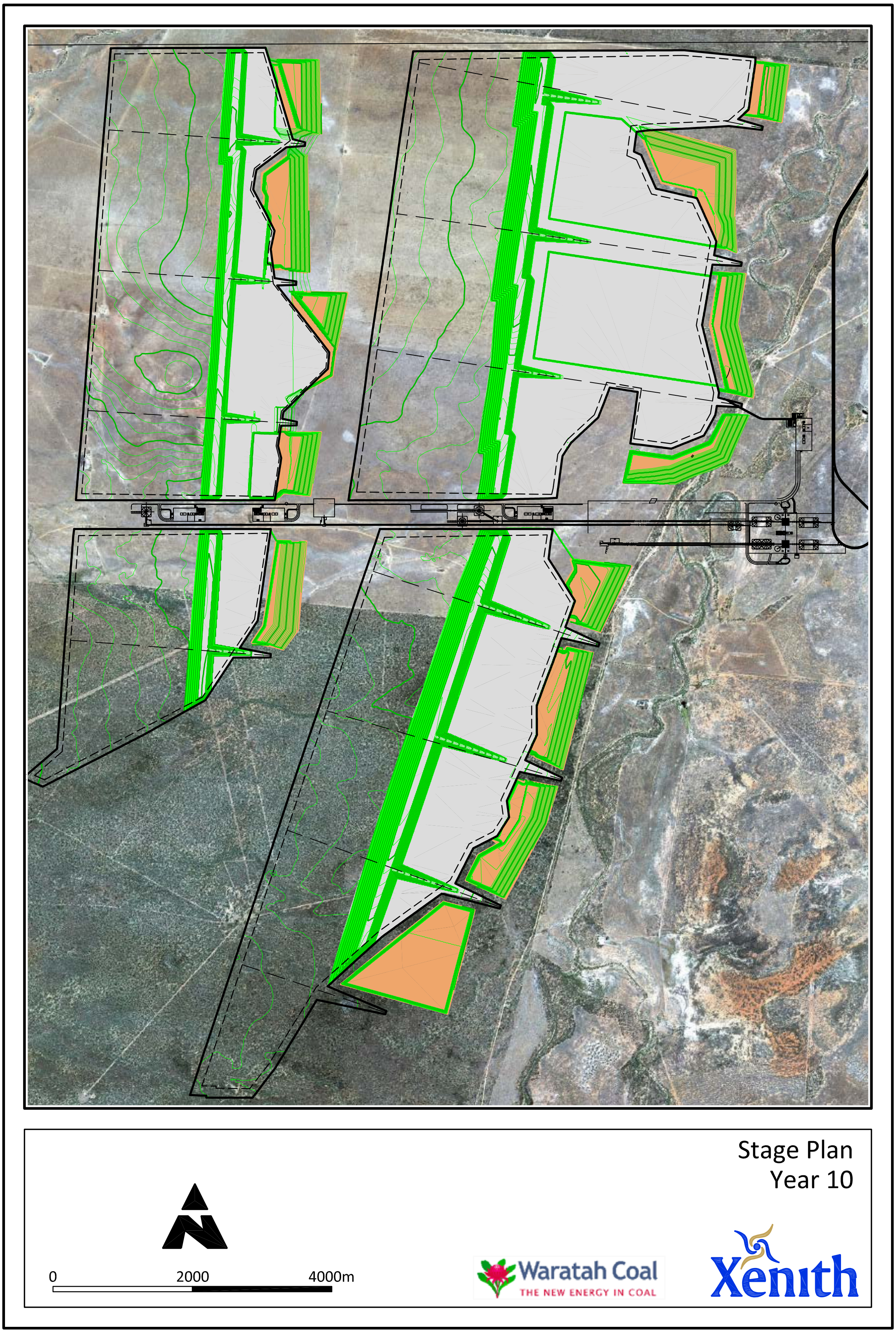


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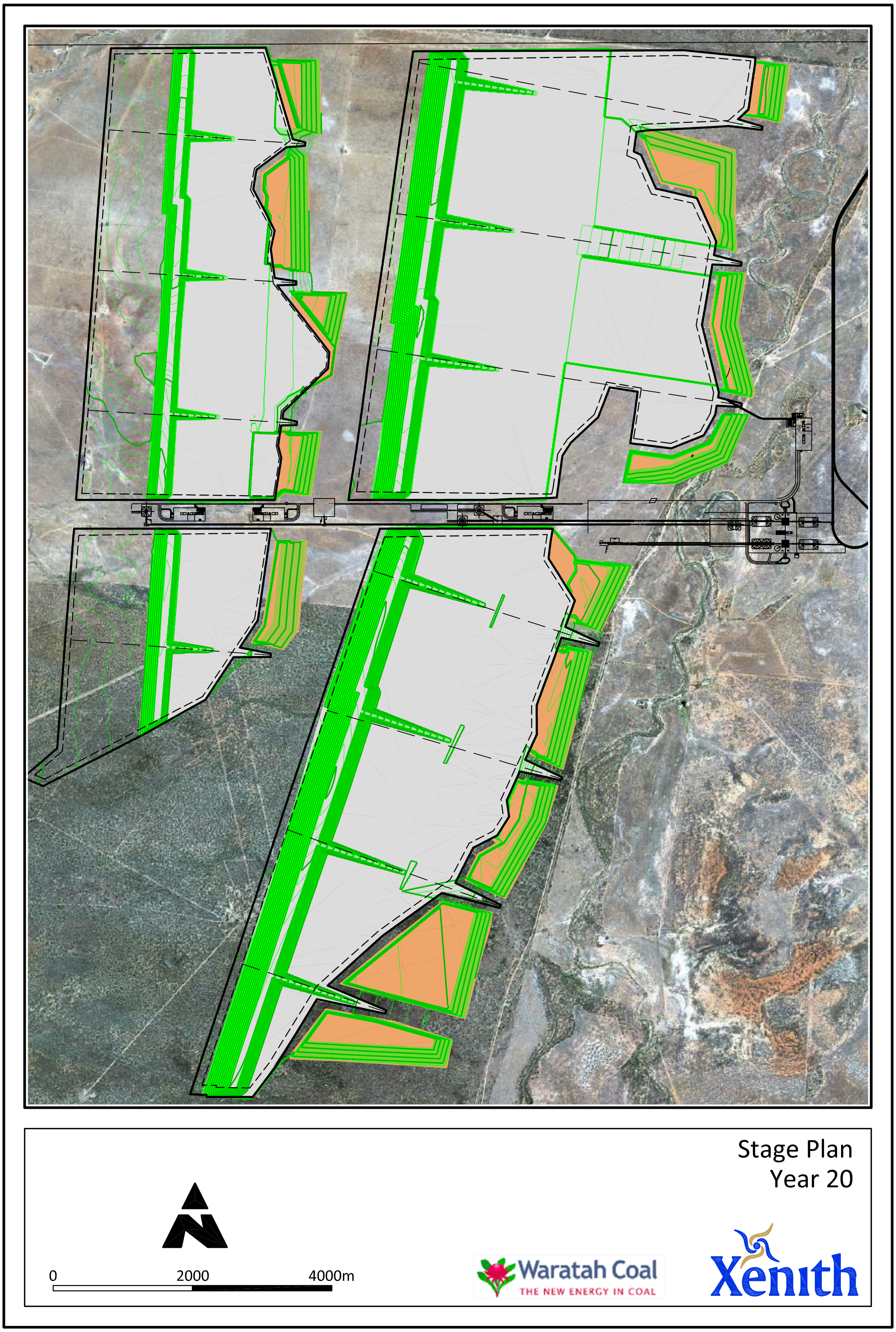
Figure 12. Opencut Year 20 Stage Plan



2.2.3 Underground Mining Development Sequence

The development of the underground mines will be initiated via inclined drifts down from the surface, with three drifts per mine. These drifts will separately service personnel and materials, the conveyor and ventilation, and will begin on the surface near the open cut mining areas, and develop in an east-to-west direction to meet the coal seams below ground.

Once the drifts have reached the coal seams, main development headings (consisting of five roadways running parallel to each other) will be developed in order to reach to mining areas for all the subsequent longwall blocks.

The initial production stage of longwall mining involves the development of roadways around the blocks of coal. The roadways are required to provide employee access, machine access, ventilation, electrical supply, communications systems, services lines and coal transport. They are known as “gateroads”, and also define the boundaries of the block.

The development roadways remove only a minor portion of the coal seam area, and are designed to maintain stability during both the development and longwall extraction phases. The roadways support mechanical strata control, which is not intended to fail or converge significantly during the life of the mine. Consequently, there are no subsidence impacts from development roadway workings (“first workings”).

The value of coal extracted with the associated development of roadways does not meet mining costs of extracting this coal. However, the economic returns from investing in roadway development result from the subsequent longwall extraction, utilising previously developed roadways.

Longwall face equipment is installed at the end of the longwall block furthest away from the main headings, allowing coal extraction to proceed in a “retreating” method back towards the main headings. Upon completion of the mining of each block, the longwall equipment will locate back to the other end of the next block in the series, and the mining process repeats.

Longwall mining removes the blocks of coal between the developed roadways. Longwall shearing machinery travels back and forth across the coalface in each block. This machine (“shearer”) cuts the coal from the coalface on each pass and a face conveyor, running along the full length of the coalface, carries this away to discharge onto a belt conveyor. A series of belt conveyors then carry the coal out of the mine.

The section in front of the coalface is held up by a series of hydraulic roof supports. These temporarily hold up the roof strata, and enable enough space for the shearer and face conveyor. After each slice of coal is removed (typically one m in width), the face conveyor, hydraulic roof supports and the shearer are moved forward. As the hydraulic roof support moves forward the overlying strata (“roof”) behind the equipment collapses into the void, creating what are known as the ‘goaf’ areas. The extent of the overlying strata collapse and the associated shearing and cracking of the strata depends upon the strata geology, the longwall block width, the seam height extracted, and the depth of cover.

Due to the breaking up and swelling of the rock mass into this void, the amount by which the overlying strata subsides is less than the height of the coal extracted, with the amount of subsidence movement decreasing with height above the coal seam.

The five year underground development sequence for the B and D seams are shown in **Figure 13** and **Figure 14** respectively.

Figure 13. B Seam Mine Development - 5 Year Intervals

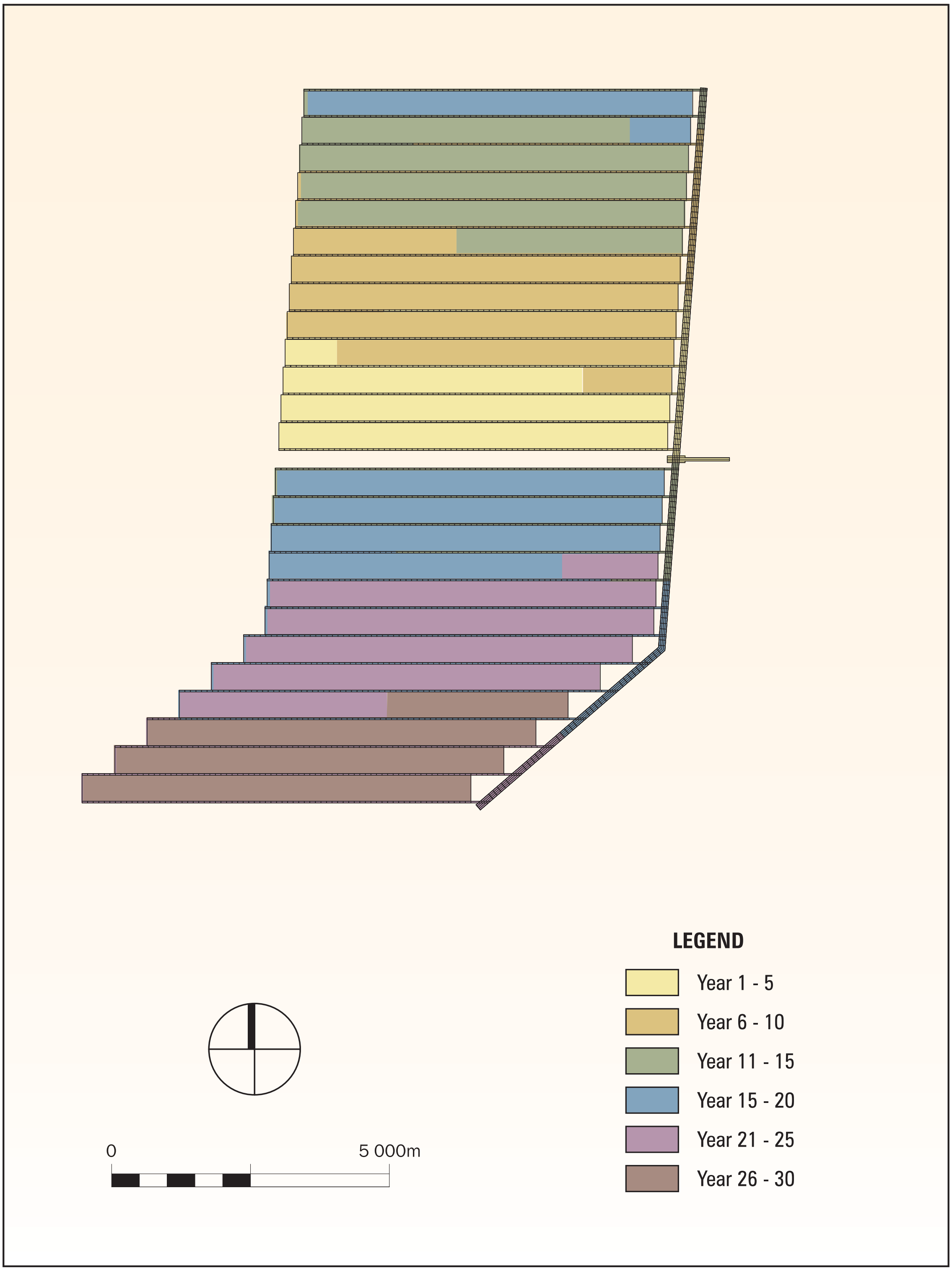


Figure 14. D Seam Mine Development - 5 Year Intervals

2.3 Coal Processing and Handling

The CHPP facility will operate at a nominal plant feed rate of 8,000 tph as received (AR) to target the required annual plant feed rate of 56 Mtpa ar with a full plant operating hours design allowance of 7,000 hours (h). To maximise modular throughput for the proposed CHPP a desliming screen aperture of two millimetres (mm) chosen and (at this aperture), a capacity of approximately 1,000 tph / module should be achievable for the range of likely feed types to the plant. This modular capacity and the requirement for dual rail load out loops dictated the arrangement for the CHPP facility would be two plants each consisting of four 1,000 tph modules.

A single conveyor will feed each of the two plants and this will require a suitable feed distribution system to be installed to evenly distribute the feed tonnage across the four modules in each plant. The feed will become slurry at this point through addition of water to transport and optimise feed conditions to the desliming screens.

The function of the desliming screen is to remove sub-sized particles (-2.0 millimetre (mm) material) from, and dewater, the dense medium cyclone feed (+2.0 mm material). Screening is achieved by presenting particles to the screen deck surface and moving particles smaller than the aperture through the sieve surface. Vibration of the screen assists this process by stratifying the bed, giving particles more opportunity to present to the screen surface.

The CHPP will be based on conventional wet beneficiation processes using proven technology that is used extensively throughout the Australian coal industry. The 2 mm coarse coal fraction will be beneficiated in dense medium cyclones. In this process the 2 mm material from the desliming screens is mixed with a magnetite / water medium and pumped to a single large diameter dense medium cyclone in each module. Dense medium cyclones separate based on density with the high-density non-coal material reporting to coarse rejects and the lower density coal reporting to product after dewatering in coarse coal centrifuges.

The 2.0 mm raw coal slurry from the desliming screens is pumped to classifying cyclones in each module that remove the 0.125 mm material and the bulk of the water from this stream. The <-2 to +0.125> mm fine coal fraction will be beneficiated using spirals in a water based separation. Spirals product is dewatered in fine coal centrifuges and reports with the dense medium cyclone plant product conveyor. Spirals reject is dewatered on high frequency screens with the coarse spirals reject particles reporting with the dense medium cyclone reject conveyor and the fine spiral reject particles reporting to the tailings thickener.

The sub 0.125 mm material will be discarded to tailings due to the high operating / capital costs and low marginal value typically associated with coal in this size fraction. The sub 0.125 mm particles are conditioned with flocculants, a process carried out within thickening tanks. The thickening process forms an aqueous tailings slurry allowing tailings to be transported via a pipe network to a filter press system. There will be four 48 m diameter tailings thickeners installed as part of this project.

The filter press method utilizes filter press belts to dewater tailings to produce tailings paste. The paste is then conveyed to a stock pile ready to be loaded onto trucks using frontend loaders. The tailings paste will be loaded onto trucks and transported to containment cells within the spoil piles where it will be dumped and track rolled by dozers, together with coarse rejects. The tailings storage facilities within spoil areas will be clay lined and clay capped to be later topsoiled and rehabilitated. Compaction of tailings paste and rejects will minimize oxidization, exposure to water and seepage.

Run off water will report to pit voids and be recycled for coal processing.

The plant will be controlled from a single computerised control room. The control room is part of a building separated from the CHPP, but adjacent to the CHPP, which also houses all the power supply and motor control panels and PLC hardware.

2.4 Mine Rehabilitation

The proposed post-mine land use for disturbed areas is a mosaic of self sustaining vegetation communities and grazing land, containing native tree, shrub and grass species, and improved pasture species as appropriate.

The criteria for achieving self-sustaining final landforms will be developed during the operation as part of the Closure Plan for the project, considering the results of site-specific rehabilitation trials, monitoring and research programs.

The design of spoil dumps is an important part of the mine rehabilitation. These will be constructed in lifts of between 10 to 20 metres (m), and final dump slopes, where practical, will be regraded to an average of 10% slope or less, with contour drainage benches retained between the lifts at suitable intervals. Local plant species will be included in the seed mix to be applied to the landforms so as to restore elements of the pre-mining vegetation communities to the rehabilitated floral assemblages. The main features of the progressive rehabilitation process are:

- Construction of a stable final landform consisting of out of pit spoil dumps, in pit spoil dumps and rehabilitated final voids
- progressive construction of dumps to final landform design, to minimise reshaping at the end of mining
- immediate respreading of suitable topsoil across available reshaped areas or stockpiling until suitable reshaped areas are available
- contour ripping immediately after topsoil placement to control erosion
- seeding with an appropriate seed mix prior to the wet season to maximise the benefits of subsequent rainfall
- application of appropriate fertiliser for plant establishment if required
- respreading cleared vegetation on rehabilitated land
- managing direct rainfall and runoff from the rehabilitated landform in sediment dams and in rehabilitated final voids.

2.5 Environmentally Relevant Activities

The *Environmental Protection Act 1994* (EP Act) is administered by the Department of Environment and Heritage Protection (DEHP). It provides the framework to managing Queensland's environment within the principles of ecologically sustainable development. The EP Act outlines the responsibility and the duty of care all persons have to the environment. Under the Act, an approval is required for activities that could cause actual or potential environmental harm by the generation of emissions or through carrying out the activity, could cause contamination or are listed as 'other notifiable activities'. Particular activities, known as Environmentally Relevant Activities (ERAs) as defined under Schedule 2 to the Environmental Protection Regulation 2008.

ERAs likely to be carried out during the construction and operational phases of the project are outlined in **Table 3**. These ERAs will be approved under the Environmental Authority for the Project, except where the activity occurs outside of the mining lease area, which will then require a development permit granted under the *Sustainable Planing Act*.

Table 3. ERA relevant to the China First Coal Mine

Environmentally Relevant Activity	Trigger
ERA 8 Chemical Storage	3 Storing the following total quantity of chemicals of class C1 or C2 combustible liquids under AS1940 or dangerous goods class 3: $10m^3$ to $500m^3$
ERA 14 Electricity generation	2. Generating electricity by using a fuel, other than gas, at a rated capacity of: 10MW electrical to 150MW electrical
ERA 17 Abrasive blasting	Cleaning equipment or structures on a commercial basis using a stream of abrasives in either a wet or dry pressure stream.
18 Boilermaking or engineering	Boilermaking, assembling, building or manufacturing a total of 200t or more of metal product in a year.
21 Motor vehicle workshop operation	Operating a workshop on a commercial basis or in the course of carrying on a commercial enterprise involving any of the following relating to motor vehicles: maintaining mechanical components, engine cooling radiators or body panels;
ERA 31 Mineral Processing	2(b) Mineral processing; >100,000t/yr
ERA 60 Waste Disposal	1 Operating a facility for disposing of, in a year, the following quantity of waste (any combination of regulated waste, general waste and limited regulated waste — and <5t untreated clinical wastes if in a scheduled area): less than 50000t
ERA 63 Sewerage Treatment	2 Operating sewage treatment works, other than no-release works, if treated effluent is discharged from the works to an infiltration trench or through an irrigation scheme, with a total daily peak design capacity of: b) more than 100 to 1500EP; c) more than 1500 to 4000EP;

3. Environmental Values, Impacts, Commitments and EA Conditions

3.1 Content of the Section

This EM Plan was compiled by following the process outlined in the Guidelines published by the Queensland DEHP. This process is shown in **Figure 15**.

Figure 15. Flowsheet for the preparation of an EM Plan – DEHP Guidelines

Identification of **environmental values** through detailed site investigations

↓

Identification of **potential impacts on environmental values** identified

↓

Development of **environmental protection objectives** to minimise potential impacts

↓

Development of environmental commitments including **control measures** to achieve the stated objectives

↓

Development of **proposed environmental authority conditions** to be included in the environmental authority

The guiding definitions for the terms that are used throughout the EM Plan are as follows:

Environmental Values: Environmental values are those qualities or physical characteristics of the environment that are conducive to ecological health, public amenity or safety.

Section 9 of the EP Act describes an Environmental Value as:

- a quality or physical characteristic of the environment that is conducive to ecological health or public amenity or safety; or
- another quality of the environment identified and declared to be an environmental value under an environmental protection policy or regulation."

Environmental Protection Objectives: Describes the key elements of the environment and the outcomes to be protected in order to minimise impacts on the environmental values.

Control Strategies: Provide a contextual framework for the proposed Environmental Authority conditions and describe the strategies proposed to meet the environmental protection objectives.

Proposed Environmental Authority Conditions: These are draft conditions containing measurable indicators and standards that are proposed to be included in the Environmental Authority to protect identified environmental values that may be impacted on by the Project.

Indicators: These are the indicators by which the level of achievement of the environmental protection objectives can be determined, in a measurable and auditable way.

Standards: These are numerical standards for each of the indicators by which adequate levels of achievement of the environmental protection objectives and protection of the environmental values can be determined.

3.2 General Conditions

There are a number of general issues that do not relate to environmental values or control strategies, but are to be included in the Environmental Authority. Conditions of the Environmental Authority are proposed here for 'Schedule A – General Conditions'.

General Conditions

(A1) The environmental authority holder must provide to the administering authority financial assurance for the amount and in the form acceptable to the administering authority in accordance with the most recent edition of the administrative authority's Guideline – Calculating financial assurance for mining projects, before the proposed mining activities can commence or be varied.

(A2) The amount of the financial assurance must be reviewed by the holder of this environmental authority when a plan of operations is amended or replaced or the environmental authority is amended.

Coal extraction

(A3) The environmental authority holder is approved for a coal extraction rate of up to 56 million tonnes per annum (mtpa) of run-of-mine (ROM) ore in accordance with this environmental authority.

Maintenance of measures, plant and equipment

(A4) The environmental authority holder must:

a) install all measures, plant and equipment necessary to ensure compliance with the conditions of this environmental authority

b) maintain such measures, plant and equipment in a proper and efficient condition

c) operate such measures, plant and equipment in a proper and efficient manner.

(A5) No change, replacement or alteration of ant plant or equipment is permitted if the change, replacement or alteration increases, or is likely to substantially increase the risk of unlawful environmental harm caused by the mining activities.

Monitoring and records

(A6) Except where specified otherwise in another condition of this authority, all monitoring records or reports required by this environmental authority must be kept for a period of not less than five years.

(A7) Upon request from the administrative authority, copies of monitoring records and reports must be made available and / or provided to the administering authority's nominated office within ten business days or by an alternative timeframe agreed between the administering authority and the holder.

(A8) Any management or monitoring plans, systems or programs required to be developed and implemented by a condition of this environmental authority must be reviewed for effectiveness in minimizing the likelihood of environmental harm on an annual basis, and amended promptly if required, unless a particular review date and amendment program is specified in the plan, system or program.

Notification of Emergencies, Incidents and Exceptions

(A9) The holder of this environmental authority must notify the administering authority by written notification within 24 hours, after becoming aware of any emergency or incident which results in the release of contaminants not in accordance, or reasonably expected to be not in accordance with the conditions of this environmental authority.

(A10) The holder of this environmental authority must notify the administering authority by written notification within 24 hours, after becoming aware of any emergency, incident or information about circumstances which results or may result in environmental harm not in accordance with the conditions of this environmental authority or a contravention of the conditions of this environmental authority.

(A11) Not more than ten business days following the initial notification of an emergency, incident or information about circumstances which result or may result in environmental harm or the release of contaminants, written advice must be provided to the administering authority in relation to:

a) available results and interpretation of any samples taken and analysed

b) proposed actions to prevent a recurrence of the emergency or incident.

(A12) The notification in Condition A9 and Condition A10 must include, but not be limited to, the following:

a) the environmental authority number and name of the holder

b) the name and telephone number of the designated contact person

c) the location of the emergency or incident

d) the date and time of the emergency or incident

e) the time the holder of the environmental authority became aware of the emergency or incident

f) where known:

i. the estimated quantity and type of substances involved in the emergency or incident

ii. the actual or potential cause of the emergency or incident

iii. a description of the nature and effects of the emergency or incident including environmental risks and any risks to public health or livestock

g) any sampling conducted or proposed, relevant to the emergency or incident

h) immediate actions taken to prevent or mitigate any further environmental harm caused by the emergency or incident

i) what notification of stakeholders who may be affected by the emergency or incident has occurred or is being undertaken.

Risk Management

(A14) The holder of the environmental authority must develop and implement a risk management system for mining activities which conforms to the Standard for Risk Management (ISO31000:2009) within three months of the issue of the environmental authority.

Note: Implementation of a risk management system is not a defence against a breach of any other condition of this environmental authority.

Emergency response and contingency planning

(A15) An emergency response / contingency plan must be developed and implemented within the current plan of operations to manage unacceptable risks identified in the risk management system of the associated monitoring.

(A16) The emergency response / contingency plan must address the following matters:

a) response procedures to be implemented to reduce the likelihood of environmental harm arising from incidents of unacceptable risk

b) response procedures to minimise the extent and duration of environmental harm by an incident

c) the practices and procedures to be employed to restore the environment or mitigate any environmental impact caused

d) a description of the resources to be used to respond to incidents

e) the training of staff that will be called upon to respond to incidents

f) procedures to investigate the cause of any incidents, including releases and where necessary, implement remedial actions to reduce the likelihood of recurrence of similar events

g) the provision and availability of documented procedures to staff attending any incident to enable them to effectively respond

h) timely and accurate reporting of the circumstance and nature of incidents to the administering authority.

Third party audit

(A17) The holder of the environmental authority must nominate an appropriate third party auditor to audit compliance with the conditions of this environmental authority within one year of the commencement of this environmental authority, and then at regular intervals not exceeding three years.

(A18) The holder must, at its cost, arrange for the independent certification by a third party auditor of the findings of the audit report required under Condition A15.

(A19) Within ninety days of completing the audit, provide a written report to the administering authority detailing any non-compliance issues that were found (if no non-compliance issues were found this should be stated in the report). If non-compliance issues were found the report must also address:

a) actions taken by the holder of this environmental authority to ensure compliance with this environmental authority

b) actions taken to prevent a recurrence of non-compliance.

(A20) Where a condition of this environmental authority requires compliance with a standard published externally to this environmental authority and the standard is amended or changed subsequent to the issue of this environmental authority the holder of this environmental authority must:

a) comply with the amended or changed standard within three years of the amendment or change being made, unless a different period is specified in the amended standard or relevant legislation

b) until compliance with the amended or changed standard is achieved, continue to remain in compliance with the standard that was current immediately prior to the relevant amendment or change.

Activity

(A21) Land subject to mining activities and early works must be rehabilitated to a non-polluting, safe, stable and self-sustaining landform.

(A22) Contaminants must not be released to the receiving environment unless they are in accordance with the contaminant limits authorized by the environmental authority.

(A 23) This environmental authority authorizes environmental harm referred to in the conditions. Where a condition or this environmental authority is silent on a matter, the lack of a condition or silence does not authorize environmental harm.

Community – General

(A 24) The holder of this environmental authority must record the following details for all complaints received and provide the information to the administering authority:

a) name, address and contact number for the complainant

b) time and date of complaint

c) investigations undertaken

d) conclusions formed

e) actions taken to resolve the complaint

f) any abatement measures implemented

g) person responsible for resolving the complaint.

(A 25) The holder of this environmental authority must, when requested by the administering authority, undertake relevant specified monitoring within a timeframe nominated or agreed to by the administering authority to investigate any complaint of environmental harm. The results of the investigation (including an analysis and interpretation of the monitoring results) and abatement measures, where implemented, must provide to the administering authority within ten business days of completion of the investigation, or no later than ten business days after the timeframe nominated by the administering authority to undertake the investigation.

END OF CONDITIONS FOR SCHEDULE A

4. Air Quality

4.1 Background

Dust is the main potential air contaminant to be emitted from the China First Coal Mine. Pollutants such as sulfur dioxide (SO_2), oxides of nitrogen (NOx) and volatile organic compounds (VOCs) are potential air contaminants associated with the combustion of diesel fuels at the mining site but are considered to be emitted in insufficient levels to result in measurable adverse air quality impacts at nearby sensitive locations.

The Project site is situated within a rural setting, with a number of coal mines proposed for development in the area. Sensitive receptors occur near to the Project site and are shown at **Figure 16**.

An air quality assessment was undertaken for the Project, as detailed in the Environmental Impact Statement (EIS) and Supplementary Environmental Impact Statement (SEIS), from which the results and assessment details have been derived for this EM Plan. For the purposes of this EM Plan and considering the predominantly rural environment within the study area, the estimated background levels for dust were:

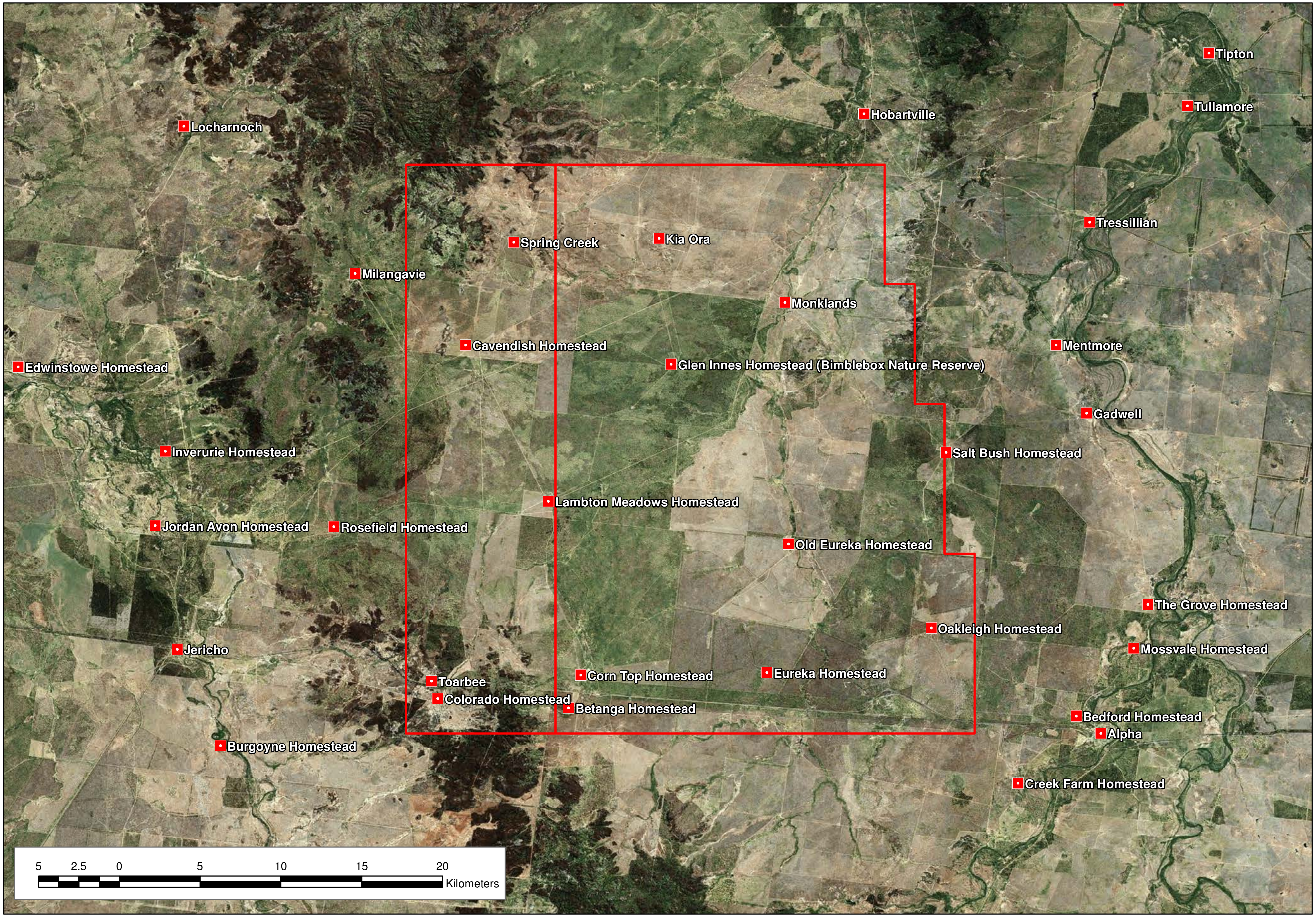
- 26 µg/m³ for 24-hour average particulate matter with an aerodynamic diameter less than ten microns (PM_{10}) levels (70th percentile of 24-hour concentrations, averaged during 2006-2009)
- 22 µg/m³ for annual average PM_{10} levels (annual average concentrations, averaged during 2006-2009)
- 5.2 µg/m³ for 24-hour average particulate matter with an aerodynamic diameter less than ten microns ($PM_{2.5)}$ levels (20% of PM_{10} values, based on Midwest Research Institute, 2006)
- 4.4 µg/m³ for annual average $PM_{2.5}$ levels (20% of PM_{10} values, based on Midwest Research Institute, 2006)
- 44 µg/m³ for annual average Total Suspended Particulate (TSP) levels (twice PM_{10} values, based on Midwest Research Institute, 2006).

The use of 20% of PM_{10} to estimate $PM_{2.5}$ background concentrations is based on Midwest Research Institute (2006), in which the recommended ratio of $PM_{2.5}$ to PM_{10} is 0.2 for agriculture activities, which is applicable to the mine where terrestrial wind erosion is presumably the major source of background dust emissions.

The impacts to air quality from the activities at the mine have been assessed against guidelines for TSP, PM_{10} and $PM_{2.5}$ defined in the Environmental Protection (Air) Policy 2008 (EPP (Air)) for the protection of environmental values. Dust deposition rates have also been assessed against relevant guidelines.

Air dispersion modelling has been used to predict ground-level concentrations of pollutants and rates of dust deposition, based on 2008 meteorological data for the mine region and estimated emission rates for the mine's activities. The modelling assessment used a suite of modelling tools to estimate air quality impacts. First, The Air Pollution Model (TAPM) and CALMET were used in combination to generate a fine-resolution, three-dimensional meteorological fields for 2008; and then CALPUFF was used to simulate the transport, dilution and deposition of emissions from the sources in the atmosphere.

Figure 16. Mine sensitive receptors and EIS Study Area boundary



Emission rates were estimated using methodologies sourced from National Pollutant Inventory and USEPA published emission estimation methodologies. To assess worst case conditions, emissions were estimated for year 19 of the mine's life, as this represents peak emissions. The major sources of emissions were waste handling by the draglines, the transport of waste to the out of pit waste dumps, hauling of coal and wind erosion of exposed areas.

The proposed mitigation measures will ensure air pollutants across both construction and operational phases of the Project will not diminish or degrade the ambient air quality to the extent that it will adversely impact human health and ecological health of terrestrial flora and fauna.

Waratah will be able to sustain mining activities in accordance with its commitment principles through the introduction and continuous review of dust management and mitigation systems during the construction and operational phases of the mine.

4.2 Emission Sources

4.2.1 Construction Emission Sources

Construction of the China First Mine will include the development of:

- internal road network, including light-vehicle access roads, heavy-vehicle haul roads and a site access road
- overland conveyors and transfer stations
- the coal handling preparation plants and associated stockpiles
- tailings storage facilities
- administrative buildings
- equipment workshop facilities
- 275 kV electricity transmission line, electrical power substations and associated facilities
- a water supply pipeline
- on and off-site water retention dams
- 2,000 person accommodation village
- onsite airstrip
- cut and cover operations for the underground mines.

The emissions associated with the development of the open cut mines have been considered as part of the ongoing operation of the mine.

Emissions from construction activities will be primarily dust related, with some minor emissions of combustion pollutants, such as NO_x, due to diesel and petrol combustion in vehicles and construction equipment.

Construction emissions will be minor in comparison with emissions from the operation of the mine. In addition, the emissions will be temporary in duration and the location of emissions will change. Therefore these emissions have not been estimated (with the exception of the cut and cover operations), and their impacts have not been modelled. The impacts of construction activities will be managed through the EM Plan which will implement the following dust mitigation strategies:

- water sprays on unsealed roads

- restricting vehicle speeds on unsealed haul roads to reduce dust generation and keep vehicles to well-defined roads
- minimise haul distances between construction sites to spoil stockpiles
- treat or cover stockpiled material to prevent wind erosion
- regularly clean machinery and vehicle tyres to prevent wheel entrained dust emissions
- route roads away from sensitive receptors wherever practical
- minimise topsoil and vegetation removal, and revegetate disturbed areas as soon as possible
- ongoing visual monitoring of dust on a daily basis, with ramping down of activities in the instance of high dust emissions.

In addition dust emissions during construction can be managed by considering the coordination of the construction schedules. Ensuring that there are no delays in construction activities will decrease the amount of time that disturbed land remains exposed for wind erosion.

4.2.2 Operation Emission Sources

The following pollutants will be released to the atmosphere from the mining activities:

- SO_2
- NO_x
- carbon monoxide (CO)
- VOCs
- particulate matter with an aerodynamic diameter less than ten microns (PM_{10})
- particulate matter with an aerodynamic diameter less than two and half microns ($PM_{2.5}$)
- TSP.

Air quality impacts were assessed in the air quality assessment that supported the environmental impact assessment using dispersion modelling for the operational phase of the mine for the following pollutants of interest:

- $PM_{2.5}$
- PM_{10}
- TSP (including dust deposition).

The low sulfur content of Australian diesel, in combination with the fact that mining equipment is widely dispersed over mine sites, makes it unlikely that the SO_2 goals will be exceeded off-site, even in mining operations that use large quantities of diesel. For this reason, no detailed study was required to demonstrate that emissions of SO_2 from the China First Mine will not significantly affect ambient SO_2 concentrations. Similarly, NO_x, CO and volatile organic compound emissions from the mine's activities are too small and too widely dispersed to require a detailed modelling assessment.

Greenhouse gases, CO_2 and methane (CH_4), emitted from this Project will not impact air quality as they have no adverse impacts on human health and environment, except that they may lead to climate change. Therefore, the air quality impacts of greenhouse gases are not considered in this chapter.

Odour may rise from fuel burning of vehicles or equipment or explosive usage, but it is not expected to reach significant levels in the ambient air to cause amenity impacts. Hence the potential impacts were not quantitatively evaluated in the air quality impact assessment.

4.3 Environmental Values

The environmental values of the air environment to be enhanced or protected are:

- the qualities that make the air environment suitable for the life, health and wellbeing of humans
- the amenity of the area
- the aesthetic environment.

4.4 Potential Impacts on the Environmental Value

The mining processes that will generate dust at the Project are as follows:

- creation of initial box cut
- pre-strip removal of overburden with the truck and shovel fleet and in pit dumping of overburden
- dragline removal of overburden, operating close to the bottom of each pit
- excavator removal of coal from the bottom of the pit and transfer to coal trucks
- drilling and blasting of overburden and coal seams
- dozers, shovels and graders as support to the draglines, truck and shovel fleet, on the overburden dumps and on the coal stockpiles
- box-cut spoil disposal area and in-pit dumps for dumping of overburden, grading of the surface and wind-generated dust prior to rehabilitation
- trucks on haul roads to transport ROM coal to the CHPP for processing, overburden to the dumps and the rejects from the CHPP for disposal to the reject disposal pits
- ROM coal handling area, including dumping of coal, dozer operations, stacking and reclaiming ROM coal and coal crushing and sizing
- ROM coal which is crushed at the ROM receival station and transported by overland conveyor to the ROM coal stockpile
- product coal handling during reclamation from the product coal stockpiles and due to wind erosion
- train load out involving the dumping of product coal into the rail wagons.

A cumulative air quality assessment was conducted using estimated emission rates for the proposed Alpha coal mine and the proposed Kevin's Corner coal mine located immediately to the north of the China First Coal Mine Project.

In order to model worst case cumulative impacts that best coincide with the worst case impacts for the China First Coal Mine Project the following operational years were chosen for Alpha coal mine and Kevin's Corner coal mine:

- Alpha coal mine – Year 20
- Kevin's Corner – Year 25.

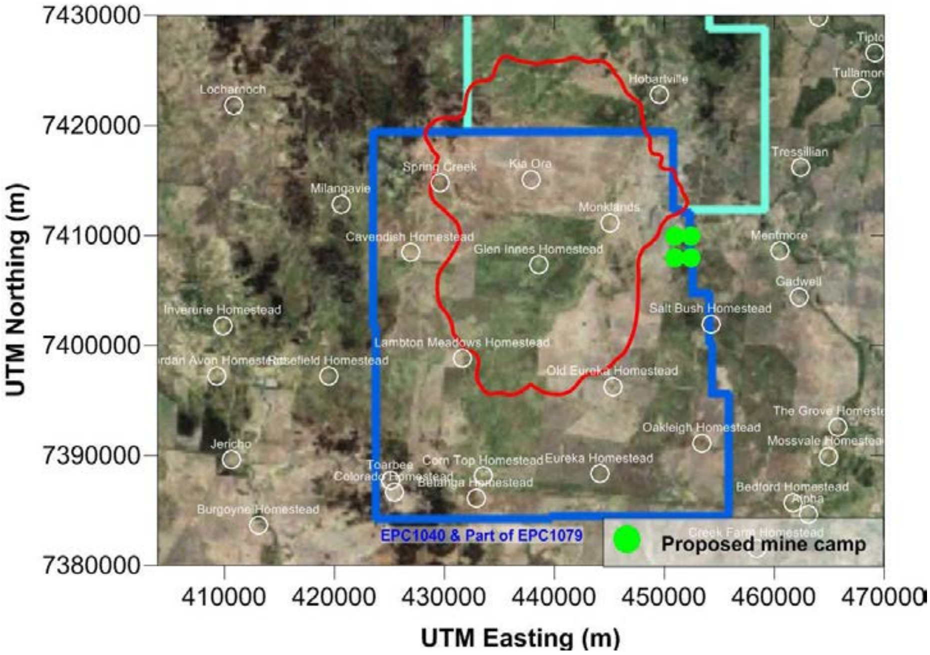
It was estimated that these years would most closely coincide with Year 19 emissions from the China First Coal Mine Project and are also considered to be representative of worst case impacts from both surrounding proposed mines.

Based on the air quality modelling results and recommended acquisition criteria, the following sensitive receptors will be acquired by the China First Coal Mine Project in order to avoid significant air quality impacts:

- Kiaora
- Monklands
- Spring Creek
- Glen Innes (Bimblebox Nature Reserve).

The affected sensitive receptors are shown in **Figure 17**.

Figure 17. Sensitive receptors and recommended acquisition criteria



The next highest air quality impacts are predicted for Lambton Meadows homestead, Hobartville and the Cavendish homestead.

The cumulative impact air quality model which includes maximum emissions from the China First Coal Mine Project, year 20 emissions from Alpha coal mine and year 25 emissions from Kevin's Corner coal mine shows that air quality levels at these sensitive receptors are within Queensland air quality criteria.

It is expected that on-going air quality monitoring at sensitive receptors will be required in order to manage air quality impacts on an on-going basis as part of a reactive air quality management plan. That plan will incorporate continuous air quality monitoring adjacent to sensitive receptors. Additional emission controls such as increased road watering and modifying operations is recommended when high particulate matter concentrations are recorded at sensitive receptors.

No exceedance of guidelines is predicted for the nearby townships of Jericho and Alpha.

4.5 Environmental Protection Objective

The environmental protection objective for air quality is to minimise the impacts of mine-derived dust on sensitive receivers beyond the boundaries of the relevant mining leases.

4.6 Performance Criteria

The performance criteria for air quality are:

- compliance with the requirements of the Project's Environmental Authority
- ambient air monitoring in accordance with the monitoring program outlined below
- the number of air quality complaints.

The EPP (Air) objectives and Queensland DEHP guideline for TSP, PM_{10}, $PM_{2.5}$ and dust deposition are included in **Table 4**.

Table 4. Project goals for particulate matter

Pollutant	Averaging Period	Protection Category	Objective or Goal	Jurisdiction
TSP	Annual	Health and well-being	90 µg/m^3	EPP (Air)
PM_{10}	24-hour	Health and well-being	50 µg/m^3	EPP (Air)[1]
$PM_{2.5}$	24-hour [1]	Health and well-being	25 µg/m^3	EPP (Air)
	Annual	Health and well-being	8 µg/m^3	EPP (Air)
Dust Deposition	Monthly	Amenity	4 g/m^2/month	Queensland EHP

1. Exceedances due to natural events (e.g. dust storms, bushfires) should be excluding monitoring data when comparing against performance criteria

4.7 Air Quality Control Strategies

Dust mitigation for the operation of the China First Mine involves several elements to ensure adequate management of air quality in the vicinity of the mine, namely:

- engineering control measures
- dust suppression measures
- rehabilitation of exposed surfaces
- operational procedures.

Engineering Control Measures

Waratah Coal has designed engineering control measures into the Project where appropriate and technically possible.

In particular, these control measures have been applied at the CHPP and include the following:

- in-pit crushing and conveying
- enclosure of transfer points and sizing stations
- roof on overland conveyors
- belt washing and belt scrapers to minimise dust from the return conveyors

- reduced drop height from stackers to stockpiles
- reduced drop height of draglines
- eliminating side casting
- enclosure of raw coal surge bins
- install improved coal train loading infrastructure to control overloading and minimise spillage
- install improved load profiling systems to create a more streamlined and consistent surface of coal in each wagon.

Dust Suppression Measures

Dust suppression measures primarily include the application of water to control dust emissions. The following measures will be implemented:

- minimising topsoil and vegetation removal and revegetation of disturbed areas as soon as possible
- revegetation of exposed areas to be exposed for more than three months
- minimise pre-strip to a maximum of one block ahead
- pave areas where practical around offices, carparks, maintenance and storage areas
- visual monitoring of dust on a daily basis with ramping down of activities in the instance of high dust emissions
- watering of haul roads to suppress dust emissions equivalent to an efficiency of 75%
- watering of ROM stockpiles using water sprays and water cannons that are operated on timers. The use of timers avoids the potential for missing a scheduled watering operation. The timers can also be operated manually in particularly hot or windy conditions
- fogging system on outlets from transfer points and sizing stations
- water sprays on stacker/reclaimer units
- use of tippler wagons (gondola) rather than the more traditional bottom dump coal wagons
- provide a fiberglass cover to the top of the wagons
- maintain high moisture content of product coal and reject material as they leave the CHPP which avoids the need for supplementary watering. Immediately after the coal is dewatered in the CHPP, the coal will be above the dust extinction moisture limit (the lower limit at which dust-prone materials will no longer create dust) and so will not be a source of dust
- Waratah Coal has budgeted for and designed the train load out facility to allow for a polymer-based dust suppression unit. However a decision on construction and installation of the dust suppression unit at the train load out, to reduce dust emissions during rail transport, will be made after review of success rates of this technology in use by other projects
- where coal mining activities result in exceedance of dust criteria and impacts on residential sensitive receptors, dust mitigation measures will be implemented at the residence in consultation with the owners
- where reasonable and feasible mitigation measures are unable to reduce pollutant concentrations to levels which safeguard public health and amenity, affected land may be acquired from the landowners in accordance with approved acquisition criteria.

In the event that adverse conditions are encountered during operation of the Project, additional dust suppression measures will be implemented.

Rehabilitation of Exposed Surfaces

Rehabilitation of exposed surfaces will be undertaken progressively as mining and stockpiling activities are completed (time from disturbance to rehabilitated estimated at approximately 2-5 years), and will include the use of fast-growing temporary cover material to accelerate the effectiveness of dust controls.

Operational Procedures

The following operational procedures for the Project will be implemented in order to meet targets for air quality performance:

- use of water trucks to achieve sufficient watering of haul roads and other high-risk areas to suppress dust emissions equivalent to an efficiency of 75%. The schedule for truck use will be developed for the Project and will incorporate consideration of recent rainfall and weather conditions
- use of water sprays and foggers as directed, with additional use as determined by ambient conditions
- maintenance of water spray equipment and engineering controls to minimise dust emissions
- sufficient number of watering trucks to allow for continuation of dust suppression when one or more truck is out of service
- monitoring of ambient air quality in the vicinity of the mine
- maintain a register of dust complaints
- implementation of an appropriate speed limit for vehicles on unsealed roads, especially where close to sensitive receptors
- design haul roads to have a less erodible surface, such as using materials with a lower silt content
- haul roads that are redundant will be shut down and revegetated as soon as practical
- chemical suppressants and paving may be used for semi-permanent haul roads (not for in-pit haul roads)
- regular cleaning of machinery and vehicles tyres to prevent wheel entrained dust emissions
- minimise soil stockpiles in areas close to sensitive receptors
- use of large capacity trucks to haul overburden and coal to minimise travel distances
- underground loading of coal at the preparation facilities
- manage topsoil stripping so that dust does not become a safety hazard or severe nuisance
- restrict land disturbance to that necessary for the operation and minimise the area of land disturbed at any one time
- implement a permit to disturb system
- avoid burning cleared vegetation
- product coal supplied for coal transport will have a coal-surface water content designed to reduce dust emissions during rail transport.

4.8 Monitoring

The air quality management strategy for the site includes the use of dust monitoring equipment that can assist in determining the effectiveness of dust control strategies. Data obtained from the monitoring program will be used to identify potential air quality issues related to the operational management of mining activities at the Project site. The data will aid in the identification of key dust-emission source(s) and will allow Wararah Coal to develop targeted and effective mitigation measures than can be incorporated into the operational procedures for the daily management of dust impacts.

4.8.1 Ambient Air Monitoring Program

The ambient air quality monitoring program is described in this section.

Sampling practices, procedures and parameters for contaminant testing

The following pollutants will be monitored in the air surrounding the Project:

- dust deposition
- PM_{10} and $PM_{2.5}$ ambient concentrations.

The location of dust deposition gauges is shown in **Figure 18**. The dust deposition gauge network will be maintained in accordance with relevant Australian Standards and sampled monthly to determine insoluble matter (g/m^2/month) and ash content (percent).

Dust deposition rates are to be maintained within guidance criteria to avoid nuisance impacts at sensitive receptors within the mine lease area (i.e. < 4 g/m^2/month). All dust depositional gauges will be sampled monthly for insoluble matter and ash in accordance with *Australian Standard 3580.10.1 2003 Methods for sampling and analysis of ambient air – Determination of particulate matter – Deposited matter – Gravimetric method.*

The monitoring of ambient concentrations will be conducted using a regulatory method (in order to assess regulatory compliance) and continuously so that a reactive air quality management plan can be informed by the air quality monitoring network.

The most common regulatory methods for monitoring ambient concentrations surrounding major extractive industries are by using high volume air samplers (HVAS) or tapered element oscillating microbalance (TEOM) analyser. TEOMs produce continuous measurements that can be used to assess regulatory compliance and feed into a reactive air quality management plan, whereas the use of HVAS would require the use of co-located continuous measurement techniques such as an E-sampler or beta attenuation monitor (BAM), as the measurement method is not continuous.

Ambient air concentration rates are to be maintained within the Queensland EPP Air criteria at sensitive receptors.

Sampling using a HVAS will be undertaken in accordance with:

- *AS/NZS 3580.9.6:2003 Methods for sampling and analysis of ambient air - Determination of suspended particulate matter - PM(sub)10(/sub) high volume sampler with size-selective inlet - Gravimetric method*

Sampling using a TEOM will be undertaken in accordance with:

- *AS 3580.9.8 Methods for sampling and analysis of ambient air – Method 9.8: Determination of suspended particulate matter – PM_{10} continuous direct mass method using a tapered element oscillating microbalance analyser.*

Waratah Coal will undertake continuous monitoring of PM_{10} and $PM_{2.5}$ ambient air concentrations using an E-Sampler, E-BAM or DustTrack (or equivalent method) at the same locations as any HVAS. If using TEOMs to monitor ambient air quality, a co-located E-Sampler, E-BAM or DustTrack (or equivalent method) will be used to monitor $PM_{2.5}$ concentrations. Neither the TEOM, E-Sampler, E-BAM nor DustTrack is a recognised regulatory method for measuring $PM_{2.5}$, but will be useful to provide air quality data on a continuous basis.

The continuous measurements will provide continuous feedback information on air quality and be incorporated into a dust management plan once the mine is operational.

Any non-conformances recorded by regulatory methods - HVAS, TEOM or dust deposition gauges will be investigated to determine the source or event(s) that led to the non-conformance and if possible, measures taken to minimise the possibility of re-occurrence.

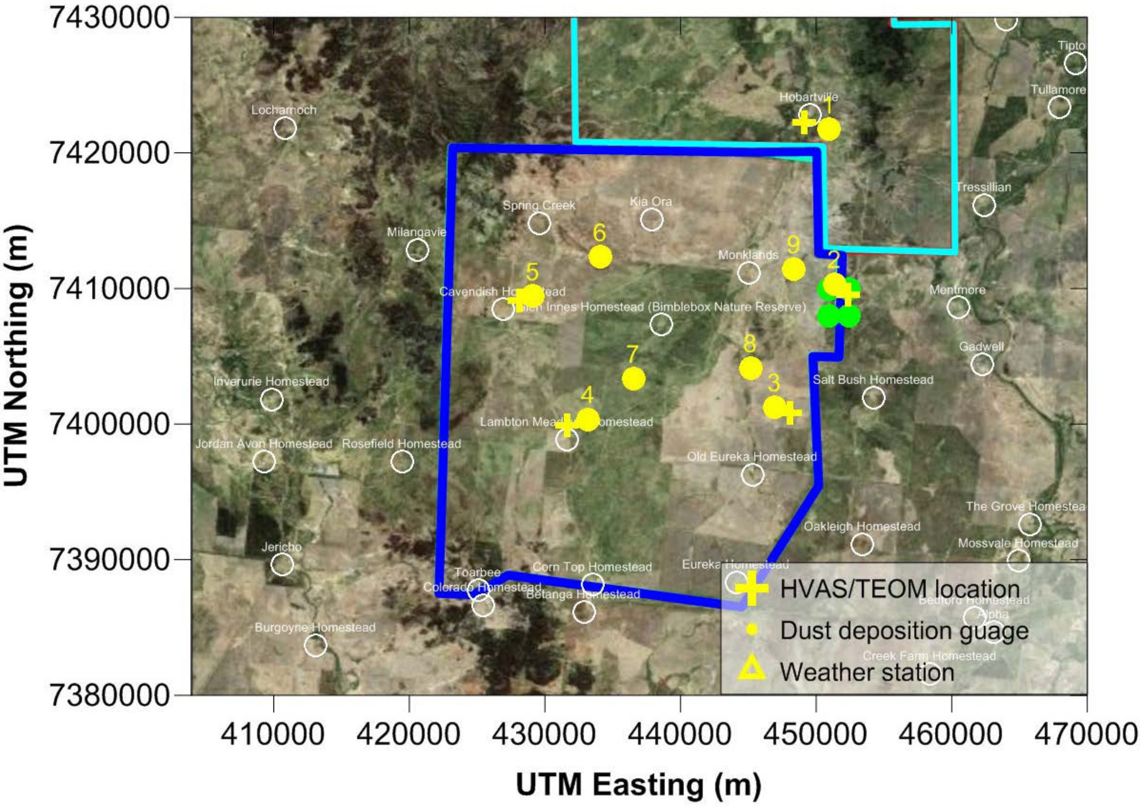
In the event of any exceedance, the mining practices will be reviewed, modified and documented, where appropriate, and corrective actions will be undertaken.

Selection of sampling locations to demonstrate that samples collected will be representative of the air quality of the area

The proposed locations of five HVAS or TEOMs (and associated co-located continuous air quality monitors), nine dust deposition gauges and a weather station in relation to the China First Coal Mine Project are shown in **Figure 18**. Final locations of the air quality monitoring stations will need to take into account the availability of power. HVAS or TEOMs require a 240 V power supply.

The locations of the ambient air quality samplers have been selected based on proximity to major emission sources at the China First Coal Mine Project mine and the location of surrounding sensitive receptors.

Figure 18. Location of air quality monitoring stations – preliminary air quality monitoring plan



Frequency of sampling to be undertaken at each location including the number of samples to be taken, sampling period/duration; continuous or semi-continuous sampling

The sampling frequency for each location and parameter is sumamrised in **Table 6**.

Meteorological data collection, including at least the wind speed and wind direction during the air quality monitoring program at the monitoring locations.

A weather station has been installed and commenced collecting data on 27 April 2012. The following data is collected by the weather station:

- daily rainfall
- continuous wind speed, wind gust and direction
- continuous temperature
- continuous relative humidity
- continuous solar radiation
- continuous barometric pressure

Evaporation rates are also monitored, parametrically using an Environdata FAO56 Evaporation Calculation (EV30). Using this monitor, evaporation rates are calculated using monitored relative humidity, air temperature, wind speed and solar radiation. Evaporation rates will be used to inform the daily road watering requirements to control emissions from haul roads.

The weather station is currently located next to the sensitive receptor named "Kiaora".

The proposed location for the weather station once the mine becomes operational is provided in **Figure 18**. It is considered that the location proposed in **Figure 18** will be representative for the surrounding area. Wind speed is measured at 10 m above the ground level.

A summary of the instrumentation to be allocated to each of the monitoring sites is given in **Table 5**.

The sampling frequency for each location and parameter is summarised in **Table 6.**

Table 5. Instrumentation to be allocated at each monitoring site

Site ID	TSP	PM_{10} [a] (TEOM)	$PM_{2.5}$ (E-sampler/BAM/DustTrack)	DUST DEP	MET
Site 1	✗	✓	✓	✓	✗
Site 2	✗	✓	✓	✓	✓
Site 3	✗	✓	✓	✓	✗
Site 4	✗	✓	✓	✓	✗
Site 5	✗	✓	✓	✓	✗
Site 6	✗	✗	✗	✓	✗
Site 7	✗	✗	✗	✓	✗
Site 8	✗	✗	✗	✓	✗
Site 9	✗	✗	✗	✓	✗

a. Alternatively a HVAS may be located at sites 1, 2, 3, 4 and 5. In this case, it is recommended that a collated E/Sampler/BAM or DustTrack is also allocated to the site to provide continuous PM_{10} monitoring

Table 6: Sampling parameters for each location

Monitored Parameter	Frequency	Number of samples	Continuous or Batch Sampling
Dust deposition	Once every 30 days (=/- two days) as per *Australian Standard 3580.10.1 2003*	One sample per site	Batch sampling
PM_{10} - HVAS	Monitor over 24 hours every 6 days	One sample per 6 days	Semi-continuous
PM_{10} - TEOM	Monitor continuously	One reading every 10 minutes	Continuous
PM_{10} – E-sampler	Continuous	One reading every 10 minutes	Continuous
$PM_{2.5}$ – E-sampler/BAM/DustTrack	Continuous	One reading every 10 minutes	Continuous

4.8.2 Operational Monitoring Program

Air quality monitoring data will be examined once the mine is operational in order to develop short term air quality criteria (e.g. 1 hour, 4 hour) and management response strategies to avoid exceedances of regulatory air quality criteria.

Data obtained from the operational monitoring program will be used to identify potential air quality issues related to the operational management of mining activities at the China First Mine site. The data will aid in the identification of key dust-emission source(s) and will allow Waratah Coal to develop targeted and effective mitigation measures than can be incorporated into the operational procedures for the daily management of dust impacts.

The key components of the operational monitoring program are the meteorological station, the dust deposition gauges at all locations, and the continuous dust monitoring network sites.

The operational monitoring program will involve three stages of actions.

Stage 1 Monitoring

- review of ambient air network monitoring results on a monthly basis.

Stage 1 Actions

If an exceedence of the DEHP dust deposition goal of 4 g/m^2/month is obtained at any of the monitoring locations that do not have continuous monitoring, the following actions will be implemented:

- query the laboratory in relation to any unusual findings during the analysis
- review wind rose data in order to identify general direction of possible dust emission source(s)
- review site-based activities focusing on identifying if there have been any changes to activities in locales identified by the monthly wind rose compared with the previous month
- if corrective measures are identifiable, these will be implemented
- exceedance, corrective actions and outcomes will be recorded and reported based on the site-based incident report procedure.

Stage 2 Monitoring

Stage 2 of the monitoring program will be implemented at any and all sites (that do not have continuous monitoring) for which there is an exceedence of the DEHP dust deposition goal of 4 g/m^2/month for two consecutive months.

Stage 2 Actions

- a review of the local environment at the location of the dust deposition monitoring locations by suitably qualified site personnel in order to identify local factors or activities that may have caused high dust levels
- additional monitoring at the site(s) for which there have been exceedances of the DEHP dust deposition goal of 4 g/m^2/month for two consecutive months will include one month of continuous monitoring of PM_{10} using a method approved in consultation with DEHP. The one month period is to coincide with the 30 day cycle of the dust deposition monitoring.

Stage 2 Corrective Actions

- if corrective measures are identifiable, these will be implemented
- exceedances, corrective actions and outcomes will be recorded and reported based on the site-based incident reporting procedure.

Stage 3 Monitoring

Stage 3 monitoring will be implemented if there is an exceedence of the DEHP guideline of 4 g/m^2/month for a period of four consecutive months, or if Stage 2 monitoring highlights that dust emissions from site-based activities are attributing to elevated levels of PM_{10} that are considered harmful by the regulatory authority. The need to implement Stage 3 monitoring will result from the inability of the Stage 2 monitoring program to isolate and mitigate problematic dust emission source(s).

Stage 3 Actions

- continuation of Stage 1 monitoring at all locations
- continuation of Stage 2 monitoring at locations for which there have been exceedances of the Queensland DEHP guideline for dust deposition of 4 g/m^2/month
- an air quality specialist will be commissioned to:
    - conduct a site-based "Dust Audit"
    - review the suitability of the site-based monitoring program
    - provide recommendations
    - prepare a report outlining the findings and recommendations of the "Dust Audit".

Stage 3 Corrective Actions

- if corrective measures are identifiable, these will be implemented
- exceedances, corrective actions and outcomes will be recorded and reported based on the site-based incident reporting procedure.

Waratah Coal will also:

- investigate all complaints about dust promptly and take appropriate action to reduce dust nuisance
- maintain a register of dust complaints
- review dust monitoring data to identify trends and implement corrective actions if necessary.

4.9 Commitments

The following commitments are made in relation to the preservation of air quality values for the Project:

- the Project will achieve and maintain the level of dust control outlined in the Environmental Authority
- preparation of a reactive Air Quality Management Plan and Dust Management Plan for the operational mine
- preparation of a detailed Mine Rehabilitation Plan
- use of industry best practice techniques to reduce dust emissions from the site
- the Project will meet the Ambient Air Monitoring program requirements
- the Project will investigate all substantiated dust complaints
- the Project will implement corrective action resulting from complaints investigations as required
- all monitoring and sampling techniques will be consistent with the DEHP's Air Quality Sampling Manual and applicable Australian Standards.

4.10 Proposed Environmental Authority Conditions: Schedule B – Air

(B1) The release of dust and/or particulate matter resulting from the mining activity must not cause an environmental nuisance at any nuisance-sensitive place

(B2) Exceedance of any of the following levels measured at any sensitive or commercial place is an environmental nuisance for the purposes of (B1):

a) dust deposition of 4 grams per square metre per month based on a monthly average, when monitored in accordance with Australian Standard AS 3580.10.1:2003 (or more recent editions)

b) a concentration of total particulate matter suspended in the atmosphere of 90 micrograms per cubic metre over a 1 year averaging time, when monitored in accordance with Australian/New Zealand Standard AS/NZS 3580.9.3:2003 (or the most recent editions).

(B3) The Environmental Authority holder must take all reasonable and practical measures to limit the concentration of particulate matter generated by the mining activities at sensitive or commercial places in proximity to the site to an aerodynamic diameter of less than 10 micrometres (PM_{10}) of 50 micrograms per cubic metre over a 24-hour averaging time at any nuisance-sensitive place with no more than five exceedances recorded over twelve months, when monitored in accordance with:

a) Australian/New Zealand Standard AS/NZS 3580.9.6:2003 (or more recent editions) Methods for sampling and analysis of ambient air - Determination of suspended particulate matter – PM_{10} high volume sampler with size-selective inlet - Gravimetric method

b) any alternative method of monitoring PM_{10} which may be permitted by the Air Quality Sampling Manual as published from time to time by the administering authority.

(B4) When requested by the administering authority or as a result of a complaint (which is neither frivolous nor vexatious nor based on mistaken belief in the opinion of the authorised officer), dust and particulate monitoring must be undertaken, and the results thereof notified to the administering authority within fourteen days following completion of monitoring.

Monitoring must be carried out at a place(s) relevant to the potentially affected dust sensitive place.

Dust and particulate matter monitoring, control and reporting

(B5) The holder of the environmental authority must develop and implement a dust and particulate matter monitoring and control program.

(B6) The program must include:

a) the collection of air quality and meteorological data at locations described in **Table 7** and using the combination of monitoring methods described in **Table 8** for each of the locations and included in the Plan of Operations for operational activities

b) a system to identify adverse meteorological conditions likely to produce elevated levels of PM_{10} at a sensitive or commercial place due to the mining activities

c) a dust control strategy (see **Table 9**) that would activate the timely implementation of high management dust control actions in addition to the best practice environmental management dust control measures during periods identified in (b).

(B7) The dust and particulate matter monitoring and control program must be submitted to the administering authority with the Plan of Operations.

(B8) Where monitoring identifies instances where the concentration specified in Condition B4 is exceeded, the holder should report to the administering authority within 14 days:

a) the concentration of PM_{10} particulates at the sensitive or commercial site

b) a description of meteorological conditions recorded in accordance with **Table 7** occurring at the time

c) the concentration of PM_{10} particulates upwind of the mining activities (if known)

d) measures taken to reduce dust generated by the mining activities.

(B9) Notwithstanding condition B6, if requested by the administering authority, dust and particulate monitoring must be undertaken for a stated period at a specified sensitive or commercial place, and the results provided to the administering authority within fourteen days following completion of monitoring.

(B10) If the monitoring required by condition B9 is undertaken for over one month, then monthly interim reports should be provided to the administering authority.

(B11) The holder of the environmental authority must report annually to the administering authority:

a) the results and an analysis of dust and particulate matter monitoring, including consideration of the relevant meteorological data

b) details of the use of high management control measures including the dust and atmospheric conditions that triggered the action, when, where and what action was applied, and the effectiveness of the action meeting the requirements of conditions B3 and B4

c) identification of any trends that should be considered in management of the mining activities and dust management practices

d) any changes to the dust and particulate control actions and monitoring resulting from an analysis of (a), (b) and (c).

Table 7. Dust and particulate matter monitoring locations

Monitoring location	Monitoring Point Location (GDA94) – MGA zone 55	
Site 1	450920	7421720
Site 2	451363	7410316
Site 3	446934	7401237
Site 4	433205	7400351
Site 5	429108	7409430
Site 6	434091	7412309
Site 7	436527	7403341
Site 8	445163	7404116
Site 9	448374	7411423

Table 8. Air quality monitoring details

Air Quality Determination	Monitoring Standard	Monitoring Point Description
PM_{10}	Real-time monitoring of the 24 hour average. AS 3580.9.8:2008 Methods for sampling and analysis of ambient air – Determination of suspended particulate matter – PM_{10} continuous direct mass method using a tapered element oscillating microbalance analyser (or the most recent version), or any alternative method of monitoring PM_{10} that may be permitted by the Air Quality Sampling Manual as published from time to time by the administering authority.	Site 1, Site 2, Site 3, Site 4, Site 5
Dust deposition	AS 3580.10.1:2003 Methods for sampling and analysis of ambient air - Determination of particulate matter - Deposited matter - Gravimetric method (or the most recent version)	Site 1, Site 2, Site 3, Site 4, Site 5, Site 6, Site 7, Site 8, Site 9
Meteorological Data[1]		Site 9

[1] wind speed and direction, humidity, temperature and precipitation

Table 9. Dust and particulate control actions

Activity	Management control
Dragline - overburden	Check operators are working to standards (e.g. drop height), modification of swing pattern
Truck and Shovel	Additional watering, relocation (partial or full)
Truck loading coal	Additional watering, relocation (partial or full)
Bulldozing - overburden	Reschedule operations or relocate
Truck dumping overburden	Additional watering, rescheduling, reposition
Tailings disposal area	Additional watering, rescheduling, reposition, within spoil dump
ROM - erosion active stockpile	Regular water sprays
Truck dumping coal	Regular water sprays
Loading trains	Operation of the veneering System
Conveyor	Application of additional water
Blasting - overburden	Redesign of blasting plan or rescheduling of blast
Drilling - overburden	Redesign of blasting plan, additional watering, rescheduling, relocation
Haul roads	Additional watering, treatment with suppressant or modify operation
Grader	Additional watering or rescheduling

END OF CONDITIONS FOR SCHEDULE B

5. Noise and Vibration

5.1 Background

The project has the potential to generate noise and vibration impacts on nearby sensitive receivers. Activities at the project vary in location and nature throughout the mine life, and therefore noise levels at sensitive receivers will also vary throughout the mine life. The closest sensitive receptors identified in the noise and vibration impact assessment undertaken for the project are shown in **Figure 19** and described in **Table 10**, in order of distance from the 20 year pit limit.

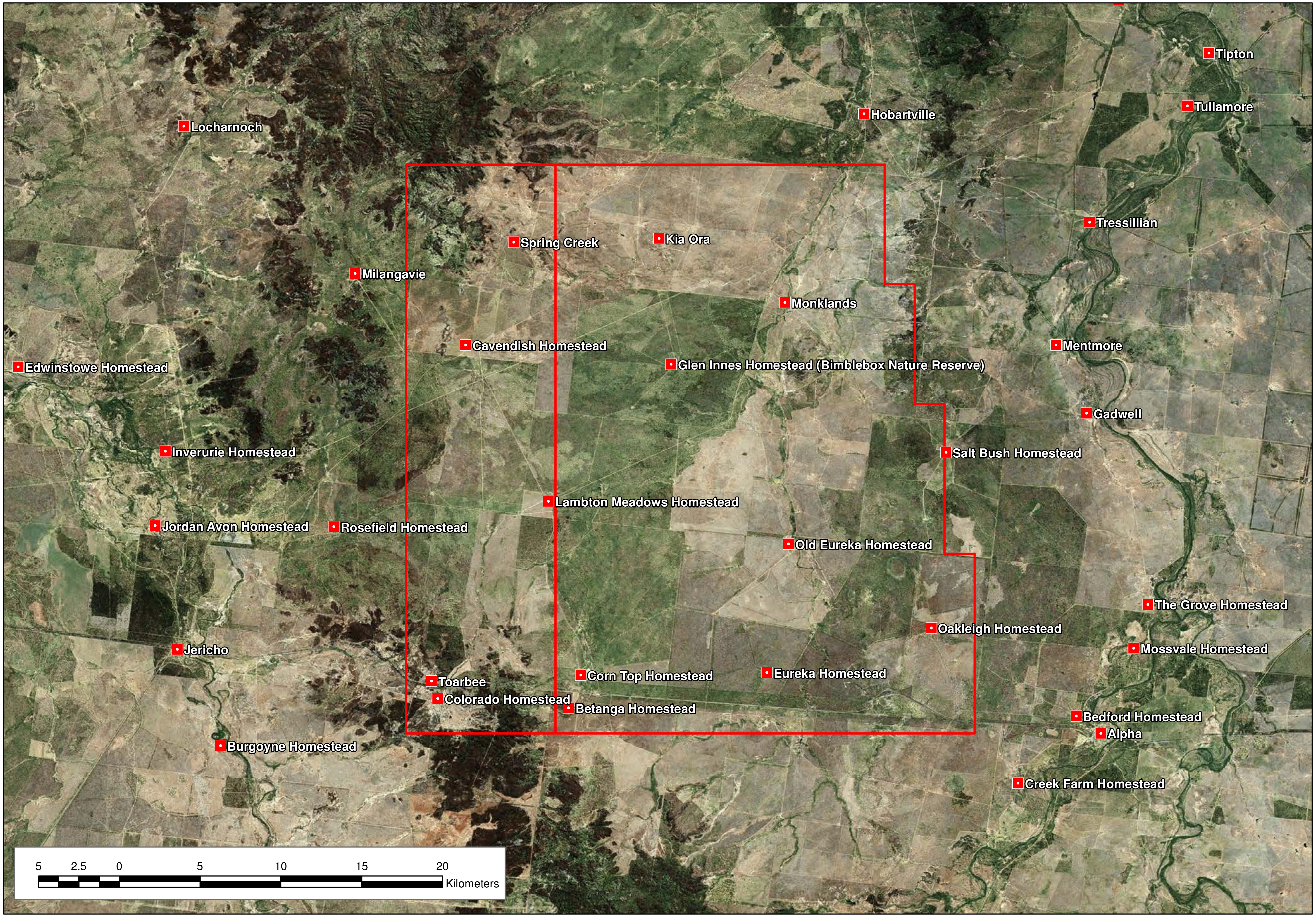
Table 10. Location of noise sensitive receptors

Receptor	Closest Distance to 20yr Pit (km)
Kiaora	Inside Pit
Monklands	1.10
Hobartville	4.70
Lambton Meadows	8.85*
Cavendish	10.20*
Salt Bush	12.65*
Eureka	14*
Corntop	17.25
Skye	18
Alpha	29.3
Jericho	31

It is important to note that the Hobartville homestead will be acquired as part of the Alpha Coal Project and is not considered in the management strategies as a sensitive receptor. For completeness, Hobartville is still discussed in this EM Plan; however, it is assumed that it will not continue as a residential property.

Kiaora and Monklands will also be acquired or relocated to offset air and noise impacts. As such, these receptors will no longer be relevant to the Project.

Figure 19. Mine sensitive receptors and EIS Study Area boundary



5.1.1 Baseline Monitoring

Baseline noise levels were monitored at four sites relevant to the mine site during the EIS assessment, for a minimum of seven days each, in accordance with:

- Australian Standard AS1055.1-1997 Acoustics - description and measurement of environmental noise, Part 1: General procedures
- the Queensland Noise Measurement Manual (3rd Edition, 1 March 2000).

The monitoring was undertaken in the autumn months between 13 and 21 April 2010, and in winter between 2 and 9 July 2010. Rating Background Levels (RBL) for daytime, evening and night-time periods determined from the monitoring program, and the $LA_{eq,1hr}$ noise levels, are shown in **Table 11.**

Table 11. Rating background noise levels

Measurement location	Rating Background Noise Level (minLA90-DBA)			Ambient Noise Level (AL) LAeq,1hr - DBA		
	Day	Evening	Night	Day	Evening	Night
Monklands	34	25	<15	44	39	32
Corntop	29	17	<15	39	35	23
Lambton Meadows	29	22	<15	37	31	23
Cavendish	35	34	22	43	47	36

Operational noise criteria for the project were determined in accordance with the Queensland Ecoaccess Guideline Planning for Noise Control based on the noise levels in **Table 11.**

No background vibration monitoring was undertaken, as there were no recognised sources of background vibration in the vicinity of the proposed mine site.

5.2 Environmental Values

The environmental values to be enhanced or protected during development of the project are:

- the qualities of the acoustic environment that are conducive to protecting the health and biodiversity of ecosystems
- the qualities of the acoustic environment that are conducive to human health and wellbeing, including by ensuring a suitable acoustic environment for individuals to sleep, study or learn and be involved in recreation, including relaxation and conversation
- the qualities of the acoustic environment that is conducive to protecting the amenity of the community, and
- the structural and cosmetic integrity of dwellings from ground vibration and overpressure.

5.3 Potential Impacts on the Environmental Values

5.3.1 Noise – Construction

There is only limited potential for significant construction noise emissions at the nearest receptors due to the nature of the construction activities, the allowable time for construction per day and the large intervening distance between the sources and the receptors. Key activities producing noise and vibration during construction that are likely to impact on sensitive receptors will be identical or less than those during the operational phase. Therefore construction phase impacts are not further discussed.

5.3.2 Noise – Operation

5.3.2.1 Noise criteria

The operational noise impacts from the site were assessed in accordance with the *Environmental Protection Act 1994* and the *EPP Noise*, with criteria set in accordance with the Queensland Ecoaccess Guideline *Planning for Noise Control* (the Guideline). The Guideline recommends a Planning Noise Level (PNL) for a new facility expressed as an unadjusted equivalent continuous measurement. The PNLs are based on the ambient noise monitoring data at the monitoring locations, the town planning designation of the area and the observed proximity to significant road transport corridors.

The Guideline recommends a PNL for a new facility expressed as an unadjusted equivalent continuous A-weighted sound pressure level ($L_{Aeq,1\ hour}$), with built-in penalties for assumed tonal and / or impulsive characteristics of a future noise source (or sources). As the adjustments for tonal and impulse noise characteristics cannot be anticipated in advance for all source / receiver situations, it is more appropriate that the PNLs are expressed as adjusted levels ($L_{Aeq\ 1\ hour,\ adj}$). The design PNLs for this project are summarised in **Table 12**. When using the PNLs to assess the received noise at a receptor from a specific source, the received level should be adjusted for tonal and / or impulsive characteristics as per the adjustments detailed in

Table 12. Design PNLs at residential receivers (outdoors)

Receivers	Design Planning Noise Level ($L_{Aeq,1hour,adj}$ – dBA)		
	Day (7am-6pm)	Evening (6pm-10pm)	Night (10pm-7am)
Monklands	29	31	28
Corntop	37	28	28
Lambton Meadows	37	30	28
Cavendish	28	28	28

Table 13. Guideline corrections to design PNLs for audible characteristics

Audible Characteristic	Criterion	Correction
Tonality	Subjectively just detectable	K1 = 2 dB
	Subjectively prominent (clearly audible) and objectively measurable by one-third octave band analysis as per AS1055.1 Clause 6.6.3	K1 = 5 dB
Impulsivity	Subjectively detectable and objectively measureable as per AS1055.1 Clause .6.4	K2 = 2 dB
	Subjectively prominent (clearly audible)	K2 = 5 dB

Workers Accommodation

Temporary accommodation facilities will be designed to achieve the noise levels shown in **Table 14** to protect workers' health and well-being.

Table 14. Noise criteria for workers accommodation

Sensitive Receptor	Time of day	Noise objectives (measured at the receptor) dB(A)		
		$L_{Aeq,adj,1hr}$	$L_{A10,adj,1hr}$	$L_{A1,adj,1hr}$
Dwelling (for indoors)	daytime and evening	35	40	45
	night-time	30	35	40

Sleep Disturbance

To prevent sleep disturbance in the low background noise environments encountered near the mine, the 5% probability of sleep awakening in the Guideline has been selected for the project. The relationship between the maximum external noise event level ($maxL_{pA}$) and the degree of dwelling sound insulation for the 5% probability off sleep awakening is shown in **Table 15**.

Table 15. Guideline for probability of sleep awakening

Typical Facade Noise Reduction	Facade Description	External maximum instantaneous noise level ($maxL_{pA,}$ dBA) corresponding to awakening probability (%)			
			5%		
5	Windows wide open		42		
10	Windows partially closed		47		
20	Single glazed, closed		57		
25	Double glazed, closed		62		

It is possible that naturally ventilated receptor dwellings may be occupied with windows fully open at times. The sleep disturbance limit for transient events on the project site to prevent sleep awakenings at such a receptor is 42 dBA ($maxL_{pA}$).

For an air-conditioned receptor dwelling the indicative limit for transient events would be 57 dBA. The sleep disturbance limits provide an upper noise limit relevant to very infrequent noise events which normally do not form part of typical operations.

As the sleep disturbance limit is much higher than the night time PNLs, sleep disturbance will be unlikely at receptor locations for normal operations.

5.3.2.2 Mine Noise impact

From the assessment conducted, noise impacts from mine operations would be expected at locations Eureka, Lambton Meadows, Salt Bush and Cavendish without any noise treatment (with no impacts at Kiaora, Monklands and Hobartville since they are expected to be acquired or moved). Attenuation is required regarding:

- crushers associated with OC2 at the source (partial enclosure) or modification of the proposed earthworks to include a berm between the OC2 crushers and Eureka, or a combination of the two. (for residence at Eureka)
- crushers associated with OC1, OC2 and the underground mines at the source (partial enclosures) and / or the combination of shielding from spoil dumps or stockpiles (for residences at Lambton Meadows, Salt Bush, Cavendish).

5.3.2.3 Blasting criteria

The criteria for blast overpressure and vibration are contained in the *Environmental Protection Act 1994* (EP Act) and the Ecoaccess *Guideline for Noise and Vibration from Blasting (*the blasting Guideline*)*. The Act contains regulated vibration criteria, with the blasting Guideline containing more stringent (in parts) advisory vibration criteria.

The following regulated criteria are specified in the EP Act:

"61 Noise from blasting is not unlawful environmental nuisance for an affected building if:

- the airblast overpressure is no more than 115 dBA Z Peak for 4 out of 5 consecutive blasts; or
- the airblast overpressure is more than 120 dBA Z Peak for any blast; or
- the ground vibration is:
  - for vibrations of more than 35 Hz – no more than 25 mm/s ground vibration, peak particle velocity
  - for vibrations of no more than 35 Hz – no more than 10 mm/s ground vibration, peak particle velocity."

The blasting Guideline advises that blasting activities should be carried out in such a manner that if blasting may affect a noise-sensitive place, then:

- the airblast overpressure must be not more than 115 dB(linear) peak for nine out of any 10 consecutive blasts initiated, regardless of the interval between blasts
- the airblast overpressure must not exceed 120 dB(linear) peak for any blast
- the ground-borne vibration must not exceed a peak particle velocity of 5 mm per second for nine out of any 10 consecutive blasts initiated, regardless of the interval between blasts
- the ground-borne vibration must not exceed a peak particle velocity of 10 mm per second for any blast

- blasting should generally only be permitted during the hours of 9am to 3pm, Monday to Friday, and from 9am to 1pm on Saturdays. Blasting should not generally take place on Sundays or public holidays.

Blasting outside these recommended times should be approved only where:

- blasting during the preferred times is clearly impracticable (in such situations blasts should be limited in number and stricter airblast overpressure and ground vibration limits should apply), or
- there is no likelihood of persons in a noise-sensitive place being affected because of the remote location of the blast site.

5.3.2.4 Blasting impact

From the assessment conducted, blasting would require detailed investigation to achieve the 115dB criterion for airblasts at Hobartville, if it remains a residential receptor. This would be in the form of adjustment to the stemming height, through shielding from spoil dumps or stockpiles and / or modification of the design of the firing of the blast charges.

5.3.2.5 Aircraft Noise impact

The only significant receptor to the use of the proposed airstrip would be the workers camp. To minimize the noise impact it is proposed to locate the workers camp a minimum of 500m from the extended centreline of the airstrip, as well as ensuring that the building envelope is adequately designed to achieve appropriate indoor noise levels described in Table 4.

5.3.2.6 Haul road noise and vibration impact

To ensure that the mine access road has a negligible impact on the surrounding residences, it is intended that:

- deliveries of heavy equipment are limited to daytime only
- the surface of the access road should be kept in good order in order to minimise impulsive noise due to road irregularities.

5.4 Environmental Protection Objectives

The environmental protection objectives for noise and vibration are to:

- avoid causing nuisance noise levels at sensitive receptors
- avoid causing nuisance airblast overpressure and ground vibration impacts at sensitive receptors.

5.5 Performance Criteria

The performance criteria for noise and vibration are:

- noise from construction activities will not cause an environmental nuisance at any sensitive or commercial place
- no nuisance airblast overpressure and ground vibration impacts at sensitive receptors
- no noise or vibration related complaints.

5.6 Control Strategies

5.6.1 Construction

Adverse construction noise levels are not predicted to occur at sensitive receptors during construction. Therefore, specific construction noise mitigation measures for specific sensitive receptors are not proposed.

General control strategies that will be implemented during the construction of the Project include the following:

General Noise Management Control Strategies

- prior to the commencement of site works, the community will be informed of the upcoming activities and likely duration
- the construction program will continue to be developed in consultation with the local community to schedule noisier activities (such as blasting) during least sensitive times of the day
- rock breaking, rock hammering, blasting and any other activities which result in impulsive or tonal noise generation will only be conducted during normal operational hours
- appropriate selection of construction processes / methodologies and equipment will be used to minimise the generation of noise
- employ respite periods for particularly noisy activities where possible
- maintain a site activity log, recording the type of activities occurring during various times of the day to assist with the retrospective investigation of community complaints relating to noise (or dust) complaints.

Plant and Equipment Noise Control Strategies

- equipment having directional noise characteristics (emits noise strongly in a particular direction) will be oriented such that noise is directed away from sensitive areas
- avoid the coincidence of noisy plant working at the same time close together adjacent to sensitive receivers
- acoustic enclosures or localised noise screens can be incorporated around fixed plant or over individual pieces of equipment as appropriate based on acoustic assessment for:
  - crusher and screening plant
  - concrete batch plant
  - maintenance area / shed

- all mechanical plant should be silenced by best practical means using current control technology and in accordance with manufacturers specifications
- where practicable, plant with the lowest noise rating which meets the requirement of the task should be selected
- where possible for works in close proximity to sensitive receivers, use electric motors in preference to diesel motors
- where enclosures are fitted to equipment, ensure doors and seals are in good working order and that doors can be closed properly against the seals
- ensure that internal combustion engines (all mobile and stationary equipment) are fitted with a suitable muffler in good repair
- where appropriate, metal surfaces subject to impacts from heavy objects (such as rock dropping into empty truck trays, or metal grates on road ramps etc.) should be lined with rubber impact protection to minimise impact noise where possible
- ensuring that tailgates on trucks are securely fitted to avoid unnecessary "clanging" noise, particularly during movement of empty trucks
- where using pneumatic equipment, select silenced compressors or use quieter hydraulic equipment
- conduct regular inspections and effective maintenance of both stationary and mobile plant and equipment (including mufflers, enclosures etc.)
- equipment not being utilised as part of the work will not be left standing with engines running for extended periods.

Traffic Noise Management Control Strategies

- reduce the potential for impacts from construction traffic by:
    - establishing designated access route/s to the site and informing drivers of these routes, parking lots and acceptable delivery times
    - undertaking regular site road maintenance (and inspections) to minimise impact noises from trucks travelling over irregularities in the road surface (such as pot-holes, washouts or ruts)
    - limiting vehicle speeds in critical areas both on and off site
    - allowing for one-way traffic flow through the site to minimise the use of reversing alarms as much as possible and minimise traffic delays
    - the use of 'smart', reversing alarms
    - limiting excessive acceleration from site exits
    - ensuring that vehicles required within compounds do not "queue" outside the worksite close to residential areas
    - where practicable, restricting entry and departure of heavy vehicles to and from the site to the standard daytime construction times where practicable
    - using best available controls over engine noise emissions by maintaining the vehicle fleet in compliance with Australian Design Rule 28/01 for engine noise emissions, tested in accordance with the National Road Transport Commission document Stationary Exhaust Noise Test Procedures for In-Service Motor Vehicles (NTC, 2006).

Blasting Overpressure and Vibration Control Strategies

- blasting will be designed and managed by a blasting contractor, who will control blast overpressure and vibration in accordance with the Project limits, through a detailed management plan. The plan must address Australian Standard 2187–2006 Explosives—Storage and Use Part 2: Use of explosives, and will include the following types of measures to minimise impacts:
    - reducing maximum instantaneous charge of each blast
    - changing drilling patterns, burden, blast hole diameter, deck loading, location, spacing and orientation of blast holes or using a combination of appropriate delays
    - where possible orienting faces so that they do not face directly towards residences and keeping face heights to a minimum
- consider weather forecasts in the ongoing management of blast impacts (allowing for the effects of adverse wind on the propagation of air blast to surrounding areas).

5.6.2 Operations

During the mining operations, noise emissions will be reviewed on a regular basis. This revision will involve noise modeling on a minimum rolling five year basis, with any associated revision of the noise management procedures carried out in association with the results of this modeling. The appropriate noise and vibration monitoring plan which corresponds to the five year predictions will be reviewed and updated on the same basis.

Adverse construction noise levels are predicted to occur at “Hobartville”, “Kiaora” and “Monklands”. “Kiaora” and “Monklands” will cease to be residential dwellings, and therefore no long sensitive receptors, once the mine is operational. Similarly, “Hobartville” will cease to be a residential dwelling once the Alpha Coal Project is operational and therefore will no longer be a sensitive receptor. Therefore, specific operational noise mitigation measures for specific sensitive receptors are not proposed.

General control strategies established during construction will, where relevant continue to be implemented during operations.

5.7 Monitoring

5.7.1 Ongoing Monitoring

A permanent noise and vibration monitoring site will be established at the accommodation camp. Non-permanent monitoring will be undertaken at the properties “Cavendish” and “Corn Top”, and at “Hobartville” if this location remains a residential property.

All noise monitoring will be carried out in accordance with the Noise Measurement Manual (DERM, 2000) and *AS1055:1997 Acoustics – Description and Measurement of Environmental Noise*. All noise monitoring instruments will comply with *AS IEC 61672.1 – 2004 Electroacoustics – Sound level meters – Specifications*. All instruments will have valid and current calibration certificates traceable to a NATA certified laboratory.

The permanent noise logger will be set to statistically process and store the measured LA_{eq}, LA_{10}, LA_{50}, LA_{90}, LA_1 and LA_{max} noise levels and ground vibration (peak particle velocity, mm) every 15 minutes with the measuring microphones set at 1.2 – 1.5 m above ground level. Calibration of the systems will be regularly verified.

Attended noise measurements will be conducted quarterly during day, evening and night-time periods over a 48 hour period at the same locations using the same measurement time interval. The combination of permanent and short-term annual noise monitoring will ensure that a comprehensive monitoring program for continuous noise and vibration is achieved. Additionally, attended noise monitoring will be carried out promptly at other sensitive receptor location(s) in response to any substantiated complaint(s).

5.8 Commitments

The following commitments are made for the Project:

- on-going noise and vibration monitoring will continue to be carried out in accordance with the requirements of EP Act, the EPP (Noise), Environmental Protection Regulation 2008, and the Environmental Authority
- the Project will investigate all noise and vibration related complaints
- corrective actions resulting from complaints investigations will be implemented.

5.9 Proposed Environmental Authority Conditions – Schedule D – Noise and Vibration

Noise nuisance

(D1) Noise from the mining activity must not cause a noise nuisance at any sensitive place.

(D2) All noise from the mining activity must not exceed the levels specified in **Table 16** at any sensitive place.

Table 16. EPP (Noise) acoustic quality objectives for residential dwellings

Sensitive Receptor	Time of day	Acoustic quality objectives (measured at the receptor) dB(A)			Environmental value
		$L_{Aeq,adj,1hr}$	$L_{A10,adj,1hr}$	$L_{A1,adj,1hr}$	
Dwelling (for outdoors)	daytime and evening	50	55	65	health and wellbeing
Dwelling (for indoors)	daytime and evening	35	40	45	health and wellbeing
	night-time	30	35	40	health and wellbeing in relation to the ability to sleep

(D3) Noise is not considered to be a nuisance under condition D1 if monitoring shows that noise from the mining activity does not exceed the following levels in the time periods specified in **Table 17**.

Table 17. Noise limits (sensitive place)

Receivers	Noise Limits			
	$maxL_{pA}$ [1]	$L_{Aeq,1hour,adj}$ (dBA) [1]		
	10pm-7am	7am-6pm	6pm-10pm	10pm-7am
Corntop	42	37	28	28
Lambton Meadows	42	37	30	28
Cavendish	42	28	28	28
Other residential receptors	42	37	28	28

Note 1 External noise limit

Noise monitoring

(D4) When requested by the administering authority, noise monitoring must be undertaken within a reasonable and practicable timeframe nominated by the administering authority to investigate any complaint (which is neither frivolous nor vexatious nor based on mistaken belief in the opinion of the authorised officer) of noise nuisance at any sensitive place, and the results must be notified within fourteen days to the administering authority following completion of monitoring. Monitoring must include:

a) $LA_{eq,adj,15\ mins}$ (external)

b) $LA_{1,15}$ mins (internal – or a measured external noise level and calculation of corresponding internal noise level)

c) the level and frequency of occurrence of impulsive or tonal noise

d) atmospheric conditions including wind speed and direction

e) effects due to extraneous factors such as traffic noise

f) location date and time of recording.

(D5) The method of measurement and reporting of noise levels must comply with the current edition of the Department of Environment and Resource Management's Noise Measurement Manual and any subsequent versions.

(D6) If monitoring indicates exceedance of the relevant limits in **Table 17**, then the environmental authority holder must:

a) address the complaint including the use of appropriate dispute resolution if required

b) immediately implement noise abatement measures so that emissions of noise from the activity do not result in further environmental nuisance.

Vibration nuisance

(D7) Subject to conditions D8 and D9, vibration from the mining activity must not cause an environmental nuisance at any sensitive or commercial place.

(D8) If the environmental authority holder can provide evidence through monitoring that the limits defined in Table D2 are not being exceeded then the holder is not in breach of condition D7.

(D9) If monitoring indicates exceedance of the relevant limits in **Table 18**, then the environmental authority holder must:

a) address the complaint including the use of appropriate dispute resolution if required

b) immediately implement vibration abatement measures so that vibration from the activity does not result in further environmental nuisance.

Table 18. Airblast overpressure and peak particle velocity levels

Blast noise and vibration parameter	Monday to Sunday - 8am to 5pm
Airblast overpressure level (dB linear peak)	115 dB (linear peak) for 4 out of any 5 consecutive blasts regardless of the interval between blasts. Any single blast must not exceed 120 dB (linear peak).
Peak particle velocity (mm/s)	the ground-borne vibration must not exceed a peak particle velocity of 5mm per second for nine out of any 10 consecutive blasts initiated, regardless of the interval between blasts must not exceed a peak particle velocity of 10mm per second for any blast.

(D10) When requested by the administering authority, vibration monitoring must be undertaken within a reasonable and practicable timeframe nominated by the administering authority to investigate any complaint (which is neither frivolous nor vexatious nor based on mistaken belief in the opinion of the authorised officer) of environmental nuisance at any sensitive or commercial place, and the results must be notified within fourteen days to the administering authority following completion of monitoring.

(D11) The method of measurement and reporting of vibration levels must comply with Appendix J of AS2187.2-2006.

Airblast overpressure nuisance

(D12) Subject to Conditions D13 and D14, airblast overpressure level from blasting operations must not cause an environmental nuisance, at any sensitive or commercial place.

(D13) If the environmental authority holder can provide evidence through monitoring that the limits defined in **Table 18** are not being exceeded then the holder is not in breach of condition D12.

(D14) If monitoring indicates exceedance of the relevant limits in **Table 18**, then the environmental authority holder must:

a) address the complaint including the use of appropriate dispute resolution if required

b) immediately implement airblast overpressure abatement measures so that airblast overpressure from the activity do not result in further environmental nuisance.

(D15) When requested by the administering authority, airblast overpressure monitoring must be undertaken within a reasonable and practicable timeframe nominated by the administering authority to investigate any complaint (which is neither frivolous nor vexatious nor based on mistaken belief in the opinion of the authorised officer) of environmental nuisance at any sensitive or commercial place, and the results must be notified within fourteen days to the administering authority following completion of monitoring.

(D16) Airblast overpressure monitoring must include the following descriptors, characteristics and conditions:

a) location of the blast(s) within the mining area (including which bench level)

b) atmospheric conditions including temperature, relative humidity and wind speed and direction

c) location, date and time of recording.

(D17) The method of measurement and reporting of airblast overpressure levels must comply with Appendix J of AS 2187.2-2006.

END OF CONDITIONS FOR SCHEDULE D

6. Traffic

6.1 Background

The regional transport network in the vicinity of the mine that will be subject to construction and operation traffic is illustrated in **Figure 20**. The majority of these roads are administered by BRC, the exceptions being the Capricorn Highway and Clermont-Alpha Road, which are state controlled roads managed by Department of Transport and Main Roads (DTMR). A brief description of these public roads is as follows:

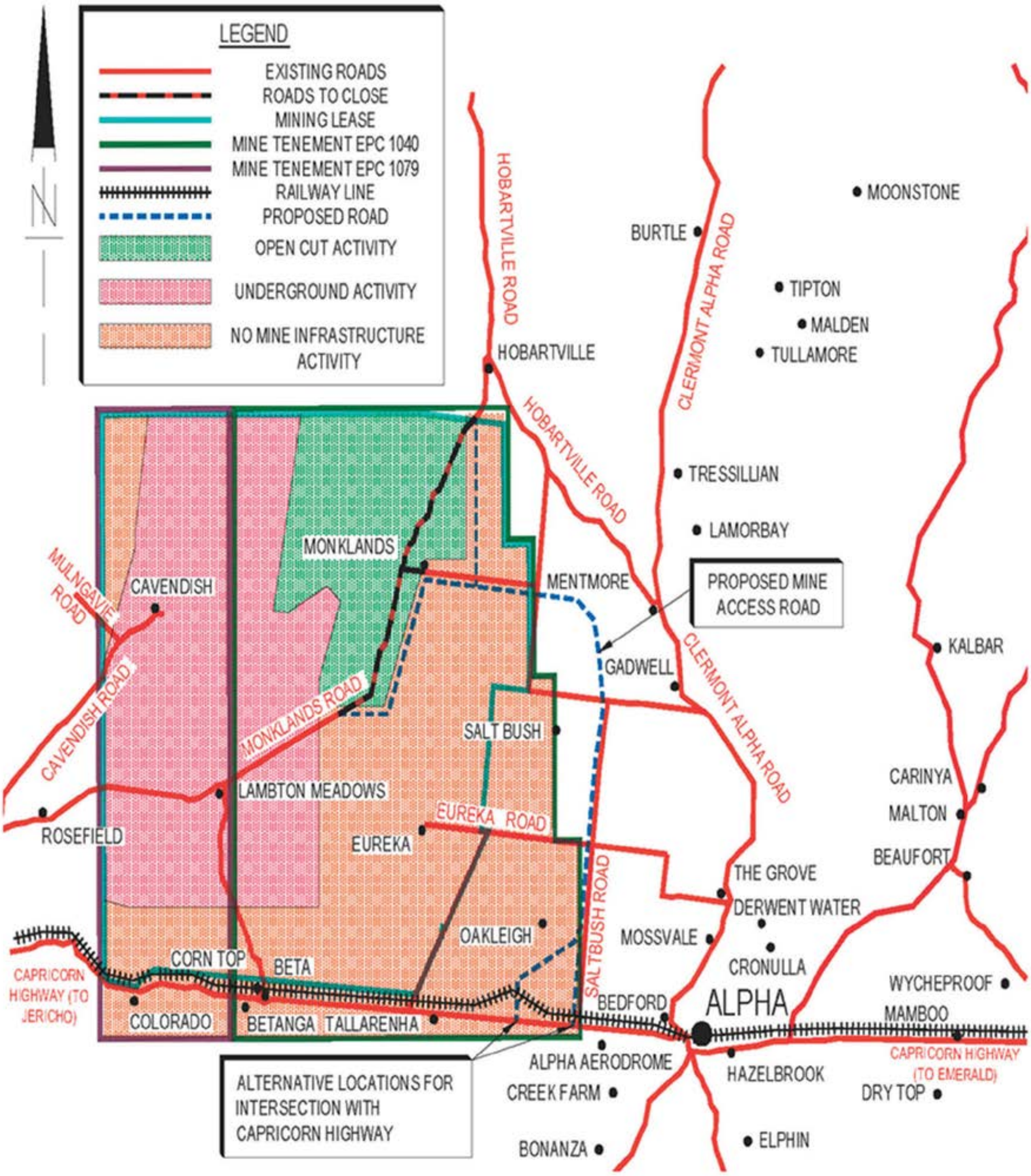
- Capricorn Highway (DTMR) – a state strategic fully sealed two lane carriageways, with sealed shoulders and overtaking lanes throughout. It is a moderately trafficked highway with 100km/hr speed limits except through townships. It generally runs east to west from Rockhampton to join the Landsborough Highway at Barcaldine
- Clermont-Alpha Road (DTMR) – a single lane carriageway that connects the Capricorn Highway at Alpha with the township of Clermont. This road generally heads in a northerly direction and is sealed for the first 35 km from Alpha and within approximately 7 km of Clermont
- Hobartville Road (BRC) - a 17 m wide formed unsealed route connecting Hobartville Homestead with the Clermont-Alpha Road. This section is approximately 19km long and generally able to accommodate bi-directional traffic
- Monklands Road / Jericho-Degulla Rd (BRC) – a local access route connecting Hobartville Homestead and the Capricorn Highway east of Jericho, via Lambton Meadows Station. This 12 m wide unsealed road passes through the middle part of the proposed mining lease
- Saltbush Road (BRC) –an unsealed local road that connects the Capricorn Highway 7 km west of Alpha with Eureka Road to the north. This 10 km section of road is approximately 15 m wide and generally provides adequate space for passing traffic
- Eureka Road (BRC) – an east to west running local access route from Saltbush Road to Eureka Station. This 15m wide unsealed route passes through the proposed mining lease
- Cavendish Road (BRC) – an unsealed route connecting Cavendish Station with the township of Jericho. A small section of this route passes through the western portion of the proposed mining lease
- Mulngavie Road (BRC) – a local access route stemming from Cavendish Road which runs in a northerly direction. Part of this unsealed route traverses the proposed mining lease boundary.

In addition to those roads documented above, a select number of unnamed council roads exists in the vicinity of the proposed mine. These roads, as illustrated **Figure 20**, operate within dedicated road reserves and generally exist in both a formed and unformed state.

The nearest major road to the proposed mining lease is the Clermont-Alpha Road. From Alpha the mine site is most effectively accessed via Hobartville Road, then Monklands Road.

Following a review of the existing local road network, it is proposed to upgrade the existing Saltbush Road to provide a direct connection between the mine and the Capricorn Hwy. This road would provide a more direct access route from Alpha than via the Clermont-Alpha Road which follows the Alpha Creek alignment.

Figure 20. Regional transport network at the mine site



All coal outputs will be transported from the site to port via rail. Additionally, the majority of any overburden will remain on the site. As such, heavy vehicle access is primarily to supply the site with equipment and resources to undertake mining operations.

6.1.1 Construction and Operational Usage

Mine generated traffic will consist of several categories including Drive in Drive out (DIDO); state, regional and local staff; specialist contractors; and servicing of development. These trips will be distributed throughout the road network on a local, regional, state, interstate and over dimensional level. These trips will in some cases be assigned to the road network based on standard assignment principles, most notably DIDO trips; however larger and over dimensional vehicles will be assigned to the road network based on road condition and level of maintenance.

The following categorisation has been used to define distribution and assignment:

Local mine generated trips will generally include staff and support service vehicles based in the towns of Jerico and Alpha. It is fully expected that these trips will be heavily orientated to the Capricorn Highway.

Regional mine generated trips will generally include support services and some DIDO generated trips. These trips will generally be distributed to the east and west on the Capricorn highway and will include the towns of Emerald and Barcaldine.

State mine generated will generally include service and support orientated trips, and will generally be orientated to the east of Emerald and include Rockhampton and Gladstone.

DIDO Drive In/Drive Out mine generated traffic will generally include drive in drive out trips which generally includes staff accommodated on site who will travel from Rockhampton and Gladstone in the east and to a lesser extent Mackay. The average commute time to mine activities is 4.5 hours; in consideration of a standard deviation from the mean this would place these DIDO trips at the far extremities of likely DIDO movements. It would also appear economically beneficial to fly from these points of origin in most cases.

Interstate mine generated trips will be heavily orientated to the main primary road network, routes generally encompassing the Capricorn Highway before using the Bruce Highway the Gregory Highway and the Landsborough Highway.

Over Dimensional mine generated trips will generally commute from Mackay to the north and Rockhampton and Gladstone to the east. Due to the nature and size of the vehicles it is expected that those trips generated by the development from Mackay will not use the Clermont Alpha Road. These vehicles and associated loads will specifically require drivers to use only well maintained and sealed roads.

6.1.1.1 Construction

The total truck requirements will be approximately 18,654 trucks over the three year construction of the site. This equates to an average of 18 trucks per day. It is noted that this equates to 36 vehicle movements per day, with loaded and unloaded vehicle movements per trip. It is assumed that all equipment provided to the site is dedicated to the site for the term of its use. As such, items such as mobile cranes and forklifts will be located on-site and not transported to and from the site as required.

Approximately 75% of these trips will be from the local area. These will consist of material deliveries from local quarries and suppliers for materials and infrastructure components. The remainder will be distributed from the wider region, state wide (including ports) and national.

As such, 14 vehicles per day are expected to be local, while four heavy vehicle movements per day will continue beyond the local area.

During the construction it is estimated that there will be approximately 2,500 staff on site. It is assumed that construction will take place under 12 hour shifts. It is further noted that during the later construction period that there will be a total of 4,500 staff operating at the site for a short period of time as construction and operation activities overlap. In order to ascertain an approximation of staff generated traffic the following parameters have been assumed:

- it is assumed 95% of staff will be accommodated on site
- 5% of workers (including subcontractors) will access the site utilising private vehicles, with an average car occupancy for passenger vehicles of two persons
- on-site accommodated staff will consist of 90% Fly In Fly Out (FIFO) and 10% DIDO
- peak hour movements account for approximately 40% of daily traffic.

The traffic generation also takes into account the expected roster and shift systems which would result in:

- 60% of workers rostered on
- two shifts of 12 hours each, with 70% of rostered staff on day shift and 30% on night shift.

As such, the maximum staff accessing the site for a shift on a given day will be 208. This will generate:

- long distance /shared driving - DIDO trips generally have an occupancy of two persons per vehicle based on observations for DIDO trips on the Peak Downs Highway
- 208 workers utilising 92 cars and 3 buses, equivalent to 184 vehicular movements.

This is considered a worst case scenario as it assumes that shift workers, admin staff and sub-contractors all arrive and depart the site during the same peak hour, which is unlikely to occur. A strong emphasis will also be placed on maximising multi-use transport such as buses.

Based on the above assessment of construction (non site staff) vehicles trips it is estimated that there will be an average of 14 Heavy Goods Vehicles trips per day attracted to the development site during the construction phase. Based on a 70% roster of staff, it is estimated that there will be approximately 3 bus trips and 89 private vehicle trips per day generated by the development site during the construction phase. This equates to 6 bus movements and 178 private vehicles per day movements.

The daily traffic volume generated by the site is expected to equate to 0.01 vehicle movements per day for each member of staff employed at the mine. These traffic volumes are expected to be distributed as follows:

- 80% to the immediate local area (Alpha and surrounds)
- 30% to continue to Emerald and beyond
- 15% to Jericho
- 5% north of the mine site.

Of the mine generated traffic, 5% (approximately five vehicles per day) are expected to continue through Barcaldine toward Longreach. Additionally, 30% is expected to pass through Emerald to the east, while 5% will head north via the Gregory Highway, these are primarily expected to consist of long distance heavy vehicle movements, servicing the site from major regional centres near the coast and interstate. The location of regional centres such as Rockhampton and Gladstone, and to a lesser extent Emerald, Blackwater and Dingo all to the east are likely to see the majority of trips attracted eastward, it is also noted that most northerly trips will also head via emerald before turning north.

6.1.1.2 Operation

The total truck requirements will be approximately 93,087 trucks over the first 25 years operation of the site. This equates to an average of 11 trucks per day, or 22 vehicle movements per day, with loaded and unloaded vehicle movements per trip. It is assumed that all equipment provided to the site is dedicated to the site for the term of its use. As such, items such as excavators and dump trucks will be located on-site and not transported to and from as required.

A larger portion of operational traffic will be from non-local sources, with basic material requirements (such as road base and structural materials) reduced from the construction stage and an increased focus on more specialist requirements, such as fuel and explosives, which are sourced from further destinations. This will result in approximately 3 vehicles per day (vpd) from local and 8vpd from non local sources, however, it is anticipated that bulk items such as fuel will be transported via 95,000ltr fuel tanker wagons in the new fuel trains on the new heavy haul train line.

It is expected at least 95% of the 2,000 man work-force will be accommodated on site, with up to 5% accommodated off site. Approximately 60% on shift, 40% off and also a 70/30 split between day and night shift. Staff will be transported from the airfield to the accommodation centre and mine site internally via communal transport mainly buses seating between 16 and 50 passengers based on demand.

Of the 95% of staff to be accommodated on site, it is assumed that approximately 10% will commute via a DIDO basis. The remaining on site accommodated staff are expected to commute on a FIFO basis.

The remaining 5% of staff are expected to stay locally and will commute on a daily basis to the mine. The local based staff are expected to be employed within the administration and servicing of the development. It is expected that offsite local resident staff will commute with an average occupancy per vehicle of two staff members. It is expected that this will equate to approximately 60 trips per day.

To summarise:

- it is assumed 90% of staff will be accommodated on site
- 10% of workers (including subcontractors) will access the site utilising private vehicles, with an average car occupancy for passenger vehicles of two persons
- peak hour movements account for approximately 40% of daily traffic.

The traffic generation also takes into account the expected roster and shift systems which would result in:

- 70% of workers rostered on
- two shifts of 12 hours each, with 70% of rostered staff on day shift and 30% on night shift.

This is considered a worst case scenario as it assumes that shift workers, admin staff and sub-contractors all arrive and depart the site during the same peak hour, which is unlikely to occur.

The daily traffic volume generated by the site is expected to equate to 0.26 vehicle movements per day per for each member of staff employed at the mine. These traffic volumes are expected to be distributed as follows:

- 80 % to Alpha
- 15 % to Jericho
- 5 % north of the mine site.

Of the traffic generated by the mine 30% is expected to continue through Alpha to Emerald, largely consisting of heavy vehicles and possibly mine workers who may DIDO between rostered periods.

All coal outputs will be transported from the mine site to the coal terminal via rail. Additionally, the overburden will remain within the mining lease area. Therefore, heavy vehicles to and from the mine will be primarily to supply the site with equipment, services and resources to undertake the daily mining operations.

The local distribution of heavy vehicles travelling to and from the mine site will be 100 % to the Capricorn Highway, with:

- 15 % to the west
- 85 % to the east, including:
    - 45 % terminating at Alpha
    - 30 % continuing eastbound on to Emerald and beyond
    - 10% to travel north primarily via the Gregory Highway
- the Clermont Alpha road will not be utilised by Heavy Vehicles, due to the existing conditions and in general the lack of northbound trips. Hauliers and heavy vehicle mining trip providers will be explicitly advised not to utilise this route as part of the mines future road user management plan.

6.2 Environmental Value

The environmental value to be protected is the safety, health and well-being of Project employees, visitors and the community using State, local and mine-site road networks.

6.3 Potential Impacts on the Environmental Value

6.3.1 Road Capacity Assessment

The development and operation of the mine is expected to have an impact on some of the regional roads. This is illustrated in **Table 19**, which provides the estimated increases in Average Annual Daily Traffic (AADT) on local roads resulting from both the construction and operation stages of the mine.

Table 19. AADT Impact on local roads

Road Section	Current Traffic	Mine Generated Traffic	
		Construction	Operation
Capricorn Highway (new road to Jericho)	400 vpd	220 vpd	135 vpd
Capricorn Highway (new road to Alpha)	390 vpd	1,160 vpd	720 vpd
Capricorn Highway (east of Alpha)	420 vpd	435 vpd	270vpd
Clermont-Alpha Road (south of mine)	80 vpd	0 vpd	0 vpd
Clermont-Alpha Road (north of mine)	16 vpd	73 vpd	45 vpd
Monklands Road* (south of mine)	15 vpd	0 vpd	0 vpd
New Mine Access Road	NA	1,380vpd	855 vpd
***Note: Traffic volumes on local roads are an estimate only.**			

Significant growth in traffic volumes will result from the development of the mine, particularly during construction. This includes increases of several hundred percent on the Capricorn Highway, albeit from a very low base.

Background traffic growth on local roads is also expected to increase as a result of the mine stimulating additional development in the area to provide goods and services to the site. In particular, Alpha is likely to grow significantly, with demand for new accommodation, retail and food outlets, emergency services, and other key industries.

BRC estimate that the future population within the Alpha region will be in the order of 2,000, which could be achieved as early as 2015 should targeted mines in the region be operational by then. This would increase the regional population by 200%, with corresponding traffic volume increases, particularly on the Capricorn Highway.

In accordance with DTMR guidelines, the capacity of local roads was assessed through consideration of Level of Service (LOS). For a 100 km/hr two lane rural road, a LOS A is achieved where the percentage following time is less than 40%. This equates to a maximum daily traffic volume of approximately 4,000 vehicles. As per **Table 19**, no road in the local area is expected to carry more than 3,000 vpd, inclusive of background traffic growth and direct mine traffic. As such, the provision of adequate two-lane, two-way carriageways will retain a LOS A on all roads used by mine site traffic.

6.3.2 Intersection Assessment

6.3.2.1 Road Network

In relation to all local intersections and the Level of Service they are generally not expected to experience any significant congestion where traffic volumes are less than 3,500 vpd in total. As with the LOS, intersections are generally not likely to experience any significant congestion where traffic volumes are less than 3,000 vpd in total. As such un-signalised priority controlled intersections will be suitable to cater for future traffic volumes.

The critical intersection for the mine will be where the proposed mine access road intersects the Capricorn Highway. At peak times, this intersection could carry traffic volumes of up to 1,380 vpd and 855 vpd during construction and operation of the mine site respectively. Vehicles travelling to the mine will mostly be outbound from Alpha and thus require a right turn off the highway onto the access road.

Despite the potential growth in traffic directly associated with the mine, the very low turn volumes on other local road intersections is unlikely to be significant enough to warrant upgrades. Indirectly, however, the existence of the mine may generate further development along local streets of the Alpha Township, thereby necessitating upgrades. These may include Burns Street, Moore Street and the Aerodrome Access Road. The need for these upgrades will be investigated in association with the development of the township, with consideration of mine traffic.

6.3.2.2 Rail Network

The proposed mine access road will need to cross the existing passenger railway service west of Alpha. This road is expected to carry up to 2,300 vpd over a train line with less than 10 services per week. Therefore vehicular / train exposure will be less than 23,000 vehicles per week during peak construction times.

Ensuring sufficient spacing for vehicles queuing at the rail intersection will be an important requirement. Where Saltbush Road intersects the highway, the rail line is located only 35 m to the north. This is considered inappropriate, particularly with road trains being over 50 m long, which would result in a rear trailer overhanging the rail line while giving way at the Capricorn Highway. A similar conflict would occur where a road train waits for a passing train and obstructs the highway.

Alternatively, the second proposed option is to have the highway intersection located a further 1.8 km west of Saltbush Road. This will provide for at least 200 m between the highway and railway crossing and therefore ensure sufficient queuing space.

6.3.3 Internal Road Network

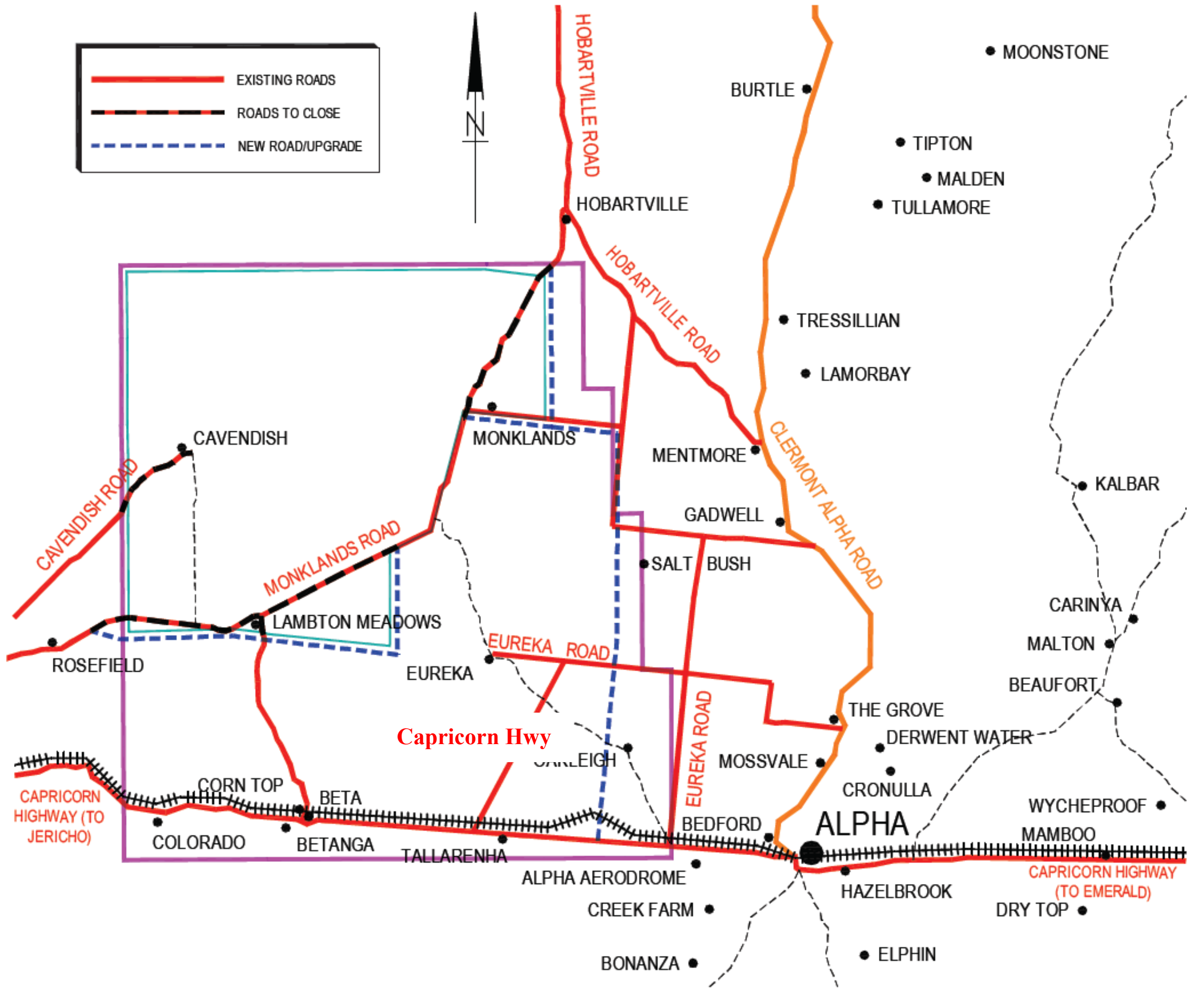
A number of council roads providing access to homesteads lie within the proposed MLA. These include Cavendish Road, Monklands Road, Eureka Road and a number of unnamed roads, as illustrated in **Figure 21**.

The main impact of future mine operations on these existing roads will be to those directly affected from surface mining. This will include part of Monklands Road in the north east, which will need to be severed and replaced with an alternate route around the open cut areas.

In underground mining only areas, no major disruption to surface roads over these areas is expected. Roads located outside the mining lease are expected to continue to operate within their respective road reserves.

Waratah Coal

Figure 21. Relocated Roads



6.4 Environmental Protection Objective

The environmental protection objective is to protect the safety, health and well-being of Project employees, visitors and the community using State, local and mine-site road networks.

6.5 Performance Criteria

The performance criteria adopted for traffic management are:

- no road users or mine personnel are injured as a result of traffic or traffic related impacts from the mine construction or operation
- no intersections, roads or other traffic related components associated with the mine present a safety hazard to the public or mine staff / contractors
- road users are not significantly delayed due to the construction or operation of the Project.

6.6 Control Strategies

The following control strategies will be implemented for the Project in relation to traffic:

- transport of hazardous and dangerous materials during the construction phase will be undertaken in accordance with the DEHP tracking system as defined in Environment Protection (Waste Management) Regulation 2000
- prepare a Traffic Management Plan in consultation with DTMR, Queensland Police Force and the BRC for all elements of the works to include measures to minimise the adverse effects on the road network and school bus routes. The plan would address the safety and convenience for all road users and consider the following:
    - keep one lane open at all times
    - installation of proper signage to make drivers aware about road works and guide them through the work area
    - measures to help ensure safety and manage the changes in traffic conditions (e.g. traffic controllers and / or variable message signage
    - wet weather specific operational requirements including any management measures necessary to address any potential environmental impacts of wet weather operations)
    - truck routes and construction site access
    - maintenance of traffic flows past worksites on all bus routes
- the roadwork contractor will be advised to avoid the school pick up and drop off periods as a general measure
- control working hours and avoid haulage tasks during peak traffic periods and during school drop-off and pick-up times. Where haulage in peak hours is unavoidable, such activities will be managed in accordance with specific traffic management plans provided to the relevant agencies in advance
- use established truck routes and arterial roads for the haulage of construction materials and spoil in order to minimise truck traffic on local roads
- minimise congestion effects through effective staging of the construction work
- analyse the capacity of intersections and road links along the haulage routes in order to identify and mitigate against any operational impacts
- model the exit sign and construction traffic (on the major roads and intersections in the vicinity of the site) in order to predict the effect of temporary traffic arrangements
- provide signage and delineation past the work site, including any diversion routes
- implement measures to help ensure safety and manage the changes in traffic conditions (e.g. traffic controllers and / or variable message signage)
- intersection configurations will be confirmed for all new intersections and any revised existing intersections to ensure they are adequate to safely cater for the future traffic volumes and that the intersection performance criteria are met
- identify management and process controls as a means of mitigating or eliminating the hazards and risks associated with construction traffic and transport during construction

- consider drainage as well as the volume of traffic during and post construction to ensure that road designs are suitable to account for scour and load capacity
- for construction and realignment of local roads, the appropriate industry and local government standards and codes of practice will be adopted in undertaking the works.

Heavy Vehicle Movement

- each haulage contractor will be required to prepare a Road Use Management Plan which addresses the following key items associated with the haulage of materials:
    - haulage routes
    - safety management
    - traffic management
    - operations
    - environmental controls
    - emergency plans
- control heavy vehicle movements to avoid interference with major events
- avoidance of haulage tasks during peak traffic periods and during the school drop-off and pick-up times. Where haulage in peak hours in unavoidable, such activities will be managed in accordance with specific traffic management plans provided to the relevant agencies and BRC in advance
- prepare dilapidation surveys prior to haulage operations to identify any pre-start improvement. A maintenance plan will be prepared to manage any impacts during construction and a post construction survey undertaken to confirm the need or otherwise for restoration following completion
- use established truck routes and arterial roads for the haulage of construction materials and spoil in order to minimise truck traffic on local roads.

Local Traffic

- notify local communities and local authorities where practicable about proposed changes to local traffic access and possible delays due to construction activities and provision of clear signage of changed traffic conditions and alternative routes.

Workforce Transportation and Parking

- provide sufficient parking to accommodate employees' vehicles and give instruction to commuting employees to use the providing parking facilities in order to avoid traffic disruption due to road side parking
- provide buses and encourage car pooling for transportation of construction workforce.

Emergency vehicles

- ensure at least one lane will be kept open on all roads during the construction period.

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6.7 Commitments

The following commitments are made in relation to traffic for the Project:

- road works identified in the control strategies will be implemented to mitigate the traffic impacts of the project
- a privately-operated transport service will transport the workforce between the accommodation village and the mine
- continue to work with DTMR to ensure a practical solution to intersection upgrades.
- Promote safe driving over long distances (fatigue management) in consultation with the local road action group

6.8 Proposed Environmental Authority Conditions

There are no proposed environmental authority conditions for traffic.

7. Waste Management

7.1 Background

7.1.1 Regulatory Framework

The legal framework governing waste and its management in Queensland are the:

- EP Act
- Environment Protection Regulation 2008
- Environment Protection (Waste Management) Regulation 2000
- Environment Protection (Waste Management) Policy 2000 (EPP (Waste)).

7.1.1.1 Definition of Waste

Section 13 of the EP Act defines "*waste*" as:

a) left over, or an unwanted by-product, from an industrial, commercial, domestic or other activity

b) surplus to the industrial, commercial, domestic or other activity generating wastes.

The EP (Waste) Regulation defines general waste as waste other than regulated waste. Regulated wastes are defined in Schedule 1 of the EP (Waste) Regulation as non-domestic waste (which is defined in Schedule 7 of the Regulation). The EPP (Waste) defines regulated waste, as any waste:

a) that contains a significant quantity and concentration of a hazardous contaminant

b) where the hazardous contaminant exhibits hazardous characteristics because of its toxicity, carcinogenicity, mutagenicity, teratogenicity, flammability, corrosivity, reactivity, ignitability or infectiousness, through its physical, chemical or biological characteristics

c) that may cause environmental harm if improperly transported, treated, stored, disposed or otherwise managed.

7.1.2 Waste Management Principles and Hierarchies

The EPP (Waste) provides guidance for waste management through waste management principles and hierarchies. The principles are:

a) polluter pays principle – all costs associated with waste management should, where possible, be borne by the waste generator

b) user pay principle – all costs associated with the use of a resource should, where possible, be included in the price of goods and services developed from the resource

c) product stewardship principle – the producer or importer of a product should take all reasonable steps to minimise environmental harm from the production, use and disposal of the product.

The waste management principles are based on the Waste Management Hierarchy presented in Part 3 of the EPP (Waste). The waste management hierarchy is a framework for prioritising waste management practices to achieve the best possible environmental outcome.

The hierarchy includes:

- avoid waste by optimising methods used within the construction, operation and decommissioning phases
- reuse waste by identification secondary sources that can utilise the waste
- recycle waste by identification facilities that can recycle the particular waste stream
- energy recovery from waste
- disposal of waste at an appropriate facility.

The EPP (Waste) also requires that 'cleaner production' be considered in determining how waste is managed. Cleaner Production (CP) principles provide for the implementation of solutions that increase efficiency and performance while reducing impacts to the environment and supporting the goals of sustainable development.

Cleaner production and eco-efficiency are practical and effective ways for more efficient use of the materials and energy employed, while minimising the generation of wastes and emissions. The mine's waste management strategy aligns with cleaner production principles that ultimately aim to reduce the quantity of waste generated as a result of the Project. By reducing resource consumption and waste production, cleaner production can ameliorate the negative environmental impact of the Project while reducing the cost of production.

Implementing cleaner production requires an assessment (and subsequent re-assessment as the strategy is a living document) of inputs, production processes, and pollution/wastes from the production, consumption and disposal of products and services, and changes to these through good housekeeping practices, process changes, design changes or new technologies.

Generally cleaner production techniques can be implemented through:

- good housekeeping - changes in operational procedures and management allow for the elimination of waste and emission generation. Examples include spill prevention and improved instruction of workers and training
- product modifications - change the product characteristics, such as shape and material composition are CP processes. The lifetime of the new product, is for example, extended, the product is easier to repair, and/or the manufacturing of the product is less polluting
- input substitution – this refers to the use of less polluting raw and adjunct materials and the use of process auxiliaries (such as lubricants and coolants) with a longer service lifetime
- technology modifications – this includes improving process automation, process optimisation, equipment redesign and process substitution
- closed loop recycling – recycling can occur through the reclamation from a production process that would otherwise be disposed of as waste and using it as an input in the same production process. This could take place through reuse as raw material, recovery of materials or other application.

Aspects of the Project that may contribute to cleaner production outcomes include:

- assessing the Project's footprint to minimise the extent of clearing and grubbing activities
- selecting the best available and most practical coal extraction and processing technology to ensure the appropriate energy intensity and production efficiency
- selecting durable plant and equipment throughout the Project lifecycle to minimise the purchase of new plant and equipment

- selecting the most appropriate processes during operation and maintenance, such as the reuse of runoff for dust suppression, and the recycling of sewage within the water treatment plant for reuse or irrigation
- recycling of materials such as glass, paper, cardboard and timber
- recycling of process wastewater from reuse throughout the Project.

In Queensland, certain activities require the tracking of waste:

- where the waste being transported is general waste, the transporter is required to be approved by the local government under s 369 of the EP Act
- where the waste is a regulated waste as defined in the EPR, the transporter must be licensed by the department as a regulated waste transporter
- if the waste is trackable waste as defined by s 17 of the EPR (Waste), all waste handlers must comply with the applicable waste tracking requirements.

Further, the treatment, storage and transport of regulated waste requires and environmental approval under the EP Act due to its classification as an ERA. All applicable requirements and the persons responsible for each of the tasks are reflected in the China First Waste Management Plan (WMP).

7.2 Waste Generated by the Project

The Project will generate non-mineral waste during the construction and the operational phases. These sources include:

- regulated waste including hydrocarbon waste (i.e. waste oil, oily water, oily sludge, grease, coolant, oil rags, oil filters, drums, detergents, solvents, batteries, tyres, paints and resins)
- general waste including food waste, packaging and food containers
- recyclable waste including paper, cardboard, plastics, glass and aluminium cans
- wood waste including timber, pallets, and off-cuts
- tyres including light vehicle tyres and mine truck tyres
- scrap metal and off-cuts from the water supply pipeline and mine infrastructure areas including drums, cans, scrap, containers, nails, screws
- sewage effluent and sludge.

An indicative inventory of wastes generated by the Project is shown in **Table 20**.

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Table 20. Mine - waste inventory, characterisation and disposal option

Project Activity	Waste Generated	Waste Characterisation	Phase Waste Expected			Temporary Site Storage	Final Disposal Option
			Construction	Operation	Decommission		
General Earthworks							
Vegetation clearing	Plant material	Biodegradable solid	Yes	-	-	Stockpile	Reuse
	Weeds	Biodegradable solid – some seeds may regenerate.	Yes	-	-	Stockpile	Refer to Weed management plan.
	Mulch	Biodegradable solid	Yes	-	Yes	Stockpile	Reuse
	Timber	Solid inert	Yes	-	-	Stockpile	Recycle
Topsoil placement/removal	Topsoil	Solid inert	Yes	-	Yes	Stockpile	Reuse
Excavation of unsuitable in-situ material	Spoil	Solid inert*	Yes	-	Yes	Stockpile	Reuse
		Potential contamination	Yes	-	Yes	Separate stockpile from non-contaminated material	Disposal with potential treatment and re-use.
Placement or removal of sub-grade/fill	Excess fill	Inert solid	Yes	-	Yes	Stockpile	Reuse
Concrete Batching							
Concrete manufacture	Process wastewater	Alkaline liquid	Yes	Yes	-	Sediment pond	Treat and reuse
	Surplus cement	Solid inert	Yes	Yes	-	Stockpile	Reuse
	Surplus concrete	Solid inert	Yes	Yes	-	Stockpile	Reuse

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Project Activity	Waste Generated	Waste Characterisation	Phase Waste Expected			Temporary Site Storage	Final Disposal Option
			Construction	Operation	Decommission		
Coal Handling and Preparation Plant							
Run of mine coal handling	Tailings / rejects	Contaminated material	-	Yes	-	Tailings / waste rock storage areas	Covered with benign rock material for permanent burial
	Mine water (from work area runoff or ground water seepage)	Contaminated liquid	-	Yes	-	Sediment pond	Reuse in CHPP process
Coal stockpiling	Fugitive dust particles	Potentially hazardous material	-	Yes	-	Not applicable	Not applicable
	Runoff	Hazardous liquid	-	Yes	-	Sediment pond	Reuse in CHPP process
Coal washing	Process wastewater	Hazardous liquid	-	Yes	-	Coal washery waste disposal area	Reuse in CHPP process
General Track Works for Rail Loops							
Laying/removal of cable	Surplus cable	Solid inert (nonferrous metal)	Yes	Yes	Yes	Scrap metal skip	Recycle
	Surplus conduit	Solid inert	Yes	Yes	Yes	Stockpile	Recycle
Laying/removal of ballast	Surplus ballast	Solid inert	Yes	Yes	Yes	Stockpile	Reuse
Laying/removal of sleepers	Broken or surplus sleepers	Solid inert	Yes	Yes	Yes	Stockpile	Reuse/ Recycling Facility
Laying/removal of track	Surplus steel	Solid inert (ferrous metal)	Yes	Yes	Yes	Scrap metal skip	Sale
	Surplus fittings	Solid inert (ferrous metal)	Yes	Yes	Yes	Scrap metal skip	Recycle

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Project Activity	Waste Generated	Waste Characterisation	Phase Waste Expected			Temporary Site Storage	Final Disposal Option
			Construction	Operation	Decommission		
Plant Maintenance							
Routine Maintenance (oil change. water check etc.)	Waste oil, lubricants, fuels.	Hazardous liquid	Yes	Yes	Yes	Designated storage in bunded tanks/drums	Disposal
	Used filters and oily rags.	Hazardous material	Yes	Yes	Yes	Designated storage in receptacle.	Disposal
High level plant maintenance	Waste oil, fuel, lubricants, hydraulic fluid.	Hazardous liquid	Yes	Yes	Yes	Designated storage	Disposal
	Broken parts	Solid inert (likely to be ferrous metal)	Yes	Yes	Yes	Scrap metal skip or general waste skip.	Recycle or dispose.
	Tyres	Solid inert (limited regulated waste)	Yes	Yes	Yes	Stockpile	Recycle
	Batteries	Hazardous material	Yes	Yes	Yes	Stockpile	Recycle
Wash down	Waste wash down water containing Sediment, Detergent	Contaminated Liquid	Yes	Yes	Yes	Sedimentation pond.	Treat for reuse, or disposal
Receival of parts/supplies	Packaging material, timber pallets, plastic/paper/cardboard	Solid inert	Yes	Yes	Yes	Stockpile pallets. Paper, plastic and cardboard to be stored in recycling receptacle.	Recycle/reuse
Chemical and fuel storage	Empty containers	Hazardous liquid	Yes	Yes	Yes	Stockpile	Disposal
	Surplus material	Hazardous liquid	Yes	Yes	Yes	Liquid to be stored in designated drums in bunded area.	Recycle or disposal at appropriate facility by licensed transporter.

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Project Activity	Waste Generated	Waste Characterisation	Phase Waste Expected			Temporary Site Storage	Final Disposal Option
			Construction	Operation	Decommission		
	Spill cleanup material	Hazardous material (solid)	Yes	Yes	Yes	Designated bins.	Disposal at appropriate facility by licensed transporter.
Workers Village, Offices and Associated Facilities							
Dining facilities	Grey water	Contaminated liquid	Yes	Yes	Yes	Onsite septic	Collection and disposal by contractor
	General waste including putrescible and organic.	Biodegradable	Yes	Yes	Yes	General waste skips or dedicated compost receptacle.	Dispose or application of compost.
	Packaging material	Solid inert	Yes	Yes	Yes	Dedicated recycle bin	Recycle
Printing	Waste paper	Solid inert	Yes	Yes	Yes	Dedicated recycle bin	Recycle
	Printing cartridges	Solid inert	Yes	Yes	Yes	Dedicated recycle bin	Recycle
Ablutions	Sewage	Biodegradable liquid, biological hazard	Yes	Yes	Yes	Onsite septic	Collection and disposal by contractor
	Grey water	Contaminated liquid	Yes	Yes	Yes	Onsite septic	Collection and disposal by contractor

7.2.1 Construction Waste

During the construction of the mine, the major infrastructure components include:

- site preparation works including the establishment of overburden and topsoil stockpiles
- CHPP including coal stockpile areas
- railway turning loops and coal load out facility
- water management structures including dams, levee banks and sediment traps
- haulage and access roads
- ancillary infrastructure including mine office, communications, services, and associated amenities.

Site Preparation Works: The excavation of the overburden will comprise topsoil, clay and a variety of rock material. Each will be stored in distinct stockpiles to ensure reuse of materials where practicable. The topsoil material (with appropriate sediment and erosion controls implemented) will be used in the progressive rehabilitation of the mine. Clay material extracted, and where deemed to be suitable by permeability testing, may be used to construct mine levee banks. Geotechnical investigations indicate that the majority of the rock material is Non Acid Forming (NAF) material. It is anticipated that there will be minimal waste generation during these works, as the NAF material can be used to construct mine structures including tailings storage facilities, mine levee walls and the Overburden Emplacement Facility.

CHPP: Waste generated during the construction of the CHPP will include general building waste such as surplus spoil from site when re-profiling the pad area, surplus concrete from footings, and steel off cuts from the sheet metal used in construction.

Railway Turning Loops and Coal Load Out Facility: Waste generated during the construction of the railway turning loops will include materials described in the construction of the rail alignment including surplus spoil, ballast, concrete sleepers and steel off cuts from the track and fittings. The predominant waste streams generated from the construction of the coal load out facility will be general building waste including surplus spoil from preparation of the infrastructure pad area, nonferrous and ferrous metals from construction of the conveyor frames and associated structures, surplus cement / concrete and to a lesser extent, packaging material. In order to minimise the extent of general building waste generated during the construction phase of the Project, where feasible and practicable, Waratah Coal will prefabricate materials off-site, with transportation and drop-off at designated points along the rail alignment. By procuring construction materials to the specifications and quantities necessary, general building waste from the Project will be considerably reduced.

Water Management Structures: It is expected that the majority of the excavated material from the water management structures will have the potential for reuse in construction of other Project components such as haulage or access roads. It is anticipated that a separate area adjacent to the borrow pit will be designated for the storage of unsuitable material. The quantity of surplus material is not yet able to be determined.

Haulage and Access Roads: Waste streams are expected to consist predominantly of green waste from clearing, surplus spoil and fill material, and limited hydrocarbon / oils from plant equipment during grading and compaction works. The majority of the spoil material will be stockpiled for reuse during rehabilitation of the mine site, while surplus fill will be used in other areas of the Project during construction including the pad area of the mine offices and amenities.

Workers Village, Mine office and Associated Amenities: Waste streams anticipated to be generated during the construction of this mine infrastructure will predominantly occur during the early works phase where vegetation will be cleared, and the surface profile stripped in preparation of the sub-grade / pad areas and installation of foundations and footings. General building waste including excess concrete, bricks, ferrous and nonferrous metal off cuts and surplus electrical cable associated with the establishment of services are also expected. Stormwater runoff will also be generated from the construction area. An appropriate Erosion and Sediment and Control Plan (ESCP) will be implemented to ensure that clean stormwater is diverted around the site boundary, and any sediment laden runoff is captured in catch drains. Stormwater and grey water / sewage will be generated during all phases of the Project and are discussed separately in below. Waste packing material will also be generated for office furniture, equipment and supplies associated with the mine site offices and amenities.

Estimated quantities of wastes generated by mine and infrastructure construction activities, together with identified management options are shown in **Table 21**. Quantities of waste were estimated based on information from other coal mine sites in Central Queensland.

Table 21. Waste generation estimates during construction phase

Waste Type	Source(s)	Management Method	Approximate Quantity
Cleared vegetation	Mine, water pipeline, site infrastructure including dams, diversion, levee and sewage treatment plant	Reuse vegetation waste on-site for rehabilitation, landscaping and erosion control where possible.	700,000 – 900,000 tonnes
Excavated waste	Access roads, site infrastructure and site fencing.	Refill any excavations and spread any excess soil over the nearby area and revegetate.	All used as fill on site
Concrete material, bricks, pavers, pipes	Site infrastructure area and water supply pipeline.	Minimise waste by producing/procuring only the amount required. Excess waste will be disposed of in one or more of the in-pit spoil dumps on-site.	3,000 tonnes
Steel/metal off-cuts	Site infrastructure area and water pipeline.	Minimise waste by producing/procuring only the amount required. Segregation and collection on-site. Transportation off-site by a waste contractor for off-site recycling.	800 tonnes
Timber pallets and off-cuts	Site infrastructure area and workshop.	Minimise waste by producing/procuring only the amount required. Any undamaged pallets will be returned to the supplier for reuse. Excess waste will be chipped and reused on-site as mulch for landscaping and erosion control where practical. Left over waste will be dumped in one or more of the in-pit spoil dumps on-site.	2,500 tonnes
Electrical wastes	Contractor crib rooms, offices, accommodation	Segregation of electrical wastes for removal off site	725 tonnes

Waste Type	Source(s)	Management Method	Approximate Quantity
	facilities, and mine, CHPP and infrastructure facilities.	for recycling or reprocessing where possible by the waste contractor.	
Paints, solvents, sealants and resins.	Site infrastructure area, workshop and water supply pipeline.	Minimise waste by producing/procuring only the amount required. Collection on-site and storage in a segregated area. Transportation offsite by licensed regulated waste transporter, and disposal at a licensed facility.	<1 tonne
General wastes including food waste, packaging materials etc.	Construction offices and workshop.	General waste will be taken off-site for disposal at the on-site landfill. Collection and segregation of recyclable waste on-site. Transportation by a waste contractor for off-site recycling.	Cardboard – 2,000 tonnes Plastics – 750 tonnes Glass – 200 tonnes General Putrescible – 2,500 tonnes
Batteries	Mobile phones, radios, vehicles, equipment, etc.	Mobile phone, radio and other batteries to be segregated and then collected by a licensed waste contractor for reuse, reprocessing, recycling or disposal.	350 tonnes
Grease trap wastes	Workshop.	Wastes will be collected and taken by licensed regulated waste transporter to a licensed facility for recycling.	3,000 litres
Waste oil and containers	Workshop. Collected and stored on-site in a bunded tank.	Transported off-site by a licensed regulated waste transporter, to a licensed facility for recycling.	Oils (synthetic and mineral) – 10,000 tonnes Other hydrocarbon and hydrocarbon contaminated materials – 10,000 tonnes Empty waste oil containers - <1 tonne
Oily water	Workshop.	Oil will be separated from water. The resulting oil will be collected and transported off-site by a licensed regulated waste transporter to a licensed facility for recycling. The separated water will be disposed of through the Sewage Treatment Plant system.	5,000 -7,000 litres
Tyres	Workshop.	Light vehicle tyres will be stored onsite and	1,500 tyres

Waste Type	Source(s)	Management Method	Approximate Quantity
		transported off-site by a licensed regulated waste transporter to a licensed facility for recycling or disposal.	
Sewage Treatment Plant (STP) waste and residues (sewage sludge)	Administration offices, workshops.	Disposed of in an appropriate facility by a licensed contractor.	Sewage effluent – 300,000 k/l Sludge – 90 tonnes
Asbestos	Removal of existing farm facilities	Asbestos will be removed and disposed by a specialist contractor.	To be identified during construction.
Other regulated waste	Various across site	All regulated wastes shall be collected and removed by a specialised licensed waste contractors or specialist maintenance personnel. Tracking of all regulated wastes will be undertaken.	To be identified during construction.

7.2.2 Operational Waste

Aside from tailings and overburden wastes, the operation of the mine site is likely to generate the following wastes:

Workers Village: A workers village will be constructed to cater for a maximum of 2,000 personnel. The workers village will include accommodation, kitchens, dining halls, wet messes, and recreational facilities. The predominant waste streams are likely to include black water, grey water, grease trap waste (from kitchen operations), recyclables and general domestic waste including food scraps. The black and grey water will be diverted to the mine site sewage treatment facilities (STF) with a capacity sufficient to cater for peak personnel volumes. A contractor will manage the STF and be responsible for the quality of the water post treatment so it can be used for irrigation / dust suppression purposes within the Project.

Mine Office: Waste streams will comprise predominantly paper and cardboard recyclables. Printer toner cartridges will be segregated for collection and recycling. Some general domestic waste including food scraps will be disposed of consistent with the workers village.

Maintenance: Extensive plant and equipment will be used at the mine. This will result in frequent servicing requirements. Waste streams associated with such activities will include regulated waste (tyres and rubber off cuts) and hazardous material such as waste oil, lubricants, coolant and oily rags. Scrap metal may also be generated from broken machinery.

Estimated quantities of wastes generated by mine and infrastructure operations activities, together with identified management options are shown in **Table 22**. Quantities of waste were estimated based on information from other coal mine sites in Central Queensland.

Table 22. Waste Generated during Operations

Waste Type	Source(s)	Management Method	Approximate Quantity per annum
Green waste	Clearing of vegetation for ongoing development of the mine.	Suitable material to be reused on site to provide fauna habitat. Remaining material to be chipped and mulched for reuse during progressive rehabilitation and revegetation. Burning of green waste will only occur as a last resort, subject to obtaining permits and approvals.	50,000 tonnes
Waste oil	Workshop and mobile service vehicles.	Collected on-site then transported offsite by a licensed regulated waste transporter, to a licensed facility for recycling or treatment and disposal.	Oils (synthetic and mineral) – 3,000 tonnes Other hydrocarbon and hydrocarbon contaminated materials – 3,000 tonnes Waste oil containers - <1 tonne
Scrap metal, drums	Site Infrastructure Area, including administration, workshops.	Segregation and collection on-site. Transportation off-site by a waste contractor for off-site recycling.	2,000 tonnes
General wastes including putrescible and organic (food waste), some plastics and paper not suitable for recycling	Workshop, office.	Collection on-site and storage in segregated area. Waste will be dumped in one or more of the in-pit spoil dumps on-site.	100 tonnes
Recyclable waste including paper and cardboard, plastics, and glass	Workshop, office.	Segregation and collection on-site. Transportation by a waste contractor for off-site recycling.	1,500 tonnes
Paints, solvents, sealants and resins	Workshop.	Collected on-site and stored in a segregated area. Then transported off-site by a licensed regulated waste transporter, to a licensed facility for treatment and disposal.	<1 tonne
Blasting residue (from use of ANFO explosive, boosters and detonator)	Blasting of overburden	Fragments to be buried in overburden stockpiles.	20,000 tonnes
Timber pallets and off-cuts	Site Infrastructure Area, including administration,	Minimise waste by producing/procuring only the amount required.	<1 tonne

Waste Type	Source(s)	Management Method	Approximate Quantity per annum
	workshops.	Any undamaged pallets will be returned to the supplier for reuse. Excess waste will be chipped and reused on-site as mulch for landscaping and erosion control where practical. Left over waste will be disposed of in one or more of the in-pit spoil dumps on-site.	
Tyres	Workshop.	Light vehicle tyres will be stored onsite and transported off-site by a licensed regulated waste transporter to a licensed facility for recycling or disposal. Mine truck tyres will be buried on-site, the locations of which will need to be recorded in accordance with EPA requirements.	2,000
Vehicle batteries	Site Infrastructure Area including administration, workshops.	Collected on-site in a segregated area. Then transported off-site by a licensed regulated waste transporter to a licensed facility for recycling.	100 tonnes
Discharge from vehicle wash-down	Vehicle wash-down facilities at MIA	Vehicle wash-down water and associated contaminants will be collected and put through a hydrocarbon separator. Hydrocarbon emulsion will be disposed by a licensed contractor as a regulated waste, clarified waters will be discharged to a holding dam, and sediments will be disposed to the tailings storage facility.	300,000 k/L
Regulated waste sewage waste and residues (sewage sludge)	Sewage Treatment Plant.	Wastes will be transported and disposed of by licensed contractor at a licensed facility.	Sewage effluent – 100,000 k/L Sludge – 40 tonne
Mineral wastes			
Tailings (including process water)	Coal handling, preparation and processing	Fine particulates from the coal processing will be disposed to a TSF in paste form. Tailings will be capped following suitable drying of materials.	5,300,000 tonnes

Waste Type	Source(s)	Management Method	Approximate Quantity per annum
		The area of the tailings disposal cell will then be rehabilitated and in-pit disposal options will be used.	
Coarse rejects	Coal handling, preparation and processing	During the first year of operation, coarse rejects will be encapsulated in the out-of-pit spoil pile. When sufficient space is available, all coarse rejects will be stored within the in-pit spoil piles above groundwater level.	10,705,000 tonnes

7.2.3 Decommissioning Waste

Prior to the decommissioning of the Project, a mine closure and rehabilitation plan will be prepared. The plan will assess the volume and types of waste anticipated to be generated through this final phase of the Project. The plan will be based on the best practice principles at the time, and will be undertaken in line with the waste management hierarchy to identify the most appropriate measures to manage the remaining waste on the Project site. Site infrastructure will be decommissioned and demolished in line with the intended post Project land use.

7.2.4 Mining Waste

The Project consists of two open cut operations producing 20 Mtpa and four longwall mines producing 36 Mtpa. Total annual ROM feed will be 56 Mtpa, producing 40 Mtpa of washed coal.

The open cut mines will have a combined strike length of about 26 km. Truck and shovel and dragline excavation methods will be used to complete strip mining.

Mining waste includes overburden, and coarse rejects and tailings produced in the wash plants. Coarse rejects sizing will be -50 mm and the tailings will consist of a fine, silty sand (-2 to +0.125 mm). The open cut mines will have an average annual overburden volume of 305 Mtpa.

Dried rejects will be transported from the surge bins to containment cells in the spoil piles. Tailings will be dewatered by filter pressing and then trucked to clay lined containment cells in the spoil piles.

7.2.4.1 Mine Waste Storage

The proposed Tailings Storage Facility (TSF) for the China First Coal Project will be encapsulated in cells developed within the box cut and spoil pile areas. The location of the initial cells will be adjacent to the lox lines of the initial box cut, approximately 2 km to 5 km from the CHPP. The area can be generally described as flat terrain with alluvial clay soil profiles. **Figure 22** shows the overall site layout.

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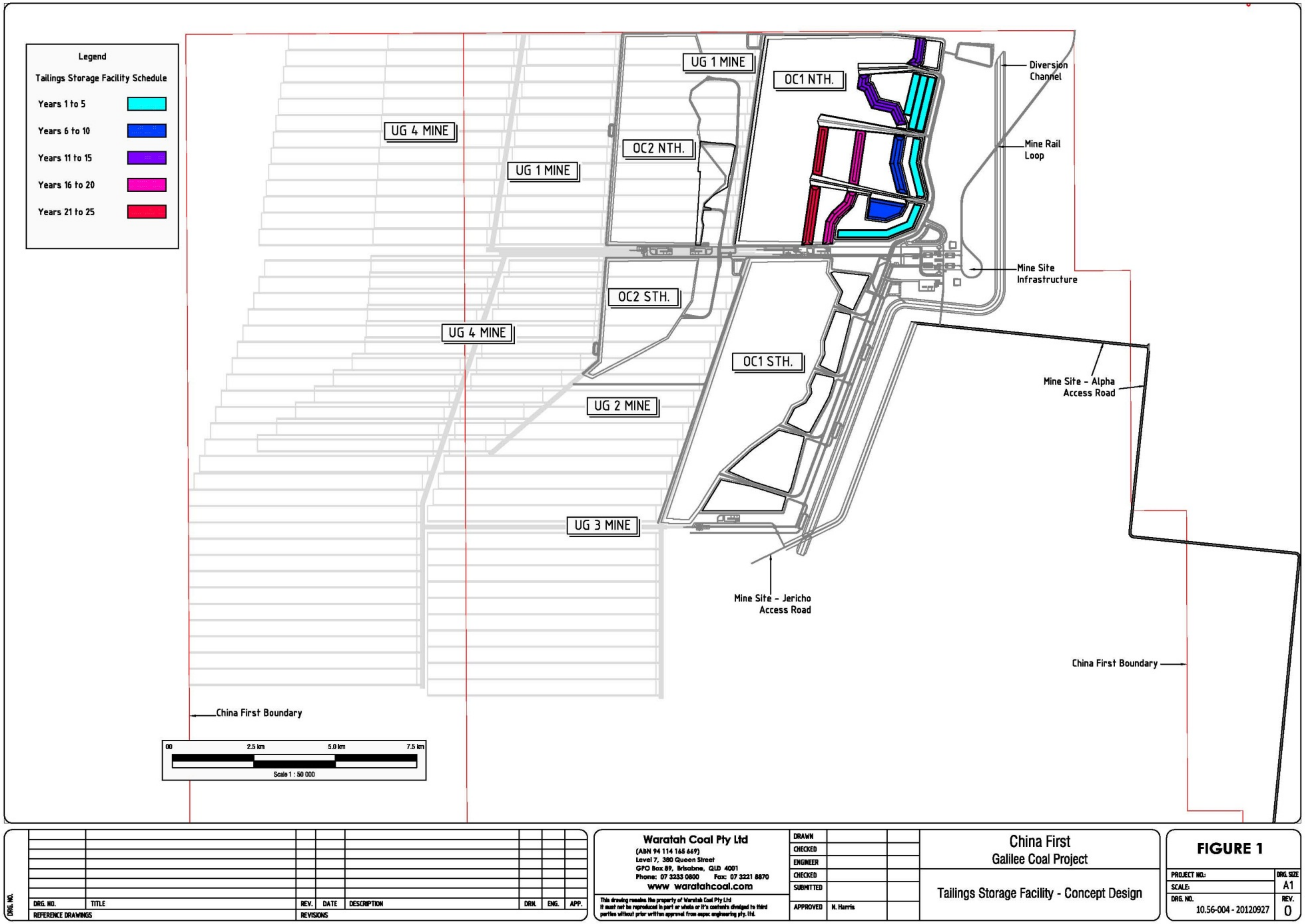
Figure 22. Tailings storage facility – concept design



Over burden

Open cut development will proceed by strip mining. Overburden will be dumped at angle of repose. Spoil piles will be flattened by dozer, topsoiled and seeded.

Coarse Waste Rejects

Coarse waste rejects will be trucked to disposal cells in the spoil piles. Cells will be lined with impervious clay. The rejects will be dumped in the cells, track compacted by dozer and sealed with a clay blanket to prevent oxidisation. The annual rejects production is listed in **Table 23**.

Tailings Management

Tailings Storage Facility

The China First Coal Mine TSF will be designed to receive and store tailings produced by the CHPP for the nominal 25 years mine life. Tailings paste and rejects will be trucked to dedicated TSF cells within the box cut and other spoil areas. **Table 23** shows the estimated storage requirements per year over the life of the mine.

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Table 23. Tailings storage capacity requirements

Life of mine (yrs)	Raw coal (000 tonnes)	Solid rejects (000 tonnes 19%)	Rejects moisture (16%) Ml/yr	Solid tailings (% 000 tonnes 9.5%) Ml/yr	Tailings moisture (26%) Ml/yr	Stored tailings and rejects (m^3/yr)	Cumulative tailings and rejects (m3)	TSF Stage	Five year stage (m^3)
1-3 (construction)									
1	26,681	5,096	815	2,535	659	6,457,533	6,457,533		
2	45,147	8,623	1,380	4,289	1,115	10,926,811	17,384,344		
3	55,583	10,616	1,699	5,280	1,373	13,452,609	30,836,953		
4	56,048	10,705	1,713	5,325	1,384	13,565,152	44,402,105		
5	56,048	10,705	1,713	5,325	1,384	13,565,152	57,967,256	Stage 1 - Out of Pit	57,967,256
6	56,048	10705	1713	5325	1384	13,565,152	71,532,408		
7	56,048	10,705	1,713	5,325	1,384	13,565,152	85,097,560		
8	56,048	10,705	1,713	5,325	1,384	13,565,152	98,662,711		
9	56,048	10,705	1,713	5,325	1,384	13,565,152	112,227,863		
10	56,048	10,705	1,713	5,325	1,384	13,565,152	125,793,015	Stage 2 - In pit	67,825,758
11	56,048	10,705	1,713	5,325	1,384	13,565,152	139,358,166		
12	56,048	10,705	1,713	5,325	1,384	13,565,152	152,923,318		
13	56,048	10,705	1,713	5,325	1,384	13,565,152	166,488,470		
14	56,048	10,705	1,713	5,325	1,384	13,565,152	180,053,621		
15	56,048	10,705	1,713	5,325	1,384	13,565,152	193,618,773	Stage 3 - In pit	67,825,758
16	56,048	10,705	1,713	5,325	1,384	13,565,152	207,183,925		
17	56,048	10,705	1,713	5,325	1,384	13,565,152	220,749,076		
18	56,048	10,705	1,713	5,325	1,384	13,565,152	234,314,228		
19	56,048	10,705	1,713	5,325	1,384	13,565,152	247,879,380		
20	56,048	10,705	1,713	5,325	1,384	13,565,152	261,444,531	Stage 4 - In pit	67,825,758
21	56,048	10,705	1,713	5,325	1,384	13,565,152	275,009,683		
22	56,048	10,705	1,713	5,325	1,384	13,565,152	288,574,835		
23	56,048	10,705	1,713	5,325	1,384	13,565,152	302,139,986		
24	56,048	10,705	1,713	5,325	1,384	13,565,152	315,705,138		
25	56,048	10,705	1,713	5,325	1,384	13,565,152	329,270,290	Stage 5 - In pit	67,825,758

Tailings Emplacement Strategy

It is proposed to truck tailings and rejects to properly engineered containment cells constructed in spoil piles. The coarse and fine rejects are to be enveloped in an impervious clay blanket.

Geochemical testing indicates that coarse and fine rejects are benign and will remain so if they are encapsulated in an impervious clay blanket, to prevent oxidisation.

The construction of these cells will be as follows:

- Out of Pit Tailings Storage - Year 1 to Year 5
    - design storage capacity for 57,967,256 m^3 for first five years of production
    - areas within the proposed footprint of overburden waste will be stripped of topsoil and earth embankments made from overburden waste materials will be placed to form TSF cells. The cell embankments and floors will be further lined with an impervious blanket of clay encapsulating the tailings and rejects
    - the dam wall embankment will initially be 10 m high and will be increased by lifts of 10m
    - when the cell capacity of the storage area is nearing full capacity with allowable contingency, the cell wall will be further raise by another 10m. This process will continue to cater for the design capacity of 80 Mt for five years
- In Pit Tailings Storage - Year 6 to Year 25
    - design storage capacity for 271,303,033 m^3 for operational years 6 to 25
    - several in pit and in spoil TSF cells will be developed to cater for operational tailings for years 6 to 25
    - each cell will cater for approximately five years of operations with a capacity of 67,825,758 m^3
    - the initial in pit cell will be placed in a designed void left by original boxcut by strategically placing spoil to form cell embankments and protect down dip mining operations
    - the existing low wall will be a natural clay face, or where not, lined with compacted clay with a design grade of 1 vertical to 3 horizontal
    - both end walls and high wall spoil embankments will be lined with compacted clay on batter slopes of 1 vertical to 3 horizontal
    - the in pit cell wall embankment will have a depth of 40 m and will trend down to 80m in the southern mining areas
    - tailings and rejects will then be trucked to the cell, dumped and track compacted by dozer
    - when the cell capacity of the storage area is nearing full capacity with allowable contingency, the dam wall will be further raise by increments of 5 m. This process will continue to cater for the design capacity of 67,825,758 m^3 for five years.

The anticipated progression and staging of the TSF is outlined in **Table 24**.

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Table 24. TSF cell / stage estimated volumes

Cell Number	Stage Number	Crest RL (m)	Storage Capacity 000 (m^3)	Cumulative Capacity 000 (m^3)	Life of Mine (yrs)
1	1	10	6,457,533	6,457,533	1
1	2	20	10,926,811	17,384,344	2
1	3	30	13,452,609	30,836,953	3
1	4	40	13,565,152	44,402,105	4
1	5	50	13,565,152	57,967,256	5
2	1	10	13,565,152	71,532,408	6
2	2	20	13,565,152	85,097,560	7
2	3	30	13,565,152	98,662,711	8
2	4	40	13,565,152	112,227,863	9
2	5	50	13,565,152	125,793,015	10
3	1	10	13,565,152	139,358,166	11
3	2	20	13,565,152	152,923,318	12
3	3	30	13,565,152	166,488,470	13
3	4	40	13,565,152	180,053,621	14
3	5	50	13,565,152	193,618,773	15
4	1	10	13,565,152	207,183,925	16
4	2	20	13,565,152	220,749,076	17
4	3	30	13,565,152	234,314,228	18
4	4	40	13,565,152	247,879,380	19
4	5	50	13,565,152	261,444,531	20
5	1	10	13,565,152	275,009,683	21
5	2	20	13,565,152	288,574,835	22
5	3	30	13,565,152	302,139,986	23
5	4	40	13,565,152	315,705,138	24
5	5	50	13,565,152	329,270,290	25

Design Criteria - Embankment

The geotechnical requirements for the tailings and the reject cells are that the rejects are enveloped in clay blankets that are effectively impervious and that the batters of the cells are geotechnically stable. Recommended batter slope is 1 (vertical) on 3 (horizontal).

Rejects comprise fresh sandstone, siltstone and claystone fragments less than 50 mm in diameter. Tailings grain size varies from 0.030 mm to 0.25 mm.

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The clay blanket is to be placed on track compacted Permian spoil in 300 mm layers. The blanket true thickness is 1.5m. Minimum required dry density ratio is 98% standard compaction at optimum moisture content (OMC) plus 2% for cohesive soils. The maximum dry density shall be determined in accordance with Test No 5.1.1. (Standard Compaction) of AS 1289 for cohesive material.

Good quality non-dispersive, clay is required for the blankets. The material shall be well graded sandy/silty clay as defined below:

- Liquid Limit WL 30 % to 60 %
- Plasticity Index I_p 15 % to 45 %

Emerson dispersion testing will be undertaken to ensure that non-dispersive blanket clay is used.

Proper compaction standards at the required moisture content (OMC, plus 2 %) will be used in the construction of the embankment. The first 1,000 mm placed in contact with natural foundations or track compacted spoil shall have a minimum of 20 % passing the 75 µm sieve.

Tailings and rejects will be placed in layers and track compacted using a dozer.

Design parameters used for TSF include:

- embankment slope stability, factor of safety of 1.5
- short term construction stability factor of safety of 1.2
- a factor of safety of 1.1 under seismic loading conditions
- an allowance for freeboard of 0.5 m plus 0.8 m for Design Storage Allowance requirement
- seismic coefficient of 0.04 g for horizontal force

The above criteria are in accordance with internationally accepted guidelines including those of ANCOLD.

Design Criteria – Seepage Control

Seepage control will be achieved by enveloping the tailings and rejects in an impervious clay blanket. In situ permeability testing will be completed in the blanket to ensure that it is water tight. Piezometers will be installed to check for seepage.

7.2.5 Potentially Acid Generating Material

Overburden

Geological logging of drill cores has not detected any oxidisable pyrite and all cores are NAF. Overburden material is benign and poses not risk to the immediate or downstream environment.

All spoil piles will be reshaped, topsoiled and seeded for appropriate vegetation growth.

Coarse Rejects

Dewatered coarse rejects will be transported from the rejects bin to containment cells in the spoil piles. Rejects will be track compacted and encapsulated in an impervious clay blanket, to prevent oxidisation.

Tailings

Tailings will be filter pressed to remove moisture and then trucked to clay lined containment cells in the spoil piles. Dried tailings will be track compacted and capped with impervious clay. In the unlikely event that the tailings pH falls below 5.0, the tailings surface will be lime dosed, prior to sealing.

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7.3 Environmental Values

Environmental values at the Project site that may potentially be impacted upon by non-mineral waste include:

- the life, health and wellbeing of people
- the biological integrity and diversity of ecosystems and processes surrounding the mine
- the integrity of receiving environments such as land, air, surface water and groundwater (including the suitability of water for agricultural use)
- the stability of disturbed land and ensuring it is non-polluting
- the suitability of land for beneficial post mining land use
- visual amenity.

7.4 Potential Impacts on the Environmental Values

Environmental harm could occur in an around the Project site if wastes are not managed properly. Sensitive receptors including residences and ecosystems surrounding the Project site could be detrimentally impacted if waste streams entered waterways and groundwater systems and then flowed off-site. Similarly, air emissions have the potential to impact sensitive receptors off-site. The following waste streams from the Project have the potential to impact on the above mentioned environmental values:

- solid waste (other than mineral waste) including regulated waste, general waste and sewage
- waste water from the mining operations and processing plant
- air emissions including particulates, fumes and odour from the Project during construction and operation.

7.5 Environmental Protection Objectives

The environmental protection objectives for waste are:

- to avoid contaminating land, surface water or groundwater through poor waste management practices
- to manage waste through the use of licensed contractors, transporters and disposal facilities
- to minimise the generation of waste in accordance with the waste management hierarchy listed in the Environmental Protection (Waste Management) Policy 2000 which involves:
    - implementation of the waste minimisation hierarchy with these waste management options:
        a. waste avoidance
        b. waste re-use
        c. waste recycling
    - compliance with national and state waste management policies, the EP Act and associated regulatory instruments as a minimum
    - effective waste disposal (as a last option).

7.6 Performance Criteria

The performance criteria for waste management are:

- prevent adverse environmental impacts from waste management during the construction phase
- adherence to waste minimisation principles
- adhere to waste management hierarchy by:
  - minimising waste generation
  - maximising water and materials reuse and recycling
  - safely treating and disposing of all non-reusable and non-recyclable materials
- managing mine waste in accordance with mine waste management strategies.

7.7 Control Strategies

General Waste Management Strategies

Waste Avoidance

Waste avoidance is the first hierarchical step in reducing the amount of waste produced. The generation of waste can be avoided by:

- substituting inputs that generate waste
- increasing efficiency in the use of raw materials, energy, water or land
- redesigning processes or products
- improving maintenance and operation of equipment.

Careful Project planning will ensure that the amount of material brought on-site for the construction and operating of the mine is minimised, resulting in a cost saving and reducing the volume of waste generated. Any excess materials and used chemical containers will, where practical, be returned to the supplier or other local users. Waratah Coal will also consider packaging issues when purchasing resources for the Project and will encourage bulk purchasing to reduce the amount of packaging waste.

Waste Reuse/Recycling

The appropriate management and storage of wastes will prevent on-site and off-site pollution and enhance opportunities for reuse. Waste will be sent for disposal to landfill only once other options have been exhausted. Waste streams will be assessed for potential reuse, prior to transport to an approved disposal facility. Wastes will be reused or recycled where possible:

- vegetation wastes from site clearing will be used on site in rehabilitation and landscaping
- topsoil from disturbed areas will be used in rehabilitation activities on-site
- where possible, recyclable materials will be purchased for use throughout the Project
- solvents, metals and oil will be recovered and re-used
- recyclable wastes will be collected separately and reused or recycled, such as

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- timber from concrete formwork
- scrap steel and off-cuts
- pallets
- plastics
- paper and cardboard
- oils.

Waste Separation

Waste, where practicable and taking into account health and hygiene issues, will be segregated and collected on-site and stored in suitable containers for removal to approved facilities as agreed with the relevant local council prior to construction. It is anticipated that a portion of all construction materials will be recycled. Adequate separation of components of the waste stream at the point of generation will be practiced by the Project. Products such as steel, glass, paper, cardboard and aluminum cans will be segregated from general waste. Waste separation at the source will be achieved by providing bins for reusable or recyclable materials. A number of locations will be allocated within the mine area for the collection of large quantities of waste to enable segregation of wastes for recycling. Some of these materials collected will have a market demand. There are likely to be opportunities to reuse and recycle aluminum cans, some containers such as glass bottles, paper, cardboard, pallets, drums, timber, oils, and scrap metal. The Project will review the marketability of its waste for recycling and reuse on a regular basis should sufficient amounts of reusable / recyclable waste be produced as a result of construction and operation.

Waste Disposal

Wastes generated by the Project will be disposed of in a way that causes the least harm to the environment.

Operational and construction solid wastes that cannot be recycled or reused will be disposed of at an appropriate facility, depending on the waste type. Facilities in the region include:

- licensed regulated waste facilities
- Material recycling facility
- transfer stations.

Specific Waste Management Methods

<u>Construction Waste</u>

Wastes generated by Project construction activities will be managed as shown in **Table** 25 and in accordance with the WMP and other requirements discussed below.

Table 25. Waste Management for the Construction Phase

Waste Type	Source(s)	Management Method
Cleared vegetation.	Mine footprint, water pipeline, site infrastructure including dams, diversion, levee and sewage treatment plant.	Reuse vegetation waste on-site for rehabilitation, landscaping and erosion control where possible.
Excavated soil.	Access roads, site infrastructure and site fencing.	Refill any excavations and spread any excess soil over the nearby area and revegetate.
Concrete.	Site infrastructure area and water supply pipeline.	Minimise waste by producing / procuring only the amount required. Excess waste will be disposed of to an in-pit spoil dump on-site.
Steel/metal off-cuts.	Site infrastructure area and water pipeline.	Minimise waste by producing/procuring only the amount required. Segregation and collection on-site. Transportation off-site by a waste contractor for offsite recycling.
Timber pallets and off-cuts.	Site infrastructure area and workshop.	Minimise waste by producing/procuring only the amount required. Any undamaged pallets will be returned to the supplier for reuse. Excess waste will be chipped and reused on-site as mulch for landscaping and erosion control where practical. Left over waste will be disposed of to an in-pit spoil dump on-site.
Paints and resins.	Site infrastructure area, workshop and water supply pipeline	Minimise waste by producing/procuring only the amount required. Collection on-site and storage in a segregated area. Transportation off-site by licensed regulated waste transporter, and disposal at a licensed facility.
General wastes including food waste, packaging materials some plastics and paper.	Construction offices and workshop.	General waste will be taken off-site for disposal at one of the local regional landfills or to a purpose built onsite landfill.
Recyclable wastes including paper and cardboard, plastics, glass, aluminum cans.	Construction offices.	Collection and segregation on-site. Transportation by a waste contractor for off-site recycling.

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Waste Type	Source(s)	Management Method
Grease trap wastes.	Workshop.	Wastes will be collected and taken by licensed regulated waste transporter to a licensed facility for recycling.
Waste oil and containers.	Workshop. Collected and stored on-site in a bunded tank.	Transported off-site by a licensed regulated waste transporter, to a licensed facility for recycling.
Oily water.	Workshop.	Oil will be separated from water. The resulting oil will be collected and transported off-site by a licensed regulated waste transporter to a licensed facility for recycling. The separated water will be disposed of through the Sewage Treatment Plant system.
Tyres.	Workshop.	Light vehicle tyres will be stored on-site and transported off-site by a licensed regulated waste transporter to a licensed facility for recycling or disposal.
Sewage Treatment Plant (STP) and residues (sewage sludge).	Administration offices, workshops.	Disposed of in an appropriate facility by a licensed contractor.
Sewage Treatment Plant (STP) effluent.	Construction and administration offices.	STP effluent to be discharged to the purpose built onsite dam.
Water Treatment Plant (WTP) residues.	Construction and administration offices.	Blackflush water from the WTP will be discharged to the purpose built onsite dam. Residue will accumulate in the ponds and the ponds will be remediated at the end of the mine life.

Operational Waste

The management method for each waste type (other than mineral wastes) likely to be generated during operational phase of the mine is shown in **Table 26**. Waste generated during the operational phase of the Project will be managed in accordance with the WMP.

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Table 26. Waste Management: Operation Phase

Waste Type	Source(s)	Management Method
Oily sludge, absorbent, degreaser, grease, oily rags, oil filters.	Workshop and mobile service vehicles.	Collected on-site then transported off-site by a licensed regulated waste transporter, to a licensed facility for recycling or treatment and disposal.
Waste oil containers.	Workshop and mobile service vehicles.	Drained on-site. Drums will be transported off-site by waste contractor for off-site reuse, recycling or disposal.
Scrap metal, drums.	Site infrastructure area, including administration, workshops.	Segregation and collection on-site. Transportation off-site by a waste contractor for off-site recycling.
General wastes including putrescible and organic (food waste), some plastics and paper not suitable for recycling.	Workshop, office.	Collection on-site and storage in segregated area. Transportation off-site for disposal at one of the local regional landfills or to a purpose built onsite landfill.
Recyclable waste including paper and cardboard, plastics, and glass.	Workshop, office.	Segregation and collection on-site. Transportation by a waste contractor for off-site recycling.
Hazardous waste paints and resins.	Workshop.	Collected on-site and stored in a segregated area. Then transported off-site by a licensed regulated waste transporter, to a licensed facility for treatment and disposal.
Timber pallets and offcuts.	Site infrastructure area, including administration, workshops.	Minimise waste by producing/procuring only the amount required. Any undamaged pallets will be returned to the supplier for reuse. Excess waste will be chipped and reused on-site as mulch for landscaping and erosion control where practical. Excess waste will be disposed of to an in-pit spoil dump on-site.
Tyres.	Workshop.	Light vehicle tyres will be stored on-site and transported offsite by a licensed regulated waste transporter to a licensed facility for recycling or disposal. Mine truck tyres will be buried on-site, the locations of which will need to be recorded in accordance with DEHP requirements.

Waste Type	Source(s)	Management Method
Vehicle batteries.	Site infrastructure area including administration, workshops.	Collected on-site in a segregated area. Then transported offsite by a licensed regulated waste transporter to a licensed facility for recycling.
Regulated waste, sewage waste and residues (sewage sludge).	Sewage Treatment Plant.	Wastes will be transported and disposed of by licensed contractor at a licensed facility.
Regulated waste and sewage wastewater discharge from the STP.	Sewage Treatment Plant.	STP effluent to be discharged to the purpose built onsite dam.
Process plant water.	Process plant.	Process plant water will be recycled to minimise raw water make-up requirements for the site.
Water Treatment Plant (WTP) residues.	Water Treatment Plant.	Backflush water from the WTP will be discharged to the purpose built onsite dam. Residue will accumulate in the ponds and the ponds will be remediated at the end of the mine life.
Stormwater runoff.	Workshop and offices.	Clean stormwater runoff will be collected and contained by a drainage system and directed to on-site retention dams. The water will be reused as a source of water for the CHPP on-site. Surplus water will only be released if there is no storage capacity available and there are no further reuse options available for the site.

Waste Management Procedures

The Environmental Management System (EMS) for the Project will address waste management with an aim to minimising the quantity of waste generated and improving on the waste disposal and management techniques adopted. The principles for waste minimisation and management for the Project are as follows:

- the overarching principle for waste management for the Project is:
    - programs are in place to ensure that wastes are eliminated (or where possible avoided), reduced, reused, recycled, treated, or properly disposed of. Records are kept to ensure that all wastes can be tracked from source to disposal, and waste receiving facilities are audited to ensure conformance to appropriate waste standards

- supporting principles for waste minimisation and management for the Project are:
    - initiatives are identified and implemented to use raw materials and natural resources efficiently
    - initiatives are identified and implemented to reduce the environmental impact of operations. Programs are implemented to protect, manage and, where appropriate, enhance biodiversity values
    - existing and new products and services are assessed for their potential to provide Health, Safety, Environment and Community (HSEC) benefits or cause adverse HSEC impacts over their life cycle
    - opportunities are sought to conduct or support research and innovation that promotes the use of products and technologies that are safe and efficient in their use of energy, natural resources and other materials
    - advice is made available to employees, contractors, distributors, customers and the community regarding the possible HSEC impacts associated with the production, transport, storage, use, recycling and disposal of products associated with the Project
    - systems are in place to identify, evaluate and respond to HSEC related external influences (e.g. customer needs and expectations, regulations, voluntary standards and competitor initiatives) that could impact on products and business activities associated with the Project
- all waste generated on-site during the construction and operation phase will be disposed of in accordance with the WMP, which will provide for:
    - waste stream characterisation and separation
    - assessment of waste reduction opportunities for identified waste
- management of waste in accordance with the waste management hierarchy as identified in the overarching principle for waste management.

Waste Management Plan

Waratah Coal will prepare and implement a WMP for the Project. The intent of the WMP is to:

- maintain due diligence to ensure compliance with legislation
- support waste minimisation through an 'avoid, reduce, reuse and recycle' approach
- facilitate good housekeeping practices thereby removing potential health and safety hazards
- ensure efficient removal of regulated wastes off-site and ensure that the disposal facilities receiving the waste are regularly audited
- ensure records are made of waste stream volumes, thus enabling the setting and measurement of waste management performance objectives and targets
- ensure that employees, contractors, distributors and customers understand their obligations under the WMP
- provide for continual improvement in waste management practices and processes

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- minimise impact to future rehabilitation of the mine site as well as prevention of land, air and water contamination (both on-site and off-site).

Wastes will be managed to avoid adverse impacts on environmental values including the life, health and well-being of people and the diversity of ecological processes and associated ecosystems surrounding the mine.

Corporate HSEC Objectives and Targets

Measurable Corporate HSEC goals will be established by Waratah Coal. The goals and associated performance indicators will be consistent with desired HSEC targets, which will take into account the significant HSEC risks, legal and other requirements, technological options, business requirements and the interests of stakeholders.

Waste management objectives and targets will be established and performance indicators documented, communicated, monitored and reviewed. The progress of actions will be monitored and reported by the Waste Management Coordinator on a monthly basis to site management. Where trends indicate failure to achieve targets, the Waste Management Coordinator will initiate investigations and identify corrective actions to enable targets to be achieved.

The following are indicative waste management key performance indicators (KPIs) that would be implemented through the site EMS and China First WMP:

- storage and disposal of waste and hazardous substances:
    - 95% correctly disposed of in accordance with procedures (tracked in contamination reports)
    - all hazardous substances disposed of according to the relevant Australian Standard (and if none available the relevant Waratah Coal standard operating procedure)
- waste reduction including:
    - waste to landfill and / or onsite disposal
    - volumes of petrol, oil and lubricants
    - hazardous material spills
    - workshop consumables (i.e. filters, rags).

Additional waste management objectives for the Project include:

- development of recycling targets based on information on department waste streams and volumes
- investigation of potential reuse of certain streams of regulated waste like the use of waste oil in onsite operations
- enhancement of workforce knowledge on correct segregation of general and recyclable waste streams.

Risk Assessment

The WMP will include a risk assessment process to be used to identify the potential risk of various wastes on surrounding sensitive receptors. This will allow Waratah Coal to focus resources on the high risk issues during construction and operation.

Roles and Responsibilities

The roles, responsibilities and authorities for effectively and continually improving the waste management system for the Project will be detailed in the WMP.

Employee and Contractor Training and Awareness

All waste management contractors will have the necessary qualifications to remove waste from site. This will include attendance at generic inductions, obtaining appropriate licenses, being classed as Queensland Coal Board competent, and undergoing a Queensland Coal Board medical examination. All site personnel and contractors must implement the site waste management standards and procedures.

Emergency Preparedness

Waratah Coal will develop a hazard and emergency response protocol to enable appropriate response to emergency situations and potential incidents so that impacts on environment, employees and surrounding communities are minimised. The protocol will be established as part of the site Emergency Management Plan and through Standard Operating Procedures in regard to spill response procedures. Standard procedures for the storage, handling, disposal and spill response for potentially hazardous waste materials will be adopted. Sites that become contaminated will be investigated, managed and remediated in consultation with the DEHP and in accordance with the requirements of the contaminated land provisions of the EP Act.

Mining Waste

Mining waste will be managed in accordance with the strategies outlined in WMP. The specific mine waste component of the WMP will address the following:

- identification of mining waste materials that could potentially generate acid mine drainage and/or could have the potential to be saline, sodic, or dispersive
- implementation of mining waste management strategies to address conditions of the Environmental Authority
- monitoring mining waste materials storage locations
- auditing mining waste materials management and storage locations against the WMP to ensure mining waste management strategy objectives are being met.

7.8 Monitoring

7.8.1 General Mine Waste

Monitoring of waste management at the Project site under the WMP will be undertaken regularly. This will enable Waratah Coal to:

- compile and analyse waste data to enable continuous improvement of waste avoidance, reduction and management measures throughout all components of the Project
- monitor and, if required, initiate actions to fulfil waste objectives and targets
- assess actual waste management results and compare with predicted impacts and mitigation measures
- monitor potential environmental impacts
- enable positive actions to be taken in the event of incidents or accidents.

Waste Tracking and Reporting

The movement of regulated waste in Queensland is subject to a waste tracking system under the EP (Waste) Regulation. All waste movement from the site will be tracked in accordance with the requirements of

Schedule 2 of the EP (Waste) Regulation, as detailed in the WMP. This will include the completion of Waste Transport Certificates for the collection, transport and management of regulated wastes from the Project.

If the waste is regulated and is listed as trackable under the EP (Waste) Regulation, all waste handlers (generators, transporters, and receivers) need to complete their part of a Waste Transport Certificate. The purpose of the document is for reference information for the DEHP. With this document the DEHP can than follow the waste from the point of origin, transportation route and final destination. The waste properties and characteristics will be known to make sure the waste has been properly handled, treated, stored, transported and disposed of correctly by appropriate licensed personnel and facilities.

The Waste Transport Certificate is available from DEHP offices. A copy of the certificate will travel with the waste from the loading point to the delivery of the waste at the final disposal facility. Each document is numbered. The document number then becomes the waste load reference number. Two versions of the Waste Transport Certificate are available, one for intrastate waste transport and one for interstate waste transport. These documents are required to be kept for minimum five years. If the waste contains asbestos, the documents will be kept for 40 years. The waste tracking documents will remain on-site for six months after the waste is transported off-site. After the six months the documents will be forwarded to head office and archived after two years.

Specifically, the Waste Transport Certificate will be used to record the following information:

- name, address, local government area and contact details of generator
- name, address, contact details and environmental authority number of receiver
- name, address, contact details and environmental authority number of transporter
- the day and time the waste is given to the transporter
- the load number
- registration number of the vehicle transporting the load
- if the waste is a dangerous good:
    - the type and number of containers in which the waste is contained
    - its UN number
    - its packing group designator
    - it’s dangerous goods class and any subsidiary risk
- the following details of the waste:
    - the type of waste
    - amount expressed in kilograms or litres
    - its physical nature (solid, liquid, paste or gas)
    - its waste code
- the waste origin code for the activity that generated the waste.

If the waste is regulated but not trackable then only the following needs to be documented:

- date of transport
- type and quantity of waste

- Waste Transport Certificate Number (if required)
- transporters company name
- selected route of transport
- final destination/facility
- accepted by (transporters signature)
- records of any incidents that may have occurred en route.

The reports for regulated wastes and DEHP Waste Transport Certificates will be forwarded to the Waratah Coal Waste Management Coordinator. Waste contractors will also be required to provide Waratah Coal with monthly reports which outline different waste types, their disposal methods and tracking.

In addition, the treatment, storage and transport of regulated waste require an Environmental Authority under the EP Act. Where Waratah Coal and/or a contractor carry out these activities, Waratah Coal and/or the contractor will be required to hold the appropriate approvals. These requirements will be incorporated into the WMP.

Auditing, Reporting and Investigation

The WMP will be subject to regular internal and external audits. The findings of these audits will be used to develop methodologies aimed at improving waste reuse, recycling and minimisation. The targets and progress of actions will be monitored and reported by the Project's Waste Management Coordinator on a monthly basis to mine management. Where trends indicate failure to achieve targets, the Waste Management Coordinator will initiate investigations and identify corrective actions to enable targets to be achieved. The DEHP may also audit any aspect of the WMP at any time.

The mine will maintain a HSEC process to ensure appropriate management of unplanned incidents, including reporting, notification, investigation, analysis, corrective and preventive action, follow up and incident closure. Incidents related to waste management will be handled in accordance with the Corporate HSEC. Where appropriate, recommendations made through this system will be incorporated into the WMP.

7.8.2 Mining Waste

Groundwater monitoring bores will be installed as part of an overall site network. The design of the groundwater monitoring network associated with the TSF would include:

- an electromagnetic (EM) survey on the down-gradient side of the TSF to establish baseline conditions, prior to operation of the TSF
- drilling and construction of nested groundwater monitoring bores both up and down-gradient of the TSF. The design of the nested sites would include a deep bore screened in saturated sediments and a shallow bore that would be drilled dry initially, and then would be monitored for the leakage of water from the TSF
- hydraulic testing on monitoring bores to test the saturated hydraulic conductivity of the material underlying the TSF
- seepage modelling to predict the hydraulic conductivity of material to assess leakage likelihood
- daily water level monitoring (automatic data loggers) reviewed monthly and monthly groundwater quality monitoring from bores to establish baseline levels prior to development of the facility. Based on available information from the WMP the major potential

contaminants could include sulphate, elevated EC/TDS, decreased alkalinity and pH. If the seepage is acidic this may result in mobilisation of metals, most likely aluminium, iron and manganese, though other metals/metalloids to be monitored should include cadmium, copper, lead, nickel, selenium, and zinc

- the suite of parameters to be tested as part of the groundwater monitoring program for the TSF will include:
    - field parameters – pH and EC
    - major/minor ions, including TDS, calcium, magnesium, potassium, sodium, chloride, sulphate, alkalinity (hydroxide, carbonate, bicarbonate, total), fluoride
    - metals/metalloids, including aluminium, arsenic, antimony, boron, cadmium, chromium, cobalt, copper, iron, lead, mercury, manganese, molybdenum, nickel, selenium, silver, uranium, vanadium, zinc
    - the parameter list would be modified once the TSF is operational, and the nature and characteristics of liquid generated by the TSF is better identified.

Groundwater level and quality will be monitored over the duration of the tailings discharge operations. A separate specific groundwater monitoring plan will be developed as part of an on-going closure plan to monitor groundwater after completion of mining.

Other monitoring and investigations will include:

- EM surveys within 12 months of commencement of tailings emplacement, and then over the life of the mine, to monitor for leachate leakage from the TSF
- monthly water level and quarterly water quality monitoring
- annual reporting of water level and water quality results.

Should the situation arise where trigger levels are exceeded, investigations will be undertaken to:

- establish if environmental harm has occurred or is likely to occur as a result of the trigger level exceedance(s)
- implement short term measures to manage or mitigate the potential for environmental harm
- implement long-term mitigation measures required to address any existing contamination, and to prevent recurrence of contamination.

7.9 Commitments

7.9.1 General Mine Waste

Waratah Coal will:

- develop and implement a detailed waste management guideline utilising the principles of the waste management hierarchy
- work with local councils to determine the current landfill capacities and accepted waste types and will work with councils to assist with the planning of expansion and upgrade of landfills to ensure wastes generated from the mine can be accommodated if required

- encourage the procurement of pre-fabricated materials where practicable
- encourage local businesses to take advantage of opportunities for re-use and recycling, if available or initiate opportunities, if unavailable. Regularly review the waste management plan including the marketability of wastes and the results of waste audits to improve waste management
- establish contracts with companies encouraging sustainable waste management practices
- a register of all chemicals stored on the China First Mine site will be maintained.
- the storage and handling of flammable and combustible liquids will be in accordance with AS 1940 – Storage and Handling of Flammable and Combustible Liquids
- all regulated waste will be appropriately disposed of to a facility licensed to receive such wastes and, where required, be tracked
- as part of the staff awareness and induction program, re-use and recycling will be encouraged.

7.9.2 Mining Waste

- initial boxcut mining will be completed as a truck and shovel operation. Boxcut spoil has a high clay content and will be used to construct containment cells and clay blanket envelopes for rejects and tailings. The waste footprint area will be significantly reduced by utilising spoil disposal areas for containment cells rather than constructing tailings dams. Boxcut spoil areas will be stripped of topsoil prior to dumping
- all spoil will be placed at angle of repose for geotechnical stability and will be further flattened prior to final rehabilitation. Containment cells will have geotechnically stable batters of 1 (vertical) on 3 (horizontal) and will be lined with impervious clay blankets
- dried coarse rejects and filter pressed tailings will be trucked to containment cells, dumped and track compacted in layers by dozer. All containment cells will be capped with impervious clay, prior to topsoiling and seeding
- the geochemical properties of tailings and rejects have been determined by the examination and testing of drill cores. Based on these results the rejects and tailings will have a low capacity to be potentially acid forming. The total sulphur content is average and minor oxidisable pyrite has been detected in the core. Low groundwater salinities indicate that salinity levels in the tailings will be low
- no metal enrichment is expected in the tailings or rejects. Anticipated pH range is 6.0 to 8.5. Because the tailings and rejects will be encased in properly constructed clay blankets, there will be no possibility of oxidisation occurring
- the tailings solids will be monitored to determine pH, electrical conductivity, sulphur species and acid neutralising capacity initially on a monthly basis until geochemical trends have been established. Monitoring will then continue on an annual basis
- in the unlikely event of any seepage from containment cells, this water would gravitate through the spoil, downdip to the pit void, where all water is recycled to the wash plants for re-use. Pit water downdip of the cells will be initially monitored on a monthly basis and tested for pH, electricity conductivity and total dissolved solids. Testing for major anions, cations and trace elements will be initially completed every three months and then annually

- groundwater level and quality will be monitored for the duration of tailings disposal operation as well as after the closure of the mine and infrastructure, as part of an on-going closure plan. Groundwater monitoring bores will be installed and strategically positioned adjacent to disposal areas
- embankment monitoring instrumentation would be installed within the tailings containment embankments to monitor performance. This will ensure stability of the embankments during operations and embankment raising. Piezometers will be installed to check groundwater levels
- survey monuments would be installed along each embankment. These monuments would be surveyed on a regular basis to detect any embankment movements. The information derived from both piezometers and monuments will be used to assess the overall stability of the embankments
- a meteorological station will be installed near the containment cells to monitor and record rainfall and evaporation data
- during rehabilitation of spoil piles, all slopes will be flattened to be geotechnically stable and erosion resistant. All spoil surfaces will then be topsoiled and seeded with appropriate vegetation cover. Vegetation growth will be monitored and if necessary, re-seeding will be carried out.

7.10 Proposed Environmental Authority Conditions: Schedule E – Waste Management

Scrap Tyres

(E1) Scrap tyres stored awaiting disposal or transport for take-back and recycling, or waste-to-energy options must be stored in stable stacks of up to four tyres or less or less than three metres high (whichever is greater), and at least 10 m from any other scrap tyre storage area, or combustible or flammable material, including vegetation.

(E2) All reasonable and practicable fire prevention measures must be implemented, including removal of grass and other materials within a 10 m radius of the scrap tyre storage area.

(E3) Disposing of scrap tyres resulting from the authorised activities in spoil emplacements is acceptable, provided tyres are placed as deep in the spoil as reasonably practicable. A record must be kept of the number and location for tyres disposed.

(E4) Scrap tyres resulting from the mining activities disposed within the operational land must not impede saturated aquifers or compromise the stability of the consolidated landform.

Waste Management

(E5) A Waste Management Plan, must be developed and implemented prior to the commencement of mining activities and must cover:

a) how the environmental authority holder will recognise and apply the waste management hierarchy

b) characterisations of wastes generated from the Project and general volume trends over the past five years

c) waste commitments with auditable targets to reduce, reuse and recycle

d) waste management control strategies including:

   i. the type of wastes

   ii. segregation of the wastes

   iii. storage of the wastes

   iv. transport of the wastes

   v. monitoring and reporting matters concerning the waste

   vi. emergency response planning

   vii. disposal, reused and recycling options

e) the potential adverse and beneficial impacts of the wastes generated

f) the hazardous characteristics of the wastes generated including:

   i. disposal procedures for hazardous wastes,

   ii. processes to be implemented to allow for continuous improvement of the waste management systems

   iii. identification of responsible staff (positions) for implementing, managing and reporting the Waste Management Plan

   iv. staff awareness and induction programs that encourage re-use and recycling.

Waste General

(E6) Waste that is removed from the site must be taken to a facility that is lawfully able to accept the waste under the *Environmental Protection Act 1994*.

(E7) A record of all waste removed from site must be kept detailing the following information:

a) date of pickup of waste

b) description of waste

c) quantity of waste

d) origin of the waste

e) destination of the waste.

(E8) All regulated waste removed from the site must be removed by a person who holds a current approval to transport such waste under the provisions of the *Environmental protection Act 1994.*

(E9) Each container of regulated waste must be marked to identify the waste contained therein.

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Sewage Treatment

(E10) The daily operation of the wastewater treatment plant must be carried out by a person(s) with appropriate experience and / or qualifications to ensure the effective operation of the treatment system.

(E11) Pipelines and fittings associated with the effluent irrigation system must be clearly identified. Lockable valves or removable handles must be fitted to all release pipelines situated in public access areas.

(E12) Treated effluent from the sewage treatment plant must only be discharged from the authorized discharge points, as specified in **Table 27** and discharge to the areas shown in **Table 29** in compliance with the limits stated in **Table 28** and the conditions of this authority.

Table 27. Effluent discharge location

Authorised Discharge Point	Location	Easting (GDA94)	Northing (GDA94)
Effluent Discharge Point 1	*	*	*
Effluent Discharge Point 2	*	*	*
Effluent Discharge Point 3	*	*	*

* Information to be added when provided by the authority holder

Table 28. Effluent discharge limits

Quality Characteristics	Release limits		
	Minimum	Median	Maximum
5 day Biological oxygen demand (mg/L)	-	-	20
Suspended solids (mg/L)	-	-	30
Thermotolerent coliforms (Cfu/100mL[2])	-	10	-
Total phosphorous (mg/L)	-	-	15
Total nitrogen (mg/L)	-	-	30
Electrical Conductivity (µS/cm)	-	1,600	-
pH	6.5	-	8.5

Table 29. Effluent irrigation area

Authorised Discharge Point	Effluent Irrigation Location	Easting (GDA94)	Northing (GDA94)
Effluent Discharge Point 1	Effluent Irrigation Area 1	*	*
Effluent Discharge Point 2	Effluent Irrigation Area 2	*	*
Effluent Discharge Point 3	Effluent Irrigation Area 3	*	*

* Information to be added when provided by the authority holder

(E13) Subject to condition E12 releases of effluent must not have any properties nor contain any organisms or other contaminants in concentrations that are capable of causing environmental harm.

(E14) Treated effluent must not be used for dust suppression.

(E15) Treated effluent must not be released from the site to any waters of the bed and banks of any waters.

(E16) Water or storm waters contaminated be sewage treatment activities must not be released to any waters or the bed and banks of any waters.

(E17) The holder of this environmental authority must develop and implement an Irrigation Management Plan which adequately addresses the following:

a) efficiency of the application
b) control of sodicity in the soil
c) minimisation of degredation of soil structure
d) control of build ups of nutrients and heavy metals in the soil and subsoil from effluent and other sources
e) preventing impacts on the groundwater resources through infiltration
f) preventing subterranean flows of effluent to waters
g) method of application
h) health and safety in relation to effluent handling and irrigation.

(E18) The irrigation of effluent must be carried out in accordance with the Irrigation Management Plan, such that:

a) there is no surface ponding of effluent
b) soil erosion and soil structure damage is avoided
c) percolation of effluent beyond the plant root zone is minimised
d) the accumulation of nutrients and heavy metals in the soil and subsoil is minimised
e) the quality of groundwater is not adversely affected.

(E19) Notices must be prominently displayed on areas undergoing effluent irrigation warning the public that the area is irrigated with the effluent and not to use or drink the effluent. These notices must be maintained in a visible and legible condition.

(E20) The daily volume of contaminants released to land must be determined or estimated by an appropriate method, (such as a flow meter), and records kept of such determinations and estimates.

(E21) When conditions prevent the irrigation of treated effluent to land (such as during or following rain events), the contaminants must be directed to a wet weather storage or alternative measures must be taken to store or lawfully dispose of effluent (such as tanking off site or transfer to another treatment plant).

(E22) A record of the removal of treated effluent from the site must be kept detailing the following information:

a) date of pick-up of treated effluent
b) volume of treated effluent removed from the site
c) destination of the treated effluent
d) the transporter.

(E23) The responsibility for disposal of treated effluent by a third party must only be given or transferred in accordance with a written agreement (the third party agreement) that:

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a) contains a commitment from the third party to dispose of or use the effluent in such a way as to prevent environmental harm or public health incident and specifically makes the third party aware of the General Environmental Duty (GED) under section 319 of the *Environmental Protection Act 1994*, environmental sustainability of any effluent disposal, and the protection of environmental values of waters

b) requires the giving and transferring of treated effluent to cease where the holder of this environmental authority is notified or otherwise becomes aware that the third party's use of the effluent is causing or threatens to cause unlawful environmental harm or is posing a human health risk, and the third party does not rectify the situation upon written request

c) requires the third party to have implemented an Irrigation Management Plan that satisfies the requirements of Condition E17.

(E24) Monitoring at all effluent discharge points must be undertaken for the parameters specified in **Table 30** on a monthly basis. Records of the monitoring program must be kept for a period of five years.

Table 30. Effluent monitoring parameters

Quality Characteristics	Units
5 day Biological oxygen demand	mg/L
Suspended solids	mg/L
Thermotolerent coliforms	Cfu/100mL[2]
Total phosphorous	mg/L
Total nitrogen	mg/L
Electrical Conductivity	µS/cm
pH	pH units

(E25) The following must be recorded in relation to all effluent sampling:

a) the date on which the sample was taken

b) the time at which the sample was taken

c) the monitoring point at which the sample was taken

d) the measured or estimated daily flow of effluent at the time of sampling

e) the results of all monitoring.

Water Treatment - General

(E26) The daily operation of the water treatment plant must be carried out by a person(s) with appropriate experience and / or qualifications to ensure its effective operation.

(E27) Brine and any contaminated water generated from the water treatment plant must only be released from the release points specified in **Table 31** to the water management infrastructure specified in **Table 31**.

Table 31. Brine water management infrastructure

Release Point	Northing (GDA94)	Easting (GDA94)	Water Management Infrastructure
1	*	*	Temporary Brine Dam
2	*	*	Decant Dam

* information to be added when provided by the authority holder

(E28) Disposal of brine and any contaminated water to the Temporary Brine Dam must cease once the decant is operational.

(E29) The hazard category of the Temporary Brine Dam must be determined by a suitably qualified and experience person, prior to its construction and at least once every two years thereafter.

(E30) On cessation of operation of the Temporary Brine Dam, that dam must be maintained so as to avoid unlawful environmental harm until that dam is decommissioned.

(E31) The Temporary Brine Dam must be decommissioned within 12 months of the cessation of operation of the Temporary Brine Dam such that it

a) either
   i. becomes a stable landform, that no longer contains flowable substances
   ii. is approved or authorised under relevant legislation for a beneficial use
   iii. is a void authorised by the administering authority to remain after decommissioning
b) is compliant with the rehabilitation requirements of this environmental authority.

END OF CONDITIONS FOR SCHEDULE E

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8. Terrestrial Ecology

8.1 Background

The predominant land use across, and around, the study site is cattle grazing. A significant proportion of the study site has been cleared of native vegetation and is maintained as cleared pasture for cattle grazing (e.g. Kiaora in the north, and Hobartville in the east). A large part of this area has been subject to blade ploughing and the introduction of exotic pasture grasses. In these areas, Buffel Grass (*Pennisetum ciliare*) is dominant. The project area encompasses (wholly or in part) the following properties:

- Spring Creek
- Kiaora
- Glen Innes
- Lambton Meadows
- Cavendish
- Hobartville
- Monklands.

In contrast, a notable area of woodland habitats (including native remnant and native regrowth) has been retained throughout study site (e.g. Glen Innes within the central sector, and parts of Cavendish and Lambton Meadows in the west). Generally, these areas are also subject to cattle grazing, though it is apparent, that there are differences in grazing management practices implemented throughout these remnant woodland areas (e.g. differences in stocking rates, retention native pasture, and weed control). Woodland habitats are dominated by eucalypts, principally Silver-leaved Ironbark (*Eucalyptus melanophloia*) and Poplar Box (*Eucalyptus populnea*), and support a diversity of native grasses, though introduced taxa are also supported (e.g. Buffel Grass).

Within the central sector of the study site Glen Innes station supports the Bimblebox Nature Refuge, gazetted in 2003 under the Nature Conservation (Protected Areas) Regulation 1994 (SL 2003 No. 82). The majority of its 7,912 ha supports Silver-leaved Ironbark and Poplar Box woodland.

The study site is located within the Belyando River catchment, which is part of the larger Burdekin River catchment and the study site itself is transected by a variety of seasonal watercourses. The Spring Creek system drains the north-west sector of EPC1040, in an area which supports a variety of mesas and plateaus and vegetation types, including bloodwood open woodlands (dominated by *Corymbia trachyphloia*) and woodlands dominated by Lancewood (*Acacia shirleyi*). The Spring Creek system drains east and north, part of which connects with the Lagoon Creek system (off-site and to the north).

The Lagoon Creek system drains generally northwards through the extent of the study site. The system includes:

- Pebbly Creek-draining east across the central sector of the site (through the Cavendish and Glen Innes properties)
- Beta Creek-which drains northwards through the southern central part of the site (through the Lambton Meadows property)

- Tallarenha Creek–draining northwards through the south-eastern part of the site
- Salt Bush Creek-draining north through the eastern areas from the south-eastern sector of the study site.

Both Beta and Tallarenha Creeks join within the central-eastern part of the site to form Lagoon Creek, where it continues to drain in a northerly direction through the north-western corner of the study site. River Red Gum (*Eucalyptus camaldulensis*) is a relatively common feature along these waterways, particularly from about the confluence of Beta and Tallarenha Creeks and northwards (where *Eucalyptus tessellaris* is often a co-dominant within riparian areas). Within these areas, large hollow-bearing trees can be a relatively common feature.

8.2 Environmental Values

8.2.1 Ecological Communities

The study area contains a mixture of vegetation biodiversity values including eucalypt open forest, acacia woodlands, and riparian communities as well as regrowth and cleared areas. Rob Friend and Associates undertook 34 secondary level and 32 quaternary level Corveg assessments in 2012 with 33 of these sites being utilised for BioCondition assessments. O2 Ecology undertook 13 secondary level and four tertiary level Corveg assessments in 2012 with 11 of these site assessed with BioCondition. Earlier surveys of the site were also undertaken by Unidel and Worley Parsons in 2010 and 2009 respectively.

The field survey confirmed that no EPBC Act listed Threatened Ecological Communities occur within the study area. Minor occurrences of Brigalow dominant and co-dominant Regional Ecosystems (REs) were found to be present (i.e. RE 10.3.3 and RE 10.4.3) but these REs are not included within the EPBC Act definition of the Threatened Ecological Community “Brigalow (*Acacia harpophylla* dominant and co-dominant)”.

Table 32 gives the break-down of the amounts of VM Act protected vegetation to be cleared to facilitate the open cut mines, and the amounts which may be affected by subsidence from underground mining activities.

As can be seen from **Table 32**, the open cut mines will require disturbance to 16,519.99 ha, of which, 4,877.49 ha (29.5%) is covered by REs classified as Least Concern under the VM Act. The remaining 11,642.50 ha (70.5) is comprised of pasture grass and other areas already cleared of native vegetation.

A further 25,598.10 ha may potentially be affected by subsidence as a result of underground mining operations. Of this area, 12,462.34 ha (48.7%) are covered by REs classified as Least Concern (LC) under the VM Act. A further 197.42 ha (0.8%) is covered by vegetation that is classified as Of Concern (OC) subdominant under the VM Act. This 197.42 ha is comprised of:

- 116.65 ha of mixed polygon made up of RE 10.10.1 (LC)/10.10.4 (LC)/10.10.3 (OC) (at ratios of 80%/10%/10% respectively)
- 80.76 ha of a mixed polygon made up of RE 10.10.5 (LC)/10.10.4 (LC)/10.10.7 (OC)/10.10.1(LC) (at ratios of 40%/30%/20%/10% respectively).

The remaining 12,938.34 ha (50.5%) overlying the areas potentially subject to subsidence is comprised of pasture grass and other areas already cleared of native vegetation.

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Table 32 Amounts of vegetation (ha) to be cleared or potentially affected by subsidence within the Mining Lease Application Area (VMA status)

	Endangered dominant	Endangered subdominant	Of Concern dominant	Of Concern sub-dominant	Least Concern	Non-remnant	Total
Open Cut	0	0	0	0	4877.49 (29.5%)	11,642.50 (70.5%)	16,519.99 (100%)
Underground (subsidence)	0	0	0	197.42 (0.8%)	12,462.34 (48.7%)	12,938.34 (50.5%)	25,598.10 (100%)

Based on the DEHP Regional Ecosystem Mapping (Version 6.1)

Waratah Coal has developed a Preliminary Biodiversity Offsets Proposal which seeks to cover the unavoidable impacts associated with both the mine site and rail corridor, and makes additional voluntary provision for the Bimblebox Nature Refuge. Information on the project's offsets is contained in the *Preliminary Biodiversity Offset Proposal* in Appendices – Volume 2 of the SEIS.

Waratah Coal has also committed to producing a subsidence management plan, which will be prepared prior to the commencement of underground mining operations. The plan will be developed in consultation with DEHP and will be risk based, flexible, responsive and capable of dealing with unexpected changes or uncertainties.

8.2.2 Flora

There are no EPBC Act listed flora species that were identified as occurring within or having ranges that overlap the mine area.

Desktop assessments predict one EPBC listed species and four NC Act species listed as occurring in the study area. One conservation significant flora species was recorded during the field surveys by Worley Parsons and Rob Friend and Associates in 2009 and 2012 respectively, this being the *Desmodium macrocarpum* (listed as Near Threatened under the NC Act). This species was not recorded during the O2 Ecology surveys in 2012. While not recorded, the species *Micromyrtus rotundifolia* (listed as Vulnerable under the NC Act) and *Acacia spania* (listed as Near Threatened under the NC Act) both have the potential to occur in vegetation communities of the study area.

8.2.3 Fauna

A total species richness of 297 native fauna species have been identified in surveys of the study site. This total is comprised of 40 mammals, 57 reptiles, 15 frogs, and 185 bird species. Seven introduced fauna species, were also identified as being present, these being the House Mouse (*Mus musculus*), Dog (*Canis familiaris*), Feral Cat (*Felis catus*), Rabbit (*Oryctolagus cuniculus*), Pig (*Sus scrofa*), Cattle (*Bos taurus*) and Cane Toad (*Rhinella marina*) were recorded during the EIS and SEIS surveys.

Of these, a total of 10 fauna species are listed as threatened under the EPBC Act and/or NC Act, as follows:

- Koala (*Phascolarctos cinereus*) – Vulnerable EPBC Act
- Little Pied Bat (*Chalinolobus picatus*) – Near Threatened NC Act
- Brigalow Scaly-foot (*Paradelma orientalis*) – Vulnerable EPBC Act and NC Act
- Cotton Pygmy Goose (*Nettapus coromandelianus*) - Near Threatened NC Act
- Freckled Duck (*Stictonetta naevosa*) – Near Threatened NC Act
- Black-necked Stork (*Ephippiorhynchus asiaticus*) – Near Threatened NC Act

- Square-tailed Kite (*Lophocitinia isura*) - Near Threatened NC Act
- Squatter Pigeon (southern) (*Geophaps scripta scripta*) – Vulnerable EPBC Act and NC Act
- Black-chinned Honeyeater (*Melithreptus gularis*) - Near Threatened NC Act
- Black-throated Finch (southern) (*Poephila cincta cincta*) – Endangered EPBC Act and Vulnerable NC Act.

8.3 Potential Impacts on Environmental Values

8.3.1 Regional Ecosystems

Field surveys have confirmed that there are no vegetation communities within the study area that are listed under the EPBC Act. As such, no impacts are expected to EPBC listed vegetation communities.

8.3.1.1 Endangered REs

Based on the DEHP Regional Ecosystem Mapping (Version 6.1) no VM Act Endangered REs are required to be cleared or will be impacted by the mine surface clearance footprint. One RE classified as Endangered under the DEHP Biodiversity Status classification occurs within the open cut footprint. The estimated clearing extent is 35.79 ha of RE 10.4.3 (see **Table 33**). Another 3.23 ha of this RE occurs above the underground mining areas, so could be subject to impacts from subsidence (see **Table 34**). The proportion that this impact (assuming that the 3.23 ha overlying the underground areas will be impacted) would represent is 0.22% of that which occurs in the Bioregion (see **Table 35**).

8.3.1.2 Of Concern REs

No VM Act Of Concern REs are required to be cleared to facilitate the open cut mining areas. However, two mixed polygons containing subdominant units of vegetation that are classified as Of Concern under the VM Act may be impacted by subsidence from the underground mining areas (see **Table 33**). The Of Concern proportions of these missed polygons amount to 11.67 ha of RE 10.10.3 and 16.15 ha of RE 10.10.7. Should these areas be impacted by subsidence, this would equate to 0.52 % and 0.68% of the extent of each of these REs within the Desert Uplands Bioregion (see **Table 35**).

Two REs classified as Of Concern under the DEHP Biodiversity Status classification occur within mixed polygons within the mine open cut clearance footprint. The estimated clearing extent is:

- RE 10.3.27 – 1,173.61 ha
- RE 10.7.5 – 8.44 ha

The proportion of these REs that this clearing would represent is 1.06% (RE 10.3.27) and 0.03% (RE 10.7.5) of that which occurs in the Bioregion.

8.3.1.3 Least Concern REs

Areas of Least Concern REs are shown in **Table 33** and **Table 34**.

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Table 33: Biodiversity and VM Act Status and amounts of REs within the open cut mining area footprint*

RE type	RE percent	Biodiversity Status	VM Act Status	Area (Ha)
non-remnant	100	-	non-rem	11642.50
10.3.27/10.3.12/10.3.3	85/10/5	OC/LC/LC	LC	743.69
10.5.5/10.5.12	90/10	LC/LC	LC	3216.22
10.5.5/10.5.12/10.3.27/11.5.5	70/15/10/5	LC/LC/OC/LC	LC	142.18
10.4.3/10.3.27	70/30	E/OC	LC	51.13
10.7.3/10.5.5/10.7.5	80/10/10	LC/LC/OC	LC	84.38
10.3.27/10.3.28	80/20	OC/LC	LC	639.89
Total				16519.99

Notes: E = Endangered, OC = Of Concern, LC = Least Concern

*Based on the DEHP Regional Ecosystem Mapping (Version 6.1)

Table 34: Biodiversity and VM Act Status and amounts of REs above the underground mining area footprint

RE type	RE percent	Biodiversity Status	VM Act Status	Area (Ha)
non-remnant	100	-	non-rem	12938.34
10.3.27/10.3.28	80/20	OC/LC	LC	1099.90
10.7.5/10.3.3/10.3.27	50/40/10	OC/LC/OC	LC	18.95
10.10.1/10.10.4/10.7.3/10.7.5	40/30/20/10	LC/LC/LC/OC	LC	172.85
10.5.5/10.5.12	90/10	LC/LC	LC	8844.68
10.7.3/10.7.5	60/40	LC/OC	LC	6.54
10.7.3	100	LC	LC	25.11
10.3.28/10.3.27/10.3.14	70/25/5	LC/OC/OC	LC	356.50
10.5.1/10.5.10	80/20	LC/LC	LC	1242.01
10.3.27/10.5.5/10.3.3	60/25/15	OC/LC/LC	LC	20.62
10.4.3	100	E	LC	3.23
10.7.3/10.7.5/10.3.3	60/20/20	LC/OC/LC	LC	99.84
10.7.3/10.5.1	80/20	LC/LC	LC	0.17
10.10.1/10.10.4/10.10.3	80/10/10	LC/LC/OC	OC-subdom	116.65
10.5.5/10.3.27/10.5.12	80/10/10	LC/OC/LC	LC	3.56
10.10.4/10.7.5/10.7.3	80/10/10	LC/OC/LC	LC	444.81
10.7.3/10.5.10	90/10	LC/LC	LC	17.35
10.5.5/10.5.4/10.5.1/10.7.3	70/10/10/10	LC/LC/LC/LC	LC	60.27

RE type	RE percent	Biodiversity Status	VM Act Status	Area (Ha)
10.10.5/10.10.4/10.10.7/10.10.1	40/30/20/10	LC/LC/OC/LC	OC-subdom	80.76
10.10.4	100	LC	LC	27.08
10.7.5	100	OC	LC	14.75
10.5.5	100	LC	LC	4.14
				25598.10

Notes: E = Endangered, OC = Of Concern, LC = Least Concern
*Based on the DEHP Regional Ecosystem Mapping (Version 6.1).

Table 35: Percentage area of REs to be impacted as compared with REs in the Desert Uplands Bioregion

RE Label	Total Open Cut (ha)	Total Subsidence (ha)	% of the Desert Uplands	Desert Uplands Bioregion (ha)
10.10.1	0	170.536	0.186	91,739.28
10.10.3	0	11.665	0.525	2,220.91
10.10.4	0	443.596	0.629	70,530.11
10.10.5	0	32.304	1.399	2,309.72
10.10.7	0	16.152	0.684	2,362.80
10.3.12	74.369	0	0.226	32,853.64
10.3.14	0	17.825	0.012	144,101.89
10.3.27	1,173.61	983.668	1.951	110,571.79
10.3.28	127.978	469.53	0.098	610,798.04
10.3.3	37.1845	30.641	0.214	31,742.12
10.4.3	35.791	3.23	0.216	18,028.79
10.5.1	0	999.669	0.113	882,467.38
10.5.10	0	250.137	0.633	39,515.92
10.5.12	342.949	884.824	0.867	141,547.88
10.5.4	0	6.027	0.008	79,210.53
10.5.5	3,002.56	8.014.54	1.172	940,367.59
10.7.3	67.504	189.767	0.256	100,560.18
10.7.5	8.438	108.575	0.442	26,458.19
11.5.5	7.109	0	0.308	2,309.72
Total	4,877.49	12,632.69	0.526	3,329,705.48

*Based on the DEHP Regional Ecosystem Mapping (Version 6.1)

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For all REs potentially impacted, clearing will never constitute more than 2% of that contained within the bioregion. It is also worth noting that, for the areas to be affected by subsidence, the extent to which the vegetation will be impacted is unknown at this stage, as underground mining has not occurred in the Galilee Basin yet so no precedence exists from which to infer the likely impacts. However, based on experience from the Bowen Basin, which has shown that not all ecological values above underground mines are impacted, it is expected that some ecological values will persist in the areas above the longwall mining panels, hence the percentages presented above in **Table 35** represent the 'worst case scenario'.

8.3.2 Flora

The Large-podded Tick-trefoil (*Desmodium macrocarpum*) has been recorded from 19 locations within the MLA area. Of the 19 locations, 18 are records from the Bimblebox Nature Refuge (BNR), and a single record exists from Monklands. Eleven of the records are located within the open cut mining footprint, seven are from within the underground mining footprint and the single record from Monklands station occurs outside of both the underground and open cut mining footprints.

Potential direct and indirect impacts associated with construction of the mine on this Near Threatened flora species include:

- direct loss of individuals through clearing activities. Approximately 95 individuals will be removed to facilitate the open cut mines.
- reduction in the long term viability of the local population. Although there is no known study on the long term viability of the Large-podded Tick-trefoil, population reduction and increased spatial isolation of plant populations generally result in decreasing genetic variation
- direct loss of potential habitat
- Potential to impact 39 specimens by subsidence from the underground mines
- potential to affect health and viability of plants outside the mine clearance and potential subsidence footprints through:
  - increased edge effects and associated potential to increasing the abundance of Buffel Grass and fire intensity
  - potential for dust to reduce the health of plants and associated vegetation retained outside the construction footprint
  - potential for temporary facilities, materials and equipment to damage plants and associated vegetation outside the construction footprint.

Whilst not recorded to date by any study, *Acacia spania* and *Micromyrtus rotundifolia* (NC Act Near Threatened and Vulnerable, respectively) are considered to both have the potential to occur in vegetation communities within the study area.

8.3.3 Fauna

A suite of potential direct and indirect impacts that have potential to impact on environmental values have been identified within the project development footprint (see **Figure 23**), and include:

- direct loss of habitat and resources as a result of vegetation clearing
- habitat fragmentation as a result of vegetation clearing which results in direct loss of fauna movement opportunities, though also indirect degradation of retained habitats
- habitat degradation associated with land subsidence following underground mining

- direct mortality impacts to terrestrial fauna
- alteration of fauna behaviour and habitat use resulting from disturbances associated with construction and operational activities (e.g. impacts associated with light, dust, noise and vibration)
- introduction of exotic weed and pest species to retained habitats
- alteration to fire regimes to retained habitats.

8.3.3.1 Habitat Loss

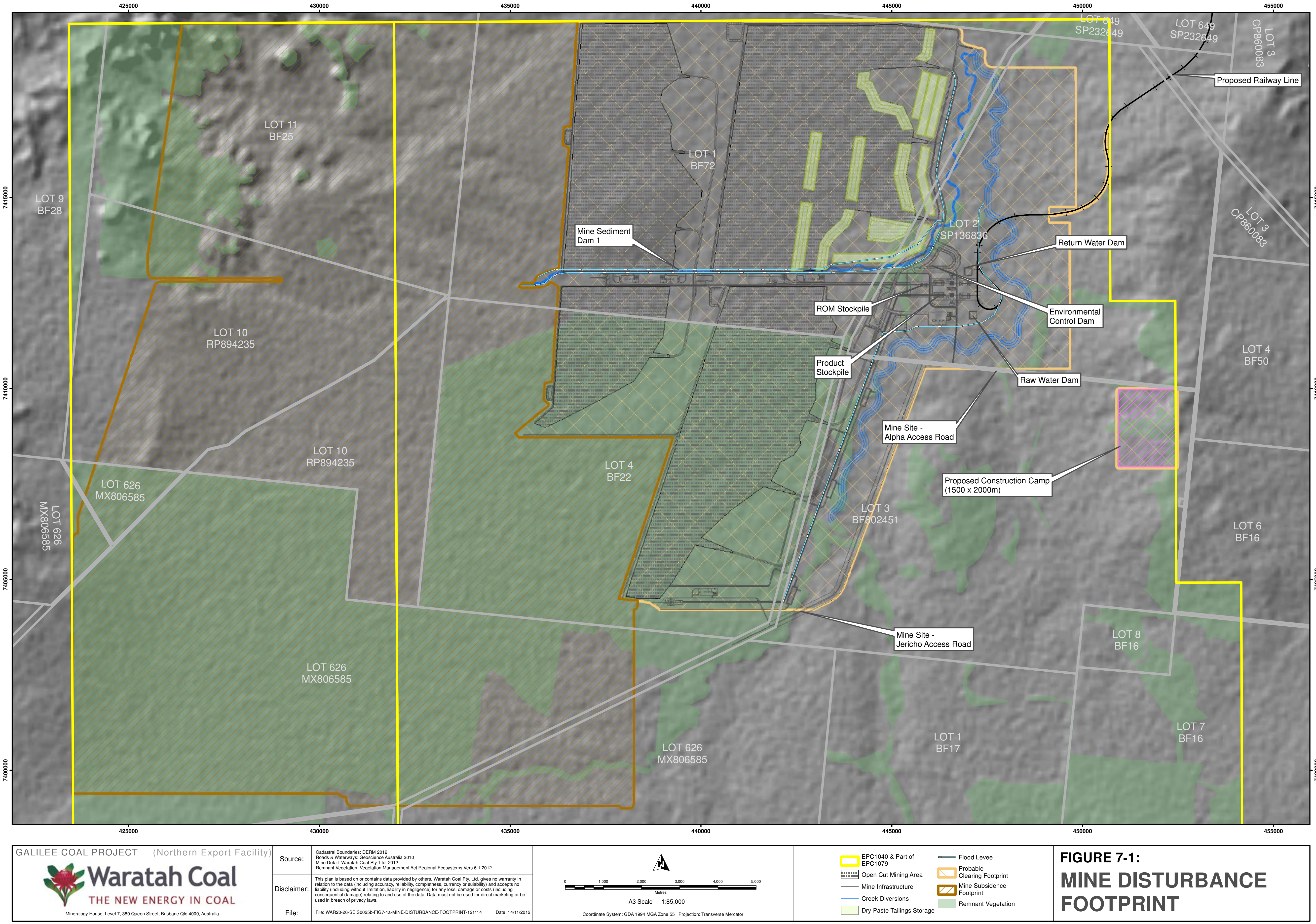
The construction phase will necessitate vegetation clearing and land disturbance for the establishment of infrastructure including roads, construction camps, workshops, creek diversions, sediment basins, etc. Vegetation clearing and land disturbance will also occur progressively during the operational phase, including the development of open cut pits, spoil dumps etc. The proposed clearing footprint for both the construction and operational phases requires a total area of land disturbance of 16,520 ha (see **Figure 23**). This clearing footprint includes approximately 4,877 ha of remnant vegetation (see **Table 33).**

The majority of the proposed clearing footprint (approximately 70%) comprises previously cleared lands of comparatively low habitat values for native fauna. Within this landscape, several Near Threatened fauna species have been recorded (i.e. Cotton Pygmy Goose and Black-necked Stork). These records are linked to the presence of water bodies, all of which are constructed dams. There are no intrinsically special or notable habitat features associated with these water bodies, though they contribute to a network of water bodies which support these species within the wider area encompassing the study site.

The findings of the field surveys and habitat assessments indicate that the key habitat areas on the study site are associated with remnant vegetation on the Bimblebox Nature Refuge, western parts of Lambton Meadows, a large habitat patch on Saltbush, and habitats within the Spring Creek area in the north-western corner of the study site. Whilst riparian habitats along Lagoon Creek are degraded, these are likely to be locally important in regard to fauna movement opportunities into and out of the study site.

The proposed clearing footprint will significantly impact on two of these areas, i.e. Bimblebox Nature Refuge and riparian habitats of Lagoon Creek. Data reviews identify that approximately 85% of the total species richness recorded on the study site has been recorded on the Bimblebox Nature Refuge. Combined with the results of the previous surveys, species richness would be expected to reach approximately 95% of total species records for the study site. Within the context of bioregional data, these findings are indicative of “high” fauna species richness.

Figure 23. Mine disturbance footprint



Whist riparian habitats of Lagoon Creek are degraded; there are habitat values for a variety of fauna. In regard to threatened fauna species, there is a record of the Near Threatened Little Pied Bat within the northern extent of these riparian habitats. It is possible, that these riparian habitats also support values for other threatened fauna, including Koala, Black-chinned Honeyeater, and Square-tailed Kite.

8.3.3.2 Habitat Fragmentation and Loss of Connectivity

Habitat fragmentation is the alteration of previously continuous habitat into spatially separated and smaller patches. Habitat fragmentation not only leads to a decrease in total amount of original habitat, but also provides a catalyst for secondary effects. Reduction in remnant vegetation patch size following fragmentation can result in fragments of a size that are insufficient to sustain viable populations and increased isolation of patches can pose risks to overall long-term population stability. However, different species respond differently to habitat loss and fragmentation and an individual species' response to fragmentation depends on its degree of specialisation, individual habitat requirements and dispersal abilities.

Whilst the clearing footprint will result in a reduction of habitat (i.e. habitat loss), it does not create any isolated habitat "islands" as such, though it does impact on habitat connectivity (e.g. riparian corridors or linear strips of vegetation that connect two or more habitat or vegetation patches). A loss or reduction in habitat connectivity can include both direct and indirect effects including:

- direct habitat loss
- mortality of wildlife during construction and operation due to collisions with vehicles
- fragmentation and degradation of the remaining habitat
- disruption of movements, dispersal and behaviour due to the creation of both physical (lack of habitat) and behavioural (not wanting to cross open areas) changes
- alteration of breeding behaviour through decreased dispersal to attract mates
- decreased genetic and biological viability of fragmented populations
- edge effects to the remaining habitat including altered microclimatic conditions, changes to microhabitat structure, incursion of weeds and feral animals and increases in pollution.

The type and severity of these effects depends on a number of factors including the behaviour and habitat requirements of the affected fauna species, the nature of the surrounding habitat and magnitude of the disturbance.

The main intent of habitat linkages is to aid the preservation of local fauna populations and overall biodiversity via their intended ability to connect habitats and ecosystems, a function that can contribute to dispersal and movement including connectivity for foraging and breeding.

The general interface between habitats of the Bimblebox Nature Refuge and riparian habitats of Lagoon Creek is likely to be of local ecological significance in terms of a habitat linkage between remnant woodland to the west (through Bimblebox Nature Refuge, Lambton Meadows and beyond) and those riparian habitats extending north along Lagoon Creek to the habitat mosaic to the north-east of the Project area and south along Tallarenha Creek to the habitat that straddles Eureka Road. Whist riparian habitats of Lagoon Creek are generally degraded, they support a level of habitat connectivity, and opportunities for wildlife movement into, though, and beyond the study site. The clearing footprint will remove a significant section of the interface and the section of riparian habitat extending north wards along Lagoon Creek.

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8.3.3.3 Habitat Degradation

Potential impacts which may result in degradation of retained habitat arising from construction and operational phase include the following:

- alteration of local surface and groundwater hydrology which may be linked to large-scale landform modification associated with open-cut mining operations and supporting infrastructure (e.g. creation of creek diversions, and large sediment and tailings dams), and land subsidence following underground mining, etc.
- creation of 'new" habitat edges will render retained habitats vulnerable to weed invasion, increases in dust exposure, light spill and wind-throw, etc.
- habitat degradation associated with land subsidence
- invasion of exotic weed species
- introduction of pest animal species
- alteration to fire regimes.

The location and extent of both the project disturbance (clearing) footprint and the predicted subsidence footprint associated with underground mining operations are shown at **Figure 23**. Beyond the direct impacts of habitat clearing, there is a suite of threats which may impact on the values of habitat to be retained on the MLA area. The key sources of degradation are the open cut and underground mining operations, and whilst there is overlap between the suites of potential impacts generated by each of the two mining strategies, there are likely to be some distinct differences in terms of intensity (scale), extent and duration, and the extent to which such impacts can be managed.

For example, the creation of new habitat edges as a result of vegetation clearing is primarily associated with progressive open-cut mining operations and not underground mining operations. Creation of 'new" habitat edges will render retained habitats susceptible to weed invasion, increases in dust exposure and tree wind-throw, etc. Whilst acknowledging there are other potential impacts associated with open cut operations, with the application of best practice management strategies, impacts associated with dust and weeds (and other operational impacts such light, noise, erosion and sediment control) can be successfully managed to minimise long-term degrading impacts to retained habitats.

In contrast, potential impacts to retained habitats associated with land subsidence are primarily associated with progressive underground mining operations and not open-cut mining operations. Subsidence due to underground (longwall) mining can cause deformation of ground surfaces. This can affect natural water flow regimes and water quality, alter groundwater hydrology and subsequently generate changes to the condition and extent of a species' habitat and to the ecological function of both flora and fauna communities. The resultant impacts can be temporary or long term.

Surfaces directly above extracted underground openings usually subside in the form of a trough, the area of which extends beyond the limits of the underground opening. The amount of subsidence and associated parameters, and the shape of the subsidence trough, are influenced greatly by the size of the panel, the dip of the seam, changes in seam thickness, topography, the existence of remnant pillars or partial extraction, extraction of more than one seam, changes in geology and the interaction due to adjacent extraction (including above and below).

Predictive modeling has been undertaken for this aspect of the project. The analysis demonstrates that surface subsidence will develop progressively within each longwall block and will present on the landform surface as a series of trough like depressions. The maximum subsidence (i.e. in the centre of the longwall panels) will range from 1.6 m in standalone mines to 3.2 m in areas of cumulative subsidence resulting from the operations in both the B-seam and D-seam subsidence (where underground mine 4 lies above underground mine 1). See **Figure 24**.

Longitudinal tension cracks of 2.5 mm to 20 mm are predicted to occur at the edge of the longwall mining panel, parallel to the chain pillar areas, where the depth of cover between the surface and the underground mines is less than 180 m. See **Figure 25**.

The primary impact to fauna habitat values will be linked to the extent and degree of degradation of the woodland tree canopy. As no underground coal mines currently exist in the Galilee Basin, there is no precedence to use as a guide to the expected impacts on ecological values from subsidence. There are relatively few published studies of the impacts of subsidence on native vegetation, and those that are available, have typically described local and specific issues (Frazier *et al*., 2010[1]), mostly from the NSW coalfield areas. The potential consequences of subsidence on vegetation are likely to be indirect and heterogeneous (Frazier *et al.,* 2010. Possible changes to near-surface regolith and soil that could affect vegetation include:

- Soil fractures causing changes to the hydrological properties of soils, which could promote local dessication
- Soil fractures could act as macropores that increase hydraulic connectivity
- High flow in fractures could lead to increased erosion
- The availability of groundwater for vegetation may be markedly changed in areas where shallow groundwater systems are within two metres of the surface.

In addition root-ball disturbance could arise from the soil rupture and shaking associated with subsidence.

As mentioned above, fracturing will only occur longitudinally parallel to the chain pillar areas where depth of cover between the surface and the mine is less than 180m. Furthermore, given the alluvial nature of the surface material in the MLA area, the cracking is not expected to exceed 20 mm. Remedial works for longitudinal surface fractures may include ripping, recompacting, seeding of the cracks and reshaping.

Depressions in the surface from subsidence can lead to ponding if unmanaged. Ponding to a depth deeper greater than 1.25m and areas that remain inundated for long periods of time can result in short-term loss of individual trees or longer-term reduction in foliar condition. Vegetation associated with the Bimblebox Nature Refuge, Lambton Meadows and local creek systems would be at greatest risk to the effects of ponding. However the longwall mining panels are aligned longitudinally with the natural fall of the land within the MLA, which drains freely to the east and is sufficient to minimise subsidence troughs. In flatter area, reshaping of any internally draining areas will be done by the construction of contour drains and appropriate rehabilitation measures.

Waratah Coal will develop a subsidence management plan to mitigate and manage the effects of subsidence on hydrology and native vegetation as much as possible. For residual impacts, Waratah Coal will provide offsets in accordance with the State and Commonwealth offsets policies.

[1] Frazier P, Jenkins R, Trotter T. 2010. *Monitoring the Effect of Longwall Mine Subsidence on Native Vegetation and Agricultural Environments. (ACARP C15013*). Report prepared for ACARP January 10 by Ecological Australia.

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Figure 24. Predicted Subsidence Contours

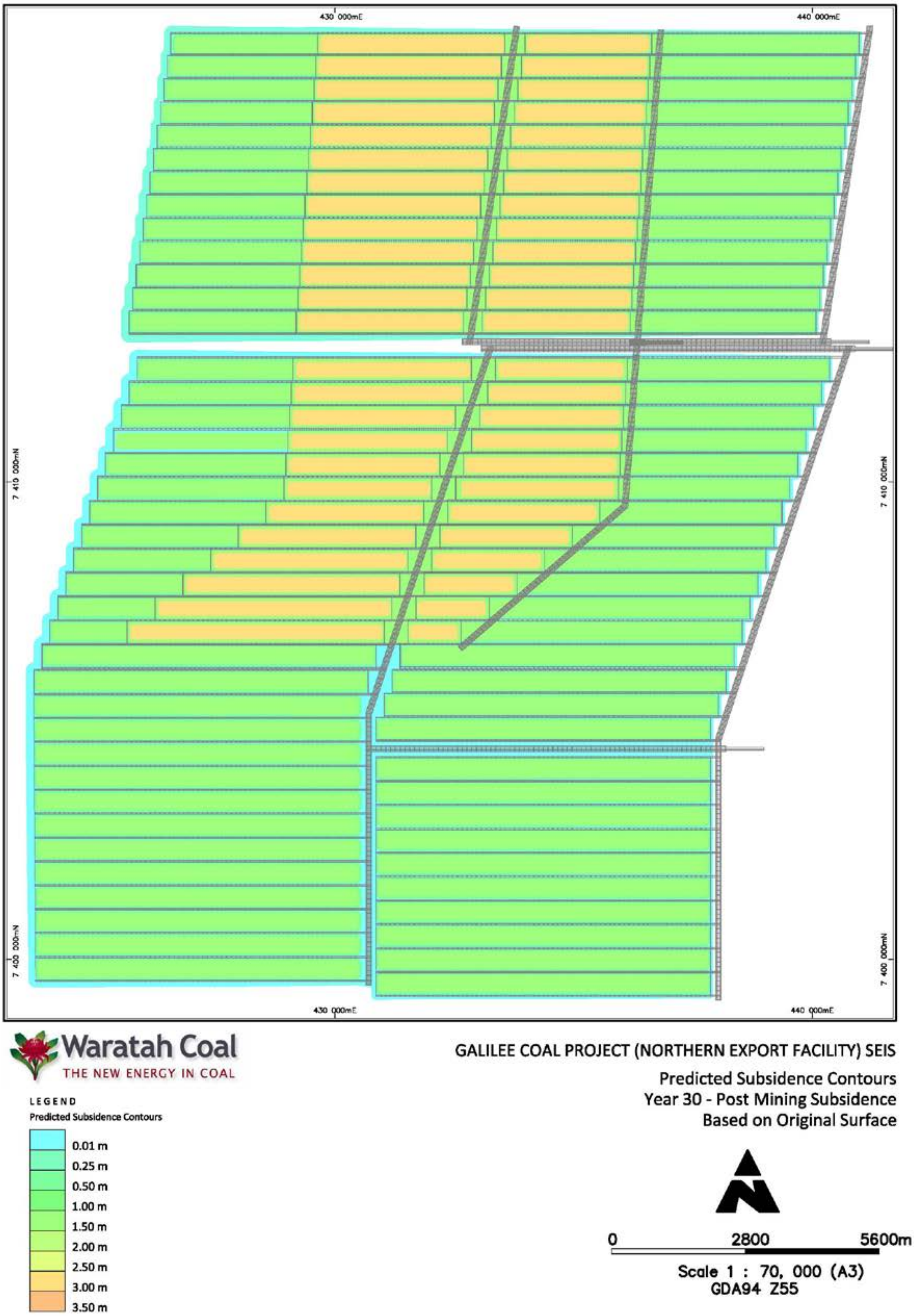
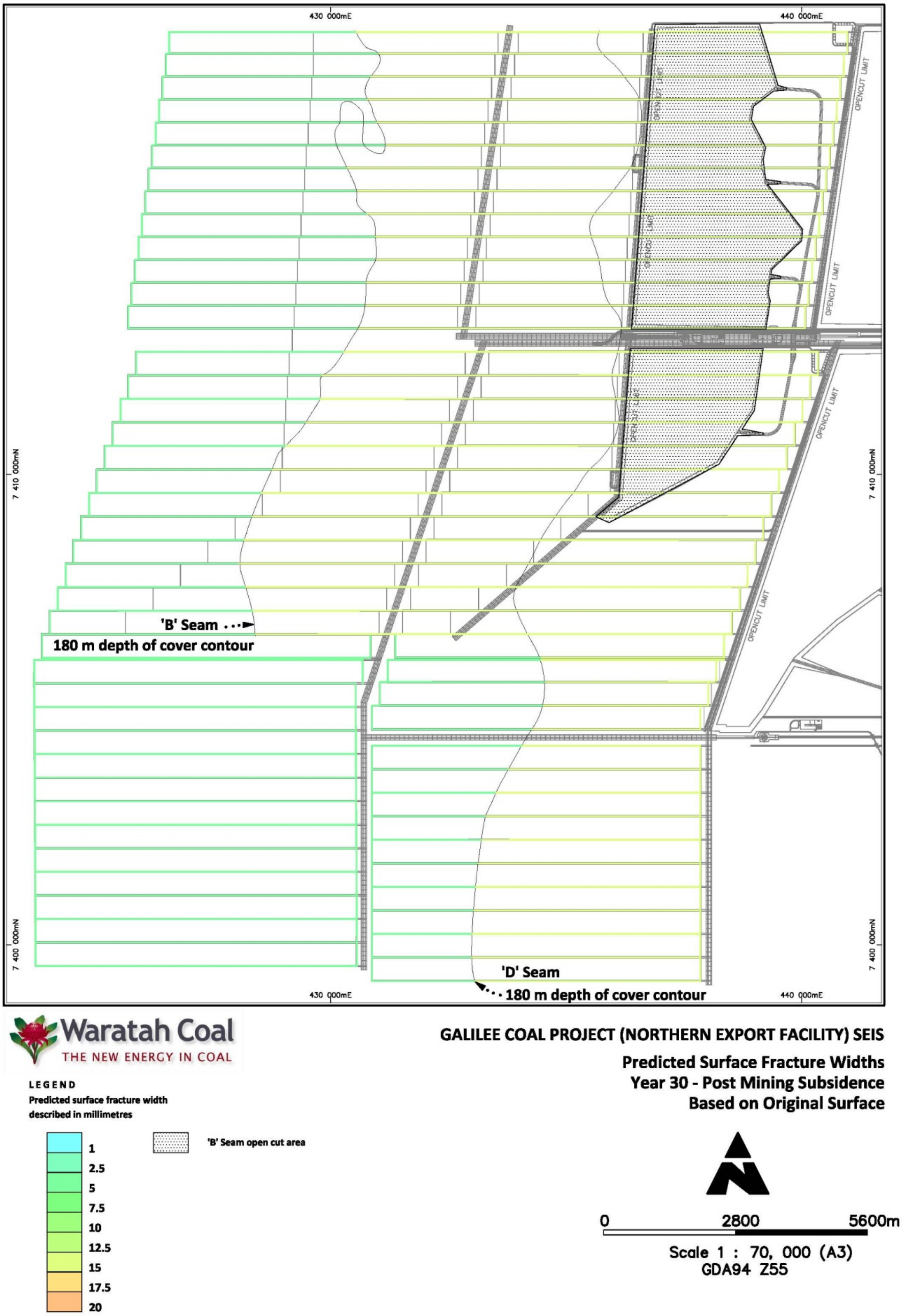


Figure 25. Predicted Surface Fracturing



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8.4 Environmental Protection Objectives

The overall environmental protection objective is to minimise significant impacts on any significant ecological communities or flora or fauna on the project site.

The management objectives are to:

- create linkages of existing remnant vegetation and biodiversity corridors and increase habitat for State and Federally listed fauna species
- restore and protect (from clearing) native regrowth and disturbed remnant vegetation to support recovery to remnant status and condition
- re-establish vegetation in cultivated areas and manage those areas to support the re-establishment of native species
- improve the ecological condition and function through the implementation of appropriate management strategies.

8.5 Performance Criteria

The performance criteria for terrestrial ecology are:

Flora

- retained vegetation is not compromised by site clearing works from the development area
- weed invasion is prevented both within the construction site and in surrounding areas.

Fauna

- the risk of injury and death to fauna is managed and minimised during site clearing operations
- retained habitat is not compromised by site clearing works, gross mechanical disturbance or impacts associated with sedimentation and / or pollutant export from the construction area
- fauna species continue to utilise the retained habitat area post-development
- protect conservation significant species, communities and habitat
- no unplanned or unapproved disturbance / clearing of flora and fauna
- compliance with the requirements of the project's environmental authority.

Biodiversity enhancement areas

Management activities will focus on managing natural regeneration of regrowth communities where there is existing regrowth with framework replanting of vegetation over existing cultivated areas. Within the overall management objectives, the performance criteria are:

- observed regeneration in areas with high potential to progress towards remnant status
- re-establishment of native plant species in areas with lower potential to progress to remnant status
- declared and environmental weed populations are minimised
- minimal disturbance to the biodiversity enhancement sites from threats including inappropriate fire regimes, grazing pressure, feral animal impacts, weed invasion and other forms of land degradation.

8.6 Control Strategies

8.6.1 Flora – Site General

The following section identifies the management strategies and measures which will be implemented in relation to mitigation of the potential impacts to flora. Implementation of a management measure listed in this section may be relevant to both construction and operation phases of the project. Whilst a variety of recommended management strategies and measures will potentially need to be incorporated within the various issue-specific management plans, they are, for completeness and with relevance to impact mitigation to fauna, listed within this section.

Supply of Relevant Site Plans

- clearing of plants must only occur in accordance with a clearing permit issued under the NC Act
- for near threatened, rare, vulnerable and endangered species listed under the Nature Conservation (Wildlife) Regulation 2006, and species identified as critical and high priority under the DEHP "Back on Track" species prioritisation methodology, a Significant Species Management Plan will be developed in consultation with DEHP
- relevant Constraints Plans detailing the staging of works, significant areas of exclusion (such as environmentally sensitive areas) and other relevant issues shall be provided to the Construction Manager, SEO and clearing contractor prior to any site preparation activities within the proposed construction area
- prior to the commencement of any vegetation clearance, the clearing contractor, in consultation with the Construction Manager and SEO, will discuss all areas to be cleared on construction plans and in the field
- all areas to be cleared shall be clearly identified on the ground by the SEO prior to the commencement of any site preparation activities
- prior to clearing in remnant vegetation, a qualified botanist should inspect the site for Endangered Vulnerable or Rare flora
- implementation of an on-site Vegetation Clearance Management system
- vegetation clearing will be staged so that only the area required for construction works is initially cleared.

Identification of Exclusion Zones

- a Vegetation Clearance Management Plan will be developed for the Project to prevent excessive clearing and impact to vegetation. Strategies include:
    - limit the clearing of riparian zones to the extent necessary for safety
    - clearly identify areas that are to be cleared on Construction Drawings
    - boundaries of areas to be cleared are to be clearly marked by tape and / or pegs and conform to limits on drawings
    - contractor to monitor vegetation clearing to ensure only approved areas are cleared

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- within zones that are not to be cleared the following activities shall not be permitted:
  - storage and mixing of materials
  - vehicle parking
  - liquid disposal
  - machinery repairs and / or refueling
  - construction site office or shed
  - combustion of any material
  - stockpiling of soil, rubble or debris
  - any filling or excavation including trench line, topsoil skimming and / or surface excavation, unless otherwise approved by the Construction Manager
  - unauthorised pesticide, herbicide or chemical applications.

Minimising Damage to Uncleared Areas

- all activities in areas to remain uncleared are to be carried out in such a manner as to minimise damage to the vegetation.

Sediment and Erosion Control

- as construction activities may impact on uncleared areas it is important to ensure sediment fencing is in place before site preparation and other earthworks commence. Prior to any site preparation operations, the SEO (or other suitably qualified personnel) is to undertake an inspection of all sediment fencing
- on completion of construction, progressive rehabilitation will be undertaken, by replacement of topsoil, contouring, re-vegetation with local native species, and mulching as soon as possible after disturbance.

Weed Management

- a Weed Management Plan (WMP) will be prepared for the site that follows the requirements of the overarching Biosecurity Management Plan (BMP)
- all mulch produced on site from cleared vegetation will exclude material from weed species. Mulch containing weed species material shall be treated separately and not used on site for revegetation works
- revegetation works are to be completed under strict supervision to avoid unnecessary soil disturbance
- a weed management plan will be prepared that includes:
  - use of wash-down facilities for vehicles and equipment entering and leaving the construction site and those areas proposed for vegetation clearance
  - all machinery, equipment and vehicles are required to be certified as “weed and vegetative matter free” prior to entering the construction site
  - weeds shall not to be used as mulch for landscape, and should be appropriately managed to prevent reseeding and / or colonization

- soil and landscaping material brought onto the site must be from a source that is clean and weed free
- management methods for declared weeds must be consistent with recommendations in DNRW Pest Fact sheets
- weed monitoring to ensure that new weed species are not introduced into the immediate area and eradicate any declared weeds.

Protection of Trees within Construction Zones

- contractor to provide fences and / or trunk girdles to prevent unintended physical damage to the root system, trunk or canopy of native vegetation identified for retention, which may be impacted upon by clearing works
- all works carried out on either foliage or root systems of trees in consultation with a qualified arboriculturist or horticulturist
- develop translocation plans for suitable listed species in consultation with a qualified arboriculturist or horticulturist
- all works to adhere to the Australian Standards (AS) 4373 – 1996 (Pruning of Amenity Trees).

Vegetation Reuse

- millable timber or timber suited to other commercial purposes will be salvaged and large woody debris suitable as aquatic or terrestrial habitat will be saved for placement in critical locations. As much of the remaining suitable material as possible will be mulched for use in rehabilitation and landscaping.

Species Management Plan

- a Species Management Plan (SMP) will be developed for Large-podded Tick-trefoil prior to construction works. It is intended that suitable translocation sites be identified within offset areas if possible and regeneration areas will be identified, and that propagated and / or removed individuals are planted at several sites.

Table 36 lists and describes (but is not limited to) the suite of general management strategies and measures applicable to the management of flora through the various stage of the Project.

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Table 36. General impact mitigation strategies and measures - flora

Management Strategies and Measures	Relevant Project Phase				Impact Category			
	Clearing	Construction	Operational	Rehabilitation and Closure	Loss of Species or Habitat	Wildfire	Weed Management	Habitat Rehabilitation
No remnant vegetation removal shall occur until relevant approvals have been obtained.	✓	✓	✓		✓		✓	
Fire fuel loads are to be monitored and vehicle activities restricted to roads, access tracks and hardened surfaces where practical to reduce the possibility of wildfire. Vehicles should be fitted with spark arrestors and firefighting equipment should be available at all construction sites.	✓	✓	✓			✓		
Areas identified for vegetation clearance are to be clearly defined and detailed in site inductions.	✓	✓			✓			
An offset strategy which compensates for all unavoidable clearing should be developed and implemented.	✓	✓	✓					
Ground surveys are to be undertaken by suitably experienced botanists prior to the commencement of all clearing operations to identify the location of any new specimens of EVNT flora species.	✓	✓	✓		✓			
All vegetation clearing boundaries to be clearly identified and marked in the field prior to clearing activities. Cleared areas to be digitally mapped upon completion of clearing activities.	✓	✓			✓			✓
All personnel will be educated through induction training to ensure understanding and compliance with environmental requirements, including the flora-relevant sections of management plans.	✓	✓	✓		✓	✓	✓	✓
All EVNT specimens requiring relocation should be transplanted into a suitable area of similar vegetation and soil outside of any disturbance area. This area should be free from any grazing pressure and have no, or a controllable level, of *Pennisetum ciliare* in the groundcover. All relocation and replanting actions are to comply with the relevant section in the Rehabilitation Management Plan.	✓	✓	✓	✓	✓			✓
All cleared vegetation should where practical be reused within the offset areas or within the rehabilitation areas.	✓	✓						✓
All areas not directly affected by construction or mining activities are to be delineated and no unauthorised disturbances should occur outside defined disturbance areas (e.g. dumping of excavated material).	✓	✓	✓					

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Management Strategies and Measures	Relevant Project Phase				Impact Category			
	Clearing	Construction	Operational	Rehabilitation and Closure	Loss of Species or Habitat	Wildfire	Weed Management	Habitat Rehabilitation
The locations of weed species to be recorded during pre-clearance surveys to identify areas requiring treatment. All weed infestations within the construction area are to be treated and / or removed from the clearing precinct prior to clearing.	✓						✓	
Stockpiling of topsoil will be undertaken in accordance with best practice storage guidelines to ensure that the seed bank in removed soil is preserved.	✓				✓			✓
Remnant vegetation areas adjacent to the mine footprint should be monitored using the Queensland Government Biocondition Assessment methodology with the purpose of identifying the presence of edge effect impacts from the mine (e.g. dust and weeds) on these areas.		✓	✓		✓		✓	✓
Infrastructure where practical to be located away from remnant vegetation areas.		✓	✓		✓		✓	
Dust monitoring to be undertaken and dust reduction measures should be implemented. Measures may include but are not limited to: • Regular maintenance and wetting of tracks to minimise dust generation • Implementation and enforcement of a site speed limit to minimise dust generation • Revegetation and rehabilitation of cleared as soon as practicable		✓	✓		✓			
Avoiding additional clearing of remnant vegetation for construction vehicle access tracks, truck turning areas and extra workspaces. A track plan is to be developed for areas of retained habitat and rehabilitation. Site protocols are to be established which restrict access to the approved track network identified by the plan.		✓	✓		✓		✓	✓
All new infrastructure should, wherever practical, be located within previously cleared areas.		✓	✓		✓		✓	✓
All diverted drainage lines should be designed to ensure that the bed and banks reflect a natural waterway and riparian vegetation can be established within these drainage lines. Watercourse diversion activities will be undertaken during the dry season utilising best practice methods to minimise risk of impact upon terrestrial and aquatic flora associated with these watercourses.		✓			✓		✓	

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8.6.2 Fauna – Site General

The following section identifies the management strategies and measures which will be implemented in relation to mitigation of the potential impacts to fauna. Implementation of a management measure listed in this section may be relevant to both construction and operation phases of the project. Whilst a variety of recommended management strategies and measures will potentially need to be incorporated within the various issue-specific management plans, they are, for completeness and with relevance to impact mitigation to fauna, listed within this section.

Table 37 describes a preliminary suite of general management strategies and measures applicable to the management of fauna through the various stage of the Project.

Of the suite of management plans required, a Fauna Management Plan (FMP) will be developed which details species specific SMPs, the practical strategies and actions which will be implemented and can be monitored, to address the issues and protocols listed below for both common and threatened fauna. The FMP does not override any existing or other approvals associated with the project and will be prepared by incorporating, where necessary, all relevant approval conditions into the document. The plan's primary authorship will be undertaken by a suitably qualified and experienced zoologist / ecologist.

The FMP will give specific regard to the protection and management of habitat values for those threatened fauna species recorded on the study site. The plan will include, but not be limited to, the following information:

- management strategies for the protection of those habitat resources and maintenance of resources and conditions to support the longer-term site usage of each species
- identification of potential conflicts between the objectives of the threatened species management plan and those of other plan strategies (e.g. bushfire management, extraction site rehabilitation; offset management) and the strategies to eliminate or mitigate potential impacts to threatened species arising from such conflicts.

A further and important objective of the FMP is to identify the monitoring program to assess fauna occurrence within retained habitats. Importantly the monitoring events would be undertaken in a systematic and standardised manner to ensure replicability, and include a component which is consistent with the site-based survey approach implemented for the Project survey program.

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Table 37. General impact mitigation strategies and measures - fauna

Management Strategies and Measures	Relevant Project Phase		Impact Category					
	Construction	Operational	Habitat Clearing	Management of retained habitat	Animal welfare	Fauna movement	Pest management	Habitat rehabilitation
No remnant vegetation removal shall occur until relevant approvals have been obtained.	✓	✓	✓					
Clearing boundaries will be delineated on all drawings and in the field to define the extent of authorized / permitted clearing.	✓	✓	✓					
Installation of vegetation clearance markers (e.g. high visibility poly-web fencing) prior to the commencement of vegetation clearance to identify and protect remnant vegetation for retention.	✓		✓	✓				
Clearly define all areas not directly affected by construction / mining activities to delineate limits of disturbance. No unauthorized disturbances should occur outside defined disturbance areas (e.g. dumping of excavated material).	✓	✓	✓	✓				
Areas identified for vegetation clearance are to be clearly defined and detailed in site inductions.	✓		✓					
No clearing is to commence without the presence of a suitably experienced and licensed spotter / catcher.	✓		✓		✓			
Pre-clearing surveys are to be undertaken by suitably experienced and licensed spotter / catchers in advance of remnant vegetation clearing and pre-empting such operations with suitable lead times to ensure that specific management and mitigation measures can be implemented (e.g. avoidance of disturbance to nesting birds).	✓		✓		✓			

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Management Strategies and Measures	Relevant Project Phase		Impact Category					
	Construction	Operational	Habitat Clearing	Management of retained habitat	Animal welfare	Fauna movement	Pest management	Habitat rehabilitation
The timing of vegetation clearance (particularly areas of remnant vegetation) should be selected in order to minimise impacts (direct and indirect disturbances) to affected fauna habitats during optimum breeding periods.	✓		✓		✓			
Conduct clearing in a sequential manner. The direction of sequential clearing should be away from the disturbance area and towards any retained vegetation or habitat links.	✓		✓		✓			
Along the interface between clearing precincts and retained habitat, trees are to be felled towards the clearing precinct to avoid damage to adjacent retained habitat.	✓		✓	✓				
No remnant vegetation clearing is to be conducted between 1700hrs and 0600 hours unless subject to area-specific exemptions identified in the management plan.	✓		✓		✓	✓		
Cleared vegetation is to be stockpiled so as not to impede wildlife, surface drainage and avoid damage to adjacent retained vegetation	✓		✓		✓	✓		
Cleared material should not be deposited in or adjacent to watercourses. Setbacks to waterways as defined by approval permits need to be adhered to.	✓		✓					
Any proposed site lighting should be designed to ensure that leakage of artificial light onto adjoining retained habitat is avoided.	✓	✓		✓				
Implementation of a comprehensive suite of dust suppression techniques to minimise impacts to	✓	✓	✓					

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Management Strategies and Measures	Relevant Project Phase		Impact Category					
	Construction	Operational	Habitat Clearing	Management of retained habitat	Animal welfare	Fauna movement	Pest management	Habitat rehabilitation
areas of retained habitat and rehabilitation which are in proximity to operational areas.								
Wildlife assessment / rescue services are to be engaged prior to vegetation clearing, to assess appropriate site clearing approaches to minimise deleterious impacts to fauna. Spotter / catcher services (wildlife handlers) are to be employed during vegetation clearing activities.	✓		✓		✓			
A pre-clearing survey for fauna (not restricted to significant species) is required prior to each stage of clearing to address animal welfare issues and relocation of fauna from clearing path.	✓		✓		✓			
A permit to interfere with wildlife from the DEHP will be required for the wildlife handling activities as will the appropriate Animal Ethics Permit.	✓	✓	✓		✓			
Spotter / catcher services (wildlife handlers) must only be undertaken by those appropriately trained and qualified.	✓	✓	✓		✓			
Where badly injured fauna require euthanasia, only personnel suitably licensed shall undertake such actions. The Australian National Health and Medical Research Council's Australian Code of Practice for the Care and Use of Animals for Scientific Purposes (2004) are to be followed when dealing with injured fauna. Alternatively, any injured fauna should be taken to the nearest veterinary clinic.	✓	✓	✓		✓			
Development and implementation of protocols for the relocation of any displaced fauna must be	✓	✓	✓		✓			

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Management Strategies and Measures	Relevant Project Phase		Impact Category					
	Construction	Operational	Habitat Clearing	Management of retained habitat	Animal welfare	Fauna movement	Pest management	Habitat rehabilitation
prepared prior to clearing operations.								
A register of fauna incidents / interactions needs to be maintained daily during clearing operations.	✓	✓	✓		✓			
Suitable buffer distances for sensitive locations (e.g. active nest sites, presence of a Koala, etc.) must be established and clearly marked as a 'no go zone' until spotter / catcher has authorised that clearing in the area can commence / continue.	✓		✓		✓			
Habitat trees are to be identified in the field and by plan prior to commencement of clearing operations. These shall be marked and dismantled using a cherry picker and a suitably qualified arborist and spotter / catcher. Hollows containing fauna shall be blocked, removed from the tree and gently lowered to the ground, with species relocated to a pre-identified, suitable site. Areas in accessible to a cherry picker, requiring hollow removal shall use a hydraulic grabber to remove and lower to the ground.	✓	✓	✓		✓			
All remnant vegetation removed should be reused, either within the offset areas and / or within the rehabilitation areas. Logs and large rocks should be placed in nearby vegetation or adjacent to such vegetation to create shelter habitat for terrestrial fauna species. These 'stock piles' may then be used during later operations to create artificial habitats within rehabilitation areas.	✓	✓	✓					✓
To ensure that the seed bank in removed soil is preserved as much as practical, stockpiling of topsoil will be undertaken in accordance with best	✓	✓	✓					✓

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Management Strategies and Measures	Relevant Project Phase		Impact Category					
	Construction	Operational	Habitat Clearing	Management of retained habitat	Animal welfare	Fauna movement	Pest management	Habitat rehabilitation
practice storage guidelines.								
Post-disturbance reconstructed landforms to be contoured to resemble the original local topography as far as practical.		✓						✓
A weed management plan will be implemented during both construction and operational phases. Weed control strategies are to be developed and implemented and include, but not be limited to the design and implementation of an ongoing eradication program which targets environmental weeds and an ongoing systematic monitoring program to detect the occurrence of environmental weeds and to assess the success of the control / eradication program.	✓	✓	✓	✓			✓	✓
Implementation of the revegetation management plan. This plan will include specifically selected flora species that will maximize the establishment of fauna habitat and maximize the potential for passive revegetation by dispersing fauna.	✓	✓		✓	✓	✓	✓	✓
Implementation of the subsidence management plan. This plan will include preemptive vegetation management in areas where subsidence is likely and ongoing monitoring to and rehabilitation to maintain ecosystem functioning is areas prone to subsidence.	✓	✓		✓	✓	✓	✓	✓
Prior to commencement of clearing operations, a survey of weed species is to be undertaken in order to identify areas requiring treatment.	✓	✓	✓				✓	
All weed infestations within the construction area are to be treated and / or removed where	✓	✓	✓				✓	

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Management Strategies and Measures	Relevant Project Phase		Impact Category					
	Construction	Operational	Habitat Clearing	Management of retained habitat	Animal welfare	Fauna movement	Pest management	Habitat rehabilitation
practical from the clearing precinct prior to clearing.								
All construction machinery entering the site shall be free of soil, weeds, soil pathogens and pest species.	✓	✓					✓	
Designated wash down points for vehicles and plant entering the site will be established and plant will be inspected prior to mobilsation and demobilisation. A register of vehicle approval certification is to be developed and maintained.	✓	✓					✓	
It will be mandatory that vehicles and equipment to be used within areas of retained habitat are subject to a separate, more detailed and comprehensive wash-down before entering such areas. The remainder of the workforce vehicles / equipment will be required to stay on project / site approved roads and designated works areas to minimise contact with weeds.	✓	✓		✓			✓	✓
The proposed development will not deliberately introduce any invasive species. Companion animals (e.g. dogs) are to be banned from all construction and operational areas.	✓	✓	✓				✓	
Feral animal control strategies are to be developed and implemented and include, but not be limited to the design and implementation of an ongoing eradication program which targets pest animals (especially cats, dogs and foxes) and an ongoing systematic monitoring program to detect the occurrence of feral animals and to assess the success of the eradication program.	✓	✓		✓			✓	✓

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Management Strategies and Measures	Relevant Project Phase		Impact Category					
	Construction	Operational	Habitat Clearing	Management of retained habitat	Animal welfare	Fauna movement	Pest management	Habitat rehabilitation
Implementation of a program to ensure strict litter / waste control throughout the construction and operational works on the site. This is to be supported by: site-wide signage; an adequate number of litter bins (which by design exclude birds and vermin); bin clearance on a regular basis; daily maintenance of crib rooms to ensure cleanliness; educational signage within crib rooms on the linkage between poor waste management practices, increases in pest animal populations and subsequent impacts to native fauna.	✓	✓					✓	
Implementation of design features for permanent structures and temporary site facilities (e.g. construction site offices. etc.) which minimise harbourage or roost opportunities for vermin and animal pests.		✓					✓	
Identify barriers to safe fauna movement and remove or modify these barriers where possible (external to the open cut mine and infrastructure operational areas).	✓	✓				✓		
Implement measures to reduce fauna mortality on roads.	✓	✓		✓	✓	✓		
Establishment of fauna exclusion fences to prevent fauna inadvertently re-entering the open cut mine operational areas.	✓	✓			✓	✓		
Monitoring of the movements of, and any incidents involving, the fauna populations will identify if there is the need for erection of fauna exclusion fencing around active quarry. If required, fencing should be designed and located with the	✓	✓			✓	✓		

Management Strategies and Measures	Relevant Project Phase		Impact Category					
	Construction	Operational	Habitat Clearing	Management of retained habitat	Animal welfare	Fauna movement	Pest management	Habitat rehabilitation
assistance of an ecologist.								
The use of barbed wire should be avoided and used only where essential to exclude stock from adjoining pastoral activities. Where the use of barbed wire cannot be avoided, the fence design should incorporate alternate strands of plain wire and barbed wire, e.g. top strand plain wire, middle strand barbed wire and bottom strand plain wire.	✓	✓		✓	✓	✓		
Existing boundary fences associated with any offset areas should be retrofitted to meet the above recommendations (assuming there is no conflict with existing / approved rights of use).	✓	✓		✓	✓	✓		
All personnel shall attend environmental training prior to entering the work site. As part of this training, all personnel will be briefed about their obligations to protect fauna.	✓	✓						
Fauna shall not be fed and direct contact with fauna is to be avoided. This includes both native and introduced species.	✓	✓			✓	✓		
Avoiding additional clearing of remnant vegetation for construction vehicle access tracks, truck turning areas and extra workspaces, etc. A track plan is to be developed for areas of retained habitat and rehabilitation. Site protocols are to be established which restrict authorised area access to the approved track network identified with the plan.	✓	✓		✓			✓	✓

8.6.3 Biodiversity Enhancement Area Control Strategies

This section details the actions that are planned to achieve the biodiversity enhancement objectives and minimise the risks associated with processes that have potential to threaten those objectives.

8.6.3.1 Weeds

Management measures to minimise the introduction, establishment and spread of non-native weeds, including Declared Pest Plants listed under the LP Act will include:

- use of a combination of selected grazing regimes and mechanical and chemical weed control, for the purpose of suppressing and reducing the abundance of weeds and encouraging regeneration of native species, while reducing fuel loads
- manual weed control undertaken using either a low volume gas powered applicator, backpack sprayer, high volume power spray, or similar methods to deliver selective and if required broad spectrum herbicides. Areas to be targeted include areas containing remnant and regrowth vegetation that are not accessible or suitable for other methods of weed control due to potential for damage to vegetation through spray drift
- mechanical weed control carried out through the use of aerial and ground-based boom spray to deliver grass selective herbicides. Mechanical slashing via tractor mounted slashers will be undertaken in some areas, and / or at times when herbicide application is deemed unsuitable. Mechanical weed control will be carried out in areas where potential impact on native vegetation is minimal and high densities of weeds exist
- any clearing or control of vegetation or non-native weeds will be conducted in a way that prevents soil erosion and maintains landform stability where associated with hill sides, slopes, gullies or watercourses and prevents unnecessary damage to native vegetation
- chemicals will be selected to minimise toxicological impacts on native fauna and waterways. Chemicals will be applied as per manufacturer's directions and in consultation with the MSDS
- vehicles and machinery weed hygiene inspections / washdowns will be conducted in accordance with site specific weed hygiene procedures prior to entering the site to reduce the spread of weed seeds and prevent the introduction of weed species. Evidence must be provided to the appropriate person that all vehicles and machinery implementing management actions within biodiversity enhancement areas have been inspected by and assessed as clean by a suitably qualified weed hygiene inspector. Any introduced soil or vegetative material will also be weed and disease free. Any personnel entering the property will be required to check their clothing for seeds, and remove seeds from clothing before entering the biodiversity enhancement areas.

8.6.3.2 Irregular or limited natural recruitment of native vegetation

Management of areas with irregular or limited natural recruitment of native vegetation will include the following measures to increase vegetation establishment:

- intensive ground preparation, planting and maintenance of areas exhibiting no reasonable potential to regenerate naturally. A target stocking rate of 800 stems per hectare will be used in these areas

- enrichment / infill planting and maintenance will be carried out in areas exhibiting poor stocking or species representation of native regrowth. An average infill rate of 100 stems per hectare, varying depending on local existing vegetation condition will be targeted in these areas
- no additional planting will be undertaken in areas where native regrowth is stable
- planting will be undertaken during periods of high soil moisture and at the commencement of the wet season
- Waratah Coal will make all reasonable efforts to procure adequate numbers of all representative species; however, sufficient stock of Desert Upland species may not be readily available and as such Waratah Coal may need to vary species and propagation methodologies within the boundaries of the regional ecosystem characterisation.

8.6.3.3 Land degradation

Measures will be put in place to prevent or minimise soil erosion or any deterioration of the soil's physical, biological or chemical properties resulting from grazing, fire break construction and access track construction and road maintenance. Controls will include:

- monitoring of all earthwork activities
- carrying out work in seasons of limited erosion potential
- the use of erosion minimisation and soil conservation practices where necessary.

8.6.3.4 Habitat Connectivity

A revegetation management plan will be developed to minimize impacts associated with habitat loss, habitat degradation loss of habitat connectivity both during mining operations and post mining. The plan will maximize the functional value of the revegetation and will include a range of strategies to ensure fauna species with differing habitat requirements are accommodated, particularly those species that have been identified to occur within the Bimble Box Nature Refuge.

The revegetation management plan will provide a range of strategies to aimed at quickly establishing habitat structure and food resources which will maximise the potential to firstly attract dispersing individuals and secondly, for dispersing individuals to disperse plant seeds which will provide for passive revegetation. This will be particularly important for revegetation associated with maximizing connectivity between the remaining sections of the Bimble Box Nature Refuge to the south of the clearing footprint, the Lagoon Creek diversion and the existing Beta and Tallarenha Creeks. Effective revegetation of these areas will maximize linkages between the existing woodlands of Lambert Meadows, Bimble Box Nature Refuge, Beta Creek to Corntop and Lagoon Creek to Tallarenha Creek which joins Saltbush woodland along Eureka Road.

Revegetation strategies and criteria will include:

- selecting a range of plant species that will provide year round food resources that are attractive to, and can sustain, dispersing individuals
- selecting pioneer species that will provide perches for avian species and shelter and food resources for a range of fauna species
- contributions to both horizontal and vertical structural complexity
- species that are compatible to the existing regional ecosystems and to the targeted fauna species such as where practical, rare or threatened species.

8.6.3.5 Subsidence Management Plans

A key component of managing impacts to ecological values and providing connectivity between the newly disturbed areas and existing woodland habitat or riparian linkages will be the development of subsidence management plans. DEHP (DERM at the time of writing) has created draft Watercourse Subsidence Guidelines for the Central Queensland Mining Industry (Version 7)_which details the information to be provided in a Subsidence Management Plan. The Subsidence Management Plan (SMP) will follow these guidelines. There are currently no guidelines for Subsidence Management Plans for vegetation communities not associated with watercourses. To minimise impacts from subsidence on this type of native vegetation and associated fauna habitat, the SMP will include for Adaptive management measures for vegetation communities (i.e. will allow for mitigation measures to be adapted as new information comes to light) to be developed as part of a wider rehabilitation management framework.

The plans will include detailed measures to mitigate potential direct and indirect subsidence impacts to the vegetation and the fauna communities that lie above the longwall panels but also those communities downstream of the works that may be impacted through altered flow regimes or drawdown. Maintaining the woodland communities within the subsided areas will be imperative for linkages between these habitats and lagoon Creek, Beta Creek, Tallarenha Creek and the Saltbush woodland.

The overall aim of the Subsidence Management Plans (SMPs) will be to:

- incorporate landholder, community and government concerns during mine planning and approvals process as well as ongoing SMP stakeholder consultation
- implement risk management plans for sensitive or important social and environmental features
- implement enhanced monitoring, reporting and review program
- incorporation of monitoring, mitigation, rehabilitation of subsidence effects in mine planning, as well as operational and post mine closure situations with particular emphasis on ongoing sequential rehabilitation.

The SMP will include detailed measures to mitigate potential direct and indirect subsidence impacts to the vegetation and the fauna communities that lie above the longwall panels and also those communities downstream of the works that may be impacted through altered flow regimes or drawdown. Maintaining the woodland communities within the subsided areas will be imperative for linkages between these habitats and Lagoon Creek, Beta Creek, Tallarenha Creek and the Saltbush woodland.

8.6.3.6 Fire

A Fire Management Plan (FMP) for the biodiversity enhancement areas will be developed through consultation with landholders, neighbouring property owners and managers, relevant industry experts and the local Rural Fire Service.

8.6.3.7 Pest animals

Management actions will be taken to minimise the introduction of pest animals and control populations of current identified pest animals within the management area in accordance with the LP Act.

Both native and non-native animals have the capacity to impact on the management area. The following species are known to impact the management area, and will be controlled as follows:

- feral pigs will be controlled by the contractor when impacts from pigs are identified using a combination of traps and shooting by licensed contractors
- control of foxes and feral cats will be undertaken by a licensed contractor on an opportunistic basis or at the advice of native fauna experts following annual monitoring and reporting programs

- macropods have the potential to have an adverse impact on regenerating vegetation and cause a significant impact to the shrub layer. If monitoring data collected from the exclusion area demonstrate adverse impacts caused by macropods and after consultation with local DEHP officers, licensed shooters will be organised, as required, to reduce numbers under an appropriate Damage Mitigation Permit.

8.6.3.8 Grazing

Grazing is proposed within the mining lease for the purposes of reducing fire risk and aiding weed control. Grazing will be managed to minimise damage to native vegetation and soil, particularly in areas identified for biodiversity enhancement works. To achieve this, grazing intensity, frequency and duration will be dictated and managed by suitability experienced land managers through the life of the mine as follows:

- controlled movement of livestock will be managed through the retention and maintenance of the existing fencing
- maintenance of fencing will be undertaken by the contractor or the landholder.

8.6.3.9 Drought

Prolonged periods of below average rainfall will impact negatively on performance of naturally regenerating and revegetated areas. To minimise the impacts of possible drought, the following measures will be put in place:

- planting operations will be carried out to take advantage of actual and forecast rainfall and only when soils are at field capacity
- revegetation works may be suspended during periods of below average actual or forecast rainfall
- grazing intensity, frequency and duration will be reduced during droughts.

8.6.3.10 Habitat degradation

To minimise impacts on the habitat of native fauna, the following measures will be put in place:

- all management activities will be undertaken in accordance with the specifications set out in this management plan as well as the rehabilitation management plan and the subsidence management plan
- wherever possible, activities in the biodiversity enhancement areas must not damage, destroy, mark, move, dig up or otherwise interfere with active nests, burrows, roots, caves or other structures used by native animals.

8.6.3.11 Unauthorised access

To prevent unauthorised access into the biodiversity enhancement areas, the following measures will be put in place:

- “Prohibited Access” signage will be erected at access tracks into the biodiversity enhancement management areas
- all authorised entry to the management areas will be reported as will be required under the access procedures that will be developed.

8.7 Monitoring

8.7.1 Flora - General

Monitoring during the construction phase will include:

- mapping of the distribution of declared and environmental weeds, particularly adjacent to roadways
- occurrences of erosion and sedimentation influencing vegetation and stream health
- dust effects on native vegetation.

Monitoring during the operations phase will include:

- the distribution of declared and environmental weeds around the perimeter of the open pits, CHPP, ROM, overland conveyor, rail route, new sediment basins, creek diversions and adjacent to new roadways and the dragline transport route
- habitat rehabilitation / restoration progress
- downstream riparian habitat
- monitoring of treated areas to assess the success of declared plant eradication
- monitoring of the project site to identify any new declared plant infestations.

8.7.2 Fauna - General

During the construction phase, a fauna monitoring program will include the following:

- frequency of fauna spotting and catching
- native animal injuries from construction activities
- pest animal activity.

During the operations phase, a fauna monitoring program will include the following:

- habitat rehabilitation / restoration progress
- fauna use of rehabilitated areas
- downstream riparian habitat
- vegetation and fauna communities within subsided areas
- pest animal activity.

8.7.3 Monitoring of Biodiversity Enhancement Areas

Ongoing monitoring and reporting will be undertaken to assess the ongoing success of biodiversity enhancement activities, particularly in areas above the underground mines. Monitoring is intended to be a measurement of how the biodiversity enhancement activities are progressing and the successful management of the potential threats to achieving desired biodiversity enhancement outcomes. Monitoring will be conducted annually by a suitably qualified ecologist. The following sections provide details of monitoring and reporting activities that will be undertaken specific to the biodiversity enhancement program.

8.7.3.1 Fixed location BioCondition assessment and photo monitoring

BioCondition monitoring will be undertaken to assess changes in the condition of vegetation as regrowth progresses. BioCondition monitoring sites will be assessed against the condition of local Reference sites of the same regional ecosystem. The method employed will follow the technique described in the BioCondition Assessment Methodology Manual Version 2.1 of March 2011.

The central point of each BioCondition assessment transect will be a photo monitoring point and each transect will be 100 m in length. The ends of the transects will be permanently marked during the first monitoring event with either a 50 mm galvanised post or galvanised star picket with a galvanised steel safety cap fixed.

Four photos will be taken at each photo monitoring point in the directions of Magnetic North, South, East and West. Photo monitoring points will be marked with either a 50 mm galvanised steel post, driven into the ground to ensure the post remains in place for the duration of the management program, or galvanised star picket with galvanised steel safety cap fixed in place. GPS points at each photo monitoring point will also be recorded.

BioCondition sites will be situated in disturbed locations within the management area reflecting the areas of worst condition with locations to be determined during planning for the first round of monitoring. These BioCondition sites will be supported by the establishment of permanent BioCondition reference sites located in undisturbed remnant vegetation adjacent to the management area or as near as practical to the management area. These will be monitored annually, at the same time as monitoring takes place within the management area, to provide an ongoing reference of the relative condition of the site in any given year. This will assist in monitoring the changes to the reference site and management area during different seasons, drought or high rainfall periods.

Data from the BioCondition Assessment will be recorded in field sheets and summaries attached to the annual monitoring report. Monitoring reports prepared for the second and subsequent years will include summary data from all previous years and summaries will be presented so as to allow trend analysis of each of the measured criteria.

8.7.3.2 Unbounded floral survey

An unbounded floral survey will be conducted at each monitoring event. The survey will be targeted at producing an overall management area floral list and will include estimates as to relative abundance based on the ACFOR subjective scale. This assessment will include estimates of weed cover and abundance.

The ACFOR scale is as follows:

- A - The species observed is "Abundant" within the given area
- C - The species observed is "Common" within the given area
- F - The species observed is "Frequent" within the given area
- O - The species observed is "Occasional" within the given area
- R - The species observed is "Rare" within the given area.

The site flora list will be used to identify suitable species for rehabilitation and infill planting, and will be reported on in the annual monitoring report.

8.7.3.3 Fauna monitoring

A baseline fauna survey will be conducted following the completion of initial major works at the site. Ideally this survey will occur between February and May following the wetter summer months, and when fauna are active. The intent of this survey will be to assess habitat features of different areas and to attempt to identify the presence of absence of species of conservation significance. A detailed methodology will be developed that considers the requirements of EPBC Act fauna survey guidelines, and permanent fauna survey sites will be established in several key locations throughout the site.

Follow up fauna surveys will be undertaken every five years at the same time each year, until five years after the completion of mining activities. Reporting of fauna survey results will be included in the annual monitoring report in the year the survey is undertaken.

Information from the baseline survey and any follow up surveys will be used to advise the ongoing management of the offset.

8.7.3.4 Fire fuel and grazing monitoring

Fire fuel and grazing monitoring will be undertaken in order to guide grazing and fire and fuel load management on the mining lease. Monitoring will be conducted prior to and during grazing events by an ecologist during annual monitoring events.

Ground cover and pasture biomass will be assessed prior to and during grazing events. The area to be grazed will be visually assessed for cover and pasture height, with grazing to generally cease when pasture height falls below 150 mm and or ground cover in pasture areas, including leaf litter, is found to be less than or equal to 70%.

Measurement will be undertaken at various locations (to be determined) within each of the management areas measuring the depth of fine grassy fuel and then averaging measurements to provide an estimate as to fire fuel load within each community. Where fine (grassy) fuel depths are found to exceed an average depth of 25cm, consideration would be given to increasing grazing events and / or back burning at the boundary to protect the site against wildfire.

Fine (grassy) fuels will be measured annually during monitoring events and recorded within the annual monitoring report.

8.7.3.5 Grazing and herbivore exclusion zone

Grazing exclusion zones will be established to determine impacts of grazing on vegetation regrowth, in order to guide the frequency, intensity and duration of livestock grazing. Grazing exclusion zones will be designed to separately determine impacts of grazing by livestock and native / feral herbivores.

Grazing exclusion zones (fenced area) will be fenced for the purpose of excluding domestic livestock for the entire duration of management. A complete herbivore exclusion zone (including native and pest fauna) or netted area of 400 m^2 (20 m by 20 m) will be established within the livestock exclusion zone. The netted exclusion zones will be located in an area that includes a mixture of exotic pasture grass and native regeneration not closer than 100 m to any external boundary. The netted exclusion zone will be assessed during monitoring events for ground cover; native species recruitment, fire fuel loads and these results will be used for comparative assessment of impacts by herbivores to inform management actions such as pest animal management. Results will be included in the annual monitoring report.

8.7.3.6 Monitoring of field works

Monitoring of biodiversity enhancement works undertaken on the site will be undertaken to determine if variations to the works program are required. This will include visual assessment of fences, access tracks, billabongs, water courses, weed control and regrowth. Monitoring will include an assessment of all works conducted in the period since the previous monitoring report, with notes to be provided within the annual monitoring report. Notes will include an assessment on the efficacy of the field work, estimate of success rates, notes on the condition of fire breaks and fences and the overall management area condition.

8.7.3.7 Reporting

Reports will be provided annually to the DEHP detailing the progress against identified management objectives. Monitoring will be conducted in autumn of each calendar year with reports provided by 30 June of each year in which monitoring is conducted.

The following list describes the components of the monitoring report:

- reporting will be provided following the completion of each monitoring program annually until the completion of the biodiversity enhance program (five years after completion of mining).

The report will contain:

- Lot on Plan property description
- photo monitoring
- BioCondition assessment and associated GPS locations of the centre point of each transect
- an overview of the progress towards achieving the desired management outcomes
- an indication of any risks or potential threats that have become apparent to the site since the implementation of biodiversity enhancement activities, how these risks impact on the enhancement works and activities to be undertaken to manage these threats and / or risks
- evidence of progress towards the desired site outcomes and (where all management outcomes have been achieved in full, document evidence of completion).

A proposed table of contents for the annual monitoring report is provided below.

- Habitat rehabilitation / restoration progress
- Introduction
- General site condition
- Annual works program report:
  - fencing and ongoing maintenance
  - fire break maintenance and maintenance of current access tracks
  - erosion control and / or soil disturbance (if required)
  - fire management and maintenance
  - grazing management, and details of grazing rotations
  - weed control
  - equipment, vehicles to be washed and blown down for weed spread measures between all management activities
  - feral animal control and macropod management
  - enrichment planting
  - monitoring and evaluation
- General site condition
- Statement of attainment against management targets
- Statement of risk management against threatening processes

- Results – biocondition assessment
- Results – photo point monitoring
- Results – unbounded floral survey
- Results – fire fuel monitoring
- Results – herbivore exclusion zone monitoring
- Results – grazing
- Weed population report
- Erosion extent report
- Appendices
    - Appendix 1: BioCondition Data
    - Appendix 2: Photo Point Monitoring Data (full set of photographs)
    - Appendix 3: Unbounded Floral Survey Data
    - Appendix 4: Mapped Extent of Erosion

8.7.3.8 Contractors Record of Works

Contractors will be required to maintain a daily record of works for each day that biodiversity enhancement works are conducted on the site. The records will include details of the number of staff employed, hours worked and tasks undertaken. Included within the record of works will be details on the quantity of all materials that are used including potted, plants, cuttings, seeds and fertilisers. Where works include the application of herbicide copies of spray reports will be attached.

The daily record of works will include sufficient spatial information so that the location and extent of works can be tracked. Spatial data will be recorded and maintained in a spatial data base, GIS (shapefile) file sets or similar.

8.7.4 Monitoring of Subsidence Areas

8.7.4.1 Streams

Where a watercourse is located above a longwall panel, subsidence of the panel can have a number of impacts on the overlying watercourse.

Some of these impacts include:

- Lowering of bed and banks
- Creation of in-stream waterholes
- Changes to local drainage patterns
- Incision processes
- Stream widening
- Erosion
- Increased overbank flows due to lowering of the high banks
- Tension cracking through both shallow and deeper underlying strata
- (including aquifers)

- Root shear and loss of riparian vegetation
- Changes to water quality (surface water and groundwater).

DEHP (DERM at the time of writing) has created draft Watercourse Subsidence Guidelines for the Central Queensland Mining Industry (Version 7)_which details the information to be provided in a Subsidence Management Plan. The Subsidence Management Plan (SMP) will follow these guidelines.

Monitoring methods set out in the guideline follow a Before-After Control-Impact (BACI) protocol advocating using both on-ground and aerial photogrammetric methods. Post subsidence monitoring must be undertaken at the following intervals.

Stream Order 1, 2 and 3 (As defined using Strahler (1952) method.)

- Within two (2) months of the initial subsidence,
- Following a rainfall event of 1 in 2 year ARI for the duration equal to the time of
- concentration for the catchment at the location of the subsidence,
- Following a peak flow event of greater than a 1 in 2 year ARI, and
- Annually.

Stream Order 4 and Higher

- Within two (2) months of the initial subsidence,
- Following a rainfall event of 1 in 5 year ARI for the duration equal to the time of
- concentration for the catchment at the location of the subsidence,
- Following a peak flow event of greater than a 1 in 5 year ARI, and
- Annually.

Reporting should occur annually and should comment on the following:

- Watercourse condition and geomorphic processes;
- The condition of vegetation in riparian zones;
- Examination of pillar zones in watercourses with particular attention to
- potential for tension cracking;
- The creation of in-stream waterholes;
- Any impacts on groundwater.

8.7.4.2 Vegetation

There are currently no guidelines for Subsidence Management Plans for vegetation communities not associated with watercourses. To minimise impacts from subsidence on this type of native vegetation and associated fauna habitat, the SMP will include for Adaptive management measures for vegetation communities (i.e. will allow for mitigation measures to be adapted as new information comes to light) to be developed as part of a wider rehabilitation management framework.

The SMP will include detailed measures to mitigate potential direct and indirect subsidence impacts to the vegetation and the fauna communities that lie above the longwall panels and also those communities downstream of the works that may be impacted through altered flow regimes or drawdown. Maintaining the woodland communities within the subsided areas will be imperative for linkages between these habitats and Lagoon Creek, Beta Creek, Tallarenha Creek and the Saltbush woodland.

The potential consequences of subsidence on vegetation are likely to be indirect and heterogeneous (Frazier et al., 2010[2]). Possible changes to near-surface regolith and soil that could affect vegetation include:

- Soil fractures causing changes to the hydrological properties of soils, which could promote local dessication
- Soil fractures could act as macropores that increase hydraulic connectivity
- High flow in fractures could lead to increased erosion
- The availability of groundwater for vegetation may be markedly changed in areas where shallow groundwater systems are within two metres of the surface.

A Monitoring Program will be developed to allow for the quantitative assessment of any direct and indirect impacts to vegetation communities that may be caused through subsidence. The aims will be to:

- Evaluate whether or not subsidence is changing the environment
- Determine which components are adversely affected, and
- Estimate the magnitude of the effects.

It is proposed to use the BioCondition monitoring framework (or a specifically tailored version of it) within a Before-After Control-Impact (BACI) design (or variant thereof) as the basis of the Monitoring Program. A series of monitoring transects will be established within areas to be subsided and within control (reference) sites of the same regional ecosystem.

It is anticipated that the field method employed will follow the technique described in the BioCondition Assessment Methodology Manual Version 2.1 of March 2011, but may be amended somewhat to emphasise or pick-up indicators considered to be affected as a result of subsidence.

Aerial photogrammetry, such as the methods described in Frazier et al. (2010) may also be used.

The geology of the Galilee Basin is considered favorable in terms of self-repair after subsidence (i.e. because of the majority of cracks that extend to the surface are expected to self-repair given the alluvial nature of the tertiary material found at the surface). It would be expected that impacts upon vegetation in these types of soils are not as severe as in places such as the Hunter Valley, which overlies sedimentary rock. However, given the lack of data with reference to the impacts of subsidence upon vegetation communities within the Galilee Basin, Waratah Coal propose to provide environmental offsets in accordance with the Commonwealth and State Offset Policy frameworks for all subsidence areas within the first five years of underground mining. Data from the monitoring program will be reviewed annually to identify any trends and/or impacts to vegetation communities. At the end of the first five year period, the data will be reviewed and compiled into a report for the Commonwealth and State agencies. The report will identify the outcomes of the monitoring with reference to the aims, that is, the report will:

- Evaluate whether or not subsidence is changing the environment
- Determine which components are adversely affected, and
- Estimate the magnitude of the effects.

[2] Frazier P, Jenkins R, Trotter T. 2010. *Monitoring the Effect of Longwall Mine Subsidence on Native Vegetation and Agricultural Environments. (ACARP C15013*). Report prepared for ACARP January 10 by Ecological Australia.

The outcomes of the first five years of monitoring will be used to inform the next five years of monitoring and any further offsets that may be required. Given the nature of the geology in the Galilee Basin, Waratah Coal expect the impacts of subsidence on vegetation to be minimal. As such, by offsetting for all vegetation to be affected by the first five years of underground mining, Waratah Coal expect to have exceeded their offset obligations, and may use any areas of offsets that are additional to requirements as advance offsets for any future impacts of subsidence that will occur in years 5 – 25 of mining.

8.8 Commitments

The following commitments will be implemented by Waratah Coal so as to minimise risks to terrestrial ecology.

Flora

- Species Management Plans (SMPs) will be developed for species as agreed to in consultation with DEHP
- rehabilitation and subsidence management plans will be developed in consultation with DEHP and will include specific measures in relation to improving habitat linkage in both riparian and terrestrial systems
- a WMP will be developed as part of the BMP prior to the commencement of activities at the site. The WMP will describe the management strategies for weed species listed under the LP Act or Local Government requirements for weeds not listed under the LP Act
- trees, shrubs and other vegetation will only be removed where required (and appropriate approvals sought where necessary). Vegetation outside mining and infrastructure areas will where ever possible remain undisturbed
- where possible, infrastructure will be placed in areas to minimise the disturbance of existing native vegetation. Existing tracks and cleared areas will be utilised, where possible
- a FMP will be prepared for the site
- cleared areas will be progressively rehabilitated in accordance with the Project rehabilitation strategies, including the incorporation of revegetation works in the ESCP
- cleared vegetation will be managed in a manner consistent with the waste hierarchy
- species used in rehabilitation will where possible be taken from the species listed to be agreed with DEHP.

Fauna

- a DEHP accredited spotted / catcher will be on-site immediately prior to vegetation clearance to inspect habitat trees (i.e. trees with hollows, fissures or with substantial food resource, mature trees or stag trees) to determine the presence of significant fauna and to implement a relocation plan for any fauna found
- native vegetation removal will be conducted only after clearance surveys have been conducted
- Project persons operating vehicles in and adjacent to the Project site will be made aware of the presence of this threatened species and the potential for it to be encountered on vehicle tracks.
- a Pest Management Plan will be developed as part of the BMP prior to the commencement of activities at the site. The BMP will describe the management strategies for pest species

listed under the LP Act, quarantine requirements or Local Government requirements for pest species not listed under the LP Act

- SMPs will be developed for species as agreed to in consultation with DEHP

Biodiversity Enhancement

- a biodiversity enhancement program focusing on the re-establishment of Desert Upland ecological systems will be developed and implemented through the life of the mine and for five years post cessation of mining activities.

8.9 Proposed Environmental Authority Conditions – Schedule H – Flora and Fauna

(H1) The impacts of mining activities on REs of Conservation Significance will be minimized where possible and practicable.

(H2) A Biosecurity Management Plan must be prepared prior to the commencement of construction activities that addresses the LP Act and local government requirements.

(H3) A qualified spotter catcher is to be engaged to work ahead of the site clearing works at the commencement of the vegetation clearing activity.

(H4) Species Management Plans must be developed for species as agreed to in consultation with DEHP

END OF CONDITIONS FOR SCHEDULE H

Waratah Coal

9. Land Management

9.1 Background

9.1.1 Land Use

The Project site and adjoining areas have historically and are currently used for cattle grazing. New extractive industries (coal mining) are proposed nearby to the China First Mine. The properties adjoining the Project site are predominantly large rural holdings used for grazing cattle on freehold and leasehold land.

A total of fifty-two separate allotments intersect EPC 1040 and EPC 1079 (with 36 lots covering the mine fooprint). Of these, the predominant land tenure type is leasehold which comprised approximately 60% of existing tenure types. Freehold land comprises approximately 25% of tenure type with the remaining 15% held as either forest reserve or easements. Four distinct parcels of freehold land exist within the mine footprint, while an additional three parcels of freehold land are located just south-west of the footprint, but within the proposed Mining Lease boundary.

Other infrastructure located approximately to the Mine's footprint include the 275 kV powerlines that run through the middle of the mine footprint, the Central Highlands railway line trends east to west and runs parallel the Capricorn Highway located at the southern extent of the proposed mining lease and a stock route is present in the southern portion of the mine site, outside of the proposed mining lease, and follows the general alignment of east west railway line and Capricorn Highway.

The mine site is also located within the Central Highlands sub-region of the Central Queensland Regional Plan. The major industries in this area are crop production, cattle grazing and coal mining with cattle grazing being the largest land use. The plan recognises the importance of resource extraction by stating that "coal mining will remain a key economic driver of the region over the next twenty years" and that "access to the region's coal reserves needs to be maintained".

9.1.2 Soils

The mine study area is dominated by Kandosol soils with Rudosols in areas of elevated terrain in the north-western and south-eastern portions of the site.

Kandosols are structureless, mostly well drained permeable soils although some yellow and most grey Kandosols have impeded sub-soil drainage. Most Kandosols have low fertility and land use is limited to grazing and native pastures. Grazing lands are susceptible to surface soil degradation such as hard setting and crusting even when grazing intensity is low.

Rudosols are soils with minimal soil development. These are relatively young soils where soil forming factors have had little time to pedalogically modify parent rocks or sediment. There are a wide variety of Rudosols in terms of texture and depth with many being stratified and some hypersaline. Rudosols are apedal or only weakly structured and show no pedological colour change apart from darkening of the top horizon. Commercial land use is generally limited to grazing of native pastures due to the soil properties or occurrence in arid regions, or both.

Soil samples were collected to assess the mine site area. A description of these samples is provided in **Table 38**. The soil investigations indicate that Kandosols are the dominant soil type in the mine area.

Table 38. Mine Site Description of Soil Samples

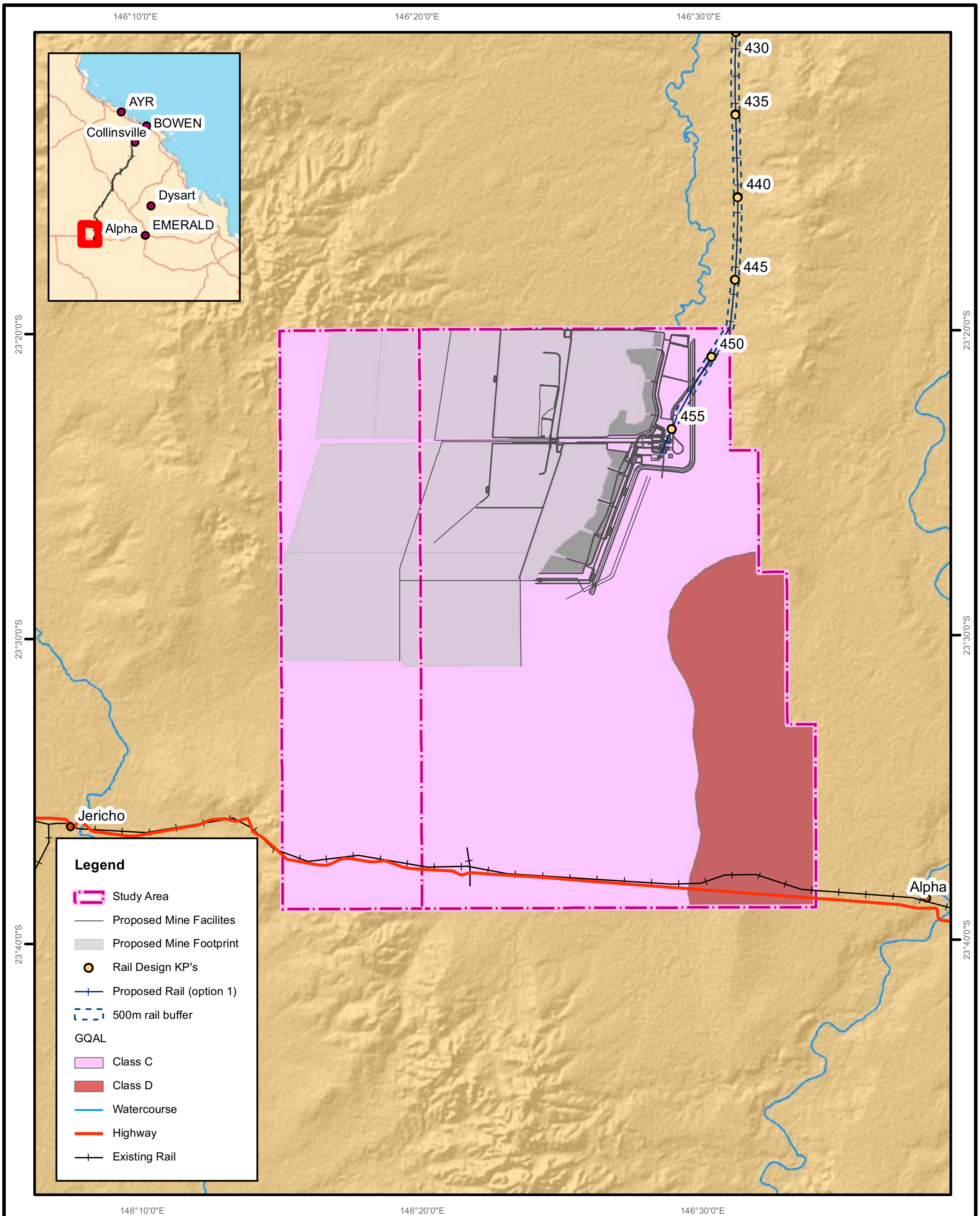
Sample	Sample Location	Soil
SS49	North east end – near rail alignment	Sandy clay, fine grain, hard, dry, non-plastic, some gravel (sub angular (9mm), underlain by gravelly, clayey sand, fine to medium grain, dry, loose, friable, brown /orange, sodic.
SS50	North east end – Tallarenha Creek	Clayey silt, dry, firm, loose, non-plastic, dark brown A horizon, pale grey B horizon.
SS51	North east end – near rail	Sandy gravels, dry, hard, friable, loose, orange, underlain by sandy gravelly clay, fine grain, friable, loose.
SS52	South east of mine site	Silty clay, dry, firm, pale grey/brown A horizon and pale grey B horizon.
SS53	Central east side of mine site	Silty clay, hard, non-plastic, dark brown underlain by soft silty clay, non plastic with orange and red colour
SS54	Central northeast mine site / Tallarenha Creek	Sandy clay, fine to medium grain, hard, non-plastic, brown, underlain by silty clay, soft, non-plastic, orange.
SS55	Central north west mine site	Clayey gravelly sand, fine grain, firm, non-plastic, orange and yellow underlain by silty clay, firm, non-plastic, dark red.
SS56	North west of mine site	Silty clay, dry, hard, dark down
SS57	Central mine site	Silty clay, dry, hard, loose, dark brown/orange underlain by silty clay, dry, firm, loose, dark orange/red colour.
SS58	Central west of site	Sandy clay, fine to medium grain, dry hard, loose, non plastic.

9.1.3 Land Suitability and Good Quality Agricultural Land

The Project site and immediate surrounds were assessed to identify potential land suitability and Good Quality Agricultural Land (GQAL) (Queensland DPI and DHLG&P, 1993). Agricultural land is defined as land used for crop or animal production, but excluding intensive animal uses (i.e. feedlots and piggeries). GQAL is land which is capable of sustainable use for agriculture, with a reasonable level of input, and without causing degradation of land or other natural resources.

Based on the results of soil sampling the land within the mine footprint would be considered class C GQAL (**Figure 26**), which is described as being "land that is suitable only for improved pastures or native pastures". There is some Class D land in the south-east of the study area but this will not be impacted by the mine. Class D land is described as "non-agricultural land, being land not suitable for agricultural uses due to extreme limitations". The suitability of beef cattle grazing on the Project site is also mostly limited by nutrient deficiencies within the soil. Water erosion and poor water availability, primarily due to the shallow nature of the soil, are also considered limiting factors within some soils.

Figure 26. Good Quality Agricultural Land



Data Source:
Transport Infrastructure and DEM: Geoscience Australia Geodata TOPO 250K Series 3 (2006);
Good Quality Agricultural Land (GQAL): based on field sampling;
Mine Infrastructure: Waratah Coal

DISCLAIMER
E3 Consulting has endeavoured to ensure accuracy and completeness of the data. E3 Consulting assumes no legal liability or responsibility for any decisions or actions resulting from the information contained within this map.

E3 consult

9.1.4 Sensitive Environmental Areas

A review of the DEHP Environmentally Sensitive Areas (ESA) mapping for the Project site revealed no conservation parks, declared fish habitat areas, wilderness areas, aquatic reserves, heritage or historic areas, national estates, world heritage listings, sites listed by international treaties or agreements or areas of cultural significance relating to biodiversity and scientific reserves.

The EPBC Act Protected Matter Search Report identified two Ramsar wetlands of international significance, whose catchment extremities fall within 100 km of the Project site. These wetlands are:

- Coongie Lakes - located approximately 750 km south-west in the far north-east corner of South Australia in the Cooper Creek sub-catchment of the Lake Eyre Basin
- the Shoalwater and Corio Bays Area located approximately 50 km north of Rockhampton and 410 km north-east of the Project.

No areas have been identified as important habitat for species listed under the *Nature Conservation Act 1992* (NC Act) or *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) as presumed extinct, critically endangered, endangered, vulnerable or near threatened. No essential habitat has been mapped within or adjacent to the Project site.

Part of the mine surface clearance footprint occurs in the north and eastern parts of the Bimblebox Nature Refuge, an area gazetted under the Nature Conservation (Protected Areas) Regulation 1994. This area is classified as a Category C Environmentally Sensitive Area under DEHP ESA mapping. The EPA (2005) identifies the site as containing 'Special biodiversity values' and 'Wildlife refugia' and is mapped as being of Local Significance.

9.1.5 Contaminated Land

Seventeen lots cover the Mining Lease Application. A search of the EMR/CMR did not identify any properties listed on either of these registers. However, during an inspection of the mine site, Lot 1 BF72, containing an Above Ground Storage Tank (AST) and cattle stockyard was observed. This lot was selected for a PSI with targeted soil sampling. The hydrocarbon impacts to soils based upon site observations of staining and the clay content of the soils present suggest a low potential for significant impacts. Based upon the extent of observed staining, distance to the nearest creeks and prior experience of spills / leakage from similar sized ASTs, the potential for impacts to penetrate more than a few centimeters below ground is considered low. It is therefore considered that the impact is unlikely to comprise serious or material environmental harm and presents a low risk.

Outside of the MLA, but within or adjacent to the study area (i.e. EPC1040 and part of EPC1079), desktop searches revealed that five lots along an existing rail line recorded a land use of "Transport Terminal" and one lot adjacent to the rail line recorded a land use as "Transformer." One of the "Transport Terminal" lots was listed on the Environmental Management Register (EMR) (possible high level of Arsenic).

The lot listed on the EMR (Lot 273 SP108314) was selected for Preliminary Site Investigation (PSI) with targeted soil sampling. This lot was representative of other rail line lots in the area. The transformer lot was not assessed further as it was not listed on the EMR. Further, due to the dangers of working in a live electrical facility and because it was located about 30 km south of the mine site, the site was considered to pose a low risk to the Project.

9.2 Environmental Values

The environmental values of the land at the Project site that are to be protected or enhanced are:

- the continued functionality of undisturbed land and ecosystems on the Project site
- the potential of topsoil for use as a resource in the rehabilitation of disturbed areas
- the stability of disturbed land and ensuring it is non-polluting
- the suitability of land to support safe beneficial post mining land uses such as agriculture and native ecosystems.

9.3 Potential Impacts on Environmental Values

Site activities with potential to impact on the land environmental values are:

- land disturbance (vegetation clearance, topsoil stripping, stockpile management) causing erosion and degradation of topsoil resources
- land disturbance resulting in a reduction in agricultural land capability and suitability, and capacity to support native ecosystems
- construction of spoil dumps and potential acid mine drainage generation
- construction of access tracks, haul roads and pits
- disposal of coarse and fine dewatered rejects and tailings
- creation of final voids
- potential land contamination from the inadequate management of hazardous materials including fuels, oils and chemicals.

9.3.1 Land Use

The development of the Mine will significantly change existing land use in the immediate area. The majority of the area within the proposed Mining Lease area has been typically used for broad scale cattle grazing on native and introduced pastures, and also grazing within bushland in some parts. This is consistent with much of the surrounding land use.

During the operation of the mine, existing land uses, such as grazing may be able to continue within the proposed mining lease in areas not directly impacted by the open cut mines and supporting infrastructure. Areas required for the operation of the mine will be disturbed and no longer available for the existing land use. The land is not considered to have unique agricultural values compared to surrounding areas and as such, the mine would not be expected to have a significant impact on agriculture in the region. It is important to note that agricultural land uses on surface areas above underground mines is not expected to be significantly affected by mining operations.

The post-mining landform will be rehabilitated to a stable landform and where possible capable of uses similar to those prior to disturbance, namely beef cattle grazing on class D GQAL (i.e. "non-agricultural land, being land not suitable for agricultural uses due to extreme limitations"). Where there is Class C GQAL ("land that is suitable only for improved pastures or native pastures"), such as in the south east of the mine footprint, this will be the desired level of rehabilitation.

Based on DEHP's (2010) Strategic Cropping Land (SCL) trigger mapping and on review of the field data there is no SCL present within the mine site.

The nine REs that currently exist within the Project footprint will be re-habilitated to retain their bushland values, if disturbed. The REs are listed as Least Concern under the VM Act and do not form part of any threatened ecological community identified under the EPBC Act. The rehabilitation works will include the use of endemic species associated with each of the REs.

The largest area of grazed bushland is located on the property "Glen Innes", also known as the Bimblebox Nature Refuge (BNR). BNR is located within the mine footprint, and directly overlies the areas identified as UG2, UG4 and OC2 South. The BNR is composed of remnant semi-arid woodlands with an understory of native shrubs, forbs and native and exotic grasses consisting predominantly of Poplar Box (*Eucalyptus populnea*) and Silver-leaved Ironbark (*Eucalyptus melanophloia*) open woodland (REs 10.5.12, 10.5.5). The BNR also contains the Near Threatened flora species, Large-podded Tick-trefoil (*Desmodium macrocarpum*). The BNR is identified as containing 'Special biodiversity values' and is of value as a 'Wildlife refugia'. It is mapped as being of State Significance within the Desert Uplands Biodiversity Planning Assessment.

Approximately half of the property would require clearing to construct the proposed associated infrastructure and open cut mines. The potential impacts on the BNR associated with grazing due to the construction of the mine include:

- direct spatial reduction in extent. It is estimated that approximately 4,017 ha of vegetation will be cleared within the BNR as a result of the Project construction
- increased edge effects within the BNR (through reducing the edge to area ratio and moving the edge) including the potential to increase the abundance of Buffel Grass (and other weeds) and the associated potential for increased fire intensity
- potential for dust to reduce the health of retained vegetation in the vicinity of the clearance footprint potential for temporary facilities, materials and equipment to damage areas outside the construction footprint.

The mitigation measures associated with the ecological values of the BNR and the other broader mosaic of remaining bushland are addressed in the terrestrial ecology section of the EM Plan. In terms of grazing, which is the dominant land use within the BNR, the management of stock within the existing and rehabilitated bushland areas will form part of the broader conservation strategy for the post-mining land use. Where existing bushland is disturbed and subsequently rehabilitated, it is expected that stock will be excluded from grazing these areas until ongoing monitoring has shown the rehabilitation can withstand grazing pressures.

9.3.2 Soils

9.3.2.1 Soil Suitability

The heavy metal concentrations of samples of overburden and interburden tested were below Environmental Investigation Levels (EILs) for all metals with the exception of total chromium which exceeded the EIL for trivalent chromium in two samples. These results were within 10% of the background range for total chromium. The excavation and stockpiling of overburden is expected to have a low risk of producing heavy metal contamination by leachate or surface runoff based upon these results.

Topsoil will be removed in the creation of the open cut mining areas as well as for some of the supporting infrastructure such as the CHPPs. Topsoils at the mine were found to have low salinity, optimal pH conditions for cultivation, low cation-exchange capacity (CEC), and generally low Exchangeable Sodium Percentage (ESP). The fertility of the soils is indicated to be low and the low ESP suggest that hard setting crusts could occur which would inhibit seedling growth in the area. With amendment by nutrients and use of appropriate seed stock, the soils could be made suitable as a growth medium.

The potential for acid generation from regolith material (topsoil and subsoil) within the Project site is low.

Some soils identified in the areas of the open cut mine area, including clays subsoils, have a high erosion potential with Emerson Crumb ratings of 1 or 2; are sodic soils and exhibit a moderate to high potential for erosion due to dispersion. Where the topsoil of these areas is disturbed by the Project's activities and where the subsoils are exposed, there is a greater potential for increased erosion. Where such disturbance occurs, at creek crossings and where sediment runoff is allowed to enter these waterways, the impact of increased sediment load could impact the health of the waterways.

During the operation of the mine, existing land uses, such as grazing may be able to continue within the mining lease in areas not directly impacted by the open cut mines and supporting infrastructure. Areas required for the operation of the mine will be disturbed and no longer available for the existing land use. The land is not considered to have high value for agriculture and as such, the mine would not be expected to have a significant impact on agriculture in the region. Dispersive soils will be buried in spoil piles to minimise erosion.

Impact to land suitability, final landforms and the appropriate mitigation measures typically include an evaluation of the future potential cropping and grazing classes of the land and limitations due to compaction of land used for roads, or use of the rehabilitated final void, stockpiles and tailings dams. Often, stockpiles and tailings dam are unsuitable land for agricultural purposes until management measures have been undertaken, whereby they may become suitable for higher classes of cropping and grazing. Final voids may be suitable for wetlands or recreational land use following rehabilitation.

9.3.2.2 Erosion Potential

Soils were assessed at the mine site for stability and erosion potential using prior mapping field observations and laboratory analysis of samples by Emerson Crumb tests. The Emerson Crumb test measures the susceptibility to dispersion of the soil in water. Dispersion describes the tendency for the clay fraction of a soil to go into colloidal suspension in water. The test indicates the credibility and structural stability of the soil and its susceptibility to surface sealing under irrigation and rainfall. Soils are divided into eight classes on the basis of the coherence of soil aggregates in water (see **Table 39**).

Table 39. Emerson Crumb Class Interpretation

Class	Expected Field Behaviour	Erodibility
Class 1	Almost certainly sodic Complete dispersion of undisturbed aggregate Very fragile, difficult to manage	High
Class 2	Highly likely to be sodic Some dispersion of undisturbed aggregate Fragile, difficult to manage	High
Class 3	Possibly sodic Dispersion after being disturbed (for example after earthworks Fragile but stable if manage carefully	Moderate
Class4/5/6	Possibly sodic Generally stable	Moderate
Class 7	Unlikely to be sodic Stable	Low
Class 8	Unlikely to be sodic Very stable	Low

Soils were also analysed for ESP. ESP is the proportion of sodium adsorbed onto the clay mineral of the soil as a proportion of the total CEC. A high ESP is an indicator that the soil is prone to dispersion.

Analysis of the Sodium Absorption Ratio (SAR) was undertaken to measure of the sodicity of soil and is a ratio of the amount sodium in soil to the amount of calcium and magnesium. Where clay soils have a high SAR ratio, the soils lose their structure, become more dispersive and have lower soil permeability, rendering the soil less productive. A SAR >12 is generally considered high and indicates potential for the above sodic impacts. Sandy soils behave differently from clay soils and a high SAR ratio does not necessarily indicate a dispersive soil.

ESP and Ca:Mg ratios are provided in the DEHP Guidelines (1995), the DECCW (2008) ranking for laboratory exchangeable cation test results and Northcote and Skene (1972). The laboratory results of sodicity / dispersivity analysis were:

- exchangeable sodium was below the laboratory's limit of reporting in all samples except for SS49 which measured a 0.2 meq/100g indicating very low exchangeable sodium
- Ca:Mg ratio ranged from 0.6 (SS56) to 3.6 (SS53) indicating very low to medium Ca:Mg ratios across the area with very low to low Ca:Mg ratios detected in samples (SS49 (1.4), SS51 (1.8), SS56 (0.6) and SS58 (1)
- ESP is very low (<2%) to low (2%-6%) with the exception of sample SS49 (0.0-0.3mgbl) which reported an ESP of 11.2% and is classified as medium (6%-12%)
- SAR ranged from 0.21 (SS53 = 0.0-0.3mgbl) to 1.51 (SS49 =0.0-0.3mgbl) indicating a very low SAR.

ESP is very low to low except at one location. Generally low ESPs indicate that clay soils are less prone to dispersion. SAR was low and this suggests a low risk of erosion, compaction, and/or development of hard setting crusts in the soil and subsequent effects on soil fertility in clay soils. However, sandy soils typically have lower SAR than clayey soils and the very low Ca:Mg ratio indicate that these soils may be associated with dispersive soils. The results suggest that there is the potential for dispersive soils both at samples near the mine open cuts and in higher ground west of the mine open cuts.

The Emerson Crumb results and the Ca:Mg ratios suggest that soils located at the north east part of the mine area are likely to be dispersive and will require management to avoid erosion issues. The Rudosols on the higher areas in the northwest and southeast of the mine are generally shallow and rocky and will erode on slopes or scour where present in valleys.

These areas in the north east and the higher areas in the northwest and southeast of the mine are considered to have a moderate to high potential for erosion. Where the topsoil of these areas is disturbed by the Project's activities and where the subsoils are exposed, there is a greater potential for increased erosion. Where such disturbance occurs, at creek crossings and where sediment runoff is allowed to enter these waterways, the impact of increased sediment load could impact the health of the waterways. Remedial measures will be implemented to prevent this.

9.3.2.3 Contaminated Land

The following potential impacts are identified from identified contamination or potentially contaminated land resulting from the construction and operation works associated with the mine including:

- there is a low potential for significant contaminated soils to be encountered during earthworks which could lead to contamination being spread across the site
- the identified hydrocarbon impact may be delineated by completing a Stage 1 and Preliminary Stage 2 ESA

- the anticipated extent of hydrocarbon impact is considered to be unlikely to be a significant impact under the EP Act and excavation, land farming and validation of hydrocarbon impacted soils may be undertaken on Lot 1 BF72 under a remedial plan
- should the extent of the impact be greater than anticipated, then the site may be listed on the EMR and a site management plan (SMP) / remediation action plan (RAP) prepared to control the remediation and validation of the impact
- demolition of site buildings has the potential to impact soils with hazardous materials if not appropriately assessed and managed
- spills and leaks from various contaminating sources such as, petrol and other chemicals stored on site during operations should be managed properly. These sources may have the potential to leach and migrate into sensitive receptors such as waterways and permeate into the existing soil profile.

9.4 Environmental Protection Objectives

The objectives to protect the environmental values of the mined land are:

- to provide a stable, non-polluting landform
    - land disturbed by mining activities will be made stable (geotechnically and erosionally) to ensure that the post mine landform is not compromised by instability
- to provide a beneficial post-mining land use
    - the post-mine land uses for areas disturbed by mining will be a mosaic of self-sustaining vegetation communities and grazing land, using appropriate native tree, shrub and grass species, and improved pasture species as appropriate
- to minimise the extent and degree of disturbance on land and remnant vegetation as mining continues and will continue to rehabilitate land disturbed by mining
- to maximise the recovery and reuse of topsoil
- to minimise land contamination and to continue to remediate areas of contamination, as appropriate within the constraints of the continuing operations
- to minimise pre-mining disturbance and to continue to rehabilitate exploration areas.

9.5 Performance Criteria

The performance criteria for land management are:

- compliance with the requirements of the Project’s Environmental Authority
- no negative off site impacts
- stable, safe and sustainable post-mining rehabilitated landforms.

9.6 Control Strategies

9.6.1 Soils Management

Waratah Coal will prepare a topsoil management plan to minimise and manage potential impacts on soils at the Project site. The topsoil management plan will be supported by strategies delivered through the rehabilitation management plan for the mine.

The objectives of soil management are to:

- provide sufficient stable topsoil material for rehabilitation
- optimise the recovery of topsoil for rehabilitation
- identify soil resources and stripping guidelines
- identify surface areas requiring stripping (to minimise over clearing)
- manage topsoil reserves so as to not degrade the resource
- identify stockpile locations and dimensions
- identify soil movements for rehabilitation use.

In accordance with the objective of providing sufficient stable soil material for rehabilitation and to optimise soil recovery, the following strategies have been adopted:

- stockpiles to be located outside proposed mine disturbance areas
- construction of stockpiles by dozers rather than scrapers to minimise structural degradation
- construction of stockpiles with a “rough” surface condition to reduce erosion hazard, improve drainage and promote revegetation
- revegetation of stockpiles with appropriate fertiliser and seed in order to minimise weed infestation, maintain soil organic matter levels, soil structure and microbial activity and maximise the vegetative cover of the stockpile.

Disturbance areas will be stripped progressively (i.e. only as required) so as to reduce erosion and sediment generation, to reduce the extent of topsoil stockpiles and to utilise stripped topsoil as soon as possible for rehabilitation. Rehabilitation of disturbed areas (i.e. roads, embankments and batters) will be undertaken as soon as practicable after these structures are completed or as areas are no longer required.

9.6.1.1 Topsoil Stripping, Handling and Respreading

The following strategies will be implemented to prevent excessive soil deterioration associated with topsoil stripping:

- vehicular traffic will be kept to a minimum on the soils to be stripped.
- where practical Waratah Coal will apply half the recommended rates of ameliorants, such as lime or gypsum, to the surface of the soil material prior to stripping. The other half would be applied to the top-dressed material immediately after spreading. Alternatively ameliorants will be applied to the soil surface after its spreading and incorporated into the soil by ripping.
- during the stripping process there may be some unexpected changes in the depth and the nature of the soil. Avoid where practical the inclusion of obviously poorer quality material such as sub-soil clay with mottles, saline material and material dominated with stones.

- topsoil will be stripped to depths determined through ongoing topsoil management investigations at the soil
- topsoil will not be stripped in either an excessively dry or wet condition
- a combination of dozer and front-end loader, or less preferably a scraper, will be used to strip soil material. Wherever possible the use of self elevating scraper would be avoided due its detrimental effect on soil structure.
- where possible, soil material will be placed directly onto the overburden and spread immediately to maximise the retention of soil quality.
- when soil material is to be stored and the site constraints are not restrictive, the soil would ideally be deposited in stockpiles which are no deeper than 60 centimetres. Where site constraints do not allow this, stockpiles will be no deeper than 3 metres in order to minimise problems with anaerobic conditions.
- stockpiles will be protected and re-vegetated as soon as possible to minimise loss of soil quality. The minimum works would involve placement of surface mulch or undersowing of a cover crop for temporary stockpiles where the final revegetation seed mixture is not used. Typically, longer term stockpiles would be revegetated with the final revegetation seed mixture of grasses and legumes.
- stockpiles will be located in areas away from drainage lines or windy areas in order to minimise the risk of soil and wind erosion.
- a good vegetative cover will be maintained on stockpiles and on top dressed areas until ground cover is well established. This will be achieved through the exclusion of stock and by controlling weed growth.
- appropriate weed control strategies, particularly for any noxious weeds will be implemented. Immediate revegetation will provide vegetative competition to assist with the control of undesirable plant species.
- each topsoil stockpile will be cleared identified with appropriate signage (e.g. 'Topsoil Stockpile') to ensure the resource is identifiable to all mine staff.
- topsoil stripping and the topsoil spreading process will be managed by a competent supervisor who is aware of the above principles and familiar with the handling of soil materials.
- the surface of soil stockpiles will be left in as coarsely textured a condition as possible in order to promote infiltration and minimise erosion, until vegetation is established and to prevent anaerobic zones forming
- an inventory of available suitable surface cover material will be maintained to ensure adequate topsoil materials are available for planned rehabilitation activities.

Surface soils will generally be stripped and placed directly into stockpiles using dozers (where practical). The predicted annual soil stripping volumes and detailed stockpile locations will be provided in the Plan of Operation (PoO). Annual soil stripping and stockpiling volumes will be reported as required by the EA.

Not all reshaped overburden areas will require topdressing using conserved topsoil reserves, when direct tree seeding techniques are implemented in the revegetation program. Where possible, suitable topsoil will be re-spread directly onto reshaped areas. Where topsoil resources allow, topsoil will be spread to a minimum depth of 10 cm on all regraded spoil. Topsoil will be spread, treated with fertilizer or ameliorants (if required) and seeded in one consecutive operation, to reduce the potential for topsoil loss to wind and water erosion.

Prior to re-spreading stockpiled topsoil onto reshaped overburden (particularly onto designated tree seeding areas), an assessment of weed infestation on stockpiles will be undertaken to determine if individual stockpiles require herbicide application and / or scalping of weed species prior to topsoil spreading.

Covering vegetation can make the removal of specific topsoil depths difficult and excessive quantities of vegetative matter in long term stockpiles may promote chemical and biological degradation of the seed reserves that are a future source of regeneration during rehabilitation. Prior to stripping, vegetation will be removed or reduced by grazing and / or clearing.

A general protocol for soil handling is presented below and includes soil handling measures which optimise the retention of soil characteristics (in terms of nutrients and micro-organisms) favourable to plant growth:

- to ensure preservation of seed reserves, soil stripping will occur as a distinct operation to enable the separate removal and stockpiling of soil reserves
- topsoil and subsoil reserves will be stockpiled separately, where practicable
- dozers will be used for soil stripping, where practical
- the surface of the completed stockpiles will be left in a "rough" condition to help promote water infiltration and minimise erosion prior to vegetation establishment.

Desirable configurations for large, long term soil stockpiles are up to 2 m in height and 1V:4H outer batter slopes. Following construction, topsoil stockpiles will be sown with suitable grass and legume species to maintain soil viability for future rehabilitation works, and to minimise erosion and discourage opportunistic weed growth. Soil rejuvenation practices will be undertaken prior to the use of topsoil from long-term stockpiles.

Sampling and analysis of topsoil resources for pH, conductivity, exchangeable Na% and nutrient requirements, whether stockpiled or in situ, will be undertaken prior to respreading, to assess suitability. This will assist in identifying potential soil deficiencies and estimating required rates of fertilizer or ameliorant (i.e. gypsum or lime) application.

Contour ripping across the grade (to minimise erosion and cultivate the surface in readiness for sowing) will be constructed away from the true contour, at a designed gradient (0.5% to 1%) to drain water towards the sediment control structures. The use of engineered waterways using erosion blankets, ground-cover vegetation and/or rip rap will be used to safely dispose of runoff downslope. Sediment control basins will be constructed to capture sediment laden runoff prior to off-site release.

9.6.2 Erosion and Sediment Controls

Erosion and sediment controls will be implemented across the China First Coal Mine for all phases of the operation including construction activities, operational/ maintenance activities and during rehabilitation to mitigate the impacts of the operations on watercourses and the surrounding environment. Erosion and sedimentation controls for the China First Coal Mine would be achieved by implementing the following key principles:

- conducting best practice land clearing procedures for all proposed disturbance areas including:
  - co-ordinating mining sequences to minimise exposure of disturbed soils to the elements
  - topsoil stripping procedures to reduce deterioration in topsoil quality and dust generation
- appropriate storage of topsoil stockpiles in areas away from roadways and other drainage lines

- appropriate design of fire trails, access tracks and haul roads
- use of diversion structures to separate 'clean' water runoff from disturbed areas runoff, to minimise volumes of sediment-laden and mine water for management
- ensuring sediment-laden runoff is treated via designated sediment control devices
- revegetation of disturbed areas as soon as possible following the completion of construction activities
- temporary erosion and sediment controls to be in place prior to any construction and mining activity outside of an existing dirty water management system
- subsidence impacts to be remediated to address erosion issues as a result of subsidence
- implementing an effective maintenance program for the site.

The above principles are addressed in further detail in the sections below.

9.6.2.1 Water management classification

For management purposes, the water within China First Coal Mine has been divided into three classes depending upon the source of the runoff. The classification of the runoff, its source and the way it is managed is provided in **Table 40**.

Table 40. Water management classes within the China First Coal Mine Project

Surface Water Classification	Source/s of runoff	Treatment
Mine water	Haul roads	Contained within the mine water management system. Potential for controlled release in accordance with Environmental Authority conditions
	Open cut mine pits	
	Coal handling and stockpile areas	
	Un-shaped soil overburden dumps	
	Workshop areas (potentially contaminated with hydrocarbons)	As above but has extra treatments such as oil and water separators to further treat the water
Dirty water	Rehabilitated areas that are still establishing	Directed to appropriately sized dirty water sediment dams which are actively maintained and keep in a drawn down state
	General disturbance areas (construction areas, pre-stripped areas, gas drainage works)	
	Shaped soil overburden dumps	
Clean Water	Areas that are undisturbed	Diverted around disturbance areas and allowed to flow into existing drainage lines off site
	Rehabilitated areas that are fully established and stable (at least greater than 5 years old)	

Based on the above categories of surface water, numerous recommendations have been made to ensure any water flowing from the site is within appropriate water quality criteria.

9.6.2.2 Land Clearing Procedures (Clearing and Topsoil Stripping)

Land disturbance is minimised to avoid exposing unnecessary land to the processes related to erosion and sedimentation. This is achieved through planning all operations to ensure that only the areas which are under active excavation are cleared and that there is no damage to any trees and pasture areas outside the limits to be cleared. The cleared width will be limited to that required to accommodate excavation plus areas required for overburden placement and topsoil stockpiling. General vegetation clearing will not be undertaken until earthwork operations are ready to commence.

All proposed erosion and sediment control measures are implemented in advance of, or in conjunction with, vegetation clearing and soil stripping operations. Prior to vegetation clearing or soil stripping operations, the stripping panel is delineated on a plan and in the field will be marked by survey pegs placed at intervals on each side of the disturbed area. Topsoil limits and the topsoil stripping depths are shown on the pegs. Where possible, topsoil is stripped in moist condition to reduce deterioration in topsoil quality and dust generation, and only be stockpiled when no areas of reshaped overburden are available for direct placement and spreading.

9.6.2.3 Topsoil Stockpiles

Where suitable areas are unavailable for the immediate respreading, topsoil is stockpiled to a maximum depth of three metres and subsequently applied when the areas become available. The period of the stockpiling is minimised in order to reduce the detrimental effects of the storage of any native seed in the soil and damage to the soil structure.

All stockpiles are shaped, trimmed (max batter slope 3H:1V) then ripped and immediately sown with a sterile cover crop and permanent pasture species to provide stockpile stabilisation. Sediment fences are constructed around the downslope perimeters of the stockpiles where required to provide temporary sediment control until vegetation becomes established. Surface drainage in the vicinity of the stockpiles is configured as to direct any runoff around the area so not to cause any potential erosion of the loose material.

Where topsoil is used as the growing medium, it is re-spread in the reverse sequence to its removal, so that the organic layer, containing any seed or vegetation, is returned to the surface. Re-spreading on the contour aids runoff control and increased moisture retention for subsequent plant growth. Re-spread topsoil should be levelled to achieve an even surface, avoiding a compacted or an over-smooth finish.

9.6.2.4 Access tracks

Access tracks are to be constructed in accordance with appropriate engineering design standards. Surface drainage is optimised and stabilised, thereby reducing roadside erosion and sedimentation. Appropriate control measures are constructed on all fire/access roads with cross fall drainage at 3% either side of the road crown to be largely responsible for immediate water shed from the road surface. Techniques that could be used to provide crossfall on the track include crowing, infall and outfall.

Table drains, mitre drains, culverts and cross drains are used where required to safely convey the water from the track surface so to prevent runoff from eroding them or adjacent land. Mitre drain spacing should not exceed 50m even on soils with low erodibility. Cross drains are placed every 20 m to 90 m depending on the road grade and soil erodibility as required.

Cut and fill batters associated with service tracks are formed to a safe slope and stabilised by vegetation. Where cut batters are greater than 1.5 m, stabilisation methods are applied to these areas, such as laying back, revegetation and drainage. Stabilisation is assisted by spreading topsoil and/or by applying chemical or organic mulch over the exposed batter surface. Where fill batters are greater than 2:1, re-grading may be required.

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9.6.2.5 Haul Roads

Haul roads located throughout the China First Coal Mine are within the mine water management system, with runoff reporting to existing mine dams or mine water sediment dams. The ultimate goal for the site is to ensure that water is contained within these dams and that they are de-watered when required so that water is not allowed to discharge from the site. The Mine will work towards achieving this to ensure best management practices are adhered to. If the runoff from haul road constructions are not contained within the existing mine water system, dams will be constructed to contain this water and allow it to be pumped back into the mine water management system for re-use and release if necessary.

During any construction of haul roads (outside the open cut pit), temporary erosion and sediment controls will be implemented. Sediment filter fencing will be strategically located around fill termination points as the road alignment approaches clean water drainage lines. The silt fencing will not be removed until construction of each culvert is completed. Road construction will then continue over the culvert. Temporary sediment trapping devices may be required during construction to filter sediment-laden runoff from small areas (0.5 ha or less). Where haul roads are required to cross any watercourses, they will generally be constructed so that they cross perpendicular to the watercourse, subject to other constraints. Once constructed, more long term sediment controls such as mine water sediment dams will be constructed at the outlet points of the mitre drains to contain water within the mine water management system.

9.6.2.6 Diversion Structures (Clean Water)

In order to minimise the volume of dirty and mine water to be treated, all clean runoff water is diverted where possible into clean water drainage lines to be directed off-site. This not only reduces the potential for erosion to occur on disturbed areas, but also reduces the pressure on the dirty and mine water management controls which are required to treat sediment-laden runoff to an acceptable standard for discharge. Suitably designed and constructed diversion drains will be implemented where practical around the China First Coal Mine. In general, the drains typically would be trapezoidal in shape with maximum side slopes of 1V:2H. Where peak design water velocities exceed 1.5m/s, the drains typically would be protected from scour using either erosion channel liners and/or geofabric with rock rip-rap armouring.

The clean water inception dams will collect clean water for transferal to neighbouring clean water drainage lines, increasing the amount of clean water diverted around the site.

9.6.2.7 Diversion Structures (Mine and Dirty Water)

Catch drains will be utilised throughout the site to minimise erosion and re-direct potentially contaminated runoff into dirty water sediment dams and mine water dams. Runoff from disturbed areas, such as overburden dumps, is conveyed to these dams by catch drains.

For runoff from rehabilitation areas, the water management structures would be appropriately designed before layout and construction. Typically the water management structures include contour banks, which are constructed at intervals down the slope of rehabilitation areas to control surface flow and minimize erosion on spoil dumps. The effect of these is to divide long slopes into a series of short slopes with the catchment area commencing at each bank. This prevents runoff from reaching a depth of flow or velocity which would cause erosion. As the slope angle of the landform increases, the banks are spaced closer together. The banks typically should have a longitudinal grade of 1.2%. Where peak design water velocities exceed 1.5m/s, the drains should be protected from scour using either erosion channel liners and/or geofabric with rock rip-rap armouring.

9.6.2.8 Control Devices (Mine Water)

Mine water dams and mine water sediment dams (generally smaller structures) would be established around the mine to contain potentially contaminated 'mine' water. This water has the potential to contain elevated salinity concentrations and/or potential hydrocarbon contamination as a result of runoff from haul roads, workshop areas and areas exposed to carbonaceous material. They would also function as sediment dams for sediment control but would not be designed such that they discharged into neighbouring watercourses, unless released in accordance with the Environmental Authority.

9.6.2.9 Control Devices (DirtyWater)

Dirty water sediment dams are intended to catch runoff from disturbed areas that are not exposed to potential contamination of hydrocarbons or carbonaceous material. These include general construction areas, shaped overburden areas and rehabilitation areas. In general dirty water sediment dams should be constructed on all disturbed areas not draining to pit voids or mine water dams. The dams are constructed for the purpose of capturing sediment-laden runoff prior to off-site release. Dirty water sediment dams assist in improving water quality throughout the mine site.

The number and capacity of dams will be related to the total area of catchment, the duration of disturbance and the anticipated soil loss. The capacity of each dam would be derived from the relevant Queensland Government benchmark design reference for sediment control. The dams would be constructed to at least the recommended minimum design criteria required by the Environmental Authority.

The following points will be considered when selecting future sites for sediment dams:

- each dam will be located so that runoff may easily be directed to it, without the need for extensive channel excavation or for excessive channel gradient. Channels will discharge into the dam without risk of erosion. Similarly, spillways will be designed and located so as to safely convey the maximum anticipated discharge
- the material from which the dam is constructed will be stable and will be excavated from the reservoir area or be imported from elsewhere on the mine, if necessary. Highly dispersible clays will not be used in the cores of dam embankments.

9.6.2.10 Subsidence

The underground mining activities will result in surface subsidence that will develop progressively within each longwall mining block and present on the surface as a series of trough like depressions. The maximum subsidence (i.e. in the centre of the longwall panels) will range from 1.6 m in standalone mines to 3.2 m in areas of cumulative subsidence where underground mine 4 lies above underground mine 1. See **Figure 24**.

Longitudinal tension cracks of 2.5 mm to 20 mm are predicted to occur at the edge of the longwall mining panel, parallel to the chain pillar areas, where the depth of cover between the surface and the underground mines is less than 180 m. See **Figure 25**. Remedial works for longitudinal surface fractures may include ripping, recompacting, seeding of the cracks and reshaping.

Depressions in the surface from subsidence can lead to ponding if unmanaged, however the longwall mining panels are aligned longitudinally with the natural fall of the land within the MLA, which drains freely to the east and is sufficient to minimise subsidence troughs. In flatter area, reshaping of any internally draining areas will be done by the construction of contour drains and appropriate rehabilitation measures.

9.6.2.11 Revegetation

All disturbed areas not forming part of the operational activities will be revegetated to stabilise the surface and reduce the potential for erosion. This would be undertaken as soon as possible following the completion of construction activities. Revegetation is undertaken in accordance with the rehabilitation plan strategies.

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9.6.2.12 Temporary Erosion and Sediment Controls

Prior to any construction activity (including soil stripping, road construction, and bulk earthworks), temporary erosion and sediment control measures are installed. The following sub-sections include temporary erosion and sediment control features that may be utilized at the site.

Sediment Filter Fences

There may, on occasion, be a disturbance area which is either not protected by existing structures or requires additional temporary protection against erosion and sedimentation. In these cases it may be suitable to install sediment filter fencing. Sediment filter fences filter run-off leaving the site, trapping sediment and allowing filtered water to pass. Sediment filter fences are constructed around the base of any areas of exposed land that are not subject to concentrated overland flow, that are not adequately protected by existing structures and that are not within the mine water management system. Sediment filter fencing is installed around the extent of the disturbance areas where sediment-laden water could potentially enter clean downstream receiving waters.

Sediment filter fences are normally placed on the contour or slightly convex to the contour. The contour on each end of the fence should be turned to create a stilling pond upslope of the fence. Where possible, a silt fence system should consist of a series of overlapping fences. Each fence should be no longer than about 40 metres. They should not intercept large concentrated or channelised flows. The fences are constructed in accordance with the Sediment Fence Standard Drawing (SD6-8) of the 'Blue Book'. Silt fences require regular maintenance. Trapped sediments should be removed, pickets straightened, filter cloth re-secured and tightened.

Sandbag Weirs

Sandbag weirs are sometimes installed within existing swale drains or existing drainage channels, which are not able to be regularly graded. The use of these devices is limited to temporary erosion and sediment control in channels during construction or high disturbance phase mining.

The weirs are typically installed at a minimum of 40 metre intervals. As with sediment filter fences, sandbag weirs may be installed prior to any works commencing on the site in existing channels and immediately after the construction of new channels. Inspections of the sandbag weirs after rain should take place with removal of the collected sediment as required. Damaged/shifted bags would be repaired or replaced.

Temporary Drains

Runoff from areas exposed during the works is to be controlled by construction of temporary contour and diversion drains. These drains generally take the form of channels constructed across a slope, with a ridge of the lower side. They would be implemented immediately after a construction site is cleared to intercept and divert runoff from the site to nearby stable areas at non-erosive velocities. The drains would be formed with a gentle grade of approximately 1.2%

Temporary Silt Traps

Temporary sediment trapping devices may be required during construction to trap and filter sediment-laden runoff from small areas (0.5 ha or less) prior to discharge. They would be used to trap small amounts of runoff water and filter sediment from runoff before entering the natural watercourses or to protect adjacent lands. These would typically be used at the discharge point of mitre drains and other similar devices.

9.6.3 Rehabilitation and Decommissioning

This section describes the broad strategies and methods for progressive and final rehabilitation of areas disturbed by mining and associated infrastructure activities, expected final landforms and the proposed final land uses. The section also describes the decommissioning plan and preferred rehabilitation strategy for the mine and the MIA. Detailed figures showing expected rehabilitation schedules will be included in the Plan of

Operations (PoO) that will be prepared once final detailed design of the mine layout is completed. The PoO will be submitted to Government for review and approval prior to the commencement of mining activities.

Further specific rehabilitation and decommissioning measures to avoid or minimise any impacts will be identified in the Environmental Authority, and ultimately the PoO and the Mine Closure Plan that will be finalized prior to the commencement of mine closure activities.

It may be the case that the best beneficial use of some of the supporting infrastructure components (i.e. water supply infrastructure, roads, power transmission lines) is leaving the infrastructure in place to support other local needs. This will be discussed with the relevant authorities and landholders prior to formalizing the decommissioning strategy. If the preferred outcome is to leave some of the infrastructure components in-situ as operating infrastructure, Waratah Coal will facilitate the transfer of operating licences and obligations to the relevant parties and prepare a transitional plan.

9.6.3.1 Rehabilitation Hierarchy

The Department of Environment and Heritage Protection (DEHP) has produced the Rehabilitation Requirements for Mining Projects Guideline (2011) which provides the following rehabilitation hierarchy to prevent of minimise environmental harm:

- avoid disturbance that will require rehabilitation
- reinstate a “natural ecosystem” as similar as possible to the original ecosystem (where the project is occurring on previously natural vegetated land)
- develop an alternative outcome with a higher economic value than the previous land use
- reinstate the previous land use (e.g. grazing in this instance)
- develop lower value land use
- leave the site in an unusable condition or with a potential to generate future pollution or adversely affect environmental values.

9.6.3.1.1 Approach to the hierarchy

The Project will where practicable avoid the un-necessary disturbance to land within the mine area. Where the project disturbs “natural systems” the rehabilitation objectives will be to reinstate the affected lands to a condition as similar as possible to the original system. The Project will provide offsets for areas of “natural vegetation” with high ecological value in accordance with extant Commonwealth and State “offset policies”.

The vast majority of the lands that will be disturbed by the mine have been disturbed and modified as a result of the existing grazing activities. Disturbances range from highly modified systems (i.e. chain-pulled and blade-plowed paddocks) through to less-modified paddocks (i.e. understory containing environment weeds). The project will aim to re-establish affected lands to as close as practicable to previous agricultural land uses.

The Project will result in some areas that will not be returned to the previous land use (i.e. the final pit voids). These areas will where practicable be developed to a lower value land use. These areas will be left in a state that is stable, is not a health risk to humans or livestock, and minimizes potential to generate future pollution or adversely affect environmental values.

9.6.3.2 Objectives

The rehabilitation objectives for the mine have been identified and can be split into short-term and long-term objectives. These short and long-term objectives are identified below.

Short-Term

Short-term rehabilitation objectives for the mine are:

- to minimise clearing / vegetation disturbance consistent with operational requirements
- to schedule operations including overburden/interburden emplacement and shaping, and revegetation to minimise visual exposure
- to rehabilitate areas of disturbance no longer required for mining related operations
- to apply soil (topsoil / subsoil) to the final landform based on material availability and post-mining land use
- to stabilise all earthworks, drainage lines and disturbed areas in order to minimise erosion and sedimentation
- to control vermin, feral animals and noxious weeds.

Long-Term

The long-term aim is to rehabilitate the land to a low maintenance, stable and safe landform that blends with the surrounding topography and maximises the return of agricultural land suitability comparable to pre-mining levels. These long-term aims include:

- continuation and/or restoration of biodiversity and ecological integrity of areas affected by mining or agriculture within the mining lease
- preservation of downstream water quality for ecological and existing beneficial uses
- to establish a low maintenance, geotechnically stable landform commensurate with agricultural and nature conservation land uses
- to blend the created landforms to appear as a natural extension with the surrounding landforms
- to provide habitat for fauna and corridors for fauna movement within the final landform
- to monitor rehabilitation success in terms of physical and biological parameters.

In addition to the EM Plan, the MCP will describe the specific operational activities required to be undertaken in order to complete rehabilitation and decommissioning of the Project.

9.6.3.3 Rehabilitation Strategy

The mine site has been divided into four management area. These being:

- in pit and out of pit waste dumps
- final voids
- mine infrastructure
- subsidence areas.

Proposed completion criteria have been prepared for each area and are shown in **Table 41**.

Areas that are disturbed by mining activities will be rehabilitated to a safe and stable landform with a self-sustaining vegetation cover. Rehabilitation of disturbed land will commence typically within two years of the areas becoming available for rehabilitation. In some situations; however, the commencement of progressive rehabilitation activities may be delayed or not be possible. To achieve the desired rehabilitation objectives, rehabilitation will be conducted so that:

- an appropriate mix of native and introduced plant species are utilised to achieve a mosaic of grazing and bushland areas to support post-mine land uses that are consistent to that currently in place
- landscaping and rehabilitation works will where practicable include endemic native species of local provenance, and where suitable will also make use of conservation significant flora species or species that can provide habitat opportunities for conservation of significant fauna
- the potential for erosion is reduced
- the potential for environmental impacts associated with the release of dust is minimised
- the quality of surface water released from the site is unlikely to result in harm to the downstream environmental values
- the quality of surface water released from the site is unlikely to result in negative impacts to the downstream beneficial users of the resource.

A Rehabilitation Management Plan (RMP) will be developed to incorporate the control strategies and monitoring programs identified in the EM Plan. The RMP will be prepared in consultation with relevant Government Departments and will take into consideration Government Policy objectives at the time of preparation.

9.6.3.4 Completion Criteria

Preliminary completion criteria (or closure criteria) for the rehabilitation of the Project have been proposed in **Table 41**. The completion criteria have been replicated from the success criteria identified for the nearby Alpha Coal Project to enable consistency in monitoring and reporting by the proponent, and assessment by DEHP. Whilst the Rehabilitation Element, Indicator and Criteria will be consistent with the Alpha Coal rehabilitation program, specific sub-criteria will be developed specific to the mine. These sub-criteria will be developed based on the monitoring of progressive rehabilitation and the success criteria will be reviewed every three to five years.

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Table 41. Rehabilitation Completion Criteria

Rehabilitation Element	Indicator	Criteria
1. In–Pit and Out-of-Pit Waste Dumps		
Landform stability	Slope gradient	No less than 75% of the area has slopes <10° and up to 25% of the area has slopes >10°. Where reject layers are present and exposed, the landform is capped.
	Erosion control	Erosion control structures are installed commensurate with the slope of the landform. Average annual soil loss is <40 tonnes/ha/yr (sheet erosion). Dimensions and frequency of occurrence of erosion rills and gullies are no greater than that in reference sites* that exhibit similar landform characteristics.
	Surface water drainage	Use of contour banks and diversion drains to direct water into stable areas or sediment control basins.
Water quality		Ensure receiving waters affected by surface water runoff have contaminant limits of electrical conductivity maximum of 2,000 µS/cm and pH range of 5.5 to 9.5, or as determined to be sustainable subject to future investigations and setting water quality objectives.
Water storages, creek diversions		Clean water storages and diversions to be stabilised and left as required. Dirty water storages to be cleaned out and rehabilitated to a stable non-polluting condition.
Topsoil	Salinity (electrical conductivity)	Soil salinity content is <0.6 dS/m.
	pH	Soil pH is between 5.5 and 8.5.
	Sodium content	Soil Exchange Sodium Percentage (ESP) is <15%.
	Nutrient cycling	Nutrient accumulation and recycling processes are occurring as evidenced by the presence of a litter layer, mycorrhizae and/or other microsymbionts. Adequate macro and micro-nutrients are present.
Vegetation	Land use	Area accomplishes and remains as a healthy working bushland ecosystem.
	Surface cover	Minimum of 70% vegetative cover is present (or 50% if rocks, logs or other features of cover are present). No bare surfaces >20 m^2 in area or >10 m in length down-slope.
	Species composition	Comprise a mixture of native trees, shrubs and grasses representative of regionally occurring woodland to open forest where possible.
	Community structure	Groundcover, understorey and overstorey structure similar to that of appropriate reference site(s)*.

Rehabilitation Element	Indicator	Criteria
	Resilience to disturbance	Established species survive and/or regenerate after disturbance. Weeds do not dominate native species after disturbance or after rain. Pests do not occur in substantial numbers or visibly affect the development of native plant species.
	Sustainability	Species are capable of setting viable seed, flowering or otherwise reproducing. Evidence of second generation of tree/shrub species. Vegetation develops and maintains a litter layer evidenced by a consistent mass and depth of litter over subsequent seasons. More than 75% of shrubs and/or trees are healthy when ranked healthy, sick or dead.
Fauna	Vertebrate species	Representation of a range of species characteristics (e.g. activity pattern, habitat usage, diet, dispersal character etc. from each faunal assemblage group (e.g. reptiles, birds, mammals), present in the ecosystem type, based on pre-mine fauna lists and sighted within the three-year period preceding mine lease relinquishment. Sighting of species of conservation significance or indicators of the presence of species of conservation significance (e.g. tracks) likely to be present in the established ecosystem type within the three-year period preceding mine closure (assuming non-mine related disturbance has not eliminated local populations thereby removing the colonizing source). The number of vertebrate species does not decrease by more than 25% in the successive seasons prior to mine lease relinquishment or by more than 40% over the two successive seasons prior to mine lease relinquishment.
	Invertebrate species	Presence of representatives of a broad range of functional indicator groups involved in different ecological processes (including termites for soil structure, Collembola for decomposition, Hemiptera for herbivory and predatory groups such as arachnids, centipedes, earwigs, cockroaches and ants as indicators of a range of other processes.
	Habitat structure	Typical food, shelter and water sources required by the majority of vertebrate and invertebrate inhabitants of that ecosystem type are present, including: a variety of food plants; evidence of active use of habitat provided during rehabilitation such as nest boxes, stags and logs and signs of natural generation of shelter sources including leaf litter.
Safety		Risk assessment has been undertaken in accordance with relevant guidelines and Australian Standards and risks reduced to levels agreed with the stakeholders.
2. Final Voids (including Ramps)		
Landform stability	Slope gradient	Highwall faces exhibit long-term geotechnical stability and a geotechnical report has been completed. Competent rock highwall to have slope of <65°. Incompetent rock highwall to have slope of <17°. Low wall to have slope of <17°. Ramp walls not backfilled exhibit long-term geotechnical stability and a geotechnical report has been completed. In-pit rejects and spoil slope gradients can exceed 15%.
	Erosion control	Erosion mitigation measures have been applied to ensure slope stability.

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Rehabilitation Element	Indicator	Criteria
	Surface water drainage	Use of contour banks and diversion drains to direct water into stable areas or sediment control basins.
Water quality		Electrical conductivity of any void water may exceed 2,000 µS/cm if an ecological assessment shows the long-term ecological stability and groundwater quality is not adversely affected.
Water storages, creek diversions		As for 1.
Topsoil		As for 1.
Vegetation	Land use	Where ramps and in-pit spoil design allow, area accomplishes and remains as a healthy working bushland ecosystem (although naturalised grasses may be used).
	Surface cover	As for 1.
	Species composition	Comprise a mixture grasses, shrubs and trees (where possible) suitable for establishment on steeper slopes
	Community structure	Groundcover and understorey structure to that of appropriate reference site(s)*.
	Resilience to disturbance	As for 1.
	Sustainability	More than 75% of individual grasses and shrubs are healthy when ranked healthy, sick or dead.
Safety		Risk assessment has been completed and risk mitigation measures have been implemented. Where risk mitigation measures include bunds, safety fences and warning signs, these have been erected generally in accordance with relevant guidelines and Australian Standards.
3. Mine Industrial Areas		
Landform stability	Slope gradient	Area has gradient of <2°.
	Erosion control	Erosion mitigation measures have been applied.
	Surface water drainage	Use of contour banks and diversion drains to direct water into stable areas or sediment control basins.
Water quality		Ensure receiving waters affected by surface water runoff have contaminant limits of electrical conductivity maximum of 1,500 µS/cm and pH range of 5.5 to 9.5, or as determined to be sustainable subject to future investigations and setting water quality objectives

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Rehabilitation Element	Indicator	Criteria
Water storages, creek diversions		Clean water storages and diversions to be stabilised and left as required. Dirty water storages to be cleaned out and rehabilitated to a stable non-polluting condition.
Topsoil	Salinity (electrical conductivity)	Soil salinity content is <0.6 dS/m.
	pH	Soil pH is between 5.5 and 8.5.
	Sodium content	Soil Exchange Sodium Percentage (ESP) is <15%.
	Nutrient cycling	Nutrient accumulation and recycling processes are occurring as evidenced by the presence of a litter layer, mycorrhizae and/or other microsymbionts. Adequate macro and micro-nutrients are present.
Vegetation	Land use	Buildings, water storage, roads (except those used by the public) and other infrastructure have been removed unless stakeholders have entered into formal written agreements for their retention. Areas are readily accessible and conducive to safe cattle management activities. Predicted economics and /or benefits have been defined and agreed by the stakeholders.
	Surface cover	Minimum of 70% vegetative cover is present (or 50% if rocks, logs or other features of cover are present). No bare surfaces >20 m^2 in area or >10 m in length down slope.
	Species composition	Palatable, nutritious pasture grass species are present.
	Community structure	Desirable grass species comprise at least 60% of total grass cover. Tree density and height of >25 stems per 5 ha each being >2 m in height.
	Resilience to disturbance	Established species survive and/or regenerate after disturbance. Weeds do not dominate native species after disturbance or after rain. Pests do not occur in substantial numbers or visibly affect the development of native plant species.
	Sustainability	Nitrogen fixing grass species present. More than 75% of shrubs and/or trees are healthy when ranked healthy, sick or dead.
Fauna	Vertebrate species	Representation of a range of species characteristics (e.g. activity pattern, habitat usage, diet, dispersal character etc.) from each faunal assemblage group (e.g. reptiles, birds, mammals), present in the grassland ecosystem type, based on pre-mine fauna lists and sighted within the three-year period preceding mine closure. The number of vertebrate species does not decrease by more than 25% in the successive seasons prior to mine closure or by more than 40% over the two successive seasons prior to mine closure.
	Invertebrate species	Presence of representatives of a broad range of functional indicator groups involved in different pastoral ecological processes (including termites for soil structure, Collembola for decomposition, Hemiptera for herbivory and predatory groups such as arachnids, centipedes, earwigs, cockroaches and ants as indicators of a range of other processes.

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Rehabilitation Element	Indicator	Criteria
	Habitat structure	Typical food, shelter and water sources required by the majority of vertebrate and invertebrate inhabitants of pastoral ecosystem type are present, including: a variety of food plants and signs of natural generation of shelter sources including leaf litter.
Safety		Risk assessment has been undertaken in accordance with relevant guidelines and Australian Standards and risks reduced to levels agreed with the stakeholders. Closure documentation includes the contaminated sites register which identifies contaminated sites and the treatment applied.
4. Subsidence Areas		
Landform stability	Erosion control	Erosion mitigation measures have been applied
	Subsidence impacts	Perform regular inspections over subsidence areas to identify any surface cracks and / or sinkholes Undertake minimal clearing, if required, of areas around cracks and / or sinkholes to allow for ripping and seeding Ripping and seeding of areas where required. Following initial ripping and seeding, if trees are to be planted, they will not be planted until enough rain has fallen. Seed and / or plant appropriate native species of vegetation to achieve a post-subsidence land use the same as that pre-subsidence (i.e. low intensity cattle grazing). Regrade subsidence areas and where necessary backfill with mine spoil to control surface water flow and minimise erosion and sedimentation. Undertake drainage works, such as graded banks and diversion drains, to partially drain larger subsidence voids and direct water into stable areas or sediment control areas. If ripping is not feasible due to the width of the cracks, topsoil will be stripped and stockpiled. Clay material will be imported to fill and seal cracks and the topsoil will be respread once the cracks have sealed. The area with then be reseeded with appropriate native plant species.
	Surface water drainage	Design local drainage works to prevent the uncontrolled flow of runoff from the subsided floodplain area over the channel banks. Small diversion bunds directing floodplain runoff to properly engineered rock chute structures will be installed to minimise bank erosion. Any internally draining subsidence troughs will be made external draining by the construction of contour drains.
Water quality		As for 1.

Rehabilitation Element	Indicator	Criteria
Water storages and creek diversions		Provide a cover of topsoil in a weathered rock matrix to create a stable substrate for revegetation of channel banks. Weathered rock provides temporary erosion protection by covering erodible soils and minimising topsoil loss. Replace sand across the channel bed, including higher sand deposits suitable for re-creation of in-channel benches. Install timber groynes/pile field retards at the base of the channel banks (extending into the channel) to mitigate erosion undercutting the channel banks and to facilitate creation of in-channel benches. The structures will be built between each of the subsided panels affecting the river before subsidence occurs. In areas where less active bank erosion develops, large woody debris will be placed in-stream to encourage the deposition of sediment and revegetation over time. Local drainage works will be designed to prevent the uncontrolled flow of runoff from the subsided floodplain area over the channel banks. Small diversion bunds directing floodplain runoff to properly engineered rock chute structures will be installed to minimise bank erosion. Topsoil will be placed on banks and banks will be revegetated. Stock will be excluded to a width of at least 30m from the top of the bank and subsided floodplain areas in order to minimise further impacts on vegetation cover and land condition. A targeted revegetation program will be undertaken in areas where surface water patterns have been affected.
Topsoil		As for 1.
Vegetation	Land use	Roads (except those used by the public) and other infrastructure have been removed unless stakeholders have entered into formal written agreements for their retention. Areas are readily accessible and conducive to safe cattle management activities. Stock will be excluded to a width of at least 30m from the top of the bank and floodplain areas in order to minimise further impacts on vegetation cover and land condition.
	Surface cover	As for 1.
	Species composition	Palatable, nutritious pasture grass species are present. Suitable species will be used for the revegetation of riparian zones.
	Community structure	Desirable native grass species comprise at least 60% of total grass cover. Tree density and height of >25 stems per 5ha each being >2m in height.
	Resilience to disturbance	As for 1.
	Sustainability	Nitrogen fixing grass species present. More than 75% of shrubs and/or trees are healthy when ranked healthy, sick or dead.

Rehabilitation Element	Indicator	Criteria
Fauna	Vertebrate species	Representation of a range of species characteristics (e.g. activity pattern, habitat usage, diet, dispersal character etc. (WBM, 2003, Kimber et. al, 1999)) from each faunal assemblage group (e.g. reptiles, birds, mammals), present in the various ecosystem types, based on pre-mine fauna lists and sighted within the three year-year period preceding mine lease relinquishment. The number of vertebrate species does not decrease by more than 25% in the successive seasons prior to mine closure or by more than 40% over the two successive seasons prior to mine lease relinquishment.
	Invertebrate species	Presence or representatives of a broad range of functional indicator groups involved in different pastoral ecological processes (including termites for soil structure, Collembola for decomposition, Hemiptera for herbivory and predatory groups such as arachnids, centipedes, earwigs, cockroaches and ants as indicators of a range of other processes.
	Habitat structure	Typical food, shelter and water sources required by the majority of vertebrate and invertebrate inhabitants of pastoral ecosystem types are present, including a variety of food plants and signs of natural generation of shelter sources including leaf litter.
Safety		Risk assessment has been undertaken in accordance with relevant guidelines and Australian Standards and risks reduced to levels agreed with the stakeholders. Closure documentation includes the contaminated sites register which identifies contaminated sites and the treatment applied.

9.6.3.5 Rehabilitation Methods

9.6.3.5.1 Progressive Rehabilitation

The progressive rehabilitation of areas disturbed through mining operations will be undertaken. The area of disturbance will be rehabilitated progressively to create a low maintenance, geotechnically stable landform commensurate with agricultural and nature conservation land uses.

Overburden emplacements will be profiled to the final desired landform specifications using bulldozers. Subsoil and topsoil will be replaced on the profiled landform in the reverse order to which it was stripped i.e. the subsoil is placed on top of the overburden and the topsoil on top of the subsoil at an appropriate thickness. Before the topsoil is spread, the ground will be scarified along the contour to a depth of 50-100 mm to break up any hard setting surfaces and to provide a good bond between the re-spread material and subsoil. The topsoil will be spread to a minimum depth of 150 mm. The re-spread topsoil will typically be ripped to a depth of 300 mm along the contour with rip lines being a maximum of 1 m apart.

Contour banks will be required to be progressively installed to direct water off the emplacement either to natural surface or into flumes which will be constructed on the final landform. The heights and depths of these contour banks will be determined through ongoing landform design.

Finally, areas will initially be sown with either a cover crop or perennial native vegetation. The areas which have been identified for agricultural use post-mining will be sown with a mixture of pasture species including short and long lived perennial grasses and legumes. Areas for nature conservation will be oversown with non-invasive perennial grasses and legumes as an interim measure until the area becomes available for inclusion in the ongoing revegetation program.

9.6.3.5.2 Program for progressive rehabilitation

The proposed mine life is 25 years. The indicative program for progressive rehabilitation is described below; however, a detailed plan will be finalized as part of the PoO.

Year 1 – Mine infrastructure completion and commencement of mining. Infrastructure construction to commence 3 years before the start of mining. All works areas to be cleared and grubbed with disposal of vegetation. Topsoil and subsoil to be stripped and separately stockpiled for future use. Initial sediment dams to be completed.

Years 1 to 3 – box cut stockpiles to be utilised as cells for rejects and tailings. Stockpiles to be stabilised and contoured. Longwall mining to commence in year 3. Initial longwall panels to be surveyed by aerial photogrametry.

Years 4 to 10 – box cut stockpiles to be reshaped, stabilised, topsoiled and seeded. In-pit waste rock dumps to be shaped and used as cells for rejects and tailings. Reshaping and stabilisation of in-pit dumps. Progressive rehabilitation to include reshaping, topsoiling and seeding. Longwall mining areas to be surveyed by aerial photogrametry, subsidence tension cracks to be ripped and recompacted, and any internally draining subsidence troughs to be made externally draining by the construction of contour drains.

Years 11 to 25 – In-pit dumps will be continued to be used as cells for the disposal of rejects and tailings. Spoil piles will be progressively reshaped, stabilised, topsoiled and seeded. Rehabilitation of longwall mining areas will continue.

Post-mining Completion Works – all final voids spoil piles will be rehabilitated. Final voids will be stabilised, topsoiled and seeded following construction of safety bunds and fencing. Mine infrastructure will be dismantled and the sites will be rehabilitated. Dams and access roads will either be left for future use or decommissioned. All rehabilitated areas will be monitored and if necessary reworked.

9.6.3.5.3 *Revegetation*

Revegetation activities will typically commence at the completion of reshaping, re-topsoiling and drainage works. The timing of these works will ideally be scheduled to enable a preferred seasonal sowing of pasture and tree seed. Where surfaces have been prepared, selected tree, shrub and pasture species will be sown using seed stock and/or planted depending on the species, slope gradients and area to be revegetated. Rehabilitation will utilise tree and shrub species at a density and richness consistent with the desired post-mine landform. Plant selection for areas to be returned to a bushland landform will be based on the following criteria:

- the species will successfully establish on the available growth medium
- the species will bind the soil
- the species diversity will result in a variety of structure and food/habitat resources.

Native flora used for rehabilitation will ideally be endemic and will be established through a combination of direct seeding or planting of tube stock/nursery-raised stock from local propagules. Seed will be collected from site where possible and treated if necessary to ensure it is adapted to environmental conditions in the area. Tree and shrub establishment on site will be dominated by the direct seeding method, currently being used at the majority of coal mines in the Bowen Basin. An initial tree and shrub mix, based on the species list from the terrestrial ecology assessment is provided in **Table 42**, and will be reviewed periodically depending on changes in best practice, technology and rehabilitation monitoring results.

Table 42. Tree and shrub species

Common Name	Scientific Name	Woodland	Grassland	Riparian Zone
Acacia cambagei	Gidgee	X		
Acacia coriacea sub sp. *Seriocophylla*	Desert Oak	X		
Acacia excels	Ironwood	X		
Acacia harpophylla	Brigalow	X		
Acacia holosericea	Soap Bush	X		
Acacia Lazaridis	Lazarides Wattle	X		
Acacia oswaldii	Milijee	X		
Acacia salicina	Sally Wattle	X		
Acacia shirleyi	Lancewood	X		
Aeschynomene indica	Budda Pea	X		
Alphitonia excels	Red Ash	X		
Aristida bigandulosa	Dark Wiregrass	X		
Aristida calycina	Dark Wiregrass	X		
Aristida inaequiglumis	Feathertop Three-awn			X
Artistida latfolia	Feathertop Wiregrass	X		X
Astrebla elymoides	Hoop Mitchell Grass		X	
Astrebla pectinata	Barley Mitchell Grass		X	
Astrebla squarrosa	Bull Mitchell Grass		X	
Atalaya hemiglauca	Whitewood	X		X
Bothriochloa ewartiana	Desert Bluegrass	X		
Brachychiton populneus	Kurrajong	X		X
Callitris glaucophylla	White Cypress Pine	X		
Carissa ovate	Currant Bush	X		
Calytrix microcoma	Desert Star Flower	X		
Chloris divaricate	Slender Chloris	X		X
Chyrsopogon fallax	Golden Beard Grass	X		

Common Name	Scientific Name	Woodland	Grassland	Riparian Zone
Corymbia dallachiana	Dallachy's Gum	X		X
Corymbia setosa	Rough-leaved Bloodwood	X		
Dactyloctenium radulans	Button Grass	X		
Dichanthium sericeum sub sp. *Sericeum*	Bluegrass	X	X	
Digitaria brownii	Cotton Panic Grass	X		
Dodonaea lanceolata var. lanceolata	Hopbush	X		
Enchylaena tomentosa	Ruby Saltbush	X		X
Eragrostis elongate	Clustered Lovegrass	X		X
Eragrostis lacunaria	Purple Lovegrass			X
Eragrostis parviflora	Weeping Lovegrass	X		X
Eremophila latrobei	Crimson Turkey Bush	X		
Eremophila mitchelli	False Sandalwood	X		
Erythrina vespertilio	Bat's Wing Coral Tree	X		
Eucalyptus brownie	Reid River Box	X		
Eucalyptus camaldulensis	Red River Gum	X		X
Eucalytpus cambageana	Dawson Gum	X		X
Eucalyptus coolabah	Coolabah	X		X
Eucalyptus melanophloia	Silver-leaved ironbark	X		X
Eucalyptus populnea	Poplar Box	X		
Eucalyptus similis	Queensland Yellowjacket	X		
Eucalyptus tessellaris	Moreton Bay Ash	X		X
Eucalyptus thozetiana	Thozet's Box	X		
Heteropogon contortus	Black Speargrass	X		X
Lysiphyllum carronii	Red Bauhinia	X		X
Melaleuca tamariscina	Weeping Bottlebrush	X		
Panicum decompositum	Native Millet	X	X	
Paspalidium caespitosum	Brigalow Grass	X		X
Pennisetum cillare	Buffel Grass	X		
Petalostigma pubescens	Quinine Bush	X		
Setaria surgens	Annual Pigeon Grass	X		
Sporobolus caroli	Fairy Grass		X	X
Themeda triandra	Kangaroo Grass	X	X	X
Triodia mitchelli	Soft Spinifex	X	X	
Triodia pungens	Soft Spinifex	X	X	

A combination of native and introduced pasture species will be used to ensure the establishment of a groundcover and thereby reduce the likelihood of erosion. Legumes may also be selected to assist in the supply of bio-available nitrogen to the soil. If the use of introduced grasses and/or legumes is deemed necessary for erosion control in the bushland areas, pasture seed and fertilizer will be applied at a lower rate than for pasture outcomes to reduce competition with tree seed and/or seedlings.

Native and exotic pasture species will be sown where the risk of erosion is less and on the more protected aspects of landforms. Introduced grass species such as Rhodes Grass (*Chloris gayana*) and Indian Couch (*Bothriochloa pertusa*) will be used on the steeper slopes (>10°) as their growth habit provides more extensive coverage in a shorter time. Aerial sowing and ground broadcasting will be conducted for pasture seed as the preferred sowing methods and grazing will be restricted whilst the vegetation is establishing.

Weed species have the potential to have a major impact during rehabilitation activities. Weed management will be a critical component of mine rehabilitation with the use of a combination of control measures including:

- herbicide spraying or scalping of weeds off soil dumps
- washdown and cleaning of high risk equipment prior to entering the site
- monitoring and control of existing weed populations and weed populations over the mine life.

All weed control will be undertaken in a manner which minimises soil disturbance. Declared weeds will be controlled in accordance with the Land Protection Pest and Stock Route Management Act 2002 (LP Act). A detailed Weed Management Plan (WMP) will be developed for the Project to ensure management of weeds in accordance with the requirements of the LP Act.

9.6.3.6 Mine Infrastructure Area

Following decommissioning, infrastructure areas will be returned to the pre-mining landform, where practicable. Where this is not practicable, bench cuts will be removed, any steep grades reduced and the landform returned to a profile similar to landforms in the region.

Land used for infrastructure components will be returned to improved pasture grazing land or dry land cropping land as occurred pre-mining, and will generally be able to be used for beef cattle grazing or potentially for fodder cropping if the water pipeline is left commissioned.

Building end use will be assessed at the time of closure, as alternative uses may be available. It is likely; however, that the main administration building, workshop, CHPP and fixed plant (including stacker / reclaimers, conveyors and gantries, transfer points, thickener tank, coarse reject hopper, vehicle wash, etc.) will be required to be demolished and removed from the site. It is likely that where infrastructure is removed, the footprint area will be dozer trimmed to facilitate the appropriate drainage of surface runoff from the site.

Sumps will be de-watered and the excess coal removed prior to the commencement of demolition. In addition, all items of equipment will be de-oiled, degassed, depressurised and isolated, and all hazardous materials removed from the site.

Appropriate surface water management structures (contour banks, drains and settlement ponds) will be constructed. The site will be rock raked to remove all surface rocks to a size of less than 0.5 m and ripped to a depth of at least 1 m. Fertilizer and pasture / tree seed will be applied to assist establish grassland post-mine land use.

9.6.3.7 Roads and Hardstands

The roads, car parks and hardstand areas associated with the Project will be removed with the inert waste material being placed in the open cut voids and buried.

A number of the haul roads may be retained for use by future landowners, post-mine closure and rehabilitation. A number of additional haul roads will also be temporarily retained following rehabilitation as access roads for rehabilitation monitoring purposes. This will be determined in consultation with stakeholders and local council. For those roads to be left operational, either permanently or temporarily, containment measures to minimize potential erosion and sediment entering into waterways will be installed.

The majority of haul roads and access tracks across the Project area requiring decommissioning will be highly compacted. As such, rehabilitation will require a combination of deep ripping, profiling, topsoiling and seeding activities. Contaminated, carbonaceous or unsuitable material will be removed from the haul roads and hardstand surfaces and disposed of to the low wall area and then covered. Reshaping will be undertaken to ensure surface level consistency with the surrounding areas. Any creek crossings will be removed and the pre-existing drainage lines re-established where practicable and beneficial. The site will be rock raked to remove all surface rocks to a size of less than 0.5 m and ripped to a depth of at least 1 m. Drainage construction will be applied where necessary. All roadside markers (tyres and guideposts) and signs are also to be removed from within the area once mine closure activities within the pit area have been completed.

9.6.3.8 Sediment Control Basins and Surface Water Features

Water storage dams will either be retained for agricultural use or rehabilitated. If not retained as water storages, water storage dams will be rehabilitated and returned to land consistent with pre-mining land uses such as low intensity beef cattle grazing. The rehabilitation process will entail dewatering, removal of any embankments and the original drainage paths re-established wherever possible. These areas will be rock raked to remove all surface rocks to a size of less than 0.5 m and ripped to a depth of at least 1 m. Fertiliser and pasture / tree seed will be applied to the site.

Rehabilitation will also vary depending on the storage history. Dams that have contained saline water may require remediation. The membrane liner of the dam and any saline material inside the dam will be removed during rehabilitation and will be disposed of by appropriate methods, in accordance with the management of saline overburden material.

Sediment control basins associated with managing water flow from the final rehabilitated surface will be retained following mine closure.

9.6.3.9 Void Management

A single final void will remain after completion of mining for each pit. To address the potential impacts, a number of key actions are proposed as part of the final void management strategy, these include:

- progressive rehabilitation of open cut areas
- design of mine plan to minimise final voids
- shaping of landforms compatible with existing topography
- battering of final void slopes
- benching and revegetation of final void slopes where possible
- construction of safety bunds around final voids
- preparation of a Land Management Plan
- preparation of the MCP.

The banks of the final void (i.e. the high wall, low wall and end walls) will be reshaped to achieve long term geotechnical stability. Ramps will be levelled to similar grades as the surrounding wall slopes.

The final slope gradients of each void, including the outer boxcut spoil slopes, low wall of the final voids, and high wall slopes will be assessed and recommended by a suitably qualified person based on the risk of long term geotechnical instability.

The voids will be externally drained so that water from the overburden piles drains away from the voids. Final void modelling will be conducted to establish the required parameters for long term void stability and water quality.

These studies will be undertaken during the life of the mine, and include detailed research and modelling. In the final five years of mine life, the capability of the void to support endemic flora and fauna will be ascertained.

Final voids are unlikely to be suitable for agricultural use, and will be investigated for alternative beneficial uses such as wetlands. Final voids can be used for rejects and tailings disposal if longwall mining persists after the completion of open cut mining.

At the end of the mine life, the final voids remaining will be bunded and fenced to inhibit access to the area. The integrity of the bund will be the responsibility of the subsequent landowner.

A Final Void Plan (FVP) will be developed in consultation with relevant Government Agencies prior to completion of mining in the first pit. The Plan will be based on the final void modelling and will detail the design parameters for each final void. The FVP will include assessment of groundwater hydrology and properties, surface water hydrology and pit wall stability. The Plan will include measures to minimise potential impacts associated with the final void and for monitoring and management of potential impacts of the void over time. Options for the final post-mine use of the void will also be included in the FVP.

9.6.3.9.1 Void Water Quality

Waratah Coal will implement a groundwater and surface water monitoring program as part of the ongoing management of final void water quality. Monitoring will be conducted on the retained void water and this will be used to assist in future review of the groundwater modelling to refine the impact predictions. Monitoring will continue for five years after closure.

The following monitoring program will be undertaken after mine closure:

- monthly gauging of water levels in each of the open cut final void for a period of two years following mine closure, and quarterly gauging of water levels for an additional two years
- annual water quality monitoring in each of the open cut final void for five years following mine closure, to monitor for increases in salinity or other dissolved analytes
- analytes monitored will include pH, Electrical Conductivity (EC), Total Dissolved Solids (TDS), TSP, Principal Cations (Na, K, Mg, and Ca), Principal Anions (Sulphate, Chloride, and Bi-carbonate) and Nutrients (Total Phosphorous and Nitrogen).

The collected data will be reviewed after the first three years of monitoring. The review will include the following:

- remodel the water balance of the void
- an assessment of water quality and future quality impacts
- revision of the Final Void Management Plan if significant changes to the initial water balance and quality modelling are evident.

9.6.3.10 Low Wall Slope Stability

The low wall is assumed to comprise of mixed, disturbed and fragmented material. Stability of the low wall will be achieved in the following manner:

- the low wall will be battered back from the angle of repose to ensure the long term geotechnical stability of the face, with the determination of geotechnical stability and recommendations as to the final slope undertaken by a qualified geotechnical engineer on the basis of an assessment of the overburden material, the likely degree of settlement, and the degree of weathering expected in the long term. However it is expected that the low wall sides of the final void will be battered back to a maximum of 18^{o} with a goal of 10^{o} being optimal

- surface water drainage on and over the low wall will be minimised through the construction of drainage control structures which will aim to divert as much of the catchment as possible away from the final void
- erosion of the low wall will be controlled by limiting the length of slope through the use of contour and graded drains, minimising the slope, and by the establishment of suitable vegetation
- battering of the low wall against the bottom of the high wall, where possible, to enhance highwall stability. Benching of the spoil material may need to be considered in some areas in order to achieve geotechnical stability and minimise erosion.

9.6.3.11 High Wall Slope Stability

The high wall is assumed to comprise undisturbed, solid material generally occurring above the economically lower-most limits of the mineable seam in the final void. Depending on the geology of the deposit, the high wall material may comprise a range of natural occurring soil or rock materials of varying strengths or states of weathering.

To ensure the safety of the final void, the surrounding final slopes should be left in a condition where the risk of slope failure is minimised. This will be assessed by a suitably qualified geotechnical engineer.

The following will be considered when assessing the geotechnical stability of the high wall:

- long term groundwater levels
- long term final void water levels
- height and inclination of slope and number and spacing of intermediate benches (as may be required to achieve the final slope)
- shear strength of the high wall soils and rocks
- density and orientation of fractures, faults, bedding planes, and any other discontinuities, and the strength along them
- the effects of the external factors, such as surface runoff.

Where possible, an appropriate grass and shrub / tree seed mix will be applied to the high wall, if necessary using specialised techniques such as aerial seeding or hydro seeding. The purpose is to establish a vegetation cover which will provide some stability, but also offer visual impact mitigation.

Waratah Coal will undertake additional investigation prior to mine closure to confirm the above criteria. Once the criteria are confirmed appropriate works will be undertaken to ensure effective long term safety, stability and management of the void.

9.6.3.12 Spontaneous Combustion

While spontaneous combustion is considered a low risk of occurring, it has been included in this document for reference as it is often an issue associated with final voids, particularly where coal seams (and other carbonaceous materials) are left exposed (i.e. not capped or covered). There is also the possibility that a bushfire occurring post-closure could ignite the seams if they are in close proximity.

The following will be undertaken to reduce the potential for spontaneous combustion to occur:

- accumulations of coal, coarse rejects and other carbonaceous material, particularly if it is known to contain pyritic material, will be buried under a minimum of 1.5 m of inert overburden material
- any remaining coal spalling will be removed from the highwall where possible

- should any outbreaks of spontaneous combustion occur during mining operation, the details of the materials involved, presence of pyrite, location, date, time and climatic conditions will be recorded on surveyed plans. These areas will be assessed at closure to ensure appropriate mitigation measures are in place to minimise the likelihood of spontaneous combustion occurring post-mine closure. These areas will also be included as part of the ongoing inspection and monitoring that will be required following closure of the mine and before final lease relinquishment.

9.6.3.13 Control of Surface Inflow

The control of surface water inflow into the final void is essential for the long term management of water quality within the pit and will also aid in the control of erosion to low walls and highwalls. Surface water is a possible cause of slope deterioration and ultimate failure.

Drainage will be directed away from the highwall face (where ever possible) through the construction of interceptor channel drains around the perimeter of the highwall and spoon drains will be utilised on the upslope side of all benches.

Drainage over the low wall will be minimised through constructing surface water diversions, and drainage on the low wall will be limited and controlled to reduce the erosion potential. The catchment area of the final void will be minimised by the installation of diversion drains.

9.6.3.14 Safety

At mine closure, one of the main priorities for the final void will be to render it safe in terms of access by humans, livestock and wildlife. In order to achieve this, the following key activities will be considered:

- instability of the low wall can induce failures or mass movement. To ensure the stability of the low walls they will be battered back
- in addition, instability of the highwall can also induce failures and mass movement. To ensure the stability of the highwalls that are to be retained post closure, an appropriately qualified Geotechnical Engineer will be consulted on final highwall design
- where possible, the exposed coal seams will be covered with inert material to prevent ignition either from spontaneous combustion, bushfires or human interference
- a physical barrier will be constructed at a safe distance from the perimeter of the void to prevent human access. The highwall areas will be secured by the construction of a trench and a safety berm, as well as a security fence along the entire length of the remaining highwall. This is to provide an engineered barrier between the pit and the surrounding area. The trench and berm are to be constructed in such a way that it will physically stop most vehicles
- suitable signs, clearly stating the risk to public safety and prohibiting public access will be erected intervals along the entire length of the fence
- surface runoff from land surrounding the void will be diverted so as to prevent any potential development of instability of the void walls
- where practicable, grasses and shrubs / trees selected to conform to the agreed post-mining rehabilitation criteria and land use will be planted along the outside edge of the bund wall to lessen any visual impact of the wall.

9.6.3.15 Final Void Monitoring

Monitoring of the final voids will be undertaken as part of an ongoing program during the care and maintenance period. The monitoring program of the final voids will include erosion control, surface water control, runoff volumes and geotechnical stability. This program will be undertaken until such time that it could be determined that the final voids pose minimal environmental and public safety risk.

Further specific details regarding final void management will be finalised as part of the detailed VMP and MCPs, which will be prepared within five years of projected mine closure in accordance with relevant development consent conditions.

9.6.3.16 Contaminated Land

The EIS has determined that the mine area has an isolated area of hydrocarbon contamination associated with minor spillage associated with an existing above ground diesel fuel storage tank. This is the only known area of reported contamination existing within the Project impact footprint. The EIS further identified that the following work procedures could lead to minor contamination events:

- drill fluid use
- liquid and solid wastes
- chemical / fuel / oil storage and handling
- chemical / fuel / oil spills and leaks.

A risk assessment of these activities suggested that identified potential impacts can be remediated with current common contaminated land practices and that these impacts are of a low risk following the adoption of mitigation measures described in the table below.

General control strategies minimise the potential impact of the Project on soil and groundwater are identified elsewhere in the EM Plan; however, other measures include:

- contaminated material will be removed and placed in an appropriate area for remediation. This material will be kept separate from any material used for rehabilitation activities
- chemical storage will comply with Australian Standards and Material Safety Data Sheets (MSDS) requirements. MSDS for products kept on site will be readily available to employees and contractors
- smaller quantities of chemicals, fuels and oils will be stored in self-bunded pallets, within a bunded area in the workshop, or in a bunded container on the site. Bulk quantities of fuel should be stored in double skinned tanks (self-bunding)
- coal stockpiles, workshop areas, chemical stores, fuel tanks and waste disposal / storage areas will be located on hardstand or compacted soil. As runoff from these areas may be contaminated, runoff will be collected using appropriate drainage and water management structures and managed within the mine water management system
- waste products (e.g. oil / water separator waste, sludges and residues), will be contained within weatherproofed, sealed and bunded areas to ensure stability of the waste containment receptacles and prevent any leakages or spills causing environmental harm to soils, surface water or groundwater. Regular inspections will be carried out of the tanks, bunds and storage areas to ensure integrity
- obtain an approval and a disposal permit by the DEHP (Contaminated Land Unit) for the removal of contaminated soil, in accordance with the EP Act
- remove contaminated soils in accordance with a DEHP approved RAP
- prepare and implement procedures for the remediation of contaminated soil spills that may occur during transport

- standard procedures for the storage, handling, disposal and spill response for potentially hazardous waste materials should be described in Standard Operating Procedures (SOPs) as part of the Project EMS
- in the event of a large spill, sites will be investigated, managed and remediated in accordance with the requirements of the contaminated land provisions of the EP Act and the QLD DEHP Draft Guidelines
- if during any site earthworks or excavation, offensive or noxious odours and / or evidence of gross contamination not previously detected is observed, site works are to cease in that area and action taken to immediately abate the environmental harm. The area will be isolated through high visibility fencing and appropriate signage so that other activities may continue elsewhere within the remediation site without representing additional risks
- store all fuels, oils and chemicals in containers less than 200 L, either in a bunded area with capacity of at least 110% of the largest container, or in a fenced and roofed compound
- install tank level indicators on fuel oil tanks for monitoring of fuel oil levels
- maintain fuel oil tanks to ensure safe and effective operation of all components
- design fuel tanks in accordance with AS 1692:2006 'Steel tanks for flammable and combustible liquids' to minimise the potential for failure of the diesel storage vessel
- maintain contractor management procedures that require contractors to provide MSDS and apply for approval prior to bringing new chemicals on site
- all staff will be trained as part of their site induction in appropriate handling, storage and containment practices for chemicals, fuel and other potential contaminants as relevant.

Onsite records will be maintained regarding any activities or incidents that have the potential to result in land contamination. An inventory will also be maintained that contains information on storage locations, personnel training and disposal procedures for all chemicals, fuel and other potential contaminants used on site.

The administering authority will be notified in writing within two business days of detection of any gross contamination and advised of remedial actions implemented to mitigate risks to the receiving environment.

9.7 Monitoring

Rehabilitation will be monitored in accordance with the approved monitoring program. Monitoring results will be assessed against the pre-determined success criteria to determine the ongoing suitability of the rehabilitation program strategies. The rehabilitation program will be reviewed on a regular basis taking into consideration the successful achievement of the rehabilitation program against pre-determined objectives and external advancements in rehabilitation techniques at other sites. Where the rehabilitation program has not been successful, the Rehabilitation Management Plan will be amended to reflect revised rehabilitation strategies and monitoring program.

Rehabilitation reporting will be submitted to the DEHP on an as required basis.

9.8 Commitments

The following commitments are made in relation to the preservation of associated with the receiving land in the Project area:

- mine closure will achieve the agreed rehabilitation success criteria
- an ongoing and progressive rehabilitation of the disturbed areas against the agreed criteria will occur throughout the life of the mine
- final voids will be designed to a standard whereby they are safe, stable and sustainable
- a Subsidence Management Plan (SMP) will be prepared for the site in accordance with the DNRM guideline: *Watercourse Subsidence – Central Queensland Mining Industry* in liason with DNRM.

9.8.1 Monitoring Program

Monitoring of the rehabilitation will be undertaken on a regular basis. Rehabilitation monitoring will include the use of reference sites to enable a comparative assessment to be undertaken in both a spatial and temporal context. The reference sites will be used to determine success of the rehabilitation strategies, as well as to test system functionality resilience against rehabilitation methods.

Information on the vegetation structure and species composition, including abundance, will be collected at established analogue (reference) sites to compare and monitor the effectiveness of rehabilitation efforts during the life of the Project, and to set rehabilitation goals for each Regional Ecosystem. Reference sites will be established and surveyed using the BioCondition reference site methodology. Reference sites will include pre-existing disturbances where this represents site conditions where Waratah Coal will undertake activities. This will be identified prior to commencing site disturbances. Reference sites will be selected to be representative of each of the REs to be disturbed.

The Queensland Herbarium's Methodology for the Establishment and Survey of Reference Sites for BioCondition will be used to select survey sites. This methodology requires that, where possible and practicable a minimum of three reference sites be set up and surveyed for each RE. Areas to be rehabilitated should be compared with a reference site that occurs as close as possible to the area to be assessed and has similar environmental conditions, i.e. the same regional ecosystem, vegetation community, similar climate (same sub-region), similar landscape conditions (soil, slope, position in the landscape, geology etc.) and similar natural disturbance (such as fire history). Reference sites will be selected in RE's with no extensive chemical or mechanical disturbance to the predominant canopy evident on the aerial photograph archive (from 1960s to recent) or on the ground.

When selecting a reference site, Waratah Coal will take into account that that the site must:

- be homogenous with regard to RE and condition status
- represent an undisturbed, late mature or Best on Offer example of the required RE. That is, the site must have minimal modification through timber harvesting, grazing, fire, erosion, dieback, flood, high recruitment of native species, and/or weed infestation ideally and be located within a reasonably large (> 5 ha) intact patch of remnant vegetation (to avoid issues of edge effects)
- be located at least 50 m from a roadside
- not be located proximally, and are established at least 3 km apart to account for potential geographic variation.

In some situations, it may be necessary to select reference sites in areas that will be disturbed. However, where possible at least one site for each RE will be located in vegetation that will not be disturbed so that it acts as a long-term reference for possible vegetation changes that are not brought about by Project disturbances.

At each reference site the following will be measured:

- topsoil characteristics
- status of active and rehabilitated soil erosion sites
- vegetation surveys including
    - the percentage foliage cover
    - height of each vegetation stratum including species dominance within each structural strata
    - flora species richness and diversity
    - fauna habitat features, litter cover and fallen woody material
- water quality from onsite and offsite monitoring points
- biodiversity of reference and rehabilitated sites.

To ensure that data capture within analogue reference sites is adequate, analogue vegetation surveying will be designed and undertaken in a manner suitable to take into account seasonal variations.

To be consistent with the monitoring program of other mines in the Galilee Basin, Waratah Coal will use the monitoring elements shown in **Table 43** to determine the level of achievement of success criteria.

Table 43. Monitoring Elements

Rehabilitation aspect	Element to be monitored
Ecosystem establishment	
Groundcover	Percentage of ground covered by vegetation, rocks, logs and other obstructions. Obstruction lengths and widths (indicates the amount of ground cover that is present to collect, hold and disseminate available resources necessary for ecosystem function) for use in Landscape Function Analysis (LFA). Fetch lengths (measure of distances of soil surface that is bare of matter that could slow water velocity) for use in LFA.
Community structure and composition	Species composition. Number and form of ground cover and understorey species per plot. Density, height, canopy cover and DBH of tree and large shrub species. Numbers, heights and species identity (where able to be determined) of any seedlings. Evidence of reproduction/regeneration (e.g. flower heads, fruits/seeds, germination of seedlings etc.). Assessment of individual plant health (healthy, sick or dead).
Habitat	Availability and variety of food sources (e.g. flowering/fruiting trees, presence of invertebrates etc.). Availability and variety of shelter (e.g. depth of leaf litter, presence of logs, hollows etc.). Presence/absence of free water.
Fauna	Presence and approximate abundance and distribution of functional indicator invertebrate species. General observations of vertebrate species (including species of conservation significance). Detailed fauna surveys including presence and approximate abundance and distribution of vertebrate species (focussing on species of conservation significance).
Weeds and pests	Species identity. Approximate numbers/level of infestation. Observations of impact on rehabilitation (if any).
Erosion monitoring and soil characteristics	
Soil	Stability, infiltration and nutrient cycling undertaken according to LFA procedure. Electrical Conductivity, as a measure of salinity. pH. Soil exchangeable Na potential.
Erosion	Location and extent of sheet wash. Location and extent of rill and gully erosion including measurements of depth, width and length. Extent of bare areas with potential to erode. Sediment movement and runoff.
Geotechnical Stability	

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Rehabilitation aspect	Element to be monitored
	Stability of batter and surface settlements, in particular where these features could impact on the performance of any surface water management system. Surface integrity of landform cover/capping (measurement of extent of integrity failure). Landform slumping (distance of material movement and extent).
Surface and groundwater	
	Groundwater quality and depth. Efficiency of landform surface water drainage systems. Presence and quality of any surface water and seepage at selected locations at the lower part of potentially acid producing landforms such as reject dumps. Water quality including pH, EC and total suspended solids of water in water storages, ramps and pits, sediment basins and sewage effluent outfalls onsite. Water quality including pH, salinity and turbidity of water entering creek/river systems on site.
Creeks and diversions	
	Vegetation density, diversity and vigour. Structural stability of channel. Water quality including pH, salinity and turbidity of water entering creek/river systems on site.

9.8.2 Maintenance

Two types of rehabilitation maintenance will be performed in rehabilitated areas:

- progressive maintenance (on a planned basis)
- failure mitigation maintenance (conducted as ongoing required).

Progressive maintenance is planned as part of rehabilitation scheduling. It will comprise repairs that are necessary following the initial construction and adjustment of planning processes, if needed.

Following initial rehabilitation, new processes such as erosion, soil formation, vegetation cover and infiltration rates will develop on the modified landform. These processes may be sustainable in the long term, or more likely they may represent an intermediate stage before final landforms / ecosystems are achieved.

Progressive maintenance activities will be scheduled to transfer intermediate landforms into permanent, long term stable landforms. The type of construction maintenance activities that will achieve this outcome will include removal of graded banks, and repair of areas where excessive erosion has removed the protective capping and exposed spoil.

Rehabilitation failure mitigation will be carried out where the established landforms are not achieving the rehabilitation objectives. The aim of the monitoring and maintenance program will be to identify any systematic issues that may result in broad scale failure of rehabilitated areas. Failure in this sense is defined as non-achievement of the rehabilitation objectives as outlined above.

9.9 Proposed Environmental Authority Conditions: Schedule F – Land

(F1) Preventing contaminant release to land

Contaminants must not be released to land in a manner which constitutes nuisance, material or serious environmental harm.

(F2) Topsoil

Topsoil must be strategically stripped ahead of mining in accordance with a topsoil management plan.

(F3) A topsoil inventory which identifies the topsoil requirements for the mining Project and availability of suitable topsoil on site must be detailed in the Plan of Operations.

(F4) Rehabilitation landform criteria

Progressive rehabilitation must commence within two years of when areas become available within the operational land.

(F5) Residual void studies

a) the holder of the environmental authority must prepare a revised residual void model for approval by the administering authority during the fifth year after commencement of operation

b) the model in F5(a) must be subject to review each subsequent five years while the mine continues to operate

c) any amendment to the approved residual void model that may arise from the reviews in a) or b) must be based on any significant changes to groundwater characteristics or other data considered relevant by the administering authority that becomes available from the groundwater monitoring program

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d) Notwithstanding obligations under a), b) and c), the holder of the environmental authority must undertake residual void water balance modelling during mine closure planning, in consultation with the administering authority, to ensure assumptions regarding surface water runoff and groundwater ingress are suitable for the site.

(F6) Residual void outcome

Complete an investigation into residual voids and submit a report to the administering authority proposing acceptance criteria to meet the outcomes in conditions F4 and landform design criteria for Departmental review and comment. On acceptance of the criteria proposed in the residual void management plan, the criteria must be specified in the EA.

The investigation must at a minimum include the following:

a) a study of options available for minimising final void area and volume

b) develop design criteria for rehabilitation of final voids

c) a void hydrology study, addressing the long-term water balance in the voids, connections to groundwater resources and water quality parameters in the long term

d) a study of the measures to protect the residual voids, uncompacted overburden and workings from the ‘probable maximum flood’ level based on the Bureau of Meteorology’s ‘probable maximum precipitation’ forecast for the locality

e) a pit wall stability study, considering the effects of long-term erosion and weathering of the pit wall and the effects of significant hydrological events

f) a study of void capability to support native flora and fauna

g) a proposal/s for end of mine void rehabilitation success criteria and final void areas and volumes.

These studies will be undertaken during the life of the mine, and will include detailed research and modelling.

(F7) Rehabilitation monitoring program

Once rehabilitation has commenced, the environmental authority holder must conduct a Rehabilitation Monitoring Program on a two yearly basis, which must include sufficient spatial and temporal replication to enable statistically valid conclusions as established under the rehabilitation program.

(F8) The Rehabilitation Monitoring Program must be developed and implemented by a person possessing appropriate qualifications and experience in the field of rehabilitation management, nominated by the environmental authority holder.

(F9) The Rehabilitation Monitoring Program must be included in the Plan of Operations and updated with each subsequent Plan of Operations, describing:

a) how the rehabilitation objectives will be achieved

b) verification of rehabilitation success.

(F10) Post closure management plan

A Post Closure Management Plan for the site must be prepared at least 18 months prior to the final coal processing on site and implemented for a nominal period of:

a) at least 20 years following final coal processing on site

b) a shorter period if the site is proven to be geotechnically and geochemically stable and it can be demonstrated to the satisfaction of the administering authority that no release of contaminants from the site will result in environmental harm.

(F11) The Post Closure Management Plan must include the following elements:

a) operation and maintenance of:
   i. wastewater collection and reticulation systems
   ii. wastewater treatment systems
   iii. the groundwater monitoring network
   iv. final cover systems
   v. vegetative cover.
b) monitoring of:
   i. surface water quality
   ii. groundwater quality
   iii. seepage rates
   iv. erosion rates
   v. the integrity and effectiveness of final cover systems
   vi. the health and resilience of native vegetation cover.

(F12) Mining waste management

A Mining Waste Management Plan together with the certification by an appropriately qualified person must be developed and implemented during the continuation of the environmental authority. The Mining Waste Management Plan must at a minimum include:

a) characterisation programs to ensure that all mining waste is progressively characterised during disposal for net acid producing potential, salinity and the following contaminants: pH, Electrical Conductivity (EC), Acid Neutralising Capacity (ANC), Net Acid Generation (NAG) (reporting NAG capacity and NAG pH after oxidation), Net Acid Producing Potential (NAPP), Total Sulfur (S), Chromium Reducible Sulfur (Scr), Boron (B) Cadmium (Cd), Iron (Fe), Aluminium (Al), Copper (Cu), Magnesium (Mg), Manganese (Mn), Calcium (Ca), Sodium (Na), Zinc (Zn) and Sulfate (SO_4)
b) characterisation programs to ensure that the physical properties of the mining waste is progressively characterised during disposal
c) the availability or leachability of metals from the mining waste
d) quantity of potentially acid forming (PAF) mining waste
e) review potential impacts of PAF mining waste on the success of proposed rehabilitation methods
f) management actions for mining waste that has been identified as having a high availability or leachability of metals in accordance with condition F12
g) management actions for mining waste that has been defined as PAF
h) identification of environmental impacts and potential environmental impacts

i) control measures for routine operations to minimise likelihood of environmental harm

j) contingency plans and emergency procedures for non-routine situations

k) periodic review of environmental performance and continual improvement.

(F13) Acid mine drainage and leachate management

Subject to the release limits defined in Departmental Interest: Water, all reasonable and practicable measures must be implemented to prevent hazardous leachate being directly or indirectly released or likely to be released as a result of the activity to the environment.

(F14) Storage and handling of flammable and combustible liquids

All flammable and combustible liquids must be contained within an on-site containment system and controlled in a manner that prevents environmental harm and maintained in accordance with the current version of AS 1940 – Storage and Handling of Flammable and Combustible Liquids.

(F15) Spillage of all flammable and combustible liquids must be controlled in a manner that prevents environmental harm.

(F16) Storage and handling of chemicals

All chemicals must be contained within an on-site containment system and controlled in a manner that prevents environmental harm and maintained in accordance with the current version of the relevant Australian Standard.

(F17) Spillage of all chemicals must be controlled in a manner that prevents environmental harm.

(F18) Exploration

Disturbance due to exploration activities in areas not scheduled to be mined must be rehabilitated in accordance with provisions detailed in the administering authority's Code of Environmental Compliance for Exploration and Mineral Development Projects.

(F19) Subsidence

A Subsidence Management Plan must be developed by an appropriately qualified person and implemented by the holder of the Environmental Authority prior to the commencement of activities that result in subsidence.

(F20) The Subsidence Management Plan must

a) provide for the proper and effective management of the actual and potential environmental impacts resulting from the mining activity and to ensure compliance with the conditions of the Environmental Authority

b) address the proposed impact of subsidence on any land, watercourse and floodplain, including but not limited to:

   i. physical condition of surface drainage:

      a. erosion

      b. areas susceptible to higher levels of erosion such as watercourse confluences

      c. incision processes

      d. stream widening

      e. tension cracking

      f. lowering of beds and banks

g. creation of instream waterholes

h. changes to local drainage patterns

ii. overland flows

a. capture of overland flow by subsided longwall panels

b. increased overbank flows due to lowering of the high bank of watercourses

c. the portion of local and large scale catchment likely to be captured by subsided longwall panels and the associated impacts on downstream users

iii. water quality

a. surface water quality

b. groundwater

c. overland flow water detained in subsided longwall panels

iv. land condition: current land condition to be impacted by subsidence

v. infrastructure: detail of existing infrastructure (should be identified where there is a potential impact from the effects of land subsidence)

c) proposed options for mitigating any impacts associated with subsidence and how these mitigation methods will be implemented

d) cumulative impacts on watercourses or catchments

e) impacts on groundwater

f) contingency procedures for emergencies

g) a program for monitoring and review of the effectiveness of the Subsidence Management Plan.

(F21) The Subsidence Management Plan must be reviewed each calendar year and a report prepared by an appropriately qualified person. The report must:

a) assess the plan against the requirements under condition F20

b) include recommended actions to ensure actual and potential environmental impacts are effectively managed for the coming year

c) identify any amendments made to the Subsidence Management Plan following the review.

(F22) The holder of the Environmental Authority must attach to the review report required by condition F21, a written response to the report and the recommended actions detailing the actions taken or to be taken by the Environmental Authority holder on stated dates:

a) to ensure compliance with the Environmental Authority

b) to prevent a recurrence of any non-compliance issues identified.

(F23) The review report required by condition F21 and the written response to the review report required by condition F22 must be submitted to the administering authority with the subsequent annual return under the signature of the appointed signatory for the annual return.

(F24) Areas impacted by subsidence, or proposed to be impacted by subsidence must be identified within the Plan of Operation.

(F25) The Plan of Operation must as a minimum:

a) identify pre-subsidence management actions to be undertaken during the period of the plan

b) identify post – subsidence management actions to be undertaken during the period of the plan

c) identify the subsidence monitoring proposed to be undertaken during the period of the plan.

(F26) The holder of this Environmental Authority must not commence subsidence of a longwall panel that will result in the subsidence of a watercourse or adjoining floodplain unless:

a) the holder has submitted to the administering authority two copies of the subsidence Management Plan detailing the subsidence activities for the watercourse or adjoining floodplain together with certification of a suitably qualified and experienced person that the plan is compliant in all respects with this Environmental Authority and in accordance with engineering best practice

b) at least 28 days has passed since the submission of the Subsidence Management Plan.

Due consideration must be given to any comments made by the administering authority about the Subsidence Management Plan and subsequent implementation of the plan.

(F27) The holder of this Environmental Authority must arrange for each subsided longwall panel to be inspected annually by a suitably qualified and experienced person, in accordance with conditions F28 through F31 until such time that the person is satisfied that the total subsidence has occurred.

(F28) At each annual inspection, the condition of each subsided longwall panel must be assessed, including the structural, hydraulic adequacy of the subsided longwall panel and the adequacy of the works with respect to the Subsidence Management Plan.

(F29) For each inspection, two copies of a report certified by the suitably qualified and experienced person, including any recommendations to ensure the integrity of each subsided longwall panel must be provided to the administering authority within 28 days of inspection.

(F30) The holder of this Environmental Authority must attached to the inspection report required by condition F28, a written response to the report and the recommended actions, detailing the actions taken or to be taken by the Environmental Authority on stated dates:

a) to ensure compliance with this environmental authority

b) to prevent a recurrence of any non-compliance issues identified.

(F31) The written response required by condition F30 to the inspection report must be submitted to the administering authority within 28 days of the submission of the inspection report required under condition F29.

END OF CONDITIONS FOR SCHEDULE F

10. Water Resources

10.1 Background

10.1.1 Surface Water Resources

The China First mine site is located within the Belyando River sub-basin within the Burdekin River basin. The western edge of EPC 1079 drains to the Cooper Creek Basin.

The Belyando Catchment is predominantly low relief floodplain with wide braided channels and alluvial plains. The Belyando Catchment is predominantly agricultural land with cattle grazing on natural vegetation. The section of the Catchment covering the mine is comprised of gently undulating plains with strongly undulating to hilly land in the north-east corner of the mine site.

The primary drainage paths through the proposed Mining Lease Application area (MLA) consist of:

- Beta and Tallarenha Creeks which originate to the south of the MLA and flow in a generally northerly direction through the southern parts of the MLA
- Lagoon Creek which originates at the junction of Beta and Tallarenha Creeks and flows in a generally northerly direction through the northern parts of the MLA.

Lagoon Creek continues to flow in a northerly direction downstream of the proposed mine lease before joining with Sandy Creek which discharges into the Belyando River 70 km downstream of the mine lease. Downstream of the Sandy Creek confluence, the Belyando River flows in a generally northerly direction before discharging into the Suttor River approximately 200 km downstream. The Suttor River continues in a northerly direction before discharging into the Burdekin River within the reservoir area of Lake Dalrymple (Burdekin Falls Dam).

The south-western corner of the MLA drains to an un-named tributary of Jordan Creek which flows in a generally westerly direction into Jordan Creek approximately 10 km to the west of the MLA. Jordan Creek flows in a north-westerly direction and discharges into the Alice River approximately 40 km downstream of the mine drainage inflow location.

The waterways in the vicinity of the proposed Galilee Coal Mine are shown in **Figure 25**.

There are no stream flow gauging stations within the mine site. Stream gauging stations on adjacent waterways have been utilised to understand the hydrological regime of the existing watercourses. DEHP currently operate stream flow gauging stations on the nearby Native Companion Creek and Mistake Creek located 30 km east and 58 km west of the MLA respectively. Statistics of gauged annual flows for these stations are summarised in **Table 44.**

The stream gauging data for Native Companion Creek and Mistake Creek indicates that an average annual runoff depth of 12 to 14 mm (approximately 2 % of mean annual rainfall) is representative of catchments in the vicinity of the MLA.

Table 44. Annual Stream Flow Statistics in Vicinity of MLA

Percentile	Native Companion Creek		Mistake Creek	
	Annual Flow (ML)	Annual Runoff Depth (mm)	Annual Flow (ML	Annual Runoff Depth (mm)
10th Percentile	1,670	0.4	22	0.3
25th Percentile	7,023	1.7	32	0.5
50th Percentile	16,239	4.0	193	2.9
75th Percentile	47,042	11.6	890	13.5
90th Percentile	155,140	38.2	2,286	34.6
Mean	58,094	14.3	803	12.2

Water quality characterisation of the existing watercourses was undertaken for the EIS. The results indicate that the streams are generally in good health with physico-chemical parameters outside of expected ranges attributed to the surrounding rural land uses and ephemeral nature of the waterways. The watercourses have been described as slightly to moderately disturbed under the DERM (2009) Queensland Water Quality Guideline classification. Key points from the water quality characterization include:

- dissolved salts were generally compliant with the Queensland Water Quality Guidelines with some marginal exceedences in isolated locations which was attributed to the ephemeral nature of the system
- pH was compliant for median, 20th and 80th percentile values with some minor exceedences which was attributed to natural fluctuations
- all metals were generally compliant with the Queensland Water Quality Guidelines except for Copper which consistently exceeded limits during both wet and dry season conditions. These exceedences have been attributed to the geological characteristics of the catchment.

Three creeks are proposed for diversion; these being Lagoon, Malcolm and Saltbush Creeks.

Lagoon Creek is the main creek traversing the MLA with an upstream catchment area of approximately 1,250 km² at the downstream MLA boundary. Lagoon Creek commences at the confluence of Beta Creek and Tallarenha Creek and traverses the mine lease in a south to north direction. The active channel has significant meandering with erosion clearly evident on the outer banks of the meanders. There are a number of pools and riffles which contain small volumes of permanent water during the wet season. There is significant sediment deposition consisting mainly of sand overlying a silty clay substrate.

Benching is present on either side of the active channel within Lagoon Creek, typically as a result of large sediment supply. The typical floodplain width ranges between 500 and 1500 m with the interaction evident between the Saltbush Creek floodplain to the east. Vegetation consisting mainly of large trees is located along the fringes of the in-stream bench with the floodplain consisting predominantly of grasses and understorey vegetation.

Malcolm Creek traverses the site in a west to east direction before merging with Lagoon Creek. The Malcolm Creek catchment covers an area of approximately 660 km² with headwaters located in the mountains to the west of the site. This steep gradient induces significant erosion resulting in a straight deeply incised active channel. This steeper gradient and higher energy level results in little to no sediment deposition and also prevents the forming of in stream benches due to the continual flow through of sediment.

There is no clearly defined floodplain associated with Malcolm Creek due to its steep nature. There is some minor vegetation consisting of small trees located on the outer edges of the active channel. Malcolm Creek is also highly disturbed with a number of dams and in-stream diversions associated with existing farming activities.

For the purpose of establishing draft Environmental Values, the receiving waterways of the Galilee Coal Mine are considered to be:

- Lagoon Creek downstream of the Galilee Coal Mine
- Sandy Creek downstream of the Lagoon Creek confluence
- Belyando River downstream of Sandy Creek confluence
- Un-named tributary of Jordan Creek downstream of the Galilee Coal Mine
- Jordan Creek downstream of the Galilee Coal Mine.

It is unlikely that surface water discharges from the Galilee Coal Mine will have any impact on waterways downstream of these waterways.

10.1.2 Surface Water Quality Data

A review of the DERM historical water quality data indicated that Violet Grove on Native Companion Creek is the closest site to the mine (approximately 20kms east) where sampling is undertaken regularly. Water quality sampling was carried out at the site between 1991 and 2005. A summary of the water quality data obtained from this site is provided in **Table 45**. **Table 46** provides a summary of results from the Belyando Catchment.

Table 45. DERM historical water quality - Violet Grove summary

Parameter	N	minimum	10^{th} Percentile	Median	90^{th} Percentile	Maximum
EC (µS/cm)	34	82	93	147.5	349.8	1589
Turbidity (NTU)	24	9	38.4	360.5	904	1944
pH	30	5.80	6.70	7.35	8.32	8.62
DO (ppm)	24	2.12	4.56	5.75	8.21	9.00
TSS (mg/L)	52	5	19	110	781	1500
TN (µg/L)	9	855	-	-	-	1530
TP (µg/L)	27	27	32	206	409	540

Table 46. Summary baseline water quality results – Upper Belyando catchment

Water Quality Parameters	Units	Minimum	20^{th} Percentile	Median	80^{th} Percentile	Maximum
Field/Physical Parameters						
Temperature	°C	21	24.88	25.2	27.84	28.9
pH	pH Unit	5.9	6.2	6.355	6.72	7.2
EC	mS/cm	0.1316	0.16	0.2375	0.301	0.482
Dissolved Oxygen	%	25	40.6	50	61	76
Turbidity	NTU	1.7	18.4	136	291.4	3185
Laboratory Parameters						
Total Alkalinity as $CaCO^3$	mg/L	15	39.4	73	92	104
Sulfate as SO_4^{2-}	mg/L	1	1	1.5	3	4
Chloride	µg/L	8,000	8,800	11,000	24,200	39,000
Calcium	mg/L	2	5.8	11	15.2	16
Magnesium	mg/L	2	3	5.5	7	10
Sodium	mg/L	5	8	9	17.4	38
Potassium	mg/L	5	8	10	10.4	31

Water Quality Parameters	Units	Minimum	20th Percentile	Median	80th Percentile	Maximum
Arsenic	µg/L	<1	1.6	2	2	15
Cadmium	µg/L	<0.1	0.2	0.2	0.2	0.2
Chromium	µg/L	<1	4.2	6	19.2	28
Copper	µg/L	<1	2	2	5.4	25
Nickel	µg/L	<1	2	3	5.4	64
Lead	µg/L	<1	3	3	11.4	17
Zinc	µg/L	<5	7.6	9	22	40
Iron	µg/L	<50	1890	4410	6436	13000
Ammonia as N	µg/L	<10	16	25	358	850
Nitrite as N	µg/L	<10	10	10	10	10
Nitrate as N	µg/L	<10	16	20	20	30
Total Kjeldahl Nitrogen as N (TKN)	µg/L	<10	560	800	1,280	2,800
Total Nitrogen as N	µg/L	<10	560	800	1,280	2,800
Total Phosphorus as P	µg/L	<10	42	70	178	560
Total Anions	mEq/L	0.72	1.052	1.805	2.28	3.22
Total Cations	mEq/L	0.79	1.138	1.785	2.196	3.3
Chlorophyll a	mg/m^3	-	1.32	1.32	1.32	1.32
PCB	µg/L	<1	4	4	4	10
PAH	µg/L	<1	<1	<1	<1	<1
TPH C_{10}-C_{36} Fraction (sum)	µg/L	<1	<1	<1	<1	<1

10.1.2.1 Water Quality Sampling

Surface water quality data for the watercourses through the mine site is limited. Water quality baseline data for these waterways and for adjacent non-affected waterways to the east of the mine site formed the preliminary basis for characterising existing water quality conditions. The baseline water quality sampling carried out to date is outlined below.

EIS Sampling

Water quality monitoring was conducted at 24 sites in the Belyando Basin, including 11 sites in the Sandy Creek sub-catchment (WQ-38, WQ-41, WQ-44 to WQ-52) and one site in the Belyando Floodplain sub-catchment (WQ-37). The remainder was in adjacent sub-catchments not potentially impacted by the mine, including Native Companion Creek and Fox Creek subcatchments.

Site location details for the EIS water quality sampling sites are given in **Table 47** and also shown in **Figure 25**. Sampling was carried out on two sampling occasions, the first being in the pre-wet season (October 2009) and the second during the post-wet season (April / May 2010) two weeks after Cyclone Ului, when the water level at some sites was at bank full level. A total of 25 samples were collected across these two surveys, 22 of which were collected during the 2010 post-wet season survey. The lack of water to sample during the pre-wet season occasion highlights the highly ephemeral nature of the waterways in the Belyando Basin and the challenges in collecting water quality data in these systems.

Table 47. Location of Belyando Basin EIS monitoring sites

Site	Creek	Latitude	Longitude
WQ29	Mistake Creek	22° 1.694'	146° 59.569'
WQ30	Mistake Creek	22° 8.420'	147° 2.776'
WQ31	Middle Creek	22° 9.369'	146° 55.981'
WQ32	Middle Creek	22° 16.183'	146° 51.678'
WQ33	Sixteen Mile Creek	22° 23.774'	146° 46.312'
WQ34	Lascelles Creek	22° 23.551'	146° 54.213'
WQ35	Sandy Creek	22° 36.823'	146° 40.932'
WQ36	Native Companion Creek	23° 7.263'	146° 40.980'
WQ37	Belyando River	23° 2.253'	146° 47.023'
WQ38	May Creek	23° 9.679'	146° 57.787'
WQ39	Belyando River - Pebbly Creek	23° 15.809'	146° 52.688'
WQ40	Malcolm Creek	23° 20.443'	146° 29.605'
WQ41	Saltbush Creek	23° 21.605'	146° 29.288'
WQ42	Lagoon Creek	23° 21.096'	146° 28.526'
WQ43	Spring Creek	23° 20.028'	146° 22.324'
WQ44	trib. of Spring Creek	23° 21.036'	146° 17.825'
WQ45	Pebbly Creek	23° 23.105'	146° 14.072'
WQ46	Tallarenha Creek	23° 23.882'	146° 27.703'
WQ47	Beta Creek	23° 30.524'	146° 22.440'
WQ48	Tallarenha Creek	23° 33.366'	146° 28.305'

SEIS Sampling

A total of nine sites were sampled for water quality as part of the SEIS near mine surface water aquatic ecology study carried out in April 2012 (see **Table 48**, **Figure 27**).

These nine sites were distributed across six catchments: Tallarenha Creek, Lagoon Creek (locally referred to as 'Monks' Creek where it intersects the Monklands property), Beta Creek, Malcolm Creek, Spring Creek and Pebbly Creek; all of which intersect the China First MLA and / or represent potential receiving waters in relation to the Project. The location details for these sites are given in **Table 48**. Sites with 'Alt' in the site code represent sites sampled that were nearby alternative sites to the corresponding EIS aquatic ecology sampling sites. Many of the sites sampled during the EIS could not be sampled in April 2012 due to access restrictions, but the same waterways were sampled on each sampling occasion.

A second round of SEIS water quality sampling was carried out in September 2012. This round of water sampling was carried out to provide greater temporal characterisation of water quality in the study area. The program involved sampling at three of the established sites from the April 2012 event (Alt-AQ14, Site04 and PC-Dam), and an additional five new sites, some of which were nominated as potential future reference sites in relation to the Project. The location details of the water quality monitoring sites sampled in September 2012 are given in **Table 49**.

Table 48. Location of near mine sites sampled as part of the SEIS aquatic ecology and water quality survey.

Site Code	Sub-catchment	Latitude	Longitude	Description	Position Relative to Project Infrastructure
LC-1	Lagoon Creek	23° 20.043' S	146° 29.120' E	Lagoon Creek	6 km d/s of causeway d/s of pit and overburden emplacement areas
LC-3	Lagoon Creek	23° 18.963' S	146° 30.128' E	Lagoon Creek	8.7 km d/s of causeway d/s of pit and overburden emplacement areas
MC-new	Malcolm Creek	23° 23.863' S	146° 25.758' E	Malcolm Creek at Kiaora causeway	Within pit area
PC-Dam	Pebbly Creek	23° 26.333' S	146° 18.829' E	Pebbly Creek Dam	Within underground mining area
TC-Dam	Tallarenha Creek	23° 26.875' S	146° 26.336' E	Tallarenha Creek Wetland	Within / directly adjacent to overburden emplacement area
SPC-Dam	Spring Creek	23° 20.230' S	146° 21.892' E	Spring Creek Dam	Within underground mining area
Alt AQ14	Lagoon Creek	23° 23.086' S	146° 27.918' E	Lagoon ("Monks") Creek at causeway	Within overburden emplacement area
BC-5	Beta Creek	23°30.897' S	146° 20.387 E	Beta Creek	Within underground mining area
Site04	Saltbush Creek	23° 20.395' S	146° 29.609' E	Saltbush Creek Lagoon	d/s of TSF / decant water facility & rail loop

Table 49. Location of SEIS water quality sites sampled in September 2012.

Site Code	Sub-catchment	Latitude	Longitude	Description	Position Relative to Project Infrastructure
PC-Dam	Pebbly Creek	23° 26.333' S	146° 18.829' E	Pebbly Creek Dam	Within underground mining area
Alt AQ14	Lagoon Creek	23° 23.086' S	146° 27.918' E	Lagoon ("Monks") Creek at causeway	Within overburden emplacement area
MC-new	Malcolm Creek	23° 23.863' S	146° 25.758' E	Malcolm Creek at Kiaora causeway	Within pit area
Site04	Saltbush Creek	23° 20.395' S	146° 29.609' E	Saltbush Creek Lagoon	d/s of TSF / decant water facility and rail loop
BC-Dam	Beta Creek	23° 30.410' S	146° 21.321' E	Beta Creek Dam	Within underground mining area
JC-1	Jordan Creek	23° 35.592' S	146° 08.038' E	Jordan Creek at highway crossing	Potential control site
NCC-1	Native Companion Creek	23° 38.563' S	146° 42.250' E	Native Companion Creek at highway crossing	Potential control site
AC-2	Alpha Creek	23° 39.190' S	146° 38.222' E	Alpha Creek at highway crossing	Potential control site
TC-1	Tallarenha Creek	23° 38.093' S	146° 28.449' E	Tallarenha Creek at highway crossing	Potential control site

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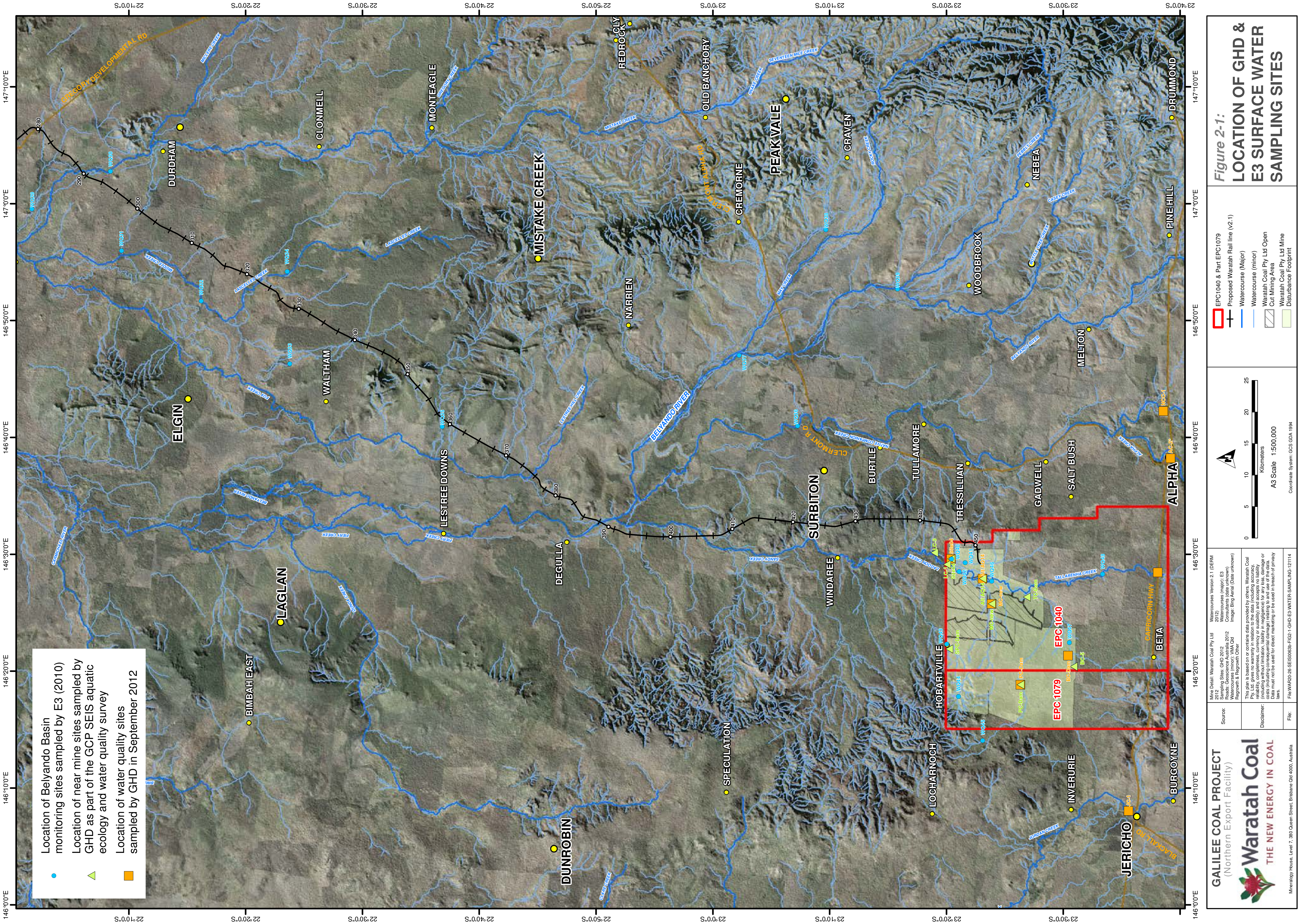
Figure 27. Location of EIS and SEIS surface water sampling sites



10.1.2.2 Parameters Monitored

For both the EIS (2010) and SEIS (2012) programs, water quality data were collected based on in situ measurements of physico-chemical water quality parameters and grab samples for analytical testing. As part of the EIS public submissions process, the DEHP recommended additional analytical measurement parameters be added to the water quality monitoring program for the SEIS. Further, organic pesticides were also added to the program in order to further characterise the effects of adjacent agricultural landuse on water quality. **Table 50** provides a comparison between the range of parameters assessed as part of the EIS and the range of parameters recommended by DEHP and monitored as part of the SEIS.

Table 50. Comparison between the range of analytical testing parameters monitored as part of the EIS and the range of analytical testing parameters recommended by DEHP and monitored as part of the SEIS survey.

Parameters Tested for as part of the EIS	Parameters Recommended by DEHP	Parameters Tested for as part of the SEIS
	Physical	
		EC
		pH
		TSS
		TDS
Major Ions	Major Ions	Major Ions
Alkalinity as $CaC0_3$	Alkalinity as $CaC0_3$	Alkalinity as $CaC0_3$
Sulphate	Sulphate	Sulphate
Chloride	Chloride	Chloride
Calcium	Calcium	Calcium
	Fluoride	Fluoride
Magnesium	Magnesium	Magnesium
Sodium	Sodium	Sodium
Potassium	Potassium	Potassium
Total Anions	Total Anions	Total Anions
Total Cations	Total Cations	Total Cations
	Metals (Total concentration)	
	Aluminium	Aluminium
Arsenic	Arsenic	Arsenic
	Boron	Boron
Cadmium	Cadmium	Cadmium
Chromium	Chromium	Chromium
	Cobalt	Cobalt
Copper	Copper	Copper
Iron	Iron	Iron
Lead	Lead	Lead
	Manganese	Manganese
	Mercury	Mercury
	Molybdenum	Molybdenum
Nickel	Nickel	Nickel
	Selenium	Selenium
	Silver	Silver
	Uranium	Uranium
	Vanadium	Vanadium

Parameters Tested for as part of the EIS	Parameters Recommended by DEHP	Parameters Tested for as part of the SEIS
	Zinc	Zinc
Metals (Dissolved)		
	Aluminium	Aluminium
	Arsenic	Arsenic
	Boron	Boron
	Cadmium	Cadmium
	Chromium	Chromium
	Cobalt	Cobalt
	Copper	Copper
	Iron	Iron
	Lead	Lead
	Manganese	Manganese
	Mercury	Mercury
	Molybdenum	Molybdenum
	Nickel	Nickel
	Selenium	Selenium
	Silver	Silver
	Uranium	Uranium
	Vanadium	Vanadium
	Zinc	Zinc
Nutrients		
Ammonia as N	Ammonia as N	Ammonia as N
Nitrate as N	Nitrate as N	Nitrate as N
Nitrite as N	Nitrite as N	Nitrite as N
TKN	TKN	TKN
TN	TN	TN
TP	TP	TP
		SRP
Primary Production		
Chlorophyll a	Chlorophyll a	Chlorophyll a
Organic Contaminants		
PCB	PCB	PCB
PAH	PAH	PAH
TPH (C10-36)	TPH (C10-36)	TPH (C10-36)
		BTEX
		O-C Pesticides
		O-P Pesticides

10.1.2.3 Water Quality Results

Based on the combined sampling carried out for the EIS and SEIS, there are 42 data points collected over four sampling occasions for most parameters and 17 data points for parameters added to the monitoring program as part of the SEIS process that were collected over two sampling occasions.

The results of the baseline monitoring carried out for the EIS and SEIS have been reported separately in various technical reports (E3, 2010; GHD, 2012 – both contained in the Galilee Coal Project SEIS Appendices), for the purpose of outlining the key baseline water quality monitoring results the median and other key percentiles for parameters monitored consistently across the two studies were compared against relevant guideline ranges and trigger values. As per the ANZECC & ARMCANZ (2000) and DERM (2009) specifications, the median value of each physico-chemical parameter (including *in situ* readings, nutrients and major ions) was compared to guideline ranges / trigger values, while for toxicants (i.e. metals), the 95th percentile value for the collected data was compared against the nominated trigger value.

Results of in situ monitoring carried out for the EIS and SEIS are given in **Table 51**.

These results show that the median pH for Belyando Catchment sites was within the guideline range for the protection of ecosystem values in slightly to moderately disturbed (SMD) Central Queensland upland streams (DERM, 2009). By contrast, median values for Electrical Conductivity (EC), dissolved oxygen % saturation (DO%) and turbidity were all outside the recommended range for the protection of ecosystem values in SMD Central Queensland upland streams (DERM, 2009). Results show that the water quality in waterways in and around the mine site were generally characterised by elevated EC, low DO% and elevated turbidity. Note that DERM (2009) advocate that the application of physico-chemical trigger values to ephemeral streams where pools are small and stagnating is inappropriate. However, in larger waterholes it would be expected that values would remain closer to guidelines. None of the sites monitored for the SEIS were small stagnant pools.

The Alpha Coal EIS (Hancock Prospecting, 2011) also found that low DO% was a consistent feature of the water bodies in the region. This is likely due to the lack of flushing during low flow periods and the breakdown of allochthonous organic material entering these waterways during high flow periods. Hancock Prospecting (2011) also reported that turbidity was generally high. They regarded this finding as not unexpected given that high turbidity is typical of ephemeral streams and for catchments exhibiting natural erosion, such as those in the Galilee Basin, where dispersive soils and steep slopes combine to result in severe sheet and gully erosion in the upper reaches of the waterways assessed. Most of the sites sampled by Hancock Prospecting (2011) also recorded EC levels above the guideline level for the Belyando-Suttor catchment.

Table 51. Comparison of percentile ranges for *in situ* physico-chemical parameters measured in the Belyando Catchment as part of the baseline monitoring program against the DERM (2009) guidelines for Central Queensland upland streams.

Water Quality Parameters	Units	DERM (2009) Upland Streams of Central QLD	Median	20th percentile	75th percentile	80th percentile
Temperature	°C	N/A	23.6	21.43	25.15	25.36
pH	pH Unit	6.5-7.5	7.06	6.60	7.60	7.67
Conductivity	mS/cm	168[1]	221.5	152.6	513.5	772.0
Dissolved Oxygen % Saturation	%	90-110	56	40.2	75.1	80
Turbidity	NTU	25	103	25	220	300

Table 52 shows that median values for Suspended Solids (SS), Ammonia as N, Total Nitrogen (TN) and Total Phosphorus (TP) all exceeded the DERM (2009) guidelines for 95% ecosystem level protection of SMD upland Central Queensland streams. Median TP and Total Alkalinity levels also exceeded the recommended ANZECC & ARMCANZ (2000) guideline level for Irrigation. None of the physical, major ion or nutrients listed in **Table 51** exceeded ANZECC & ARMCANZ (2000) guideline trigger levels in relation to Stock Watering. While not shown in **Table 51** (as this table only shows data for parameters monitored consistently over the EIS and SEIS sampling programs), median Soluble Reactive Phosphorus (SRP), as measured during the SEIS phase, was 0.02 mg/L, slightly exceeding the DERM (2009) guideline trigger value of 0.015 mg/L for SMD Central Queensland upland streams.

Hancock Prospecting (2011) reported that nutrient concentrations were elevated relative to guideline trigger values. They postulated that the source of elevated nutrients was likely attributable to grazing land use and erosion in the catchment. However, based on testing done as part of the Alpha Coal Project EIS they found that the soils present in the area were largely deficient of major soil nutrients, so soil erosion was unlikely to be the dominant influence on nutrient levels in the local surface waters. The decay of organic matter would be considered a more likely source. As observed both in this study and by Hancock Prospecting (2012) for the Kevin’s Corner SEIS, levels of inorganic Ammonia were much lower than TN, indicating that a significant portion of the nitrogen present was organic in nature. This provides further support for the above theory that the source of elevated nutrients was likely to be the breakdown of organic material. A salient point made by Hancock Prospecting (2011) in relation to the observed elevated nutrient concentrations was as follows:

”The exceedence of the guideline values for nutrient concentrations does not necessarily indicate that the levels are unsustainable or unnatural. Rather it draws attention to the limited scientific data available to characterise natural concentrations, speciation, and variability of nutrients in ephemeral streams and emphasises the need for the Project to maintain reference site water quality monitoring.”

This statement also applies with respect to the Project Water Quality Monitoring Program.

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Table 52. Comparison of percentile ranges for physical, major ion and nutrient parameters measured in the Belyando Catchment as part of the Project baseline monitoring program against relevant guidelines for ecosystem protection, stock watering and irrigation EVs.

Parameter	Units	DERM (2009) Upland Streams of Central QLD	ANZECC & ARMCANZ (2000) Stock Watering Guidelines	ANZECC & ARMCANZ (2000) Irrigation Guidelines	Median	20^{th} percentile	75^{th} percentile	80^{th} percentile
Dissolved Solids (est.)	mg/L		4,000		160.5	116.6	262.3	292.4
Suspended Solids (SS)	mg/L	10			24	11.6	79	175
Total Alkalinity as $CaCO_3$	mg/L			60	70	49.8	77	88.2
Sulphate as $SO4^{-2}$	mg/L		1,000		3	1.8	4	6
Chloride	mg/L				10	7	15.8	17
Calcium	mg/L		1,000		11	7	15.8	16.8
Magnesium	mg/L				5	3	7	7
Sodium	mg/L				10	8	17	18
Potassium	mg/L				9	7	10.8	11.8
Ammonia as N	mg/L	0.02			0.04	0.02	0.07	0.11
Nitrite as N	mg/L		30		0.01	0.006	0.030	0.034
Nitrate as N	mg/L		400		0.020	0.016	0.035	0.040
Nitrite + Nitrate as N	mg/L				0.020	0.018	0.030	0.040
Total Kjeldahl Nitrogen as N	mg/L				0.85	0.50	1.53	1.72
Total Nitrogen as N	mg/L	0.25		5	0.9	0.5	1.6	1.7
Total Phosphorus as P	mg/L	0.05		0.05	0.145	0.050	0.258	0.350
Chlorophyll a	mg/m^3	5			3	2	6.5	8

Table 53 shows percentile range data for metals (total concentrations) measured consistently across the baseline monitoring program and compares these against guideline trigger values for ecosystem protection and Stock Watering. Results in this table show that the 95th percentile for all metals listed in this table except Arsenic were above the ANZECC & ARMCANZ (2000) 95% level ecosystem guideline trigger values where these existed. However, the 80th percentile values were below those trigger values suggesting that at least 80% of the values recorded were within guideline levels. Hence comparisons based on the 95th percentile range were probably skewed by a few very high results at isolated sites. Further, where total metal concentrations are above ANZECC & ARMCANZ (2000) guideline values for ecosystem protection, this does not necessarily indicate that metals are at levels that might result in toxic effects to aquatic biota. Comparisons of dissolved metal concentrations against the ANZECC & ARMCANZ (2000) 95% level ecosystem guideline trigger values provides a better indication of this, as it is the bioavailable metal fraction that produce toxic effects or results in bioaccumulation occurring. Dissolved metal concentrations were measured for the SEIS and the results are presented in **Table 54**.

None of the 95th percentile values exceeded the ANZECC & ARMCANZ (2000) Stock Watering guidelines. Also, the median total concentrations of the metals listed in **Table 53** were below the ANZECC & ARMCANZ (2000) guidelines for Irrigation except for iron. However, the guideline trigger level for iron (of 0.2 mg/L) is related to clogging of infrastructure (drip lines, etc.), rather than animal, plant or human health. The phytotoxic guideline level for short term irrigation (10 mg/L) was exceeded only slightly for the 95th percentile result, indicating there are some occasions when spraying onto foliage may potentially cause harm to plants. Generally, however the levels of iron are generally not of great concern.

Table 54 shows the results for metals added to the monitoring program for the SEIS phase, but only for those that recorded at least some values greater than the limit of reporting (LOR). The only metals for which the 95th percentile value exceeded the ANZECC & ARMCANZ (2000) guideline range for 95% level ecosystem protection were Aluminium and Chromium. Both total and soluble Aluminium concentrations were well in excess of the nominated trigger value, while only the 95th percentile dissolved Chromium value was in excess of the ANZECC & ARMCANZ (2000) ecosystem protection guideline, suggesting that this result may have an artefact of sample analysis. The level of dissolved Aluminium present in the waterways monitored also exceeded the guideline ranges for Stock Watering and Irrigation, while the levels of dissolved Iron were also above the nominated trigger levels given in ANZECC & ARMCANZ (2000) guidelines for Irrigation (although refer to the discussion regarding iron above).

Hancock Prospecting (2011; 2012) reported exceedences of trigger values for protection of aquatic ecosystems in relation to soluble (bioavailable) Copper, Zinc and Aluminium. Exceedences for Copper, Nickel and Aluminium concentrations were consistent across all sites and occasions. Hancock (2011) attributed the elevated soluble concentrations of these metals to erosion of natural sediments from the catchment based on investigations for the Alpha Coal Project EIS showing that clay subsurface materials had Copper concentrations of 20-30 mg/kg, Zinc concentrations of 40-110 mg/kg, and Aluminium concentrations of 60,000 - 100,000 mg/kg.

While not shown here, no exceedences were recorded for any of the organic contaminant parameters (i.e. TPH, PAH, Organic-C and Organic-P pesticides, BTEX, etc.) during the surveys for the SEIS. Only a few samples recorded levels of TPH compounds above the LOR. Those instances may relate to runoff from roads or oil leaks from agricultural machinery. This finding was in accordance with observations made in the China First EIS who noted only a few instances where these compounds exceeded guideline levels in the Belyando Catchment (all in the wet season). Hancock Prospecting (2011) also noted that there were no readings for TPH above the LOR. Combined, these results suggest that the waterways within and adjacent to the Project site currently have negligible levels of organic contaminants present. This is not surprising given that the study area is remote, not near industrial landuse and most waterways sampled were not adjacent to highways and, therefore, not subject to organic contaminant input through road runoff.

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Table 53. Comparison of percentile ranges for total concentrations of metals measured consistently as part of the baseline monitoring program against relevant guidelines for ecosystem protection and stock watering.

Parameter	Unit	ANZECC & ARMCANZ (2000) 95% Ecosystem Protection	ANZECC & ARMCANZ (2000) Stock Watering	ANZECC & ARMCANZ (2000) Irrigation	Median	20th percentile	75th percentile	80th percentile	95th percentile
Arsenic	mg/L	0.013	0.5-5	0.1	0.002	0.002	0.002	0.002	0.0058
Chromium	mg/L	0.001	1		0.003	0.002	0.005	0.005	0.024
Copper	mg/L	0.014	0.4-5	0.2	0.003	0.002	0.005	0.005	0.0146
Nickel	mg/L	0.011	N/A	0.2	0.003	0.002	0.004	0.004	0.0189
Lead	mg/L	0.0034	0.1		0.003	0.002	0.0045	0.0045	0.0156
Zinc	mg/L	0.008	20	2	0.009	0.007	0.011	0.011	0.04
Iron	mg/L	N/A	N/A	0.2	2.68	1.268	5.505	5.505	12.398

Table 54. Comparison of percentile ranges for metals added to the SEIS monitoring program against relevant guidelines for ecosystem protection, stock watering and irrigation

Parameters	ANZECC & ARMCANZ (2000) 95% Ecosystem Protection	ANZECC & ARMCANZ (2000) Stock Watering	ANZECC & ARMCANZ (2000) Irrigation	Median	20th percentile	80th percentile	95th percentile
Dissolved Metals (SEIS Study only)							
Aluminium	0.055	5	5	0.55	0.2	2.172	5.389
Arsenic	0.013	5	0.1	0.001	0.001	0.002	0.002
Chromium	0.001	1		0.0025	0.0016	0.0034	0.00385
Copper	0.014	0.4-5	0.2	0.002	0.001	0.0026	0.0034
Cobalt	N/A	1	0.05	0.001	0.001	0.001	0.001
Nickel	0.011	1	0.2	0.002	0.001	0.002	0.004
Lead	0.0034	N/A	N/A	0.0015	0.0012	0.0018	0.00195

Parameters	ANZECC & ARMCANZ (2000) 95% Ecosystem Protection	ANZECC & ARMCANZ (2000) Stock Watering	ANZECC & ARMCANZ (2000) Irrigation	Median	20th percentile	80th percentile	95th percentile
Zinc	0.008	20	2	0.007	0.007	0.007	0.007
Manganese	1.9	N/A	0.2	0.005	0.0022	0.0458	0.1128
Boron	0.37	5	0.5	0.06	0.06	0.072	0.078
Iron	N/A	N/A	0.2	0.615	0.36	1	2.225
Total Metals (SEIS Study only)							
Aluminium	0.055	5	5	1.6	0.204	3.84	18.82
Cobalt	N/A	1	0.05	0.002	0.001	0.009	0.0188
Manganese	1.9	N/A	0.2	0.229	0.104	0.3332	0.6264
Vanadium	N/A	N/A	0.1	0.035	0.02	0.05	0.05
Boron	0.37	5	0.5	0.085	0.064	0.096	0.1195

10.1.2.4 Comparison with Neighbouring Coal Mine Project Monitoring Data

Hancock Prospecting (2011) presented median and 95th percentile data for various analytes for each site monitored. Those values were based on seven rounds of sampling at each site, of which there were 15 sites in total. In order to establish how the median and 95th percentile values obtained for various parameters as part of the China First baseline water quality monitoring program compare to median values for corresponding analytes obtained by Hancock Prospecting (2011), the following was done. The mean, minimum and maximum values for Hancock Prospecting (2011) median values for each parameter were calculated by summarising across the median values obtained at each of their monitoring sites. The median and 95th percentile values derived from the baseline water quality monitoring program were then compared against those values, as appropriate. Results of these comparisons are shown below in **Table 55** and **Table 56**. Note that results for major ions and cations are not presented as Hancock Prospecting (2011) presented 95th percentile data for these parameters, whereas this study did not regard these parameters as contaminants, so instead presented median value data for them. Note also that the metals listed in **Table 56** are only those for which at least one sample recorded a value greater than the LOR. Further, median values presented in this table for the Project contain a mixture of those derived for total metals across the EIS and SEIS sampling rounds (n=42, four rounds of sampling) and those relating only to sampling carried out as part of the SEIS (n=17, two rounds of sampling).

Results show that apart from median dissolved lead concentrations, the median values obtained for all physico-chemical, nutrient and metal parameters listed in **Table 53** and **Table 54** were within the ranges for median values recorded among the 15 sites monitored as part of the Alpha Coal Project EIS. On this basis, it is concluded that the water quality data collected as part of the Project baseline water quality monitoring program are broadly consistent with those collected as part of the Alpha Coal Project EIS. This finding was expected given that the two projects are regionally directly adjacent to one another and that some of the same waterways were sampled as part of the two studies. However, it is important in the context of potentially being able to adopt the interim local WQO's put forward by Hancock Prospecting (2011) as the interim EA trigger levels for the Project.

Table 55. Comparison between the China First Project median values and Alphas Coal Project median values for select physico-chemical and nutrient parameters

Parameter	Project baseline Median	Alpha Coal Project Medians		
		Mean	Min	Max
Temperature	23.6	25.17	21.7	30.65
pH	7.06	7.32	6.92	7.64
Conductivity	221.5	148.6	91.4	238
Dissolved Oxygen	56	67.6	20.6	96.5
Turbidity	103	121.5	37	212
Suspended Solids	24	32.6	12	78
Nitrite + Nitrate	0.02	0.019	0.01	0.03
Ammonia	0.04	0.031	0.015	0.05
Chlorophyll-a	3	1.6	1	4
Total Phosphorus	0.145	0.073	0.01	0.2
SRP	0.02	0.015	0.01	0.05
Total Nitrogen	0.9	0.8	0.4	1

Table 56. Comparison between China First Project median values and Alpha Coal Project median values for select metal parameters

Parameter	Project 95th percentile	Alpha Coal Project 95th percentiles		
		Mean	Min	Max
Dissolved Metals				
Aluminium	0.55	1.012	0.335	5.593
Arsenic	0.001	0.0015	0.001	0.003
Boron	0.06	0.07	0.05	0.10
Chromium	0.0025	0.001	0.001	0.004
Cobalt	0.001	0.001	0.001	0.002
Copper	0.002	0.003	0.002	0.005
Iron	0.615	1.074	0.339	2.618
Lead	0.0015	0.001	0.001	0.001
Nickel	0.002	0.002	0.002	0.004
Zinc	0.007	0.0964	0.005	0.915
Total Metals				
Aluminium	1.600	2.415	0.478	9.468
Arsenic	0.002	0.002	0.001	0.003

Parameter	Project 95th percentile	Alpha Coal Project 95th percentiles		
		Mean	Min	Max
Boron	0.085	0.061	0.001	0.088
Chromium	0.003	0.003	0.001	0.008
Cobalt	0.002	0.002	0.001	0.003
Copper	0.003	0.007	0.003	0.040
Iron	2.680	3.360	1.560	6.807
Lead	0.003	0.002	0.001	0.003
Manganese	0.229	0.155	0.037	0.342
Nickel	0.003	0.003	0.002	0.006
Zinc	0.009	0.014	0.005	0.055

10.1.2.5 Derived Local Values

A number of water quality parameters routinely exceed the nominated trigger values in the relevant guidelines. Hence, in order to derive suitable discharge license criteria under an EA for the Project, there is a need to develop local water quality objectives (WQOs) for waterways intersecting and downstream of the Project. The development of WQOs needs to be done according to instructions given in ANZECC & ARMCANZ (2000) and DERM (2009).

Firstly, data need to be collected at suitable reference sites. Reference site criteria given in DERM (2009) are as follows:

- no intensive agriculture within 20 km upstream (irrigation, widespread soil disturbance, use of agrochemicals and pine plantations). Dry-land grazing does not fall into this category
- no major extractive industry within 20 km upstream
- no major urban area (>5,000 population) within 20 km upstream
- no significant point source wastewater discharge within 20 km upstream
- seasonal flow regime not greatly altered.

Most of the sites monitored as part of the baseline water quality monitoring program comply with these criteria. The only ones that might not are those associated with farm dams (e.g. SPC-Dam, PC-Dam, BC-Dam), due to the fact that seasonal flow regimes have been significantly altered. Site Alt-AQ14 may also fall into this category as it represents artificially ponded water impounded behind a causeway. Nonetheless, given the remoteness of the study area and the lack of any significant pressures on water quality at those sites, at this stage these sites have been designated as being suitable reference sites for monitoring when establishing local water quality objectives for the Project area. Further, the limited alternative site options in the streams these sites are located on necessitate that they be given this status.

DERM (2009) recommend that in order to be statistically representative, where there are three or more reference sites being monitored, at least 12 data points are required per site and those data should be collected over at least a 12 month period, but preferably over 24 months or more. A minimum of 8 sampling events at each reference site carried out over a minimum of a 12 month period is required to establish interim local water quality objectives.

The baseline water quality monitoring carried out to date for the Project does not meet the data requirements for the number of sampling points taken at each site. A number of sites were only sampled effectively once due to the fact that most were dry during the October 2009 sampling round. Further, only three of the sites sampled 2012 were sampled twice. Moreover, for some of the parameters recommended by DEHP during the public submissions phase, there are only 17 data points. However, Hancock Prospecting (2011) collected 7 sampling rounds of data at 15 sites, most of which were considered as fulfilling the reference site criteria. Based on these data all but fulfilling the minimum requirements to derive interim water quality objectives they put forward interim water quality objectives for a range of parameters. Given that baseline water quality monitoring program data collected thus far for the Project are broadly consistent with those collected by Hancock Prospecting (2011) from the reference sites used to derive their interim water quality objectives, it is proposed that those interim water quality objectives be adopted for the Project until such time as the baseline water quality data are sufficient to derive final water quality objectives for waterways within and adjacent to the Project. Details of the interim water quality objectives put forward by Hancock Prospecting (2011), and proposed for the China First Project are given in **Table 57** and **Table 58**.

Table 57. Interim Local Water Quality Objectives for physico-chemical parameters put forward by Hancock Prospecting (2011).

Parameter	Suggested Interim Local Value	Comment
pH	6.5-7.5	Based on 20th and 80th percentile of sampling results
Turbidity (NTU)	207	Based on 80th percentile of sampling results
EC (µS/cm)	250	Based on ANZECC & ARMCANZ (2000) guidelines
Total Suspended Solids (mg/L)	123	Based on 80th percentile of sampling results
DO%	55.1-85	Based on 20th and 80th percentile of sampling results
Sulphate (mg/L)	1.3	Based on 80th percentile of sampling results
Ammonia (mg/L)	0.05	Based on 80th percentile of sampling results

Table 58. Interim Local Water Quality Objectives for metals, nutrients and major ion parameters put forward by Hancock Prospecting (2011).

Parameters	Units	Suggested Interim Local WQOs	Rationale
Total Phosphorus	mg/L	0.21	Based on 80th percentile of sampling results
Total Nitrogen	mg/L	0.91	Based on 80th percentile of sampling results
Calcium	mg/L	14.2	Based on 80th percentile of sampling results
Nitrite + Nitrate	mg/L	0.076	Based on 80th percentile of sampling results
Fluoride	mg/L	0.1	For aquatic ecosystem protection, based on LOR for PC Titrator

Waratah Coal

Parameters	Units	Suggested Interim Local WQOs	Rationale
Aluminium	mg/L	0.65	Based on 80th percentile of sampling results
Arsenic	mg/L	0.001	For aquatic ecosystem protection, based on LOR for ICP-MS
Boron	mg/L	0.001	For aquatic ecosystem protection, based on LOR for ICP-MS
Cadmium	mg/L	0.0001	For aquatic ecosystem protection, based on LOR for ICP-MS
Chromium	mg/L	0.001	For aquatic ecosystem protection, based on LOR for ICP-MS
Copper	mg/L	0.002	Based on 80th percentile of sampling results
Cobalt	mg/L	0.001	For aquatic ecosystem protection, based on LOR for ICP-MS
Iron	mg/L	1.19	Based on 80th percentile of sampling results
Lead	µg/L	0.001	For aquatic ecosystem protection, based on LOR for ICP-MS
Manganese	mg/L	0.13	Based on 80th percentile of sampling results
Mercury	mg/L	0.0001	For aquatic ecosystem protection, based on LOR for ICP-MS
Molybdenum	mg/L	0.001	For aquatic ecosystem protection, based on LOR for ICP-MS
Nickel	mg/L	0.002	For aquatic ecosystem protection, based on LOR for ICP-MS
Selenium	mg/L	0.01	For aquatic ecosystem protection, based on LOR for ICP-MS
Silver	mg/L	0.001	For aquatic ecosystem protection, based on LOR for ICP-MS
Zinc	mg/L	0.14	Based on 80th percentile of sampling results
Vanadium	mg/L	0.01	For aquatic ecosystem protection, based on LOR for ICP-MS
Uranium	mg/L	0.001	For aquatic ecosystem protection, based on LOR for ICP-MS
TPH (C6-C9)	mg/L	20	Based on Analytical LOR (ALS Method EP080/071)
TPH (C10-36)	mg/L	100	Based on Analytical LOR (ALS Method EP080/071)

10.1.3 End of Pipe discharge Limits

The current design plan for the mine would see limited releases of mine affected water off site, with the only releases expected to occur being associated with controlled releases from sediment ponds under heavy rainfall / high flow conditions. Such releases are expected to occur on average only one in every four years of mine operation.

Typically, Environmental Authorities (EAs) for mine sites stipulate the flow conditions in the receiving environment under which controlled releases are able to occur and End-of-pipe (EoP) contaminant release limits. Most contemporary EAs do not specify a fixed magnitude trigger flow for releases. The release flow trigger is usually expressed as a multiple of the release flow rate (e.g. receiving waterway flow rate must be a minimum of 20 times the release flow rate at the time of release) in order to achieve a satisfactory dilution rate. EoP release limits are typically expressed in relation to ANZECC & ARMCANZ (2000) and / or DERM (2009) trigger values or as some percentile of reference site water quality (e.g. 80th percentile of reference). At this stage there are insufficient data to determine flow release triggers and EoP contaminant limits. In order for these to be determined, the following will be carried out:

- regular (minimum of monthly) monitoring of sediment dams in order to determine the quality of the water potentially released
- further modelling of release rates from the various sediment ponds under different conditions
- further baseline monitoring to determine local water quality objectives
- monitoring at upstream reference sites in relation to release points in order to establish reference data to potentially help inform the EoP contaminant release limits.

10.1.4 Groundwater Resources

The information utilised for assessing the groundwater resources includes information gathered from previous groundwater studies, recent investigations and the DNRM groundwater data base with groundwater bores selected from a wider study area with limits which include key receptors and groundwater users (Easting 360,000 to 490,000; Northing 7,360,000 to 7,478,000 MGA).

10.1.4.1 Alluvial Aquifers

Alluvium is present throughout the Project area associated with drainage channels. Of 254 registered groundwater bores located in the wider study area, only 18 are recorded as being screened within alluvium. Mean Electrical Conductivity (EC) where EC has been recorded is 1385 µS/cm suggesting that shallow groundwater in alluvial aquifers is generally slightly brackish.

10.1.4.2 Tertiary Aquifers

Tertiary groundwater within the study area is dominated by sodium cations and chloride anions. The Tertiary aquifers within the study area are generally slightly brackish, pH neutral, contain low concentrations of trace metals, and in a few instances show elevated nutrient concentrations. The likely cause of the increased nutrient loading may be due to farming practices or general nitrogen movement in shallow systems.

10.1.4.3 Permian Aquifers

Water of the Permian aquifers is dominated by chloride anions, sodium and potassium cations and is classified as sodium - chloride waters. The pH of Permian aquifers is near neutral ranging from slightly acidic to slightly alkaline. Trace metals occur in low concentrations. The water quality within the Permian aquifers is likely to reflect the age of the water and the characteristics of the aquifer material. The Permian aquifers are most permeable in and around the various coal seams.

10.1.4.4 Great Artesian Basin and Associated Aquifers

Landowners' bores located in the Great Artesian Basin (GAB) and associated aquifers reported water quality dominated by sodium and potassium cations and chloride and bicarbonate anions. These are classified as sodium – calcium and chloride–sulfate–bicarbonate waters and are characterised by neutral to slightly acidic pH, and slightly elevated levels of trace metals. The cation-anion results reflect reports by GABCC (2009), which state that the GAB aquifers are generally sodium bicarbonates with chloride and minor carbonate.

10.2 Environmental Values

10.2.1 Surface Water Environmental Values

The Environmental Protection Policy (Water) (2009) does not define Environmental Values for the watercourses through and downstream of the mine site. In the absence of defined Environmental Values, the following site based Environmental Values were developed through the assessment of existing water uses within the receiving waterways of the mine.

10.2.1.1 Aquatic Ecosystems

The receiving waterways of the Galilee Coal Mine are ephemeral in nature and provide seasonal habitat for aquatic fauna and flora. Wetlands mapping for the receiving waterways indicates the presence of wetlands or remnant ecosystems that may contain wetlands along sections of all receiving waterways.

The receiving waterways are considered to be slightly to moderately disturbed from current grazing activities and do not contain any High Ecological Value waters.

10.2.1.2 Irrigation

There are no surface water licenses along Lagoon Creek or Sandy Creek. There are a number of surface water licenses attached to properties along the Belyando River upgradient of the China First Mine. The surface water licenses along the Belyando River downstream of the Galilee Coal Mine are listed in **Table 59**. These licenses include water extraction for irrigation use.

Table 59. Surface water licenses along Belyando River downstream of the Galilee Coal Mine

Licence Number	Licence Type	Purpose	Property Description
48434F	Licence to take water	Domestic Supply	L1 PER207046
55005A	Licence to take water	Irrigation	L3 SP112964
55006A	Licence to interfere by impounding – Embankment or Wall	Impound Water	L3 SP112964
96640A	Licence to take water	Irrigation, Water harvesting	L3 AP112964

10.2.1.3 Farm or Property Use

With cattle grazing as the dominant land use in the catchments of the receiving waterways, it is unlikely that water is extracted from the waterways for farm uses such as milking sheds, piggeries, feedlots or fruit packing.

10.2.1.4 Stock Watering

With cattle grazing as the dominant land use in the catchments of the receiving waterways, it is likely that stock have access to the receiving waterways for watering purposes.

10.2.1.5 Aquaculture

No commercial aquaculture activities are known to occur along the receiving waterways.

10.2.1.6 Human Consumption of Aquatic Foods

It is unlikely that human consumption of aquatic foods sourced from the receiving waterways occurs to any significant degree.

10.2.1.7 Primary Recreation

There are no known recreational facilities along the receiving waterways where primary contact with water is likely to occur frequently (e.g. swimming, waterskiing, etc.). Stormwater discharges from the mine will flow into Jordan Creek downstream of the township of Jericho and primary recreational uses of this section of the waterway are not expected.

10.2.1.8 Secondary Recreation

Given the ephemeral nature of the receiving waterways and the limited public access to the waterways, secondary recreational uses of the waterways (e.g. fishing, boating, etc.) is not expected to occur to any significant degree.

10.2.1.9 Visual Appreciation

Given the ephemeral nature of the receiving waterways and the limited public access to the waterways, there is expected to be limited community appreciation of the aesthetic values of the receiving waterways. Activities such as bushwalking, sightseeing, picnicking, and camping are not common along the receiving waterways.

10.2.1.10 Drinking Water

It is relatively common for riparian pastoral landholders to supplement normal drinking water supplies (i.e. rainwater tanks) during dry periods by accessing groundwater contained in river bed sands / gravels using spear pumps. The extraction of water from river bed sands / gravels is most likely to occur along the Belyando River. License Number 48434F authorises the license holder to extract surface water from the Belyando River for domestic purposes.

10.2.1.11 Industrial Use

There a number of new coal mining projects proposed within the Galilee Basin. These include the Alpha Coal Mine and Kevin's Corner Coal Mine which are proposed to be developed by Hancock Prospecting to the north (downstream) of the Galilee Coal Mine. The extraction of water from the receiving waterways (Lagoon Creek and Sandy Creek) for industrial use is not proposed for any of the downstream mining projects.

10.2.1.12 Cultural and Spiritual Values

The Burdekin Water Quality Plan identified the cultural and spiritual values of the receiving waterways by the Bidjara and Jangga traditional owners.

10.2.1.13 Draft Environmental Values

The assessment of waterway uses for the receiving waterways of the China First Mine confirmed the suitability of the draft Environmental Values identified in the Burdekin Water Quality Improvement Plan for the Sandy Creek and Belyando Floodplain subcatchments. These EVs are summarised in **Table 60**. Draft EVs for the receiving waterways in the Cooper Creek basin are assumed to be the same as those identified for the Sandy Creek subcatchment.

Table 60. Draft Environmental Values for receiving waterways of Galilee Coal Mine

Symbol	Environmental Value	Lagoon Creek & Sandy Creek[1]	Belyando River[2]	Jordan Creek and Tributary[3]
	Aquatic ecosystems (slightly to moderately disturbed)	✓	✓	✓
	Irrigation	X	✓	X
	Farm or property use	X	X	X
	Stock watering	✓	✓	✓
	Aquaculture	X	X	X
	Human consumption of aquatic foods	X	X	X
	Primary recreation	X	X	X
	Secondary recreation	X	X	X
	Visual appreciation	X	X	X
	Drinking water	X	✓	X
	Industrial use	X	X	X
	Cultural and spiritual values	✓	✓	✓

10.2.2 Groundwater Environmental Values

10.2.2.1 Tertiary Aquifers

Groundwater from the Tertiary aquifers within and surrounding the mine site exceeded the ANZECC & ARMCANZ (2000) stock drinking water guidelines for two of the constituents analysed, being Total Dissolved Solids and Nitrite as N. Both of these were exceeded at several of the wells and were at times an order of magnitude above the guideline limits. Trace metals were generally present in concentrations below the ANZECC & ARMCANZ (2000) livestock drinking water criteria.

The Tertiary aquifer groundwater did not exceed the ANZECC & ARMCANZ (2000) irrigation water thresholds for the constituents analysed. Tertiary groundwater can therefore be considered generally suitable for irrigation purposes.

Samples collected from the Tertiary aquifers in and surrounding the mine did not exceed the Australian drinking water standard (NHMRC and NRMMC 2004) guideline values for health for the analytes tested.

The ANZECC & ARMCANZ (2000) freshwater 99% criteria were exceeded on a number of occasions. Nitrogen, nitrate, nitrite and phosphorus exceed ANZECC & ARMCANZ (2000) freshwater 99% criteria within the shallow aquifers; however, they were generally lower than the ANZECC & ARMCANZ (2000) 95% criteria. Copper concentrations were also above the guidelines; however, the observed concentration range of 0.001 – 0.009 mg/L is significantly below both naturally occurring freshwater concentrations and the livestock drinking water guideline of 1 mg/L. Zinc concentrations exceeded the guidelines, with a maximum observed concentration of 4.2 mg/L.

10.2.2.2 Permian Aquifers

Water within the mine lease is currently not used for irrigation purposes; however, chloride, iron, manganese, total P and zinc exceeded ANZECC & ARMCANZ (2000) primary industry guidelines and a number of constituents exceeded the ANZECC & ARMCANZ (2000) freshwater 99% guidelines.

Groundwater from the Permian aquifers was generally below the NHMRC and NRMMC levels for a number of the analytes assessed. Both nickel and cadmium marginally exceeded the guideline levels at one of the wells sampled (War44-15 Retro).

The NHMRC and NRMMC (2010) freshwater 99% criteria were exceeded at a number of the wells. Analytes including ammonia, arsenic, cadmium, chloride, copper, iron and manganese nitrate, nitrate + nitrite, total nitrogen, total phosphorus, total dissolved solids and zinc were present in the Permian aquifers at concentrations greater than those specified in the NHMRC and NRMMC (2010) freshwater 99% guidelines.

10.2.2.3 Great Artesian Basin and Associated Aquifers

Groundwater from the GAB and associated aquifers west of the proposed mine site do not exceed the ANZECC & ARMCANZ (2000) stock drinking water or irrigation guidelines thresholds.

Groundwater from the GAB and associated aquifers did not exceed NHMRC and NRMMC 2004 for the analytes assessed.

The ANZECC & ARMCANZ (2000) freshwater 99% species protection criteria were exceeded at a number of wells and for a number of parameters. Water quality within the GAB and its associated aquifers sampled during a previous study (E3 2010) exceeded the ANZECC & ARMCANZ (2000) freshwater 99% guideline values for copper, nickel, zinc, nitrate, total nitrogen, and phosphorus.

10.3 Potential Impacts on the Environmental Values

The construction and operation of the mine has the potential to impact on hydrological processes in the region. The activities with the highest risk of causing impacts include:

- the clearing of vegetation and topsoils from work sites and stockpiling of overburden on site resulting in sediment movement though overland flow
- the storage of chemicals on site (e.g. hydrocarbons, detergents and degreasers) during construction and operations and the movement of these to streams
- the storage, seepage and overtopping of potentially contaminated water such as tailings water or pit process water in dams and basins at the mine
- the construction and operation of underground mines which may result in subsidence impacting watercourses and drainage in the immediate area
- construction and operational phase water demands
- the construction and operation of diversions to Lagoon Creek, Malcolm Creek and Saltbush Creek in the open cut mine areas
- potential effects on flooding levels in the region resulting from the creek diversions and operation of the mine
- subsidence, changing drainage and recharge patterns
- drawdown of groundwater in the region due to mine dewatering.

The following sections describe the potential impacts relevant to surface water and groundwater

10.3.1 Surface Water Impacts

10.3.1.1 Clearing and Stockpiles

The clearing of vegetation and construction of mine infrastructure (open cut areas, dams and supporting infrastructure) has the potential to increase sediment deposition in streams offsite. Overburden dumps have the highest potential to impact surrounding streams in the event of large storm events prior to full rehabilitation. Potential impacts include:

- siltation of watercourses and aquatic habitat
- irregular and unstable land forms due to gully, channel and bank erosion
- adverse ecological effects from de-silting streams
- reduced ecology and aesthetic value of streams and riparian vegetation
- increased turbidity in the streams
- clogged drainage infrastructure and increased localised flooding, silting and bank damage to trench works and drainage structures
- increased downtime during construction after storm events while these areas are rehabilitated.

10.3.1.2 Chemical and Water Storage

Inappropriately stored and handled chemicals and other hazardous substances have the potential to impact surface waters in and around the mine site during construction and operations. Chemical spills or low-level exposure of the aquatic environment to chemicals (e.g. run-off from machinery, including potential vehicle accidents), would most likely involve hydrocarbon products such as fuels and lubricants. Fuels and chemicals will be stored, transported, handled and used in accordance with relevant legislation, regulations, standards and guidelines. As such, the risk of spillage would be low.

Impacts to aquatic environments during mining operations could also result from seepage or discharge of water containing salts, metals and other potential pollutants from dams and sediment basins located on site. Discharge could occur through failure of dam walls or overflow of dam spillways into surrounding drainage areas which then make their way into adjacent streams or seepage through the walls and base of the dams into unconfined aquifers which transport the contaminants to surface waters.

10.3.1.3 Construction and Operational Phase Water Requirements

Water will need to be sourced for a number of construction activities including:

- dust suppression on cleared construction areas
- moisture adjustment for compaction of engineered fill
- concrete mixing
- construction accommodation village potable water requirements.

Water will also be required during the operational phase for activities such as:

- washing coal
- dust suppression
- underground mining
- overburden drilling
- potable water for the workers village.

Preliminary investigations suggest approximately 6,400 megalitres / year will be required for ongoing operational requirements at the mine site. Based on preliminary water balance modelling onsite water from aquifer pre-drainage, in-pit groundwater, pumping and rainfall runoff into pit voids will meet all low-quality water demands. Options for sourcing an additional 2,500 megalitres / year of raw water to meet the mine's clean water demands include a pipeline from the Burdekin River, groundwater extraction from local aquifers, or desalination of excess mine affected water..

10.3.1.4 Diversions

The diversion of Malcolm, Lagoon and Saltbush Creeks has the potential to impact the flow regime and geormorphic characteristics of the watercourses including:

- Increased flow rates due to constriction of the floodplain through the diverted reaches.
- Increased flow velocities in the diverted reaches leading to increased erosion and sediment load to downstream waterways.
- Increases in upstream flood levels caused by constriction of the floodplain through the diverted reaches. Existing and planned infrastructure such as roads and rail will need to undergo design reviews to ensure they will not be affected by flooding.
- Increase in downstream flood levels and velocities due to increased flow rates caused by the constriction of the floodplain through the diverted reaches.

10.3.1.5 Flooding Effects

It is likely that floodplain encroachment, diversion of flows or impacts associated with drainage structures (i.e. culverts, bridges, etc.) may impact on the waterway system as a result of changed flood behaviour. It is therefore crucial that the existing flow conveyance is managed and this can be achieved by incorporating appropriate creek diversion and waterway management practices into the design for the development of the mine site. This may include implementing sediment and erosion control measures and appropriately designed hydraulic structures (culverts, bridges, etc.).

It is intended that Lagoon, Malcolm and Saltbush Creeks will be diverted to reduce impacts to the mine site and overall environment. The creek diversions will include an appropriately engineered design to ensure that a positive outcome is achieved for the environment.

Impacts to the waterways may include (but are not limited to) scour and sedimentation as a result of increased velocities. It is therefore essential that appropriate scour protection measures are incorporated into the design where scour is likely to occur. Possible changes to flood levels may also occur as a result of waterway encroachment, diversion of flows or impacts associated with drainage structure design (e.g. culverts, piers, abutments etc.). Waterway crossings are likely to be required for mine access roads as well as the rail connection. It is essential that mine infrastructure is located with due consideration for flooding.

Ground subsidence caused by the underground longwall mines has the potential to affect the stability and flow characteristics of the waterways flowing through the underground mining area. Subsidence management strategies have been identified to ensure that these impacts will be monitored and managed progressively during the life of the underground mine.

Development of hydrologic and hydraulic models has already been undertaken to demonstrate that the proposed mine will not adversely affect the hydraulic characteristics of the waterways flowing through the mine lease area.

10.3.2 Groundwater Impacts

The construction and ongoing operations of the underground mines have the potential to cause subsidence directly above the mining areas. Potential impacts would include changed drainage due to ground depressions which may have an effect on the existing hydraulics of surface waters near the mine. The surface water located over the underground mines includes unnamed tributaries of Beta and Lagoon Creeks.

10.3.2.1 Great Artesian Basin

The base of the GAB is defined by the Lower Triassic Dunda Beds and Rewan Formation, a thick aquitard that lies beneath the Clematis Sandstone, the most easterly outcropping aquifer in the GAB. The Clematis Sandstone is part of the GAB recharge beds known as the Eastern Recharge Zone. This zone is 60-70 km wide between Barcaldine and the GAB boundary which lies about 20 km east of Jericho. The western edge of the current mine plan is close to the boundary of the Clematis Sandstone and the Dunda Beds, but the GAB boundary is obscured by Quaternary cover sediments. This means that the mine's footprint is designed to pass beneath the GAB's basal aquitard but will not lie beneath the GAB's basal aquifer. The aquitard has a thickness of about 300 m near the mine site but thins to the west until it pinches out about 40 km from the mine site. The low permeability of the aquitard is likely to protect the groundwater source in the Clematis Sandstone from mining depressurisation effects.

There are mapped recharge springs 30-40km to the west of the GAB boundary within the recharge zone and also to the west of the recharge zone, in the Barcaldine Spring Complex. However, these are not the discharge springs that are protected under the EPBC Act which lists the "*community of native species dependent on natural discharge of groundwater from the Great Artesian Basin*" as an endangered ecological community.

Given the distance of the recharge springs from the mine site, and the protective buffer offered by the Rewan / Dunda aquitard close to the mine site, it is unlikely that any of the springs will lose natural yield.

10.3.2.2 Drawdown and Water Levels

The inflow of groundwater into the open cut pits and longwall panels will lower the elevation of the water table in the shallow aquifer and the potentiometric surface of the deeper groundwater system. A cone of depression will establish around the mine and will recover slowly with time after mining is completed. The natural groundwater flow directions will be affected and in some areas will be reversed. This will have the effect of mobilising waters and causing mixing of different quality waters at rates faster than would occur naturally.

Drawdown will impact bores in the shallow Tertiary and Permian aquifers in the vicinity of the mine. Groundwater models developed for neighbouring mine projects to the north and south of the China First Project have predicted maximum westerly drawdown extents of 10-15 km and easterly extents of about 5 km. As the coal seams dip gently to the west, the effect is less to the east because the coal seams are truncated there by erosion.

The depth to the water table is variable across the mine site, generally being 20-60 m below ground. The water table is shallower along the drainage lines, as evidenced by typical depths of 18-20 m at the town water supply bores at Alpha. Beneath the ephemeral creeks along the eastern edge of the mine site, the water table is likely to be beyond the range of vegetation roots. As a result of the naturally depressed water table, no groundwater dependent ecosystems were identified in proximity to the mine. If mining-induced drawdown were to occur in alluvial sediments, the natural leakage from creeks to the alluvial aquifer could be enhanced but only if the water table or a perched water table intercepts the creek bed.

The average salinity of groundwaters is about 2,500 mg/L but very saline instances are recorded in the DNRM database (up to 60,000 µS/cm). The water is generally suitable for irrigation or livestock watering although some saline aquifers will not be suitable for these uses. Dewatering of the groundwater systems will result in the loss of this groundwater, at least temporarily. The water quality environmental values within the mine footprint area might be affected by mixing fresher water with more saline water.

10.3.2.3 Impact of Subsidence

When underground mining is undertaken, a fractured zone is developed above the mined panels which manifests as subsidence of the land surface. Above the underground mined seams it is likely that the fractured zone will extend to the land surface in places. This is expected to promote enhanced rainfall infiltration for a time, but it is probable that the higher infiltration rates will be short-lived as the cracks will infill with sediment after one or more rainfall events. Apart from intercepting more rainfall, there will be a freshening effect on groundwaters in or above the fractured zone due to the introduction of low-salinity rain water.

The formation of the fractured zone will be accompanied by increases in the permeability and porosity of overburden materials. This will promote higher mine inflows and lower groundwater heads.

Lower hydraulic gradients will occur also in the infilled open cut pits due to the higher permeability of waste rock compared to natural host rock. Enhanced rainfall recharge is likely on the spoil, with the introduction of fresh rain water counteracted by leaching of minerals from the waste rock.

10.3.2.4 Groundwater Contamination

Groundwater contamination will not occur *in situ* but could occur from coal rejects disposal and leaking disposal facilities. The risk of groundwater contamination from spills and leaks (from chemical, fuel and oil storage and handling at workshops and mine operations infrastructure) is low due to the naturally depressed water table.

The potential for impacts from surface storages of rejects, waste, fuel, oil and chemical storages are considered to be low because:

- groundwater levels around the mine are generally deeper and will become deeper due to drawdown around the mine
- appropriately constructed storage and handling will result in low potential for leakages or spills
- the assessment of potential for acid generation and heavy metals impacts from the mine overburden and coal reject indicate a low potential for these impacts.

10.4 Environmental Protection Objectives

10.4.1 Surface Water Resources

The objectives for the protection of surface water environmental values include:

- protect the biological integrity of the disturbed surface water aquatic ecosystem
- ensure the project does not detrimentally impact on the suitability of surface water for agricultural use
- prevent sediment mobilisation to receiving waters through correct implementation, maintenance and monitoring of construction and operations phase stormwater management controls
- prevent the uncontrolled release of mine affected water through appropriate design, monitoring and maintenance of containment structures
- limit potential for clean water contamination through appropriate implementation of the mine water management system
- achieve a dynamic state of equilibrium between the creek diversions and existing waterways through appropriate design, monitoring and maintenance
- ensure people and infrastructure are not placed at undue risk during flood events

10.4.2 Groundwater Resources

The environmental protection objectives for groundwater are to:

- minimize the extent to which the Project has a material impact on the availability and suitability of groundwater for domestic and agricultural uses
- reuse derived groundwater for operational needs in order to minimize operational water deficit requirements.

10.5 Performance Criteria

10.5.1 Surface Water

The protection of surface water values will be measured against the following performance criteria:

- compliance with the requirements of the project's environmental authority
- compliance with regulatory requirements and project commitments through the construction phase of the project

- a construction phase sediment and erosion control plan is prepared and implemented for land disturbing activities
- permanent erosion and sediment controls are implemented, maintained and monitored throughout the life of the project
- separation of “clean” and “dirty” water is maintained and monitored to minimise volume of water that is contaminated
- onsite reuse of mine affected water is maximised to prevent release to receiving waterways and minimise the need to import water from external sources
- release of mine affected water from site is compliant with the conditions of the site’s environmental authority
- disturbed areas are rehabilitated as soon practicable to minimise the contaminant loads to the mine water management system
- the mine water management system is monitored and upgraded in line with progression of the open cut mining schedule
- the hazard category of all regulated structures is reviewed annually
- regulated structures are monitored, maintained and operated to minimise the potential for uncontrolled release in accordance with the site’s environmental authority
- the water management system is designed, constructed and operated to minimise changes to natural flow regime water available for existing downstream users
- baseline water quality monitoring is undertaken to derive site specific water quality objectives
- monitoring of the receiving environment is undertaken throughout the life of the project
- a minimum level of flood protection equivalent to the 1 in 1000 year ARI event is provided for all open cut pits and other critical mine infrastructure
- flood protection levees are identified and managed as regulated structures, monitored and maintained through the life of the project
- flood protection levees and watercourse diversion works do not result in increases to inundation depth, frequency or duration for areas external to the MLA
- watercourse diversions are designed based on the principles outlined in the ACARP and DERM watercourse diversion guidelines
- watercourse diversions are designed such that existing stream characteristics are maintained including bed slope, stream length, geomorphic features and vegetation
- watercourse diversions are monitored and maintained in accordance with license conditions throughout the life of the project
- watercourse diversions are returned to their original alignment where possible prior to relinquishment
- watercourse diversions provide suitable habitat and do not impede passage of aquatic and terrestrial fauna
- watercourse diversions are constructed and maintained such that equilibrium with the natural creeks is achieved prior to relinquishment of watercourse diversion licenses

- watercourse diversions are constructed and established such that sediment mobilisation and transport is minimised from the MLA.

10.5.2 Groundwater

The protection of groundwater values will be measured against the following performance criteria:

- background groundwater quality beyond the predicted zone of mine hydraulic influence will be maintained
- no measurable influence on diffuse recharge areas along the Great Dividing Range during the mine life and post mine closure
- management of the final mine void post closure to minimise the zone of potential impact to the surrounding groundwater environment
- no material impact on surrounding groundwater users.

10.6 Control Strategies

10.6.1 Surface Water

10.6.1.1 Construction Activities

The following management and mitigation measures will be implemented to minimise potential impacts on the environmental values of surface water as a result of construction activities:

- an erosion and sediment control plan will be prepared prior to the commencement of construction activities. The plan will be prepared in accordance with the International Erosion Control Association Best Practice Erosion and Sediment Control Guidelines
- the erosion and sediment control plan will be monitored and reviewed throughout the construction phase of the project and amended to reflect changes in site operations
- construction activities that will affect existing drainage lines and control measures will only be carried out after suitable stormwater management infrastructure has been installed
- areas of disturbed or exposed soil will be managed to minimise the loss of sediment, either through revegetation and / or use of other stabilisation techniques to control erosion and increase energy dissipation
- specific construction activities will only be undertaken during the dry season. No clearing or topsoil removal work will be carried out during heavy rainfall
- stockpiling of topsoil and other material will be located away from watercourses. Usable topsoil will be stripped and stockpiled away from drainage lines to protect it from erosion
- a minimum number of passes by heavy earth moving equipment will also help to minimise erosion and dispersion of soils by the wind. Additionally, upon completion of works, revegetation using local species will take place wherever possible and as soon as practicable considering seasonal influences
- sediment control devices will be routinely inspected after rainfall events and repaired or reinstated where necessary
- water proposed to be released from sediment basins to receiving waters will be tested for quality and ensured that it meets water quality objectives

- ensure there is an adequate supply of water for dust suppression
- installation of permanent drainage structures will occur as soon as practicable to minimise exposure of erosive surfaces
- construction will be sequenced to minimise the time of soil exposure
- if dispersive soils are encountered they will be managed through appropriate use of sediment basins and dosing if necessary
- where possible, major construction will be avoided during the wet season, especially within the floodplain. Additionally, stormwater management measures such as drainage diversions and bunding will be implemented before works occur.

Specific management measures and conditions relating to each watercourse will be established including:

- the area of disturbance must be no greater than the minimum area necessary for the purpose
- the area of bed and banks disturbed by the activities must be stabilised regardless of previous stability
- the extent and duration of bare surface exposure must be minimised, and protected from weathering, rain drop impact, and water runoff
- clean water run-off must be diverted around areas of disturbance where practicable
- bed and bank stability must be managed to minimise erosion and reduce sedimentation
- where practicable, sediment must be captured and retained on-site
- machinery to be used in carrying out the activities must be selected on the basis of a type and size necessary and capable of safe operation to achieve minimal disturbance of the site
- constructed drainage and discharge structures must not alter the natural bed and bank profile.

The potential impacts of mobilisation of contaminants will be mitigated and managed through the following measures:

- bunded storage areas for contaminants will be installed, with spill cleanup kits in accordance with Australian Standards (AS1940 and AS3780) to prevent the contamination of surrounding surface runoff
- all transfers of fuels and chemicals will be controlled and managed to prevent spillage outside bunded areas
- any pollution mobilised in surface runoff, within the construction phase drainage network will be contained
- any significant leakage / spillage will be immediately reported and appropriate emergency clean-up operations implemented to prevent possible mobilisation of contaminants
- any rainfall collected in the bunded areas will be allowed to evaporate or be drained and removed to temporary construction sediment ponds
- any contaminants or major spillages of stored material in the bunded areas will be collected by licensed waste collection and transport contractors for disposal off site at a licensed facility
- waste water from wash down areas will be directed through oil and grease separators and the water directed to temporary construction ponds for re-use

- separated hydrocarbon material will be collected and periodically removed offsite by licensed waste collection and transport contractors to a licensed recycling / disposal facility.

10.6.1.2 Operational Activities

The environmental values of surface water during operational mining activities will be protected through the implementation of a site water management system. The design objectives of the proposed site water management system include:

- to ensure sufficient quantities of water can be obtained for site usage
- to ensure the segregation of "dirty" water from "clean" water
- to ensure the containment of "contaminated" water
- to minimise the accumulation of water in open cut pits by way of drainage diversions
- to maximise the use of "dirty" and "contaminated" water for dust suppression or other purposes and minimise the necessity for importing raw water
- to minimise the volume of mine affected water discharged from the mine site.

A site water management system will be operated with the focus on the separation of "clean" and "dirty" water. Water requirements will be preferentially sourced from "dirty" water run-off collected on site where appropriate. The water within the mine site has been characterised into the following four classes:

- contaminated water – surface runoff from the CHPP, ROM and stockpile areas and water contained within open cut pits. This water is likely to be saline and may also be acidic (low pH) depending on the presence of acid forming material. This water may also contain hydrocarbons of other contaminants such as metals. Runoff from these areas will be managed to prevent discharge to receiving waterways as well as meet on site water demands
- dirty water – surface runoff from spoil dumps and rehabilitated spoil areas that could contain sediments but typically not with elevated contaminant levels (e.g. salts, metals, low pH). This runoff will be directed to sedimentation dams for settling of suspended solids and on-site reuse, with discharge to receiving waters only occurring during significant rainfall events
- clean water – Surface runoff from natural catchments. Surface runoff from natural catchments will not be contained onsite and will pass through the site via creek diversions and bunding of open cut pits. For the purposes of this study, water produced from dewatering of underground mine workings and aquifer pre-drainage is assumed to be low salinity and suitable for re-use as water supply for underground mining
- raw water – Water imported from a reliable external water source that is suitable for uses that require a high specification of water quality (e.g. CHPP vacuum pumps, industrial washdown use and potable supply). It is expected that raw water for the project will be able to be supplied from a proposed SunWater pipeline from the Burdekin River to the Galilee Basin. Raw water for the project may initially need to be sourced from regional groundwater supplies until the pipeline from the Burdekin River is operational.

The site water management system will be designed based on the current open cut mining schedule for Year 1, 5, 10, 20 and 25. As the area of disturbance associated with open cut operations increases the number of dams required will also increase. Dams and structures associated with the various site water management streams will be designed and managed as follows:

- sediment dams

- designed for retention of stormwater runoff to maximise settling of suspended solids and re-use of water to meet on-site demands
- water storage volume based on the maximum contributing catchment area (over the life of mine) and the 1:10 AEP 24 hour duration rainfall depth assuming a 50% volumetric runoff coefficient
- additional sediment storage volume assumed at 20% of settling volume
- re-use of water in dams for supply to underground mines and dust suppression

- clean water dams
  - two clean water dams will be required as balancing storages associated with the mine's raw water supply network
  - dams to be a 'turkey's nest' configuration to prevent contamination from external catchment inflows
  - both dams to be HDPE lined to prevent seepage losses
- process water dams
  - process water dams will be required to manage excess water from the CHPP
  - process water dams will be required to be constructed as a 'turkeys nest' dam or with catchment diversions to prevent external catchment inflow and reduce the risk of overflow
- pit and underground dewatering dams
  - pit dewatering dams will be provided as the primary destination for water pumped from open cut pits to limit groundwater contamination and enable continuation of open cut mining
  - all dewatering dams will be sized based on containment of all wet season inflows to the open cut pits using the Design Storage Allowance (DSA)
  - re-use of water in dams will be preferentially sourced for dust suppression and reuse in underground operations
  - all dewatering dams will undergo an annual hazard and hydraulic compliance assessment in accordance with the Manual for Assessing Hazard Categories and Hydraulic Performance of Dams
  - the dams will be constructed as 'turkey's nests' or with catchment diversions to prevent external catchment inflow and contamination
- environmental dams
  - environmental dams will be provided to manage contaminated runoff from the ROM, product stockpiles and industrial areas. It is expected that runoff from these areas will have potential to be highly saline and contain other contaminants such as metals and hydrocarbons
  - environmental dams will be sized based on containment of all wet season inflows to the open cut pits using the DSA
  - re-use of water in dams will be preferentially sourced for re-use within the CHPP to prevent uncontrolled discharge

  - environmental dams will undergo an annual hazard and hydraulic compliance assessment in accordance with the Manual for Assessing Hazard Categories and Hydraulic Performance of Dams.

Creek diversions and flood protection levees will be required as a part of the clean water management system and also provide flood protection to people and infrastructure. Two separate creek diversions are required prior to commencement of operations.

Malcolm Creek Diversion - The Malcolm Creek diversion is required to protect open cut pits and the mine infrastructure corridor. The off take point for the diversion will occur west of the open cut pits within the infrastructure corridor outside of any influences from underground mine subsidence. The diversion passes through the infrastructure corridor to the existing floodplain where it will tie-in to the Lagoon Creek diversion prior to the downstream lease boundary.

Lagoon Creek and Saltbush Creek Diversion – The Lagoon Creek diversion is required to protect infrastructure including haul roads, train load out facilities and the CHPP. Lagoon Creek will be diverted around the CHPP and into the current alignment of Saltbush Creek. As a result the Saltbush Creek profile will be altered to increase capacity to cater for Lagoon Creek flows. The Lagoon Creek diversion off take will occur directly downstream of the confluence with Beta Creek and Tallarenha Creek. A flow split will occur where the diversion discharges back into Saltbush Creek with the balance of flow discharging back into Lagoon Creek. This split of flow will be self-regulated by the existing capacities of the natural creeks. This flow split will typically only occur during small events (<2 year Average Recurrence Interval (ARI)) due to the limited capacity of the existing creeks.

The design of the proposed creek diversions will be undertaken to maintain a state of dynamic equilibrium and mimic the natural condition as much as practical. The following key aspects will be considered as part of the design process to achieve this goal:

- a meandering alignment chosen (where possible) to maintain original stream length and gradient to prevent bed degradation or aggradation and increases to sediment supply downstream
- no use of hydraulic control structures (e.g. drop structures) within the diversion or any other structure that would require maintenance after relinquishment of the mine lease
- inclusion of in channel features such as benching and low flow channels based on the outcome of the geomorphic review
- compliance with DEHP hydraulic design criteria for stream power, shear stress and velocity to maintain sediment transport equilibrium
- inclusion of in channel features to provide habitat and promote ecological connectivity.

A water management plan will be prepared to examine and address all issues relevant to the importation, generation, use, and management of water associated with the project in order to minimise the quantity of water that is contaminated and released by and from the project. The water management plan will be prepared in accordance with Guideline Preparation of Water Management Plans for Mining Activities (DERM, 2010) and include the following:

- a study of the source of possible contaminants on site
- a water balance model for the site
- details of water management infrastructure including containment structures, channels, diversions, pipes, pumps, and monitoring facilities
- measures to manage and prevent saline drainage
- measures to manage and prevent acid rock drainage

- contingency procedures for emergencies
- a program for monitoring and review of the effectiveness of the water management plan.

10.6.2 Groundwater

The following management and mitigation measures will be implemented to minimise potential impacts on the environmental values of groundwater as a result of construction activities:

- permits will be sought where appropriate for the taking of groundwater
- maintenance of the established groundwater monitoring network
- establishment of a protocol for water balance metering of groundwater volumes pumped from the underground goaves and water pumped from the open cut pits
- regular downloading of water level data from the dataloggers in the monitoring network bores
- storage of water level and water quality in a database
- regular analysis of groundwater data by a qualified hydrogeologist
- establishment of trigger levels at landowner's bores that are likely to be impacted by mining
- in the event of a trigger being breached, a preliminary evaluation will be made by Waratah Coal to determine if further investigation, notification or mitigation is required
- in the event of material impact on a bore in terms of quantity or quality, Waratah Coal will implement an agreed make-good procedure that will either improve the existing supply or provide an alternative supply
- maintenance of a complaints register
- annual analysis and reporting of responses measured in the monitoring network
- annual assessment of the comparison between actual groundwater responses and predicted groundwater responses
- in the event of significant disagreement between actual and predicted responses, instigation of an update to the groundwater model that includes recalibration to the current data set in accordance with National Modelling Guidelines.

10.7 Monitoring

10.7.1 Establishment of Monitoring database

Information collected over the life of all monitoring programs is to be collected in a database for easy future reference. This information is to be held by the operator of the mine and made readily available if requested.

10.7.2 Surface Water Quality

Two forms of additional water quality monitoring will be undertaken as part of the Project Water Quality Monitoring Plan. These are:

- further baseline monitoring
- ongoing compliance monitoring.

The former is required to generate sufficient data to be able to derive water quality objectives for waterways within and adjacent to the Project site. The latter is required to assess impacts of mine-related activities on water quality in the receiving waters downstream of the mine. All sampling would be done in accordance with the DERM (2009b) Monitoring and Sampling Manual.

All physical and chemical surface water data will be validated prior to storage in the monitoring data base and used for interpretation or reporting within one week of collection / receipt.

All data will be reviewed following validation and within two weeks of receipt to allow fulfillment of regulatory reporting requirements and to facilitate timely remedial / management response

10.7.2.1 Further Baseline Monitoring

As discussed previously the current baseline water quality monitoring data set for the Project is not sufficient to derive interim water quality objectives as it stands. At least a further seven rounds of sampling is required for most of the established sites, and the sampling periods, in its entirety, needs to cover at least 12 months. Therefore, based on some sites only sampled in September this year, the baseline monitoring program will potentially need to extend to September 2013.

DEHP's preferred approach is to ideally have water quality sampling carried out under flowing conditions. A key challenge in collecting baseline water quality sampling data in ephemeral streams such as those present within and adjacent to the Project is the short-lived nature of surface water in those streams. A stream flow gauging station was not installed for the Galilee Coal Project. The nearest Queensland Government (Department of Natural Resources and Mines) stream flow gauging stations to the mine are detailed below in **Table 61**.

Table 61. DNRM Stream gauging stations in vicinity of the China First Project

Number	Station Name	Catchment Area (km^2)	Period of Record	Location
120305A	Native Companion Creek at Violet Grove	4,065	1967 to current	30 km SE of mine
003305A	Mistake Creek at Wololla	66	1974 to 1988	58 km SW of mine

Median (50th percentile) monthly flows at these gauging stations are provided below in **Table 62** and indicate that stream flows are most likely to occur during the months November to March. Note the Native Companion Creek has prolonged flow periods compared to the smaller systems within and adjacent to the Project based on visual and anecdotal evidence, so the values presented for Native Companion Creek in **Table 62** are not necessarily representative of flows systems within and adjacent to the Project. Values for Mistake Creek are likely to be more representative of these systems, based on visual observations made during site visits which indicated that Native Companion Creek was still flowing at times when systems closer to the Project site were not. Further to the above, the duration of stream flows is likely to vary significantly between different waterways due to different in soil and groundwater characteristics. The duration of inundation in reaches of creeks containing waterholes (e.g. Lagoon Creek), however, will be longer than the duration of stream flows and this provides opportunities for a somewhat extended sampling period for those systems.

Table 62. Median Monthly Flows (ML) for gauging stations near the Project site.

Month	Native Companion Creek	Mistake Creek
Jan	1,458	58
Feb	4,448	0
Mar	454	0
Apr	1	0
May	0	0
Jun	0	0
Jul	0	0
Aug	0	0
Sep	0	0
Oct	0	0
Nov	7	33
Dec	232	40

To overcome the short-lived nature of surface water presence in the waterways of interest, an intensive sampling program between the wet season and post-wet season period (i.e. December through to May) will be carried out, whereby sampling is conducted on a fortnightly basis following the first flush event of the wet season. Beyond this period, monthly monitoring will continue at sites with remaining surface water until September 2013. This will provide the best opportunity to collect sufficient data for generating local water quality objectives to inform the derivation of EA license conditions.

Notwithstanding access issues or absence of surface water at the time of sampling, monitoring would be carried out at the 20 sites listed in **Table 63**. The nominated sites cover all major waterways within and adjacent to the Project. The parameters monitored will be those listed in **Table 50** that were tested for as part of the SEIS round of sampling carried. It should be noted that sites within the Native Companion Creek sub-catchment have been included as part of baseline monitoring despite results showing that the water quality in this system was quite different to that of most of the waterways sampled within and adjacent to the Project. The reason for this was because this system flows into the Sandy Creek catchment, so it is considered important to monitor Native Companion Creek to understand its contribution to the water characteristics downstream of the Project.

In order to quickly obtain data for highly variable parameters such as EC, pH and DO% and stream height, the installation of gauging stations with automated water quality loggers will be investigated for sites in Lagoon Creek, the main receiving water in relation to the Project.

Ideally these would be located upstream and downstream of the Lagoon Creek release point and / or the confluence of Malcolm Creek and Lagoon Creek. Data loggers can be set up to take readings continuously at 15 minute intervals, so the volume of data generated for EC, pH and DO% is guaranteed to be sufficient to derive local water quality objectives for these parameters 12 months after installation. Further, continuous readings for DO% will provide a much better understanding of variation in DO%, which is critical to understanding aquatic ecosystem condition and functioning.

Table 63. Proposed Baseline Monitoring Sites

Site	Creek	Latitude	Longitude
WQ36	Native Companion Creek	23° 7.263' S	146° 40.980' E
WQ37	Belyando River	23° 2.253' S	146° 47.023' E
WQ41	Saltbush Creek	23° 21.605' S	146° 29.288' E
WQ42	Lagoon Creek	23° 21.096' S	146° 28.526' E
WQ43	Spring Creek	23° 20.028' S	146° 22.324' E
WQ44	Trib. Spring Creek	23° 21.036' S	146° 17.825' E
WQ45	Pebbly Creek	23° 23.105' S	146° 14.072' E
WQ46	Tallarenha Creek	23° 23.882' S	146° 27.703' E
WQ47	Beta Creek	23° 30.524' S	146° 22.440' E
WQ48	Tallarenha Creek	23° 33.366' S	146° 28.305' E
LC-1	Lagoon Creek	23° 20.043’ S	146° 29.120’ E
MC-new	Malcolm Creek	23° 23.863’ S	146° 25.758’ E
PC-Dam	Pebbly Creek	23° 26.333’ S	146° 18.829’ E
Alt AQ14	Lagoon Creek	23° 23.086’ S	146° 27.918’ E
BC-5	Beta Creek	23° 30.897 S	146° 20.387 E
Site04	Saltbush Creek	23° 20.395’ S	146° 29.609’ E
JC-1	Jordan Creek	23° 35.592’ S	146° 08.038’ E
NCC-1	Native Companion Creek	23° 38.563’ S	146° 42.250’ E
AC-2*	Alpha Creek	23° 39.190’ S	146° 38.222’ E
TC-1	Tallarenha Creek	23° 38.093' S	146° 28.449' E

10.7.2.2 Ongoing Monitoring

The purpose of ongoing monitoring is to assess the potential impacts of the Project by carrying out monitoring in reaches upstream and downstream of the mine and determining whether or not:

- the agreed local water quality objectives / license conditions have been met
- the quality of the water entering the mine has been altered excessively as it passes through the mining lease.

For this monitoring component, the intention is to retain baseline monitoring sites where possible so that before and after as well as upstream versus downstream comparisons can be made when assessing potential impacts. However, some baseline monitoring sites may no longer be accessible once the mine goes ahead, so cannot be included as part of the ongoing monitoring program.

Note that due to likely access issues with regards to carrying out sampling within the Alpha Coal Project ML (ML 70426), the downstream extent of monitoring in Spring Creek and Lagoon Creek has been truncated such that the most downstream sites are at the northern boundary of the China First MLA boundary. A similar issue is likely to occur with respect to accessing potential reference sites on Tallarenha Creek within the SGCP MLA (EPC 1049) (see **Figure 26**). However, to assess cumulative impacts, sampling will be carried out in Sandy Creek and the Belyando River downstream of the Alpha Coal Project. Further, should the SGCP go ahead, the reaches of Tallarenha Creek between the SGCP boundary and the Project boundary could be impacted by activities associated with the SGCP. This could potentially result in water entering the Project MLA that is already degraded to an extent that it does not meet the conditions required to maintain local EVs. Nonetheless, monitoring of this reach of Tallarenha Creek is required to determine whether or not there has been any further degradation of water quality as it exits the Project MLA (via Lagoon Creek).

Typically, EAs for coal mines recommend that ongoing monitoring include release point (End of Pipe - EoP) monitoring and sites upstream or downstream of these. At this stage, the location of release points have not been established, but it is assumed likely that there will be at least two: one on Malcolm Creek and the other on Lagoon Creek near the north-eastern boundary of the Project MLA. With that in mind, a number of potential monitoring sites have been nominated for Lagoon Creek, but these may be removed / moved depending on the location of the release points and the availability of alternative sites with surface water present. Precise release point locations will be determined during the detailed design phase.

The sites chosen for ongoing monitoring from the baseline monitoring sites are listed in **Table 64**. In addition to these sites, it recommended that an additional upstream Beta Creek site be sampled as a reference site in relation to potential subsidence impacts that might occur in Beta Creek (most likely this site would be located at the Capricorn Highway Crossing at Beta). It is also recommended that a site be sampled at the junction of Sandy Creek and Belyando River in order to assess the cumulative impacts associated with this Project, the Alpha Coal Project and the SGCP, should it go ahead. Finally, an extra site may need to be added further downstream on Jordan Creek to assess the impacts of stormwater runoff from the Project into this system. A locality map showing both the baseline and ongoing monitoring sites is presented in **Figure 28**.

Ongoing monitoring would occur following significant rainfall that generates flows in the systems being assessed and would be repeated fortnightly for as long as flows persist. Monitoring would also automatically take place in the event that controlled releases of mine affected water occur, with a daily monitoring program at the release points activated for the duration of the release; and additional monitoring taking place at sites upstream and downstream of those release points on the first day the release commences and then weekly until the release ceases.

The parameters monitored would be identical to those listed for the baseline monitoring program, but results would be compared against draft and final local water quality objectives as these are developed and, eventually, to trigger levels listed in the EA once this is in place.

Where downstream values exceed these trigger levels, the downstream values would be compared to the upstream values to assess if an impact warranting further investigation has occurred.

Table 64. Proposed Ongoing Monitoring Sites

Site	Creek	Latitude	Longitude	Rationale
WQ36	Native Companion Creek	23° 7.263'	146° 40.980'	Unimpacted stream that flows into Sandy Creek – potential reference site (particularly in relation to assessing cumulative impacts)
WQ37	Belyando River	23° 2.253'	146° 47.023'	Unimpacted stream that flows into Sandy Creek – potential reference site (particularly in relation to assessing cumulative impacts)
WQ42	Lagoon Creek	23° 21.096'	146° 28.526'	Potential monitoring site in relation to release points
WQ43	Spring Creek	23° 20.028'	146° 22.324'	Downstream impact monitoring site in relation to subsidence
WQ44	trib. of Spring Creek	23° 21.036'	146°17.825'	Upstream reference site or second impact site in relation to subsidence
WQ45	Pebbly Creek	23° 23.105'	146° 14.072'	Upstream reference site in relation to subsidence
WQ46	Tallarenha Creek	23° 23.882'	146° 27.703'	Potential monitoring site in relation to release points
WQ47	Beta Creek	23° 30.524'	146° 22.440'	Impact site in relation to subsidence
WQ48	Tallarenha Creek	23° 33.366'	146° 28.305'	Potential reference site in relation to mine runoff on Tallarenha Creek (Option 1)
LC-1	Lagoon Creek	23° 20.043’	146° 29.120’	Downstream impact monitoring site in relation to release points
MC-new	Malcolm Creek	23° 23.863’	146° 25.758’	Impact site in relation to stream diversion and / or release point
PC-Dam	Pebbly Creek	23° 26.333’	146° 18.829’	Impact site in relation to subsidence
Alt AQ14	Lagoon Creek	23° 23.086’	146° 27.918’	Potential monitoring site in relation to release points
Site04	Saltbush Creek	23° 20.395’	146° 29.609’	Reference site in relation to mine runoff / releases
JC-1	Jordan Creek	23° 35.592’	146° 08.038’	Reference site in relation to mine runoff

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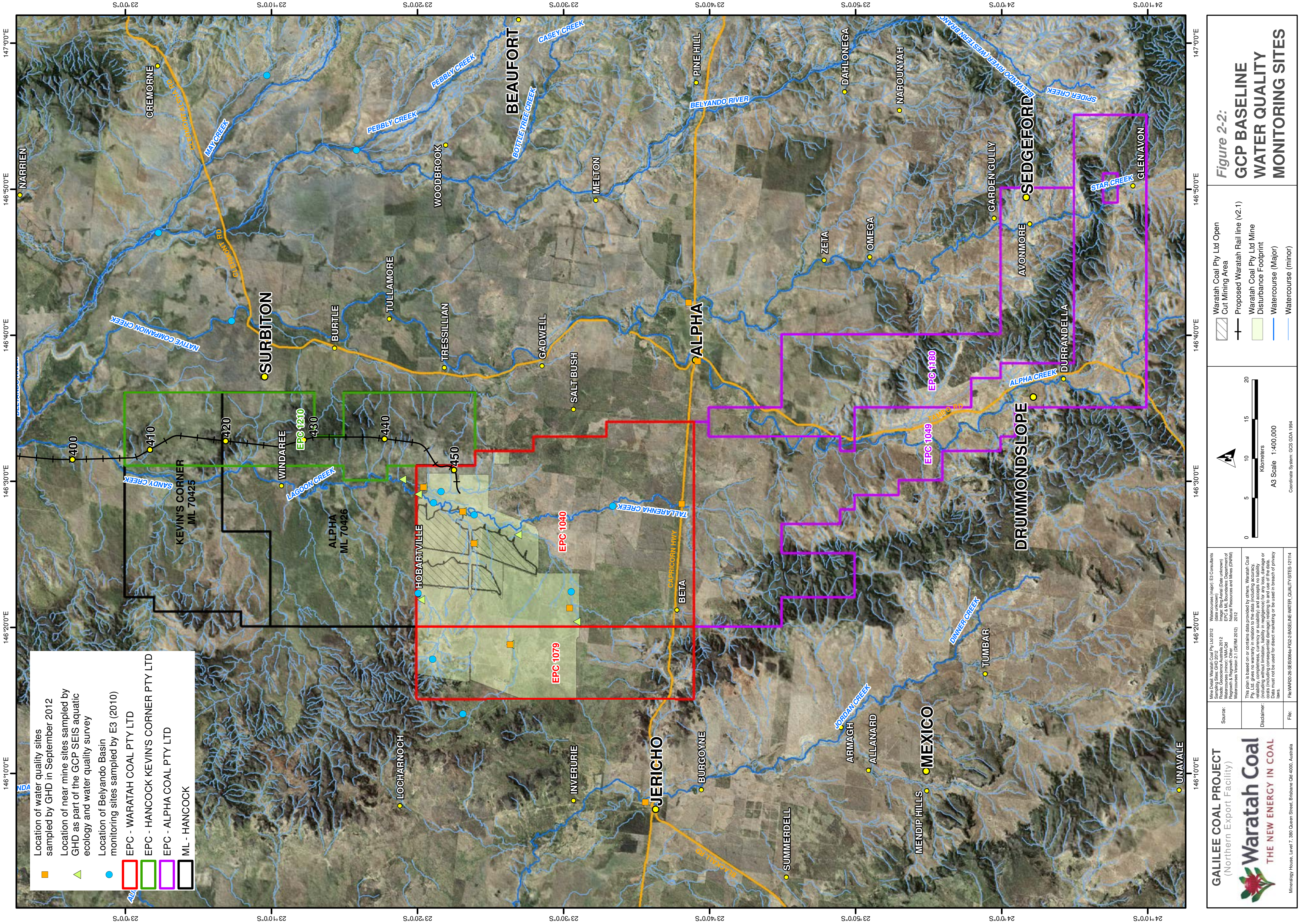
Figure 28. Location of proposed baseline and ongoing water quality monitoring sites under the Project water quality monitoring plan



10.7.3 Groundwater

The overall aims of the groundwater monitoring program are to protect surrounding groundwater and associated surface water environments from site derived impacts, and to provide system response information that will allow continual improvement in groundwater model predictions through periodic recalibration and updating of the model. The impacts can be related to groundwater level or water quality. Thus, monitoring of both groundwater levels and quality is critical to the program and for meeting regulatory compliance targets. Another aim of the program is also to assess the environmental (groundwater related) performance of particular elements of the mine site, providing early warning of potential issues before they result in unacceptable impacts. In this way sources of impacts can be readily identified and targeted remedial / management measures can be implemented proactively.

A network of groundwater monitoring bores is in place within and around the site to facilitate groundwater level and quality monitoring. The original EIS monitoring network has been expanded substantially to give a broader areal coverage over the lease and off-site, and to give vertical head information through the entire stratigraphic column down to the deepest seam to be mined by means of multi-level vibrating wire piezometers. .

The frequency of monitoring is based upon regulatory requirements, providing adequate forewarning of potential issues to allow effective implementation of remedial / management measures; to cater for seasonal variations in groundwater conditions and to provide information on temporal site activities that may result in groundwater issues. Most groundwater bores are equipped with continuously recording data loggers.

All standpipe groundwater monitoring bores are or will be equipped with automated groundwater level monitoring loggers, set to record groundwater level data at a minimum 12 hour intervals. Water level measurements will be made from a designated point marked on the surface casing (i.e. the survey point) of each bore hole when measuring manually.

All bores will be surveyed to height and position relative to agreed site datums.

Groundwater sampling will be undertaken in accordance with the current edition of the DEHP's Water Quality Sampling Manual, or subsequent updated versions. The range of groundwater analytes and the corresponding detection limits will be discussed and agreed with DEHP.

Groundwater quality monitoring parameters include:

- field parameters, pH and electrical conductivity (EC)
- major cations and ions, including total dissolved solids (TDS), calcium, magnesium, potassium, sodium, chloride, sulphate, alkalinity (hydroxide, carbonate, bicarbonate, total), and fluoride
- metals / metalloids, including aluminium, arsenic, boron, cadmium, chromium, cobalt, copper, iron, lead, mercury, manganese, molybdenum, nickel, selenium, silver, uranium, and zinc
- nutrients (total N, NOx, ammonia, phosphorus)
- Total Petroleum Hydrocarbons (TPH) at selected monitoring points.

It is expected that this analyte list will be rationalised over time in consultation with the DEHP once baselines and more critical parameters are established. This process will be used to establish a set of key monitoring parameters and trigger levels for action.

All physical (water level) and chemical groundwater data will be validated prior to storage in the monitoring data base and used for interpretation or reporting within one week of collection / receipt.

All data will be reviewed following validation and within two weeks of receipt to allow fulfillment of regulatory reporting requirements and to facilitate timely remedial / management response.

Notification to the regulating authority will occur within one month of receiving water quality analysis results, should any parameters tested exceed agreed trigger levels.

An annual report of groundwater level and groundwater quality results will be produced. The report will include an assessment of existing or potential groundwater impacts and recommendations for any remedial / management response if necessary. The report will also include recommendations for refinement of the scope of ongoing monitoring.

10.7.4 Creek Diversion Monitoring

A monitoring program for the two creek diversions has been developed to maintain the long term performance of the proposed diversions. The monitoring program has been developed in accordance with the ACARP program Monitoring and Evaluation Program for Bowen Basin River Diversions. Although this program has been developed for diversions within the Bowen Basin the fundamental requirements are considered relevant to any watercourse diversion. There are four key stages to the monitoring program which are summarised in **Table 65**.

Table 65. Diversion Monitoring Program Stages

Monitoring Stage	Objective
Baseline Monitoring	To establish a baseline dataset that can be used for comparison at the time of license renewal or diversion relinquishment.
Construction and Establishment Monitoring	To ensure diversion is constructed to the correct specification through technical oversight of construction and documentation of as constructed works including any amendments from design.
Operations Monitoring	To monitor and evaluate the diversion's performance is consistent with the original design intent.
Relinquishment Monitoring	To demonstrate that the diversion is operating as a watercourse and has reached equilibrium with adjoining reaches.

Baseline Monitoring

Baseline monitoring will be conducted for a minimum of 12 months prior to construction. Monitoring at this stage will ensure a baseline data set is developed to assess the performance requirements for operations and relinquishment monitoring.

Baseline monitoring will be utilized to establish control reaches for the diversions to determine if changes in the diversion are a result of isolated processes or an event affecting the whole stream system. The control reach locations will be located on Tallarenha Creek, upstream of the confluence with Lagoon Creek and on Malcolm Creek directly downstream of the MLA. The exact locations will be determined onsite and adequately marked to ensure consistency in monitoring.

Establish Monitoring Points

Monitoring points will be established within both the upstream downstream reach during baseline monitoring.

The control reach will be 1km long and located upstream from the proposed diversion. The purpose of the control reach is to determine if changes within the diversion reach are the result of isolated processes. The downstream reach will also be 1 km long and located downstream of the diversion to assess impacts on receiving waters.

Monitoring points are to be chosen to accurately represent the characteristics of the reach in question. Points are to be market with a star picket in a position that is unlikely to be effected by erosion, mining or maintenance activities. These same monitoring points will form the locations for the subsequent operational and relinquishment monitoring.

Index of Diversion Condition

The IDC method of recording and monitoring creek diversions will be used for the baseline monitoring in accordance with the ACARP program Monitoring and Evaluation Program for Bowen Basin River Diversions (ID&A, 2001). The IDC method is used to identify potential management issues rather than provide a scientific assessment of a diversion or stream. The IDC method utilises transects within the reaches with indicators for the geomorphic and riparian index assessed in each transect. The indicators for geomorphic index and riparian index are summarised below:

- geomorphic Index Indictors:
  - width of high flow, low flow and active channel
  - bank condition
  - bank piping
  - bed condition
  - proximity of spoil piles from bank
  - recovery
  - in stream structures.
- Riparian Index Indicators:
  - riparian Widths
  - structural stability of vegetation
  - vegetation health and growth rate
  - presence of regeneration
  - longitudinal connectivity of vegetation.

An onsite visual assessment is undertaken to assign a score to each of the indicators at each monitoring transect. These scores are then averaged across each of the monitoring points to obtain an overall score for both the riparian and geomorphic index which are then combined to give a total IDC score of up to 20.

Aerial Photographs

Aerial photographs provide a method for direct comparison of the creek condition and form for comparison with succeeding aerial photographs during operations and relinquishment monitoring. Aerial photographs should be taken not only along the proposed monitored reach but also upstream and downstream to gain a bigger picture of processes occurring within the waterway. The scale of aerial photographs should be of a scale that will allow accurate measurement of the diversion and adjoining waterway.

Survey

Longitudinal and Cross section surveys will be undertaken as part of the detailed design process to ascertain both longitudinal profile and cross sectional characteristics of the existing waterway. Longitudinal survey is to be undertaken through the channel at 10m intervals or less if there is a change in slope or elevation.

Cross section survey will be undertaken at a minimum of 10 cross sections in each reach at a variety of locations that characterise the different channel forms for that particular reach. By undertaking cross sectional survey at the same transects over time changes in channel condition such as bank erosion, deposition, aggradation, formation / loss of benches and channel widening / deepening.

All surveys can be undertaken using any appropriate method provided that it can be demonstrated that that a minimum accuracy of 0.1 m can be achieved.

Vegetation

Vegetation improves the health of a waterway through three main principals;

- collectively vegetation forms a hydraulic boundary layer adjacent the waterway bed and banks where velocities are drastically reduced increasing the resilience of the waterway to high flows
- roots bind the bank holding together soils in the same way that steel reinforces concrete
- vegetation serves an ecological purpose by improving biodiversity and creation of habitat and terrestrial migration corridors.

A vegetation survey will be undertaken prior to detailed design to assist with revegetation of the diversion reach and for comparison during relinquishment monitoring. The survey will include species, abundance and diversity of vegetation in the reach.

Flow Events

No flow data currently exists for Malcolm, Lagoon or Saltbush Creeks as the streams are located within farmland and currently ungauged. During the baseline monitoring stage information regarding the site and frequency of flow events will be approximated by validation of debris marks against hydraulic modelling undertaken in this report.

A summary of the baseline monitoring requirements are outlined in **Table 66.**

Table 66. Baseline Monitoring Requirements

Actions	Purpose
Establish Monitoring points	Establish monitoring points at both the control and downstream reaches. Monitoring points are to be chosen to accurately represent the characteristics of the reach in question
Establish Monitoring database	All information collected during monitoring from baseline to relinquishment stage is to be collected within a database for future reference.
Index of Diversion Condition	The IDC method will be undertaken at four transects for each at each of the control reaches and within the reaches to be diverted. Photographs will be taken to record the condition of the stream or river before works are initiated. Photographs will be taken of the control reach, the reach to be diverted and the downstream reach. It is recommended that photographs be taken from fixed points along the control and diversion reaches to allow future comparisons.
Aerial Photographs	Aerial photos displaying the existing condition of the creeks and also the location of the new diversion will be taken before works begin. The scale of the aerial photo should be sufficient to allow accurate measurements of the diversion and adjoining river or stream.
Survey	A cross section survey and long section survey of the stream or river upstream (Control reach) and downstream (Downstream reach) of the proposed diversion will be conducted as part of diversion detailed design. This information will be useful during relinquishment monitoring to demonstrate the diversion has had no adverse impacts on upstream and

Actions	Purpose
	downstream reaches.
Vegetation	The species, abundance and diversity of vegetation in the reach to be diverted will be recorded prior to diversion detailed design and construction. This information will also be used as part of the revegetation of the new diversion and used for comparison during relinquishment monitoring.
Flow Events	In the absence of flow data, information regarding the site and frequency of flow events will be approximated by validation of debris marks against hydraulic modelling undertaken in this report.

Construction and Establishment Monitoring

Construction and establishment monitoring will start with construction of the diversions and continue until the diversions become operational. It is recommended that the diversions will undergo an establishment phase of approximately 12 months prior to being commissioned. This will be achieved through the use of coffer dams (where possible) to prevent the diversions flowing during the establishment period. During this period it is proposed to utilise the existing watercourses to convey flows through the site.

A summary of the monitoring requirements to be undertaken during this phase are provided in **Table 67**.

Table 67. Construction Monitoring Requirements

Actions	Purpose
Execution Outputs	An execution output database will be developed to record descriptions of the design activities completed. The date of activity and completion will be noted along with details of any accompanying photographs. Design activities not completed to specification are to be recorded through as constructed drawings with an explanation and details of the modified design.
Photographs	Photographs will be taken during and immediately after the construction work is finished. Photographs will be taken from fixed photo points where possible and details such as date, time and weather conditions should accompany the photographs.
Aerial Photographs	Aerial photographs will be taken immediately after diversion construction and establishment has been completed. These photos will accurately display the extent of change and provide a baseline reference for changes that may occur in the future. Additionally, a particular feature of the rehabilitation program may be modified and details of the modification may not be recorded in the database. An aerial photograph may record the modification.
Issued Construction Drawings	A set of diversion construction drawings are to be supplied.
As construction Drawings	As constructed survey is to be undertaken and a set of As Constructed drawings supplied.

Operational Monitoring

Operational monitoring will commence after commissioning of the diversions to assess and maintain the long term performance of the systems. A summary of the operational monitoring requirements is provided in **Table 68**.

A combination of pre-determined frequency and event-based monitoring will be used throughout the life of the creek diversions. This combination represents the most effective strategy for assessing long term trends as well as the direct impacts associated with large defined flood events. The monitoring frequency for the diversions is summarised below:

- event based monitoring for flood events greater than the 10 year ARI event
- pre-determined frequency at 1, 2, 5, 7, 10, 15, 20, 25 and 30 years with the monitoring event taking place directly after the wet season.

Table 68. Operational Monitoring Requirements

Actions	Purpose
Survival of Works	The survival of in stream works including scour protection, timber piling and vegetation should be assessed during this phase of monitoring. Early detection of failure is likely to increase the options for remedial action.
Photographs	Photographs will be taken from fixed photo points along the Control reach, Diversion reach and Downstream reach on an annual basis.
Aerial Photographs	Aerial photographs of the Control reach, Diversion reach and Downstream reach should be taken on an annual basis.
Index of Diversion Condition	The IDC method will be undertaken at four transects for each at each of the control reaches and within diversions. Photographs will be taken to record the condition of the stream within the control and diversion reaches. It is recommended that photographs be taken from fixed points along the control and downstream reaches to allow future comparisons.
Survey	Longitudinal section and cross section surveys should be conducted in the Control reach, Diversion reach and Downstream reach. These surveys should be repeated every 5 years or after a major flood event.
Flow Events	Flow events should be monitored to determine the size of events the diversion has carried.

10.7.5 Relinquishment Monitoring

Relinquishment monitoring will commence at the end of the mine life to demonstrate that the diversions are operating as waterways in dynamic equilibrium and not having an adverse impact on adjoining reaches. A summary of the operational monitoring requirements is provided in **Table 69**.

Table 69. Relinquishment Monitoring Requirements

Actions	Purpose
Stage 1 Survey	Long section and cross section survey will be conducted during the first year of relinquishment monitoring. The survey should include the control reach, diversion reach and downstream reach. This survey should be compared to the 'as built' long section to assess the change in bed elevation.
Stage 1 Evaluation	Survey data from baseline and operational monitoring should be compared with data from relinquishment monitoring. Rates of change for channel top width, cross section area, horizontal displacement and vertical displacement for the control reach, diversion reach and downstream reach should be calculated.
Vegetation Assessment	Detailed vegetation assessment should be conducted during first year of relinquishment monitoring to determine key species absent from Diversion reach but present in Control reach.
Photographs	Photographs should be taken from fixed photo points in the Control, Diversion and Downstream reaches.
Aerial Photographs	Aerial photos of diversion and Control, Diversion and Downstream reaches should be taken on an annual basis.
Stage 2 Survey	A final long section and cross section survey should be conducted prior to application for licence relinquishment.
Stage 2 Evaluation	All data should be evaluated and photographs collated for presentation to regulators.

10.8 Commitments

10.8.1 Surface Water

Waratah Coal will undertake the following commitments with relation to surface water throughout the life of the project:

- implement an erosion and sediment control plan prior to the commencement of construction activities on site
- construct, monitor and maintain all sediment and erosion control devices throughout the construction phase of the project
- undertake all monitoring and sampling techniques in accordance with the DEHP's Water Quality Sampling Manual and applicable Australian Standards
- obtain and operate in accordance riverine protection permits and / or relevant guidelines (as required) for all in stream works as part of construction
- construct all creek diversions with an appropriate establishment period prior to the commencement of operations
- design and operate a site water management system to ensure containment and reuse of contaminated water on site

- design and operate a site water management system with a focus on clean water diversion through the use of creek and drainage diversions such that existing downstream water users are not adversely impacted
- rehabilitate disturbed areas as soon as practicable to minimise sediment mobilisation to receiving waters
- design and operate hazardous dams as regulated structures in accordance with regulatory requirements
- undertake additional baseline water quality modelling prior to the commencement of operations
- design and operate a site water management system to minimise demand on external water resources
- not release contaminants from the site water management system that have the potential to cause environmental harm
- operate and monitor the site water management system in accordance with the site's environmental authority
- develop and implement a receiving environment management plan prior to the commencement of operations
- design and maintain creek diversions to achieve equilibrium with existing water course
- design and construct flood levees for the protection of people and infrastructure with a 1 in 1000 year ARI flood level of immunity
- operate and maintain flood protection levees as regulated structures
- implement a monitoring program for creek diversions to assess long term performance for relinquishment at the cessation of operations
- investigate all substantiated water related complaints and implement corrective actions as necessary.

10.8.2 Groundwater

Waratah Coal will undertake the following commitments with relation to groundwater throughout the life of the project:

- a groundwater monitoring network and program will be commissioned prior to mining to establish background groundwater level and quality conditions providing a basis for mine impact assessment
- the groundwater monitoring bore network and program will be configured to facilitate assessment of potential impacts to surrounding groundwater users and other sensitive areas
- the groundwater monitoring network and program will be modified over time to cater for evolving mine influence during operation and post closure
- a data base of surrounding groundwater users potentially influenced by the mine will be established including relevant bore details as available
- records of any complaints (including basis for the complaint and actions taken) from surrounding groundwater users will be maintained for internal and potential third party / regulatory use
- groundwater monitoring will be conducted in accordance with recognised standards (i.e. AS/NZS 5667.11:1998)

- groundwater monitoring data will be maintained in an appropriate data base with data being reviewed within two weeks of receipt and validated by a qualified and experienced hydrogeologist to facilitate timely response to any issues or potential issues identified
- a formal review of all groundwater monitoring data will be conducted annually by a qualified and experienced hydrogeologist and will include recommendations for any modifications to the program and ameliorative measures considered necessary.

10.9 Proposed Environmental Authority Conditions: Schedule W – Water

Water - General

(W1) Contaminants that will or have the potential to cause serious or material environmental harm must not be released directly or indirectly to any waters except as permitted under the conditions of this environmental authority.

Notification of a Release Event

(W2) The environmental authority holder must notify the administering authority as soon as practical and no later than 24 hours after commencing to release mine affected water to the receiving environment.

Notification must include the submission of written advice to the administering authority of the following information:

a) release commencement date / time
b) expected release cessation date / time
c) release point/s
d) release volume (estimated); receiving water/s including the natural flow rate
e) details (including available data) regarding likely impacts on the receiving water(s).

Note: Modification to the administering authority must be addressed to the Manager and Project Manager of the local administering authority via email or facsimilie.

(W3) The environmental authority holder must notify the administering authority as soon as practicable (nominally within 24 hours after cessation of a release event) of the cessation of a release notified under Condition W2 and within 28 days provide the following information in writing:

a) release commencement date / time
b) natural flow volume in receiving water
c) volume of water released
d) details regarding the compliance of the release with the conditions of Department interest: water of this environmental authority (i.e. contamination limits, natural flow, discharge volume)
e) all in-situ water quality monitoring results
f) any other matters pertinent to the water release event.

Note: Successive or intermittent releases occurring within 24 hours of the cessation of any individual release can be considered part of a single release event and do not require individual notification for the purpose of compliance with Condition W2, provided the relevant details of the release are included within the notification provided in accordance with condition W3.

The controlled release of contaminants to waters must only occur from the release points specified in **Table 70** to this environmental authority.

Table 70. Controlled Contaminant Release Points, Sources and Receiving Waters

Release Point (RP)	Easting (GDA94)	Northing(GDA94)	Contaminant Source and Location	Monitoring Point	Receiving waters description
TBA	TBA	TBA	TBA	TBA	TBA

Note (*) location to be confirmed after detailed design of the dam outlet.

(W4) The release of mine affected waters to waters must not exceed the interim contaminant release limits stated in **Table 71** when measured at the monitoring points specified in **Table 70** for each quality characteristic.

Table 71. Interim Contaminant Release Mine Affected Waters trigger investigation levels

Quality characteristic	Release limits	Monitoring frequency
Electrical conductivity (µS/cm)	2,000 (maximum)	Daily during release (the first sample must be taken within two hours of commencement of release)
pH (pH Unit)	6.5 (minimum) 9.0 (maximum)	Daily during release (the first sample must be taken within two hours of commencement of release)
Total suspended Solids (mg/L)	2,000 (maximum)	Daily during release* (first sample within two hours of commencement of release)
Sulphate ($SO_4$2-) (mg/L)	1,65	Daily during release* (first sample within two hours of commencement of release)

*Note NA – not available, * local trigger values need to be developed*

(W5) The release of mine affected waters to waters from the release points must be monitored at the locations specified in **Table 70** for each quality characteristics and at the frequency specified in **Table 71** and **Table 72**. Monitoring frequency for analytes listed in **Table 72** is monitoring weekly during release with the first sample to be taken within two hours of commencement of release.

Table 72. Controlled Release Contaminant Trigger Investigation Levels (interim levels)

Quality Characteristic	Trigger Levels (maximum)	Comment on Trigger Level Monitoring
Ammonia	0.09	Based on ammonia readings from field sampling and NCC historical data
Nitrate (mg N/L)	9.0	Based on nitrate readings from field sampling and NCC historical data
Flouride (mg/L)	2,000	Protection of livestock and short term irrigation guideline
Aluminium (mg/L)	2	Based on aluminium readings from field sampling and NCC historical data
Arsenic (mg/L)	0.013	For aquatic ecosystem protection, based on SMD guidelines
Boron (mg/L)	0.037	For aquatic ecosystem protection, based on SMD guidelines
Cadmium (µg/L)	0.2	For aquatic ecosystem protection, based on SMD guideline
Chromium (mg/L)	0.001	For aquatic ecosystem protection, based on LOR for ICPMS
Copper (mg/L)	0.006	Based on copper readings from field sampling and NCC historical data

Quality Characteristic	Trigger Levels (maximum)	Comment on Trigger Level Monitoring
Cobalt (mg/L)	0.001	For aquatic ecosystem protection, based on LOR for ICPMS
Iron (mg/L)	2.3	Based on Iron readings from field sampling and NCC historical data
Lead (µg/L)	3.4	For aquatic ecosystem protection, based on SMD guidelines
Manganese (mg/L)	1,900	For aquatic ecosystem protection, based on SMD guidelines
Mercury (µg/L)	0.1	For aquatic ecosystem protection, based on LOR for CV FIMS
Molybdenum (mg/L)	0.001	For aquatic ecosystem protection, based on LOR for ICPMS
Nickel (mg/L)	0.002	For aquatic ecosystem protection, based on SMD guideline
Selenium (mg/L)	0.01	For aquatic ecosystem protection, based on LOR for ICPMS
Silver (mg/L)	0.001	For aquatic ecosystem protection, based on LOR for ICPMS
Uranium	0.001	For aquatic ecosystem protection, based on LOR for ICPMS
Vanadium (mg/L)	0.01	For aquatic ecosystem protection, based on LOR for IPCMS
Zinc (mg/L)	1.015	Based on zinc readings from field sampling and NCC historical data
Boron	370	For aquatic ecosystem protection, based on SMD guideline

Note:

1. All metals and metalloids must be measured as total (unfiltered) and dissolved (filtered). Trigger levels for metal / metalloids apply if dissolved results exceed trigger.

*2. The list of quality characteristics required to be monitored as per **Table 72** will be subject to review once the results of the monitoring data are assessed. If it is determined by consultation that there is no need to monitor for certain individual quality characteristics these can be removed from **Table 72**.*

(W6) If quality characteristics of the release exceed any of the trigger levels specified in **Table 71** during a release event, the environmental authority holder must compare the downstream results in the receiving waters to the trigger values specified in **Table 72**:

1. where the trigger values are not exceeded then no action is to be taken, or
2. where the downstream results exceed the trigger values specified in **Table 71** for any quality characteristic, compare the results of the downstream site to the data from background monitoring sites and
   a) if the result is less than the background monitoring site data, then no action is to be taken, or
   b) where the downstream result exceed the trigger values specified in **Table 72** for any quality characteristics, compare the results of the downstream site to the data from background monitoring sites and:

I. if the result is less than the background monitoring site data, then no action is to be taken; or

II. if the result is greater than the background monitoring site data, complete an investigation in accordance with the ANZECC & ARMCANZ (2000) methodology into the potential for serious or material environmental harm and provide a written report to the administering authority in the next annual return, outlining the details of the investigations carried out and actions taken to prevent environmental harm not authorised under this environmental authority.

Note: Where an investigation is being undertaken in accordance with W6(b)(ii) no further reporting is required for subsequent trigger events for that quality characteristic for actions taken to prevent environmental harm.

(W7) If an exceedence in accordance with condition W6(b)(ii) is identified, the holder of the authority must notify the administering authority.

Contaminant release events

(W8) The environmental authority holder must install, operate and maintain a stream flow gauging station to determine and record stream flows at the locations upstream of each Release Point for any receiving water into which a release occurs.

(W9) The controlled release of contaminants to waters must only take place during periods of natural flow events specified as minimum flow in **Table 73** for the contaminant release point(s) specified in **Table 71**. **Table 72** also specifies the required information that should be recorded continuously if possible, during controlled release events from any of the controlled release points identified in **Table 71**.

Table 73. Interim Release Contaminant Trigger Investigation Levels and recording requirements

Receiving water description	Gauging station description	Latitude or northing (GDA94)	Longitude or easting (GDA94)	Minimum Flow in Receiving Water Required for a Release Event	Flow recording Frequency
TBA	TBA	TBA	TBA	TBA	TBA

Note: to be finalized once the release program is finalised

(W10) Contaminant release flow rate must not exceed 10% of receiving water flow rate.

(W11) The daily quantity of contaminants released from each release point must be measured and recorded at the monitoring points in **Table 70**.

(W12) Releases to waters must be undertaken so as not to cause erosion of the bed and banks of the receiving waters, or cause a material buildup of sediment in such waters.

(W13) The release of contaminants directly or indirectly to waters:

a) must not produce any visible discolouration of receiving waters

b) must not produce any slick or other visible or odorous evidence of oil, grease or petrochemicals nor contain visible floating oil, grease, scum, litter or other objectionable matter.

Notification of release event

(W14) The authority holder must notify the administering authority as soon as practicable (no later than six hours of having commenced releasing water to the receiving environment) and for every 24 hours while releases are occurring and at the cessation of releases. Notification must be in writing (which may be in electronic form) and include:

a) release commencement date / time

b) expected release cessation date / time

c) release point/s

d) if the release limits defined in **Table 70** are exceeded

e) release volume (estimated)

f) receiving water/s including the natural flow rate

g) any details (including available data) regarding likely impacts on the receiving water(s)

h) any actions undertaken by the holder that may have contributed to the release

i) measures that have been taken to prevent or mitigate any potential or actual environmental harm.

(W15) The authority holder must notify the administering authority as soon as practicable, (nominally within 24 hours after of cessation of a release) of the cessation of a release notified under condition W13 and within 28 days provide the following information in writing:

a) release cessation date / time

b) natural flow volume in receiving water

c) volume of water released

d) details regarding the compliance of the release with the conditions of this authority (i.e. contamination limits, natural flow, discharge volume)

e) all in-situ water quality monitoring results

f) any other matters pertinent to the water release event.

Notification of release event exceedence

(W16) The environmental authority holder must, within twenty-eight days of a release that exceeds the conditions of this authority, provide a report to the administering authority detailing:

a) the reason for the release

b) the location of the release

c) all water quality monitoring results

d) any general observations

e) all calculations

f) any other matters pertinent to the water release event.

Monitoring of water storage quality

(W17) Water storages stated in **Table 74**, which are associated with the release points, must be monitored for the water quality characteristics specified in **Table 75** at the monitoring locations and at the monitoring frequency specified in **Table 74**.

Table 74. Water storage monitoring

Water Storage Description	Easting (GDA94)	Northing (GDA94)	Monitoring Location	Frequency of Monitoring
(All regulated dams)	TBA	TBA	Dam Wall	Quarterly

Note: Water monitoring locations and frequency to be provided by proponent upon completion of detailed design.

(W18) In the event that water storages defined in **Table 74** exceed the contaminant limits defined in **Table 75**, the environmental authority holder must implement measures to prevent access to waters by all livestock. Test values are “maximum” with the exception of pH which the test value is “range”.

Table 75. Onsite water storage contaminant limits

Quality characteristic	Contaminant limit
pH (pH unit)	greater than 5 but less than 9
EC (µS/cm)	6,000
Sulphate (mg/L)	1,000
Calcium (mg/L)	1,000
Fluoride (mg/L)	2
Nitrate (mg/L)	400
Aluminium (mg/L) (dissolved)	5
Arsenic (mg/L)	0.5
Cadmium (mg/L)	0.01
Cobalt (mg/L)	1
Copper (mg/L)	1
Lead (mg/L)	0.1
Nickel (mg/L)	1
Zinc (mg/L)	20

Receiving environment monitoring and contaminant trigger levels

(W19) The quality of the receiving waters must be monitored daily during controlled releases from dam/s for each quality characteristic in **Table 76** at the monitoring locations specified in **Table 77**. The monitoring frequency is to be daily during release with the first sample to be taken within two hours of the commencement of release.

Table 76. Receiving waters contaminant trigger levels

Quality characteristic	Trigger level
pH	6.5 – 9.0 (minimum - maximum)
Electrical Conductivity (µS/cm)	700 (maximum)
Suspended solids (mg/L)	1,500 (maximum)
Sulfate (mg/L)	250 (maximum)

Note N/A denotes local trigger value to be determined by the proponent based on 80 percentile of upstream reference site.

Table 77. Receiving water upstream background sites and downstream monitoring points

Monitoring points	Receiving waters location description	Latitude (GDA94)	Longitude (GDA94)
Upstream background monitoring points			
TBA			
Downstream background monitoring points			
TBA			

Note: Water monitoring locations and frequency to be provided by proponent upon completion of detailed design.

(W20) If quality characteristics of the receiving water at the downstream monitoring points exceed any of the trigger levels specified in **Table 76** during a release event, the authority holder must compare the downstream results to the upstream results in the receiving waters and:

1. where the downstream result is the same or a lower value than the upstream value for the quality characteristic then no action is to be taken
2. where the downstream results exceed the upstream results, complete an investigation in accordance with the ANZECC & ARMCANZ (2000) methodology, into the potential for

environmental harm and provide a written report to the administering authority in the next annual return, outlining:

a) details of the investigations carried out

b) actions taken to prevent environmental harm.

Note: Where an exceedence of a trigger level has occurred and is being investigated, in accordance with W20(2)(b) of this condition, no further reporting is required for subsequent trigger events for that quality characteristic.

Receiving Environment Monitoring Program (REMP)

(W21) A REMP must be implemented by three months from the date of issue of the EA to monitor and record the effects of the release of contaminants on the receiving environment periodically and whilst contaminants are being discharged from the site, with the aims of identifying and describing the extent of any adverse impacts to local environmental values, and monitoring any changes in the receiving water.

A copy of the REMP must be provided to the administering authority prior to its implementation and due consideration given to any comments made on the REMP by the administering authority.

For the purposes of the REMP, the receiving environment is the waters of the Lagoon Creek and connected waterways within ten kilometres downstream of the release.

(W22) The REMP report must address (but not necessarily be limited to) the following:

a) description of potentially affected receiving waters including key communities and background water quality characteristics based on accurate and reliable monitoring data that takes into consideration any temporal variation (e.g. seasonality)

b) description of applicable environmental values and water quality objectives to be achieved (i.e. as scheduled pursuant to the Environmental Protection (Water) Policy 2009)

c) any relevant reports prepared by other governmental or professional research organisations that relate to the receiving environment within which the REMP is proposed

d) water quality targets within the receiving environment to be achieved, and clarification of contaminant concentrations or levels indicating adverse environmental impacts during the REMP

e) monitoring for any potential adverse environmental impacts caused by the release

f) monitoring of stream flow and hydrology

g) monitoring of toxicants should consider the indicators specified in **Table 72** to assess the extent of the compliance of concentrations with water quality objectives and / or the ANZECC & ARMCANZ (2000) guidelines for slightly to moderately disturbed ecosystems

h) monitoring of physical chemical parameters specified in **Table 71** and dissolved oxygen saturation, concentration of sulphide and temperature

i) monitoring biological indicators (for macroinvertebrates in accordance with the AusRivas methodology) and metals / metalloids in sediments (in accordance with ANZECC & ARMCANZ (2000) and / or the most recent version of AS5667.12:1999 Water Quality – Sampling - Guidance on Sampling of Bottom Sediments) for permanent, semi-permanent water holes and water storages

j) the locations of monitoring points (including the locations specified in **Table 77** which are background and downstream impacted sites for each release point)

k) the frequency or scheduling of sampling and analysis sufficient to determine water quality objectives and to derive site specific reference values within two years (depending on wet season flows) in accordance with the Queensland Water Quality Guidelines 2009. For ephemeral streams, this should include periods of flow irrespective of mine or other discharges

l) specify sampling and analysis methods and quality assurance and control

m) any historical datasets to be relied upon

n) description of the statistical basis on which conclusions are drawn

o) any spatial and temporal controls to exclude potential confounding factors.

(W23) A report outlining the findings of the REMP, including all monitoring results and interpretations in accordance with condition W20 must be prepared and submitted in writing to the administering authority by (**date to be determined**). This should include an assessment of background water quality, any assimilative capacity for those contaminants monitored and the suitability of current discharge limits to protect downstream environmental values.

Water Reuse

(W24) Mine affected water may be piped or trucked or transferred by some other means that does not contravene the conditions of this environmental authority and deposited into artificial water storage structures, such as farm dams or tanks, or used directly at properties owned by the environmental authority holder for a third party for the purpose of:

a) supplying stock water subject to compliance with the quality release limited specified in **Table 78**

b) supplying water for construction and / or road maintenance in accordance with the conditions of the environmental authority.

Table 78. Stock water release limits

Quality characteristic	Units	Minimum	Maximum
pH	pH units	6.5	8.5
Electrical Conductivity	µS/cm	N/A	5,000

(W25) If the responsibility of mine affected water is given or transferred to another person in accordance with conditions W24:

a) the responsibility for the mine affected water must only be given or transferred in accordance with a written agreement (the third party agreement)

b) the third party agreement must include a commitment from the person utilising the mine affected water to use it in such a way as to prevent environmental harm or public health incidences and specifically make the persons aware of the General Environmental Duty (GED) under section 319 of the *Environmental Protection Act 1994*, environmental sustainability of the water disposal and protection of environmental values of waters

c) the third party agreement must be signed by both parties to the agreement.

Water Management Plan

(W26) A Water Management Plan must be developed by an appropriately qualified and suitable person and implemented prior to the commencement of mining activities.

(W27) The Water Management Plan must:

a) provide for effective management of actual and potential environmental impacts resulting from water management associated with the mining activity carried out under this environmental authority

b) be developed in accordance with the administering authority's guide.

(W28) The Water Management Plan must be developed in accordance with the administering authority's Guideline - *Preparation of Water Management Plans for Mining Activities* and include:

a) a study of the source of contaminants

b) a water balance model for the site

c) a water management system for the site

d) measures to manage and prevent saline drainage

e) measures to manage and prevent acid rock drainage

f) contingency procedures for emergencies

g) a program for monitoring and review of the effectiveness of the Water Management Plan.

(W29) The Water Management Plan must be reviewed each calendar year and a report prepared by an appropriately qualified person. The report must:

a) assess the plan against the requirements under Condition W26

b) include recommended actions to ensure actual and potential environmental impacts are effectively managed for the coming year

c) identify any amendments made to the Water Management Plan following the review.

(W30) The holder of the environmental authority must attach to the review report required by condition W29, a written response to the report and recommended action, detailing the actions taken or to be taken by the environmental authority holder on stated dates:

a) to ensure compliance with the environmental authority

b) to prevent a recurrence of any non-compliance issues identified.

(W31) The review report required by Condition W28 and the written response to the report required by Condition W30 must be submitted to the administering authority with the subsequent annual return under the signature of the appointed signatory for the annual return.

(W32) A copy of the Water Management Plan must be provided to the administering authority on request.

Saline Drainage

(W33) The holder of the environmental authority must ensure proper and effective measures are taken to avoid or otherwise minimise the generation and / or release of saline drainage.

Acid and Metalliferous Drainage

(W34) The holder of this environmental authority holder must ensure proper and effective measures are taken to avoid or otherwise minimise the generation and / or release of acid and metalliferous drainage.

Stormwater and Water sediment controls

(W35) An Erosion and Sediment Control Plan must be developed by an appropriately qualified person and implemented for all stages of the mining activities on the site to minimise erosion and the release of sediment to receiving waters and contamination of storm water.

(W36) Stormwater, other than mine affected water, is permitted to be released to waters from:

a) erosion and sediment control structures that are installed and operated in accordance with the Erosion and Sediment Control Plan required by condition W35

b) water management infrastructure that is installed and operated, in accordance with a Water Management Plan that complies with Condition W26, for the purpose of ensuring water does not become mine affected water.

(W37) The maintenance and clearing of any vehicles, plant or equipment must not be carried out in areas from which contaminants can be released into any receiving waters.

Groundwater

(W38) A groundwater monitoring program must be developed and submitted to the relevant authority for approval before the commencement of mining activities. The monitoring program must:

a) allow for the compilation of representative groundwater samples from the aquifers potentially affected by mining activities

b) include at least twelve sampling events, no more than two months apart over a two year period, to determine background groundwater quality

c) obtain background groundwater quality in hydraulically isolated background bore(s) that have not been affected by any mining activities (once mining activities begin) (if these exist)

d) allow for the identification of natural groundwater water level trends, hydrochemical trigger levels and contaminant levels.

(W39) In addition to Condition W38(a) groundwater quality and levels must be monitored at the locations and frequencies specified in **Table 79**.

Table 79. Groundwater monitoring program

Monitoring Sites	Parameter	Frequency	Purpose
WA3815	Groundwater Level and Chemistry	Continuous	Shallow seasonal response and open cut response
WA4213	Groundwater Level and Chemistry	Continuous	Shallow seasonal response and open cut response
WA4415	Groundwater Level and Chemistry	Continuous	Shallow seasonal response and open cut response
WBR1 (1 piezo)	Groundwater pressure	Continuous	Far-field response near Alpha town supply
WBR2 (5 piezos)	Groundwater pressure	Continuous	Near-field underground mine response
WBR3 (3 piezos)	Groundwater pressure	Continuous	Upgradient resoponse to open cut mine
WBR4 (4 piezos)	Groundwater pressure	Continuous	Upgradient response to underground mine
WBR5 (5 piezos)	Groundwater pressure	Continuous	Near-field underground mine response
WBR6 (2 piezos)	Groundwater pressure	Continuous	GAB response
LP01 (5 piezos)	Groundwater pressure	Continuous	Far-field response near Jericho town supply

Note: Details to be provided by Proponent as part of detailed design

(W40) If groundwater monitoring results greater than the trigger levels (or outside the trigger levels range for pH) specified in **Table 80** are recorded, then the following must be conducted:

a) the relevant monitoring point(s) will be re-sampled and the samples analysed for major cations and anions, and selected dissolved metals including Al, As, Sb, B, Cd, Cr, Co, Cu, Fe, Pb, Hg, Mn, Mo, Ni, Se, Ag, U, Zn

b) if elevated concentrations (above trigger) are recorded on two consecutive sampling events then an investigation into the cause, optimum response, and the potential for environmental harm must be conducted

c) if elevated concentrations are recorded on two consecutive sampling events then the administering authority will be notified within one month of receiving the analysis results.

Table 80. Groundwater contaminant limits and trigger levels

Parameter	Units	Trigger Levels	Contaminant Limits
Dissolved metals			
Aluminum (Al)	µg/L	80th per centile of background details	99th per centile of background data
Antimony (Sb)			
Arsenic (As)			
Iron (Fe)			
Molybdenum (Mo)			
Selenium (Se)			
Silver (Ag)			
Total Dissolved Solids	Mg/L		
Electrical Conductivity	µS/cm		
Major anions and cations			
Sulfate		80th per centile of background details	99th per centile of background data
Calcium			
Magnesium			
Sodium			
Potassium			
Chloride			
Carbonate			
Bicarbonate			
Total Petroleum Hydrocarbons	Ppb		
pH	Unit	6.5 – 8.5	Note: ± 1 pH unit from highest / lowest readings
Groundwater level	For interpretational purpose only		

Notes:

Baseline value ±1.0 pH, means the corresponding variation allowed is 1.0 pH unit above and below average and maximum / minimum pH values determined for the site.

Parameters and sampling frequency will be revised at the end of background sampling, based on results compiled at each monitoring point and proposed land use.

The administering authority and the holder will agree to suitable trigger levels and contaminant limits (per aquifer and season) once sufficient hydrochemical data has been compiled.

(W41) Groundwater contaminant trigger levels for **Table 80** must be finalized based on the Groundwater Monitoring Program approved under Condition W38 and submitted to the administering authority 28 days prior to commencing coal extraction.

(W42) Groundwater monitoring bores must be constructed in accordance with methods prescribed in the Minimum Construction Requirements for Water Bores in Australia – 3rd edition (LWBC), or equivalent.

(W43) The monitoring data must be reported to the administering authority, and must satisfy the following criteria:

a) data collected under the monitoring program will be forwarded to the administering authority on a quarterly basis within 30 business days of the end of each quarter and compiled in an annual monitoring report in a format approved by the administering authority

b) the proponent shall undertake an assessment of the impacts of mining on groundwater after the first 12 months of dewatering commencing and thereafter every subsequent calendar year

c) the annual monitoring report will be forwarded to the relevant authority by the first of March each calendar year

d) The monitoring report will include an assessment of impacts, any mitigation strategies as well as any recommendations for changes to the approved monitoring program

e) if there is a requirement to submit a similar groundwater report as part of any condition issued under a water licence under the *Water Act 2000* then the proponent and the relevant administering authorities may agree for the reports to be combined.

END OF CONDITIONS FOR SCHEDULE W

10.10 Proposed Environmental Authority Conditions: Schedule G – Dams

All Dams

(G1) The hazard category of each dam must be determined by a suitably qualified and experienced person, prior to its construction and at least once every two years thereafter.

(G2) Construction of any dam determined to be in the significant or high hazard category (i.e. a regulated dam) must not be commenced unless the location, basic details, and hydraulic performance of that dam are specifically referenced in this environmental authority.

(G3) On cessation of operation of any dam, that dam must be maintained so as to avoid environmental harm until that dam is decommissioned.

(G4) Prior to the cessation of the environmentally relevant activity, each dam must be decommissioned such that it either:

a) becomes a stable landform, that no longer contains flowable substances

b) is approved or authorised under relevant legislation for a beneficial use

c) is a void authorised by the administering authority to remain after decommissioning

d) is compliant with the rehabilitation requirements of this environmental authority.

Regulated Dams - Location

(G5) The following dams must be wholly located within the control points defined in **Table 81**.

Table 81. Location of regulated dams

Name of Regulated Dam	Easting GDA 94	Northing GDA 94
TBA	TBA	TBA

Note: Details to be provided by Proponent as part of detailed design

(G6) Regulated dams must be consistent with the details in **Table 82**.

Table 82. Details of regulated dams

Regulated dam	Maximum surface area (ha) (*)	Maximum volume of dam (ML) (*)	Maximum depth of dam (m) (*)	Purpose of dam
TBA	TBA	TBA	TBA	TBA

Note: Details to be provided by Proponent as part of detailed design

(G7) All dams must meet the hydraulic performance criteria specified in **Table 83**.

Table 83. Hydraulic performance criteria of regulated dams and mine water management system dams

Regulated dam	Hazard category for failure to contain	Uncontrolled discharge AEP	Hazard category for dambreak	Spillway critical design storm AEP	Mandatory reporting level
Regulated dams					
TBA	TBA	TBA	TBA	TBA	1: 100 AEP 72 hour storm volume below spillway level OR 1:100 AEP wind wave height below spillway level.

Certification and Operation

(G8) Every regulated dam must be constructed in accordance with a certified design plan that has been submitted to the administering authority, and such that the resulting dam will deliver the performance stated in that submitted design plan and that design plan is compliant in all respects with relevant conditions in this environmental authority.

(G9) Construction of a regulated dam must not be commenced unless:

a) the environmental authority holder has submitted to the administering authority two copies of a design plan, together with the certification of a suitably qualified and experienced person that the design of the regulated dam will deliver the performance stated in that submitted design plan and that dam is compliant in all respects with this environmental authority

b) at least twenty business days has passed since the receipt of those documents, or the administering authority notifies the environmental authority holder that a design plan and certification has been received.

(G10) When construction of any regulated dam is complete and prior to commencing operation of that dam, the environmental authority holder must submit to the administering authority two copies of a set of 'as constructed' drawings, together with the certification of a suitably qualified and experienced person that the dam 'as constructed' will deliver the performance stated in that submitted design plan and that dam is compliant in all respects with this environmental authority.

(G11) An operational plan must be kept current for each regulated dam.

(G12) Where an operational plan covers decommissioning and rehabilitation, those operations are to be consistent with the design plan for the dam and the rehabilitation requirements of this environmental authority.

(G13) The environmental authority holder must notify the administering authority as soon as possible, but within twenty-four hours, of the level in any regulated dam reaching the mandatory reporting level (MRL) and must immediately act to prevent or minimize any actual or potential environmental harm.

Regulated Dams - Annual Inspection and Report

(G14) Each regulated dam must be inspected annually by a suitably qualified and experienced person.

(G15) At each annual inspection, the condition and adequacy of each regulated dam must be assessed for dam safety and against the necessary structural, geotechnical and hydraulic performance criteria.

(G16) At each annual inspection, if a mandatory reporting level is required, it must be determined and marked on each regulated dam.

(G17) A final assessment of adequacy of available storage in each regulated dam must be based on a dam level observed within the month of October and result in an estimate of the level in that dam as at 1 November.

(G18) For each annual inspection, two copies of a report on the condition and adequacy of each regulated dam, certified by the suitably qualified and experienced person and including any recommended actions to be taken to ensure the integrity of each regulated dam; must be provided to the administering authority by 1 December.

(G19) The holder of this environmental authority must, within one week of receipt of the annual inspection report, consider the report and its recommendations; and as soon as possible, but within one month of receipt of the annual inspection report, formulate and implement actions to ensure that each regulated dam safely performs its intended functions.

END OF CONDITIONS FOR SCHEDULE G

11. Cultural Heritage

11.1 Background

11.1.1 Non-Indigenous Heritage

A staged assessment process for non-indigenous heritage was undertaken in the mine area, involving a comprehensive review of publically available information together with significant stakeholder consultation and field assessment. No places were identified in the desktop assessment within or in close proximity to the mine area, with the field assessment identifying the Monklands homestead complex, which includes a shearing shed of potential local significance. Development of the mine will require the removal of the Monklands homestead; however, generally the study found that the proposed mine will generally have a minimal impact on places of cultural heritage significance.

11.1.2 Indigenous Cultural Heritage

The approach used for indigenous cultural heritage involves the development of Cultural Heritage Management Plans (CHMPs), proceeding into cultural heritage surveys and development of management plans to provide management measures for ongoing works. Desktop assessments have found that no indigenous cultural heritage sites are listed on local, State, Commonwealth or World heritage registers, including the Aboriginal Cultural Heritage Database and Register within the mine area.

However, the lack of sites identified and registered does not mean no sites are present, with the limited number of detailed archaeological investigations highlighting the limited amount of detailed information documented about the area. It is known, however, that several sites exist in the area in the vicinity of the proposed mine.

To date, specific field surveys for the project have only been conducted in specific areas required for geotechnical purposes. Although the survey reports are confidential in nature, the field surveys have identified some cultural heritage material in the vicinity of the mine site. Sites identified have included isolated artefacts, stone artefact scatters and scared trees.

A series of detailed cultural heritage surveys of the proposed mine area will be undertaken in accordance with the requirements of the agreed CHMPs.

11.2 Environmental Value

The environmental value to be protected is the cultural heritage interest and significance (i.e. aesthetic, historic, scientific and social) of Indigenous and non-Indigenous use and occupation of the project site.

11.3 Potential Impacts on the Environmental Value

11.3.1 Non-Indigenous Heritage

The open cut mine and associated facilities extends over 120 km², which includes three pastoral properties: Kiaora, Glenn Innes, and Monklands. A further area of underground mining will be below the Cavendish, Spring Creek and Lambton Meadows properties.

These properties were originally part of the Hobartville run, which was consolidated from a series of smaller runs in the 1880s. With the consolidation, Hobartville became one of the largest runs in the Alpha district comprising 2,200 km². In the 1890s, however, the Queensland government began resuming parts of

Hobartville under provisions of the *Crown Lands Act 1884*. The blocks Hobartville No 3 and No 5 were part of the resumption. By the 1920s, the area had been subdivided into a number of grazing farm and grazing homestead leases including Cavendish, Kiaora, Monklands and Hazelbush. These blocks have remained substantially unchanged, although for periods some blocks have been amalgamated into larger holdings. Cavendish, for example, included Kiaora and Glen Innes, while Monklands and Saltbush have been worked as a single property for an extended period. Until the 1960s these properties, like most other in the Alpha district, principally carried sheep.

Kiaora has been operated as a separate block for more than 20 years. Most of the current infrastructure on Kiaora has been erected in this period and includes a house, sheds, dams, tanks, yards, windmills and fencing.

The infrastructure on Monklands / Saltbush has been developed from the early 20th century, and includes houses, sheds, yards, shearing shed, tanks, dams and fences.

The shearing shed possibly dates from the 1920s or earlier when the property was first established. It is a relatively small shearing shed with two stands and associated yards. The wool press remains although shearing has long ceased.

On Kiaora, none of the infrastructure has heritage significance as it has all been erected in the past 20 years.

The Monklands homestead complex comprising two houses, sheds and shearing shed could potentially have local significance as an example of a small-scale pastoral property in the Alpha district that was developed in the early 20th century. The shearing shed, in particular, is intact with some machinery and a wool press remaining *in-situ*. Monklands is a typical and good example of a smaller holding that was developed following the resumption of the larger runs in the late 19th century.

The survey and assessment of the mine area revealed that generally the project will have only a minimal impact on places of non-indigenous cultural heritage significance, with the only site identified as potentially significant being the Monklands homestead. This site would potentially meet the threshold for local significance, with evidence of use in this former sheep property in the shearing shed and wire-netting fence. The development of the mine and associated infrastructure will require the demolition or removal of the Monklands homestead complex.

11.3.2 Indigenous Heritage

No listed indigenous cultural heritage will be impacted by the planned mine development; however, there are expected to be potential impacts on some cultural heritage material within the mine development area. In instances where this cannot be avoided, measures to mitigate impacts will be agreed with the Aboriginal parties, in accordance with approved CHMPs.

Items of unrecorded Indigenous cultural heritage may occur near the proposed mine developments, and without appropriate site management initiatives, may be threatened by construction impacts. Unrecorded Indigenous heritage resources within impact areas will be identified during dedicated field surveys conducted by the relevant Aboriginal party as agreed in the CHMP. The conduct of the cultural heritage study and the implementation of site protection or remediation measures will be specified in approved CHMPs, either already agreed or still to be negotiated with each Aboriginal party.

Impact mitigation measures that may be required include avoiding certain highly sensitive areas, carrying out more field investigations including sub-surface testing, recovering datable occupation material, and collecting and relocating cultural heritage items.

11.4 Environmental Protection Objective

The environmental protection objective is to preserve the Indigenous and non-Indigenous cultural heritage values of the project site.

11.5 Performance Criteria

The performance criteria for cultural heritage management are:

- avoidance, where possible, of all heritage places and sites
- CHMPs to be developed in consultation with the relevant Aboriginal parties and complied with for the Project
- compliance with the requirements of the *Aboriginal Cultural Heritage Act 2003* and the CHMPs.

11.6 Control Strategies

11.6.1 Non-Indigenous Cultural Heritage

The development of the mine will result in direct impacts on Kiaora, Glen Innes and Monklands homesteads and surrounding landscapes. The only area currently identified that may contain heritage significance is the Monklands homestead which contains local significance as a former sheep property with evidence of use in the shearing shed and wire netting fence.

An archival recording will be undertaken to include photographs and plans as specified by the DEHP for heritage places. The recording will be undertaken for Kiaora, Glen Innes and Monklands homesteads and surrounding landscape. Copies of the photographic record will be deposited with the State Library of Queensland and the local Alpha library. Significant objects associated with the pastoral industry that the owners may wish to dispose of will be assessed and consideration given to donating to a local or regional museum.

The history and significance of the properties will be incorporated in interpretative facilities associated with the China First mine or in the local area. This will be undertaken prior to the commencement of mine construction works.

More generally, Project design will, where possible, take into account significant heritage sites and places to avoid impacting these sites where possible. Strategies to mitigate potential impacts on unexpected cultural heritage material or sites found during the construction and pre-clearing activities include the following:

- all new employees will be provided with suitable training in how to identify cultural heritage sites or objects and report the find to the Site Environmental Advisor
- all employees will be informed of their obligations to notify the Site Environmental Advisor of any cultural heritage finds
- a permit will be required before any clearing or excavation activities are carried out
- cultural heritage policies will be developed for the management of existing cultural heritage sites or finds
- Site Environmental Advisors will be informed of their obligations to notify the DEHP of any relevant finds
- regular cultural heritage educational sessions will be conducted and educational material distributed as appropriate. This material should inform the employees of what cultural heritage material may look like, and give them clear instructions on what to do if they find any such material.

11.6.2 Indigenous Cultural Heritage

For the management and mitigation of impacts on Indigenous cultural heritage, Waratah Coal will use a range of cultural heritage management processes and proven procedures that have effectively been implemented throughout Queensland, including development of CHMPs. To this end, a CHMP has already been developed and registered with DEHP's Cultural Heritage Unit.

The CHMPs will be implemented in consultation with the Aboriginal party, and in accordance with the requirements of the ACH Act. The mitigation measures included within the CHMPs will be comprehensive and entail a number of possible procedures that will include (but not be limited to):

- in the first instance, avoiding indigenous cultural heritage, wherever practical
- carrying out further detailed field investigations
- collecting and relocating cultural heritage items, as agreed with the relevant Aboriginal parties.

Consideration will be given in particular for their return to the approximate areas (i.e. grid reference locations) from which they were collected (though the rehabilitated area may be dramatically altered in appearance).

Procedures will be implemented early in the planning stages of the project to manage and/or mitigate impact on areas containing cultural heritage in the project site from mining related activities.

Management measures during construction will include:

- cultural heritage induction for the workforce and possible monitoring of specific construction activities
- procedures for the find of human remains
- procedures for unexpected finds
- a conflict resolution process.

In the event that unrecorded cultural heritage sites or materials are discovered in surface or sub-surface deposits during future operations, work at that particular location will cease and be cordoned off as a no-go area until Aboriginal party representatives are contacted to provide advice on the significance of the finds and management / mitigation options. A program of cultural heritage inductions will be implemented at the project and presented by traditional owner representatives to personnel and contractors involved in the construction and the subsequent day to day working of the mine.

Should skeletal material suspected of being of Indigenous human origin be discovered, all operations within 100 m of the skeletal material will cease immediately upon its discovery, and procedures outlined in relevant legislation and the Project's Human Remains Draft Burial Policy will be followed.

Following completion of the project, cultural heritage items recovered prior to construction and objects identified and salvaged during construction may require management and safe-keeping.

11.6.2.1 Fossils

Should significant fossil remains / specimens be identified within the mine, steps will be undertaken to secure and protect the fossils. The Queensland Museum will be notified to allow for their identification and correct preservation and removal.

11.7 Commitments

The following commitments are made in relation to the preservation of Aboriginal cultural heritage and non-Indigenous heritage values associated with the Project area:

- Waratah Coal commits to implementing procedures during site activities that aim to identify, assess and record undetected non-Indigenous heritage sites
- control strategies in the EIS will be implemented to manage known and potential cultural heritage sites and values located within the project site
- conduct regular cultural heritage education sessions/trainings to employees
- development and implementation of a CHMP in consultation with the relevant Aboriginal party, and in accordance with the requirements of the ACH Act.

11.8 Proposed Environmental Authority Conditions – Indigenous and Non-Indigenous Cultural Heritage

There are no proposed conditions for Indigenous and Non-Indigenous Cultural Heritage.

12. Environmental Management

This EM Plan has been developed to outline management measures for potential impacts associated with mining activities conducted under the environmental authority (mining lease) for the Project.

12.1 Environmental Management Framework

The Project operations will take place under an environmental management system, which will be certified against the ISO14001 Standard within the first years of operation. The EMS will incorporate, define and detail the measures used to prevent or minimise environmental harm, ensure compliance and promote continuous improvement.

Prior to construction of the Project, a Construction Environmental Management Plan will be developed to detail management measures to be used during this phase. This will include site wide, and project / aspect specific management measures and, where necessary, job specific management plans.

These overarching management plans and systems will be developed to ensure compliance, continual improvement, and ongoing mitigation. More generally, they will be developed to support the Project environmental, social and economic goals for sustainability, and commitments for the environmental management of impacts defined in this EM Plan.

12.2 Objectives and Targets

The objectives and targets for the project will be defined in more detail during development of the EMS and Project / site specific management plans for construction and operation. Generally, however, the following sustainability goals will guide the Project and the adoption of Objectives and Targets:

- adopt and integrate good management practices for design and construction of all aspects of the Project, including:
    - avoidance or minimisation and mitigation of impacts on ecological processes and habitat values adjacent to construction works
    - the implementation of a water management strategy for conservation and reuse of water
    - developing an energy efficiency strategy which includes cost-effective energy efficiency measures (such as power demand management during construction, natural lighting and ventilation in appropriate locations, fleet management to enhance fuel efficiencies)
    - waste minimisation, management and recycling
    - wise use and re-use of natural resources (such as rock and other spoil)
    - avoidance, minimisation and mitigation of impacts on people, cultural values, communities and community facilities, businesses and other employment
    - the achievement of community benefits in the vicinity of Project worksites
- comply with all applicable laws, regulations, standards and guidelines for protection of the environment

- adopt the best management means available to prevent or minimise adverse environmental impact
- describe monitoring and reporting procedures required to identify impacts on the environment
- describe incident response protocols and procedures, including:
  - lines of authority or responsibility and extent of jurisdiction for categories of incidents
  - an integrated emergency response arrangement and procedures between the emergency services, Queensland Police, hospitals, and traffic management authorities
  - an integrated environmental incident management group
- provide Project employees and contractors with adequate and contemporary training in safety, hazard and risk management, environmental procedures and social obligations
- support the role and function of the local Community Consultation Committees.

12.2.1 Roles and Responsibilities

All personnel managing or working on the Project shall be responsible for environmental management and continuous improvement in performance. All staff will be made aware of their responsibilities during the Project Induction process.

All personnel associated with the Project shall be required to comply with the requirements of all applicable environmental legislation, regulations, codes of practice as well as Project standards, procedures and work instructions. An outline of the environmental responsibilities of key personnel and contractors throughout the life of the Project are shown in **Table 84**.

Table 84. Personnel roles and responsibilities

Specific Role	Responsibilities
Construction or Operations Manager	• Incorporate the EM Plan actions and requirements into the Project specific procedures • Appoint / nominate the Environmental Manager (EM) • Allocate Project resources to manage environmental issues • Ensure suppliers and contractors comply with environmental requirements.
Systems Manager (Quality, Environmental, OH&S)	• Review the Final EM Plan to ensure compliance with AS/NZS ISO 14001. • Ensure that audits of the EM Plan are carried out and reported to the EM and Construction / Operations Manager • Provide advice and support in relation to environmental issues
Environmental Manager (EM)	• Be suitably qualified and have demonstrated experience in construction or operations environmental management • Act freely and independently to take all steps necessary to avoid or minimise adverse environmental impacts, including recommending to the construction or operations manager that activities cease due to inadequate environmental performance • Report to the construction or operations manager on the performance of the EM Plan and improvement opportunities • Review the performance of the EM Plan on a quarterly basis

Specific Role	Responsibilities
	• Review any environmental non-conformances, remediation and preventative actions • Ensure that the EM Plan is effectively established, implemented and maintained at the project level • Review and update the EM Plan and associated documentation • Be present on site during any critical construction activities and provide support to the project team to enable them to meet their environmental commitments • Arrange for environmental inspection and audit programs to be completed • Implement an appropriate environmental awareness training program and assist site personnel to complete the training program • Ensure that environmental records and files are maintained • Ensure community complaints and non-conformances are recorded and appropriately considered and acted upon • Liaise with relevant local authorities regarding works • Liaise with the general public and key stakeholders, as required • Oversee environmental monitoring requirements, as required by approvals, licenses and permits.
Project Engineers and Superintendents	• Implement the EM Plan on site • Report to the EM on environmental issues and non-conformances • Ensure that site personnel are aware of their environmental obligations • Take corrective action to resolve non-conformances.
Site Environmental Officer (SEO)	• Appoint / nominate the Site Environmental Officer (SEO) • Be on site during all construction or operations activities • Undertake daily and weekly site inspections and audits, as required by the EM Plan • Conduct site specific environmental awareness training • Investigate and report on any environmental incidents and ensure that appropriate action is taken • Complete construction inspection checklists and report to the construction environmental manager • Undertake environmental monitoring requirements, as required by approvals, licenses and permits.
Contractors	• Comply with legal and contractual requirements • Comply with management / supervisory directions • Participate in awareness training as directed by management • Notify project management prior to commencement of key activities • Notify the EM / SEO of any non-conformances or potential or actual environmental harm occurring on the site • Regularly report on activities and environmental performance.
All Personnel	• Comply with the relevant Acts, Regulations, Codes of Practice and Standards • Comply with the Environmental Policy and Procedures • Promptly report to management any non-conformances and / or breaches of the system • Participate in awareness training as directed by management. • Comply with management / supervisory directions

12.2.2 General Contractor Requirements

Each construction or operations Contractor will provide an EMP demonstrating their ability to manage their environmental impacts. The Contractor's EMP will identify how the Contractor will achieve the requirements of this EM Plan by defining their management strategies. It will be required to ensure compliance with all conditions, licenses, permits, consents and approvals relating to the construction or operational phases of the Project, relevant to the scope of works being undertaken. Conditions of license will be made available to contractors at the time of tendering for work packages.

12.2.3 Inductions and Staff Training

All personnel associated with the Project shall undergo basic environmental management training as part of the initial safety and environmental induction to inform them of their responsibilities, and to ensure they are aware of their responsibilities and are competent to carry out their work in an environmentally acceptable manner. More intensive training will be undertaken according to a person's role and accountability. This will be modular and will include information on management systems, waste management, ground disturbance procedures, and other items outlined in this EM Plan.

Ongoing instruction shall be provided via modular training packages, toolbox meetings and the like. All inductions and ongoing instruction shall be recorded on a project register to ensure all staff are inducted and receive appropriate training.

All employees (including subcontractors) shall receive awareness instruction in the following areas:

- environmental policies
- EM Plan and related documents
- site environmental objectives and targets
- understanding the regulatory requirements applying to the Project and their consequent responsibilities as a member of the Project team
- potential consequences of departure from procedures
- emergency procedures and responses
- identification of their legal obligations.

Personnel performing tasks that carry higher than standard environmental risks (for example, tree clearing) shall receive additional induction and training in a modular format to further inform them of particular requirements, risks and controls or must be certified as having completed induction and training processes and / or as having gained appropriate experience, before undertaking such tasks.

12.2.4 Communications

12.2.4.1 Internal Communications

'Toolbox' meetings shall be regularly held by each crew during construction and operational activities. During these meetings, concerns and questions raised by personnel shall be addressed and any environmental incidents that occurred previously, discussed. In addition, new environmental management procedures or information shall be discussed to ensure effective implementation. If requested by personnel or felt necessary by the Construction or Operations Manager, Project Engineers or Superintendents, Environmental Manager or SEO, specific environmental management procedures already communicated to personnel will be reiterated during these meetings.

Regular meetings shall be held between the Site Environmental Team (for example Environmental Manager and the Site Environmental Officer), the Construction or Operations Manager and Project Engineers and /or Superintendents to establish the progress of development and the schedule and location of activities over the site.

12.2.4.2 External Communications

All personnel associated with the Project shall undergo basic environmental management training as part of the initial safety and environmental induction to inform them of their responsibilities, and to ensure they are aware of their responsibilities and are competent to carry out their work in an environmentally acceptable manner. More intensive training will be undertaken according to a person's role and accountability. This will be modular and will include information on management systems, waste management, ground disturbance procedures, and other items outlined in this EM Plan.

Ongoing instruction shall be provided via modular training packages, toolbox meetings and the like. All inductions and ongoing instruction shall be recorded on a project register to ensure all staff are inducted and receive appropriate training.

All employees (including subcontractors) shall receive awareness instruction in the following areas:

- environmental policies
- EM Plan and related documents
- site environmental objectives and targets
- understanding the regulatory requirements applying to the Project and their consequent responsibilities as a member of the Project team
- potential consequences of departure from procedures
- emergency procedures and responses
- identification of their legal obligations.

Personnel performing tasks that carry higher than standard environmental risks (for example, tree clearing) shall receive additional induction and training in a modular format to further inform them of particular requirements, risks and controls or must be certified as having completed induction and training processes and / or as having gained appropriate experience, before undertaking such tasks.

12.2.5 Public Communication and Complaint Resolution

Waratah Coal will, when made aware of complaints made by stakeholders and the community, treat such complaints as environmental incidents and will investigate causes and develop resolutions. Complaints management will ensure:

- residents in adjacent properties are made aware in advance of construction activities, including blasting schedules and safety procedures
- residents believe the construction team respond promptly to identified issues and impacts
- potential impacts relating to vegetation removal and other site works which may impact on visual amenity are minimise where practicable.

In implementing the public communication process, consultation will be undertaken with key stakeholders. With respect to traffic controls, consultation will be undertaken with Queensland Police, Queensland Ambulance, Queensland Fire and Rescue Service and Queensland Transport and others where appropriate.

Construction traffic management planning will be adopted to ensure safety and prevent safety concerns regarding shared use of roads.

A communication program will be implemented to targeted residents in the immediate vicinity of pending works and the wider community including:

- regular construction updates
- advice on blasting and construction schedules
- the results of monitoring required by the EM Plan

A complaint responses system will be adopted including promotion and provision of phone, email and website contact details. Enquiries and complaints will be followed up to assist in gauging the community's perceived impacts from the Project on social and economic values and amenity, with a communications register utilised including communication activities, residents' complaints and resolution of complaints.

A number of other actions will be undertaken to manage and pre-empt complaints from the community, including:

- undertake surveys with residents within close proximity of the mine areas on an annual basis to ascertain satisfaction with environmental management and complaint management procedures
- prepare and submit details of monitoring results, audits, training and incidents to Waratah Coal on a monthly basis, with a more detailed overview on an annual basis
- undertake regular reviews of the communications register to ensure enquiries and complaints are being addressed and followed up adequately, and that no systemic issues remain without mitigation measures being put into place
- significant complaints and community issues will be reported to regulatory agencies where required
- appropriate personnel will undertake adequate environmental awareness training covering the requirements of the EM Plan regarding community liaison, incidents and complaints.

12.2.6 Monitoring and Reporting

An Environmental Monitoring Plan will be developed as part of the detailed EMPs and the EMS for the Project, which will document the overall site monitoring requirements, or links to specific documentation, to ensure monitoring is undertaken in accordance with the Environmental Authority and commitments made for the Project. The Monitoring Plan will outline the environmental monitoring to be undertaken, including monitoring sites, parameters and their frequency of measurement and also make reference to monitoring procedures and records. The plan will be made available to the administering authority on request.

Reporting of results of monitoring, auditing and general environmental performance will be undertaken on a recurring basis within the mine site (i.e. to the Construction or Operations Manager, Environmental Manager) and to Waratah Coal. Environmental incidents will be reported as outlined in the following section.

Additional reporting requirements will include (but not be limited to):

- anuual returns as required under the Environmental Authority
- National Pollutant Inventory reporting as necessary
- National Greenhouse and Energy Reporting as necessary.

12.2.7 Environmental Incident Response

The EP Act (s.320) requires that any person who becomes aware of any event or incident that may cause or has caused environmental harm to report the event or incident to the appropriate operational manager. Environmental incidents are defined as being any breaches or non-adherences to objectives and procedures prescribed in the EM Plan and environmental management procedures applied to the Project by Waratah Coal, including non-compliance with Project approval / Environmental Authority conditions. These incidents are to be reported to the SEO by the person responsible for the incident or the first person at the site of an incident. The SEO shall notify the Environmental Manager and the Construction or Operations Manager, who will consider whether the incident resulting may be a breach of statutory conditions and be responsible for any resulting notification. Waratah Coal may elect to notify authorities of incidents that are not breaches of statutory requirements.

Environmental incidents shall be assigned a level of severity, as defined below for this Project:

- **LEVEL 1**: Minor non-adherence to procedure, and a negligible environmental impact
- **LEVEL 2**: Minor non-adherence to procedure and minor environmental impact that requires little management to be rectified
- **LEVEL 3**: Moderate breach of procedure and / or an environmental impact that requires management / mitigation to be rectified that could lead to a breach of environmental approval conditions.
- **LEVEL 4**: Extreme breach of procedure and / or environmental impact that has or is likely to cause a breach of environmental approval conditions.

The level of the environmental incident shall be determined by the relevant Project Engineer, EM and SEO with advice from Waratah Coal's environmental consultants, if required.

The procedures may vary depending on the level of incident occurring. Contingency actions specific to incidents are described in the individual component management plans contained in this EM Plan and will be detailed in the Construction and Operation EMPs and EMS.

12.2.8 Documentation

Waratah Coal will maintain an Environmental Management System which be managed and maintained in accordance with ISO 14001 standards. Documentation relating to environmental issues during construction and operational phases comprises this EM Plan, permits, Works Approvals, licences and Contractors' EMPs, and will be referenced in the site EMS. This documentation shall be made available via a site intranet.

The relevant Project Engineer shall be responsible for issuing this documentation to contractor personnel and maintaining an inventory of documentation distribution. They shall be responsible for ensuring all document holders receive updates to the documents which may be made from time to time.

12.2.9 Maintenance and review

The EM Plan is an overarching strategic document which outlines the Project's overall environmental commitments to assist DEHP to prepare the Environmental Authority for the project. It is used as a planning document for the mining activities to provide the operator with a strategic framework for environmental management that is consistent with the EA.

The EM Plan will be updated on any amendment to the EA, and when the amendment is proposed by Waratah Coal, the amended EM plan will be re-submitted with the proposed EA amendment application. In addition, periodic review of the environmental management documents and systems will include review of the EM Plan. Amendments will be made where required, with any material changes to the EM Plan (comittments, deviations from the Environmental Authority) discussed with DEHP and approval sought if required.

Continual review and updating of site EMPs and the EMS will ensure they remain current, with any issues rectified and the continual improvement approach utilised in improving site management over time.

Any relevant changes will be communicated to relevant project personnel via 'Toolbox' meetings.

12.2.10 General Environmental Management Actions

12.3 Environmental Auditing and Review

The key objective of the Environmental Auditing and Review program is to monitor and report on compliance with the Environmental Authority, Plan of Operations, site EMPs this EM Plan and the EMS. Waratah Coal will conduct environmental audits to assess compliance with regulatory requirements and the performance of the site EMS and its implementing strategies and procedures.

The program will comply with legislative repoting obligations, in addition to general annual auditing of internal processes as part of the EMS continuous improvement objective, and audits will include comparison against (but not be limited to):

- commitments and performance objectives of this EM Plan, site EMPs and the EMS
- legislative requirements, including the 'General Environmental Duty' (Section 319 of the EP Act)
- Environmental Authority and other approval conditions
- the Project Objectives and Targets
- the continual improvement comittments of the Project and the EMS.

13. Definitions

Words and phrases used throughout this licence are defined below except where identified in the *Environmental Protection Act 1994* or subordinate legislation. Where a word or term is not defined, the ordinary English meaning applies, and regard should be given to the Macquarie Dictionary.

"**acceptance criteria**" means the measures by which the actions implemented to rehabilitate the land are deemed to be complete (same as completion criteria).

"**administering authority**" means the Department of Environment and Heritage Protection or its successor.

"**airblast overpressure**" means energy transmitted from the blast site within the atmosphere in the form of pressure waves. The maximum excess pressure in this wave, above ambient pressure is the peak airblast overpressure measured in decibels linear (dBL).

"**appropriately qualified person**" means a person who has professional qualifications, training, skills or experience relevant to the nominated subject matter and can give authoritative assessment, advice and analysis on performance relative to the subject matter using the relevant protocols, standards, methods or literature.

"**assess**" by a suitably qualified and experienced person in relation to a hazard assessment of a dam, means that a statutory declaration has been made by that person and, when taken together with any attached or appended documents referenced in that declaration, all of the following aspects are addressed and are sufficient to allow an independent audit at any time:

a) exactly what has been assessed and the precise nature of that assessment

b) the relevant legislative, regulatory and technical criteria on which the assessment has been based

c) the relevant data and facts on which the assessment has been based, the source of that material, and the efforts made to obtain all relevant data and facts

d) the reasoning on which the assessment has been based using the relevant data and facts, and the relevant criteria.

"**authority**" means Environmental Authority (mining activities) under the *Environmental Protection Act 1994*.

"**bed and banks**" for a waters, river, creek, stream, lake, lagoon, pond, swamp, wetland or dam means land over which the water of the waters, lake, lagoon, pond, swamp, wetland or dam normally flows or that is normally covered by the water, whether permanently or intermittently; but does not include land adjoining or adjacent to the bed and banks that is from time to time covered by floodwater.

"**beneficial use**" in respect of dams means that the current or proposed owner of the land on which a dam stands, has found a use for that dam that is:

a) of benefit to that owner in that it adds real value to their business or to the general community

b) in accordance with relevant provisions of the *Environmental Protection Act 1994*

c) sustainable by virtue of written undertakings given by that owner to maintain that dam, and

d) the transfer and use have been approved or authorised under any relevant legislation.

“**blasting**” means the use of explosive materials to fracture:

- rock, coal and other materials
- structural components or other items to facilitate removal from a site or for reuse.

"**bunded**" means within bunding consistent with Australian Standard 1940.

“**certification**”, “**certifying**” or “**certified**” by a suitably qualified and experienced person in relation to a design plan or an annual report regarding dams, means that a statutory declaration has been made by that person and, when taken together with any attached or appended documents referenced in that declaration, all of the following aspects are addressed and are sufficient to allow an independent audit at any time:

a) exactly what is being certified and the precise nature of that certification

b) the relevant legislative, regulatory and technical criteria on which the certification has been based

c) the relevant data and facts on which the certification has been based, the source of that material, and the efforts made to obtain all relevant data and facts, and

d) the reasoning on which the certification has been based using the relevant data and facts, and the relevant criteria.

“**chemical**” means:

a) an agricultural chemical product or veterinary chemical product within the meaning of the Agricultural and Veterinary Chemicals Code Act 1994 (Commonwealth), or

b) a dangerous good under the dangerous goods code, or

c) a lead hazardous substance within the meaning of the Workplace Health and Safety Regulation 1997, or

d) a drug or poison in the Standard for the Uniform Scheduling of Drugs and Poisons prepared by the Australian Health Ministers’ Advisory Council and published by the Commonwealth, or

e) any substance used as, or intended for use as:

   i. a pesticide, insecticide, fungicide, herbicide, rodenticide, nematocide, miticide, fumigant or related product, or

   ii. a surface active agent, including, for example, soap or related detergent, or

   iii. a paint solvent, pigment, dye, printing ink, industrial polish, adhesive, sealant, food additive, bleach, sanitiser, disinfectant, or biocide, or

   iv. a fertiliser for agricultural, horticultural or garden use, or

f) a substance used for, or intended for use for:

   i. mineral processing or treatment of metal, pulp and paper, textile, timber, water or wastewater, or

   ii. manufacture of plastic or synthetic rubber.

"**commercial place**" means a place used as an office or for business or commercial purposes, other than a place within the boundaries of the operational land.

“**competent person**” means the demonstrated skill and knowledge required to carry out the task to a standard necessary for the reliance upon collected data and/or protection of the environment.

"**construction**" or "**constructed**" in relation to a dam includes building a new dam and modifying or lifting an existing dam, but does not include investigations and testing necessary for purposes of preparing a design plan.

"**contaminant**" A contaminant can be:

a) a gas, liquid or solid, or

b) an odour, or

c) an organism (whether alive or dead), including a virus, or

d) energy, including noise, heat, radioactivity and electromagnetic radiation, or

e) a combination of contaminants.

"**contaminate**" means to render impure by contact or mixture.

"**contaminated**" means the substance has come into contact with a contaminant.

"**contaminated land**" has the meaning provided in schedule 3 of the *Environmental Protection Act 1994*

"**control measures**" means actions that can be taken in order to minimise environmental impacts or environmental harm. Control measures can be, but are not limited to, planning, procedural or engineering controls. Control measures has the same intent as risk treatment in AS 4360 (Risk Management).

"**controlled release**" means an active discharge where deliberate action was taken to discharge water either by pumping or opening of gates, or breach of a drain or embankment.

"**cover material**" means soil, alluvium, weathered basalt or other suitable plant growth medium. Cover material is typically non-crusting and low in salinity.

"**dam**" means a containment or proposed containment whether permanent or temporary, which is designed to contain, divert or control flowable substances. However this does not include a fabricated or manufactured tank or container designed to a recognised standard.

"**design plan**" in the context of a dam design is the documentation required under the "Code of Environmental Compliance for High Hazard Dams Containing Hazardous Waste" to describe the physical dimensions of the dam, the materials and standards to be used for construction of the dam, the procedures and criteria to be used for operating the dam and the decommissioning and rehabilitation objectives in terms procedures, works and outcomes at the end of the dam life. The documents can include design and investigation reports, drawings, specifications and certifications.

"**design storage allowance**" or "**DSA**" means an available volume, estimated in accordance with the Site Water Management Technical Guideline for Environmental Management of Exploration and Mining in Queensland (DME 1995), that must be provided in a dam as at the first of November each year in order to prevent a discharge from that dam to a probability (AEP) specified in that guideline. The DSA is estimated based on 100% runoff of wet season rainfall at the relevant AEP, taking account of process inputs during that wet season, with no allowance for evaporation.

"**development approval**" means a development approval under the *Sustainable Planning Act 2009* in relation to a matter that involves an environmentally relevant activity under the *Environmental Protection Act 1994*.

"**domestic waste**" means waste, other than domestic clean-up waste, green waste, recyclable waste, interceptor waste or waste discharged to a sewer, produced as a result of the ordinary use or occupation of domestic premises.

"**dust and noise sensitive place**" means:

- a dwelling, mobile home or caravan park, residential marina or other residential place
- a motel, hotel or hostel
- a kindergarten, school, university or other educational institution
- a medical centre or hospital
- a protected area
- a park or gardens
- a place used as an office or for business or commercial purposes and includes the cartilage of any such place.

"**dwelling**" means any of the following structures or vehicles that is principally used as a residence:

- a house, unit, motel, nursing home or other building or part of a building
- a caravan, mobile home or other vehicle or structure on land
- a water craft in a marina.

"**effluent**" treated waste water discharged from sewage treatment plants.

"**end-of-pipe**" means the location at which water is released to waters or land.

"**environment**" has the meaning provided in Section 8 of the **Environmental Protection Act 1994**.

"**environmental authority**" means an environmental authority under Chapter 5 of the *Environmental Protection Act 1994*.

"**environmental authority holder**" means the holder of this environmental authority.

"**environmental harm**" has the meaning given in the *Environmental Protection Act 1994*.

"**environmental impact**" means changes that occur in the environment as a result of the mining activities. Impacts could be positive, negative or neutral.

"**environmental management system**" means the part of the overall management system that includes organisational structure, planning activities, responsibilities, practices, procedures, processes and resources for developing, implementing, achieving, reviewing and maintaining the environmental policy and achieving compliance with the environmental authority and the general environmental duty.

"**environmentally relevant activity**" means an environmentally relevant activity as defined under Section 18 of the *Environmental Protection Act 1994* and listed under Schedule 1 of the Environmental Protection Regulation 1998.

"**environmental value**" has the meaning given in the *Environmental Protection Act 1994*;

"**expected impact**" means the predicted changes under normal conditions of a value subject to the influence of an authorised activity. Methods available for the determination of expected impacts include:

- predictions based on historical data
- knowledge based institution
- numerical analysis
- modelling.

"**financial assurance**" means a security deposit, either cash or a bank guarantee that is held by the administering authority to cover the potential:

- potential costs to rehabilitate areas disturbed by mining activities
- costs or expenses, or likely costs or expenses, mentioned in section 367 of the *Environmental Protection Act 1994.*

"**floodwater**" means water overflowing, or that has overflowed, from waters, river, creek, stream, lake, pond, wetland or dam onto or over riparian land that is not submerged when the watercourse or lake flows between or is contained within its bed and banks.

"**flowable substance**" means matter of mixture of materials which can be forced to or otherwise flow under any conditions possible in a situation. It includes water, other liquids or a mixture that includes water or any other liquid or suspended solids.

"**foreseeable future**" is the period used for assessing the total risk of an event occurring. Permanent structures and ecological sustainability should be expected to still exist at the end of a 150 year foreseeable future with an acceptable risk of failure before that time.

"**general waste**" means waste other than regulated waste.

"**hazard**" in relation to a dam as defined, means the potential for environmental harm resulting from the collapse or failure of the dam to perform its primary purpose of containing, diverting or controlling flowable substances.

"**hazard category**" means a category, either low significant or high, into which a dam is assessed as a result of the application of tables and other criteria in the Site Water Management Technical Guideline for Environmental Management of Exploration and Mining in Queensland (DME 1995).

"**hazardous substance**" means any substance, whether liquid, solid, or gaseous that could or would destroy life or impair or endanger health and includes hazardous waste.

"**hazardous waste**" means a substance, whether liquid, solid or gaseous that, if improperly treated, stored, disposed of or otherwise managed, is likely to cause environmental harm.

"**hydraulic performance**" means the capacity of a regulated dam to contain or safely pass flowable substances based on a probability (AEP) of performance failure specified for the relevant hazard category in the Site Water Management Technical Guideline for Environmental Management of Exploration and Mining in Queensland (DME 1995).

"**infrastructure**" means water storage dams, roads and tracks, buildings and other structures built for the purpose of mining activities but does not include facilities required for the long term management of mining impacts or the protection of potential resources. Such facilities include dams containing hazardous waste, waste rock dumps, voids, or ore stockpiles and buildings or other structures whose ownership can be transferred and which have a residual beneficial use for the next owner of the operational land or the background land owner.

"$\mathbf{LA}_{10,\,adj,\,10\,mins}$" means the A-weighted sound pressure level, (adjusted for tonal character and impulsiveness of the sound) exceeded for 10% of any 10 minute measurement period, using Fast response.

"$\mathbf{LA}_{1,\,adj,\,15\,mins}$" means the A-weighted sound pressure level, (adjusted for tonal character and impulsiveness of the sound) exceeded for 1% of any 15 minute measurement period, using Fast response.

"$\mathbf{LA}_{,\,max\,adj,\,T}$" means the average maximum A-weighted sound pressure level, adjusted for noise character and measured over any 10 minute period, using Fast response.

"$\mathbf{LA}_{eq,\,adj,\,15\,mins}$" means the average maximum A-weighted sound pressure level, adjusted for noise character and measured over any 10 minute period, using fast response.

"**LAr,** $_{\mathbf{1\ hour}}$' means the rating level, equal to $LA_{eq,adj,1\ hour}$.

"**land**" in the 'land schedule' of this document means land excluding waters and the atmosphere.

"**land capability**" as defined in the DME 1995 Technical Guidelines for the Environmental Management of Exploration and Mining in Queensland "noise sensitive place" or a "commercial place"

"**land suitability**" as defined in the DME 1995 Technical Guidelines for the Environmental Management of Exploration and Mining in Queensland.

"**land use**" term to describe the selected post mining use of the land, which is planned to occur after the cessation of mining operations.

"**levee**", "**dyke**" or "**bund**" means a long embankment that is designed only to provide for the containment and diversion of stormwater or flood flows from a contributing catchment, or containment and diversion of flowable materials resulting from releases from other works, during the progress of those stormwater or flood flows or those releases; and does not store any significant volume of water or flowable substances at any other times.

"**mandatory reporting level**" or "**MRL**" means a warning and reporting level determined in accordance with the Site Water Management Technical Guideline for Environmental Management of Exploration and Mining in Queensland (DME 1995). An MRL is the lowest level required in a regulated dam to allow either of the following to be retained:

a) the runoff from a 72 hour duration storm at the AEP, or

b) a wave allowance at that AEP as estimated using a recognised engineering method.

"**mg/L**" means milligrams per litre

"**mineral**" means a substance which normally occurs naturally as part of the earth's crust or is dissolved or suspended in water within or upon the earth's crust and includes a substance which may be extracted from such a substance, and includes:

- clay if mined for use for its ceramic properties, kaolin and bentonite
- foundry sand
- hydrocarbons and other substances or matter occurring in association with shale or coal and necessarily mined, extracted, produced or released by or in connection with mining for shale or coal or for the purpose of enhancing the safety of current or future mining operations for coal or the extraction or production of mineral oil there from
- limestone if mined for use for its chemical properties
- marble
- mineral oil or gas extracted or produced from shale or coal by in situ processes
- peat
- salt including brine
- shale from which mineral oil may be extracted or produced
- silica, including silica sand, if mined for use for its chemical properties
- rock mined in block or slab for building or monumental purposes

  but does not include
- living matter

- petroleum within the meaning of the *Petroleum Act 1923*
- soil, sand, gravel or rock (other than rock mined in block or slab form for building or monumental purposes) to be used or to be supplied for use as such, whether intact or in broken form
- water.

"**mine water**" means process water and contaminated storm water.

"**National Pollution Inventory**" is a database designed to provide the community, industry and government with information on the types and amounts of certain substances being emitted to the land, air and water.

"**natural flow**" means the flow of water through waters caused by nature.

"**nature**" includes:

a) ecosystems and their constituent parts, and

b) all natural and physical resources, and

c) natural dynamic processes.

"**noxious**" means harmful or injurious to health or physical well-being, other than trivial harm.

"**non-standard**" means a mining operation that if in the opinion of the administering authority does not have a low risk of serious environmental harm and the activities can not comply with the criteria for standard mining activities prescribed in schedule 1A of the Environmental Protection Regulation 1998. The standard mining activity trigger criteria are as follows:

- the mining activities do not or will not cause more than 10 ha of land to be significantly disturbed at any one time
- the mining activities do not or will not cause more than 5 ha of land to be significantly disturbed at any one time:
    - in a riverine area
    - because of mine workings
- the mining activities are not or will not be carried out in, or within 2 km of a category A Environmentally Sensitive Area
- the mining activities are not or will not be carried out in, or within 1 km of a category B Environmentally Sensitive Area
- the mining activities do not include a level 1 environmentally relevant activity
- no more than 20 persons are carrying out or will, at any one time, carry out mining activities.

"**NTU**" means nephelometric turbidity units.

"**nuisance sensitive place**" includes:

- a dwelling, residential allotment, mobile home or caravan park, residential marina or other residential premises; or
- a motel, hotel or hostel; or
- a kindergarten, school, university or other educational institution; or
- a medical centre or hospital; or

- a protected area under the Nature Conservation Act 1992, the Marine Parks Act 1992 or a World Heritage Area; or
- a public thoroughfare, park or gardens; or
- a place used as a workplace, an office or for business or commercial purposes.

  and includes a place within the curtilage of such a place reasonable used by persons at that place.

"**offensive**" means causing reasonable offence or displeasure; is disagreeable to the sense; disgusting, nauseous or repulsive, other than trivial harm.

"**operational land**" means the land associated with the Project for which this environmental authority has been granted.

"**operational plan**" means a document that amongst other things sets out procedures and criteria to be used for operating a dam during a particular time period. The operational plan as defined herein may form part of a plan of operations or plan otherwise required in legislation.

"**palletized**" means stored on a movable platform on which batteries are placed for storage or transportation.

"**peak particle velocity (ppv)**" means a measure of ground vibration magnitude which is the maximum rate of change of ground displacement with time, usually measured in millimetres/second (mms)

"**process water**" means water used or produced during the mineral development activities.

"**progressive rehabilitation**" means rehabilitation (defined below) undertaken progressively or a staged approach to rehabilitation as mining operations are ongoing.

"**receiving environment**" means all groundwater, surface water, land, and sediments that are not disturbed areas authorised by this environmental authority.

"**receiving waters**" means all groundwater and surface water that are not disturbed areas authorized by this environmental authority.

"**recycled water**" means appropriately treated effluent and urban stormwater suitable for further use.

"**reference site**" or "**analogue site**" may reflect the original location, adjacent area or another area where rehabilitation success has been completed for a similar biodiversity. Details of the reference site may be as photographs, computer generated images and vegetation models etc.

"**regulated dam**" means any dam in the significant or high hazard category as assessed using the Site Water Management Technical Guideline for Environmental Management of Exploration and Mining in Queensland (DME 1995).

"**regulated waste**" means non-domestic waste mentioned in schedule 7 of the Environmental Protection Regulation 1998 (whether or not it has been treated or immobilised), and includes:

a) for an element – any chemical compound containing the element, and

b) anything that has contained the waste.

"**rehabilitation**" the process of reshaping and revegetating land to restore it to a stable landform and in accordance with the acceptance criteria set out in this environmental authority and, where relevant, includes remediation of contaminated land.

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"**representative**" means a sample set which covers the variance in monitoring or other data either due to natural changes or operational phases of the mining activities.

"**residual void**" means an open pit resulting from the removal of ore and/or waste rock which will remain following the cessation of all mining activities and completion of rehabilitation processes.

"**risk assessment**" means the overall process of risk analysis and risk evaluation as shown in the Australian Standard for Risk Management (AS/NZS 4360:1999).

"**risk evaluation**" means the process used to determine risk management priorities by comparing the level of risk against predetermined standards, target risk levels or other criteria.

"**risk evaluation criteria**" means the level of change in an environmental value that exceeds the tolerable limits and initiates a risk management response to prevent environmental harm.

"**risk management**" means the culture, processes and structures that are directed towards the effective management of potential opportunities and adverse effects.

"**risk treatment**" means selection and implementation of appropriate options for dealing with risk, as described in the Australian Standard for Risk Management (AS/NZS 4360:1999).

"**saline drainage**" means the movement of waters, contaminated with salt(s), as a result of the mining activity.

"**self-sustaining**" means an area of land which has been rehabilitated and has maintained the required acceptance criteria without human intervention for a period nominated by the administering authority.

"**sensitive place**" means:

- a dwelling, residential allotment, mobile home or caravan park, residential marina or other residential premises; or
- a motel, hotel or hostel; or
- a medical centre or hospital; or
- a protected area under the *Nature Conservation Act 1992*, the *Marine Parks Act 1992* or a World Heritage Area; or
- a public park or gardens.

"**sewage**" means the used water of person's to be treated at a sewage treatment plant.

"**spillway**" means a weir, channel, conduit, tunnel, gate or other structure designed to permit discharges form the dam, normally under flood conditions or in anticipation of flood conditions.

"**significant disturbance**" includes land:

- if it is contaminated land; or
- it has been disturbed and human intervention is needed to rehabilitate it
    - to a state required under the relevant environmental authority; or
    - if the environmental authority does not require the land to be rehabilitated to a particular state – to its state immediately before the disturbance.

Some examples of disturbed land include:

- areas where soil has been compacted, removed, covered, exposed or stockpiled
- areas where vegetation has been removed or destroyed to an extent where the land has been made susceptible to erosion; (vegetation & topsoil)

- areas where land use suitability or capability has been diminished
- areas within a watercourse, waterway, wetland or lake where mining activities occur
- areas submerged by tailings or hazardous containment storage and dam walls in all cases
- areas under temporary infrastructure. Temporary infrastructure includes any infrastructure (roads, tracks, bridges, culverts, dams, bores, buildings, fixed machinery, hardstand areas, airstrips, helipads etc.) which is to be removed after mining activities have ceased; or
- areas where land has been contaminated and a suitability statement has not been issued.

However, the following areas are not included:

- areas off lease (e.g. roads or tracks which provide access to the mining lease)
- areas previously significantly disturbed which have achieved the rehabilitation outcomes
- by agreement with the DEHP, areas previously significantly disturbed which have not achieved the rehabilitation objective(s) due to circumstances beyond the control of the mine operator (such as climatic conditions)
- areas under permanent infrastructure. Permanent infrastructure (roads, tracks, bridges, culverts, dams, bores, buildings, fixed machinery, hardstand areas, airstrips, helipads etc.) which is to be left by agreement with the landowner. The agreement to leave permanent infrastructure must be recorded in the Landowner Agreement and lodged with the DEHP
- disturbances that pre-existed the grant of the tenure unless those areas are disturbed during the term of the tenure.

"**stable**" means geotechnical stability of the rehabilitated landform where instability related to the excessive settlement and subsidence caused by consolidation / settlement of the wastes deposited, and sliding / slumping instability has ceased.

"**stormwater**" means all surface water runoff from rainfall.

"**suitably qualified and experienced person**" in relation to dams means a person who is a Registered Professional Engineer of Queensland (RPEQ) under the provisions of the **Professional Engineers Act 1988**, OR registered as a National Professional Engineer (NPER) with the Institution of Engineers Australia, OR holds equivalent professional qualifications to the satisfaction of the administering authority for the Act; AND the administering authority for the Act is satisfied that person has knowledge, suitable experience and demonstrated expertise in relevant fields, as set out below:

a) knowledge of engineering principles related to the structures, geomechanics, hydrology, hydraulics, chemistry and environmental impact of dams, and

b) a total of five years of suitable experience and demonstrated expertise in the geomechanics of dams with particular emphasis on stability, geology and geochemistry, and

c) a total of five years of suitable experience and demonstrated expertise each, in three of the following categories:

   i. investigation and design of dams.

   ii. construction, operation and maintenance of dams.

   iii. hydrology with particular reference to flooding, estimation of extreme storms, water management or meteorology.

iv. hydraulics with particular reference to sediment transport and deposition, erosion control, beach processes.

— hydrogeology with particular reference to seepage, groundwater.

— solute transport processes and monitoring thereof.

— dam safety.

"**trivial harm**" means environmental harm which is not material or serious environmental harm and will not cause actual or potential loss or damage to property of an amount of, or amounts totalling more than $5,000.

"**tolerable limits**" means a range of parameters regarded as being sufficient to meet the objective of protecting relevant environmental values. For example, a range of settlement for a tailings capping, rather than a single value, could still meet the objective of draining the cap quickly, preventing pondage and limiting infiltration and percolation.

"**vibration sensitive place**" means a noise sensitive place or a commercial place.

"**void**" means any constructed, open excavation in the ground.

"**uncontrolled release** " means a discharge which is entirely passive. This means that no action was taken by the EA holder that caused the discharge, and no action could have been taken by the EA holder to prevent the discharge. An example of this is where a dam overflows to the environment due to runoff into a dam from a large rainfall event over the catchment to the dam that exceeded the design AEP storm event for that element of the mine water management system. An exception would be if a dam overflows due to runoff from a rainfall event and where the EA holder failed to switch on a pump (if this would have prevented the discharge), in which case the EA holder could have taken action to prevent the discharge.

"**waste**" as defined in section 13 of the *Environmental Protection Act 1994.*

"**waste management hierarchy**" has the meaning given by the Environmental Protection (Waste Management) Policy 2000.

"**waste management principles**" has the meaning given by the Environmental Protection (Waste Management) Policy 2000.

"**waste water**" means used water from the activity, process water or contaminated storm water.

"**water quality**" means the chemical, physical and biological condition of water.

"**waters**" includes river, stream, lake, lagoon, pond, swamp, wetland, unconfined surface water, unconfined water natural, bed and bank of any waters, dams, non-tidal or tidal waters (including the sea), and any under groundwater, any part-thereof "licensed vehicle"

"**µg/L**" means micrograms per litre.

"**µs.cm-1**" means microsiemens per centimetre.

14. References

ANZECC and ARMCANZ. 2000. *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*. Australian and New Zealand Environment and Conservation Council.

DERM. 2009. *Queensland Water Quality Guidelines*. Version 3. September 2009. Department of Environment and Resource Management.

DPI/DHLGP. 1992. *Planning Guidelines: The identification of Good Quality Agricultural Land, Queensland* Department of Primary Industries and the Department of Housing Local Government and Planning.

GABCC. 2009. *A Research Prospectus for the Great Artisian Basin*. Great Artisian Basin Coordinating Committee.

Hancock Prospecting, 2011. *Alpha Coal Supplementary EIS*. Hancock Prospecting.

Hancock Prospecting, 2012. *Kevins Corner Supplementary EIS*. Hancock Prospecting.

Hem, J. D. 1992. *Study and Interpretation of the Chemical Characteristics of Natural Water*. United States Geologial Survey, Water Supply Paper 2254.

NHMRC and NRMMC. 2004. Australian Drinking Water Guidelines 2004. *National Water Quality Management Strategy*. National Health and Medical Research Council and the Natural Resource Management Ministerial Council.