1 Cover Page

Codrilla Coal Mine Project
Progressive Rehabilitation & Closure Plan

ML 70450 & ML 70455

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3 Rehabilitation planning part

A Progressive Rehabilitation and Closure Plan (PRC Plan) Transition Notice was issued under section 754 of the *Environmental Protection Act 1994* (EP Act) by the Department of Environment and Science to the holders of Environmental Authority (EA) EPML00916813 for the Codrilla Coal Mine Project (Codrilla Project). The due date for submission of the PRC Plan to the administering authority is the **30th July 2021**.

This PRC Plan has been developed in accordance with sections 126C and 126D of the EP Act and with the requirements specified in the PRC plans Guideline (ESR/2019/4964 – Version 2.00).

Section 750 of the EP Act defines land outcome documents and the PRC Plan guideline (ESR/2019/4964 – Version 2.00) states that the land outcome document list is hierarchical and if there are inconsistencies between these documents on either the final outcomes or details of the outcome, then the document appearing first in the above list will prevail to the extent of the inconsistency. In the context of the Codrilla Project, the following are considered to be land outcome documents:

- EA EPML00916813 dated 6th April 2016
- EIS Assessment Report for the Codrilla Coal Mine Project dated October 2011

This PRC Plan comprises the rehabilitation planning part and the schedule.

Legislative requirements

In accordance with section 126C(1)(b) and (c)(ii) of the EP Act, the rehabilitation planning part of the PRC plan must include a description of:

- each resource tenure, including the area of each tenure
- the relevant activities to which the application relates
- the likely duration of the relevant activities
- how and where the relevant activities are to be carried out, including maps.

3.1 Project planning

3.1.1 Baseline Information

The Codrilla Project is located approximately 45km south-west of the township of Nebo in Central Queensland and approximately 120km south-west of Mackay, the nearest major regional centre. It is situated within the Isaac Regional Council which is a well-established grazing, farming and coal mining region within the Bowen Basin.

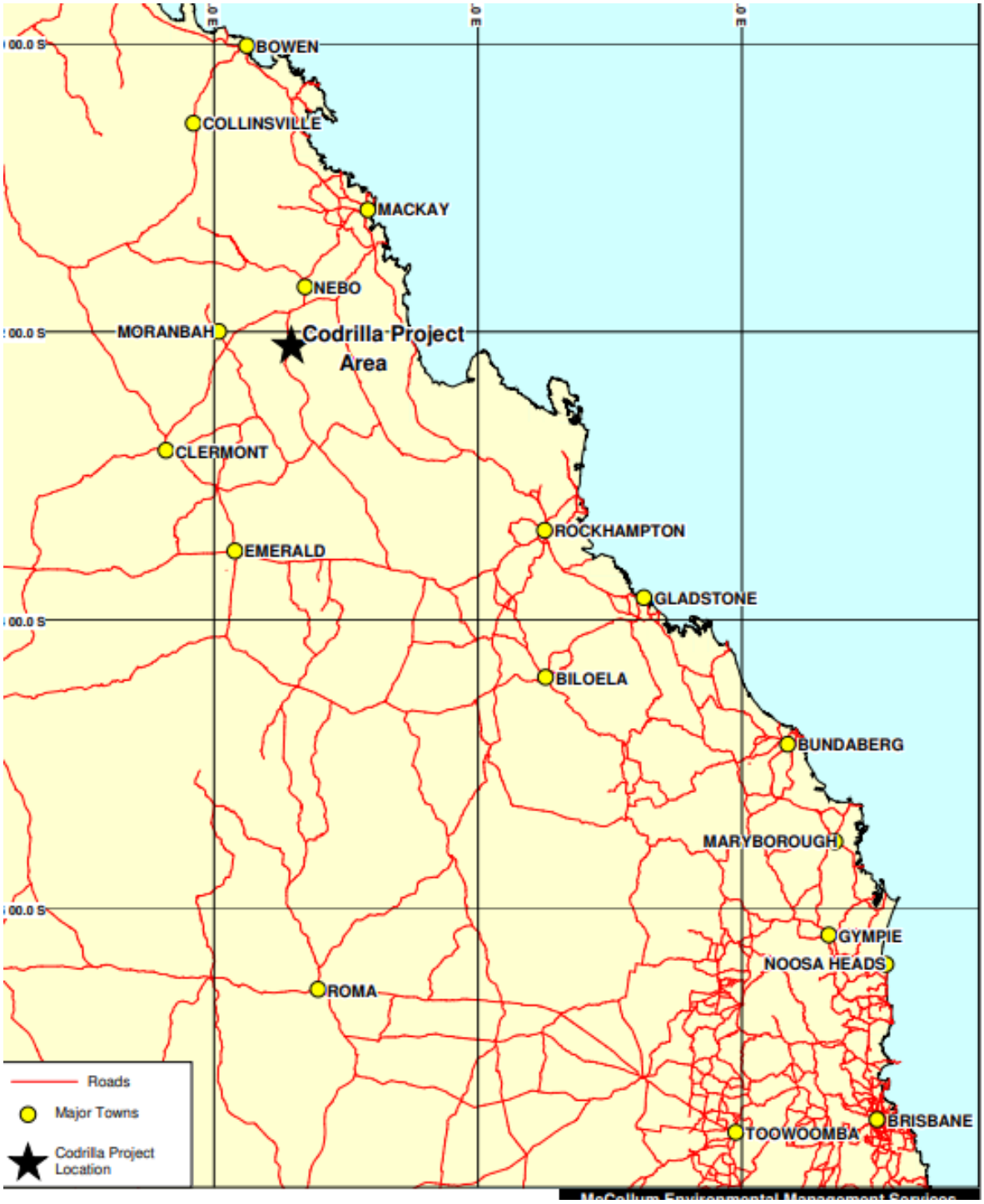

Figure 1 Project location

3.1.1.1 Site topography

To the north of the Codrilla Project area the landform is dominated by a ridge line known as the Flora Range (sometimes referred to as the Orange Range) which includes the topographic features of Mount Orange and Mount Marion, located 10km to 15km respectively to the north and northwest of the Codrilla Project. Approximately 20km to the southwest of the Codrilla Project is Mount Coxendean (also known as Coxen's Peak).

The local catchment area is dominated by Devlin Creek, which flows into the Isaac River approximately 38km to the south east of the Codrilla Project and ultimately into the Fitzroy River. Devlin Creek and its tributaries are ephemeral and only flow for short periods following significant rainfall. The general landfall is from the north west to the south east congruent with the catchment drainage system.

The general topography of the land within and immediately surrounding the Codrilla Project site is flat to gently undulating with surface relief less than 2.3° (4%).

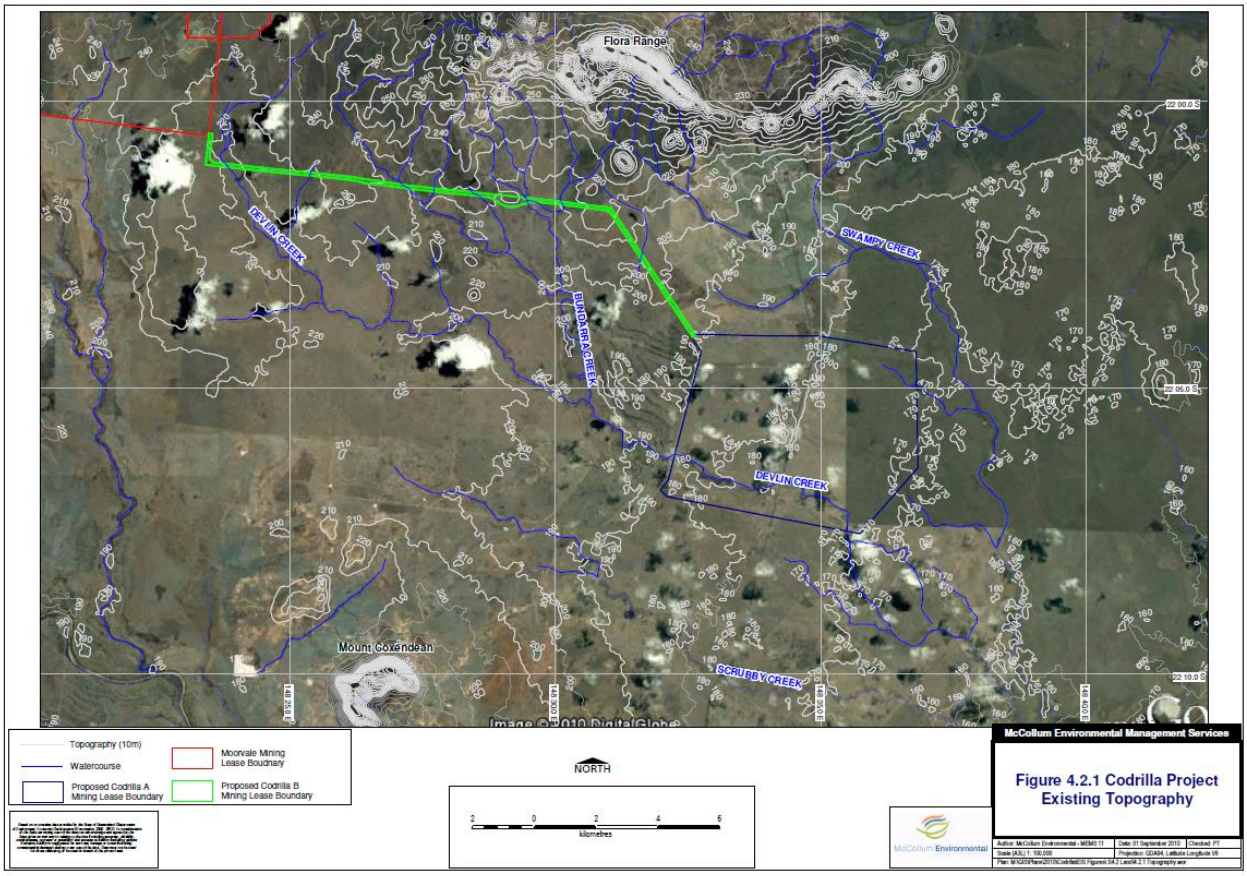

Figure 2 Existing Topography

3.1.1.2 Climate

The climate of the Codrilla Project site and surrounding areas is classified as BSh (hot semi-arid climate), according to the Köppen-Geiger climate classification. These climates tend to have hot summers and warm to cool winters with some to minimal rainfall. High variability in rainfall, temperature and evaporation are common in Central Queensland. The region experiences a predominance of southerly to south-easterly winds of low velocity (less than 10 km per hour).

Local rainfall, evaporation and temperature data has been sourced from surrounding Bureau of Meteorology weather stations:

- Moranbah Water Treatment Plant (station 034028) — operated from 1972 to March 2012.
- Moranbah Airport (station 034035) — operational from March 2012.

Climate Variability

The *State of the Climate Report 2020* (CSIRO and BoM 2020) says that Australian rainfall is highly variable, which makes it difficult to identify significant trends over time. Northern Australian average annual rainfall has increased since national records began in 1900, largely due to increases in rainfall from October to April annually.

The *State of the Climate Report 2020* says Australia's weather and climate are changing in response to a warming global climate system. Australia has warmed by around 1.44 °C (+/-0.24 °C) since 1910, with most warming occurring since 1950 and every decade since then being warmer than the one before. Warming is observed across Australia in all months with both day and night-time temperatures increasing. This warming is leading to an increase in the frequency of extreme heat events. Australia's warmest year on record was 2019, and the seven years from 2013 to 2019 all rank in the nine warmest years. The warming trend occurs against a background of year-to-year climate variability, mostly associated with El Niño and La Niña in the tropical Pacific Ocean.

Rainfall and streamflow have increased across parts of northern Australia since the 1970's. As the climate warms, heavy rainfall events are expected to continue to become more intense.

Sea surface temperatures in the Australian region have warmed by more than 1 °C since 1900, with eight of the ten warmest sea surface years on record occurring since 2010.

The *State of the Climate Report 2020* says Australia's shift to a warmer climate is accompanied by more extreme heat events on daily, multi-day and seasonal timescales.

Modelling indicates that Australia will experience more intense short-duration heavy rainfall events throughout the country. There will be fewer tropical cyclones, but a greater proportion of cyclones are projected to be of high intensity, with ongoing large variations from year to year.

There has been an increase in extreme fire weather, and in the length of the fire season, across large parts of Australia since the 1950s. The Bowen Basin region has seen a significant increase in dangerous fire weather days.

Temperature

The mean daily summer temperature in the region ranges from 20 degrees Celsius (°C) to 35.3 °C while the mean winter temperature ranges from 7.9 °C to 23.7 °C. Heat waves can occasionally be expected between October and March and frosts between May and August. Monthly average minimum and maximum temperatures for both weather stations is shown in Table 1 on the following page.

Rainfall

The Codrilla Project area has a summer dominant rainfall pattern with an average annual rainfall of 614.2 millimetres (mm) measured at the Moranbah Water Treatment Plant and 533.7 mm at Moranbah Airport. Monthly average rainfall for both weather stations is shown in Table 2 on the following page and in the rainfall & evaporation figure on page 11.

Evaporation

Evaporation rates exceed rainfall for all months of the year. Annual evaporation at the Moranbah Water Treatment Plant is approximately four times higher than annual rainfall. This leads to a high

annual net evaporative loss. Monthly average evaporation for the Moranbah Water Treatment Plant (not available for Moranbah Airport) is shown on the following page.

Table 1 Average Monthly & Annual Temperatures

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean maximum temperature (°C) — Moranbah Water Treatment Plant	33.8	33.1	32.1	29.5	26.5	23.7	23.7	25.5	29.2	32.3	33.1	34.0	29.7
Mean minimum temperature (°C) — Moranbah Water Treatment Plant	21.9	21.8	20.2	17.6	14.2	11.1	9.9	11.1	14.1	17.6	19.4	21.1	16.7
Mean maximum temperature (°C) — Moranbah Airport	35.3	32.3	32.0	30.0	27.2	24.2	24.2	26.9	30.1	32.9	35.1	35.3	30.3
Mean minimum temperature (°C) — Moranbah Airport	21.5	20.7	19.7	16.4	12.7	9.7	8.1	7.9	12.1	14.9	18.9	20.0	15.2

Table 2 Average Monthly & Annual Rainfall

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean rainfall (mm) — Moranbah Water Treatment Plant	103.8	100.7	55.4	36.4	34.5	22.1	18.0	25.0	9.1	35.7	69.3	103.9	614.2
Mean rainfall (mm) — Moranbah Airport	115.7	119.9	73.0	38.8	19.6	22.7	23.7	11.2	11.7	5.0	55.7	54.85	533.7

Table 3 Average Monthly & Annual Evaporation

	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**
Mean evaporation (mm) — Moranbah Water Treatment Plant	248	207.2	210.8	171	133.3	105	114.7	151.9	198	248	255	263.5	2306.4

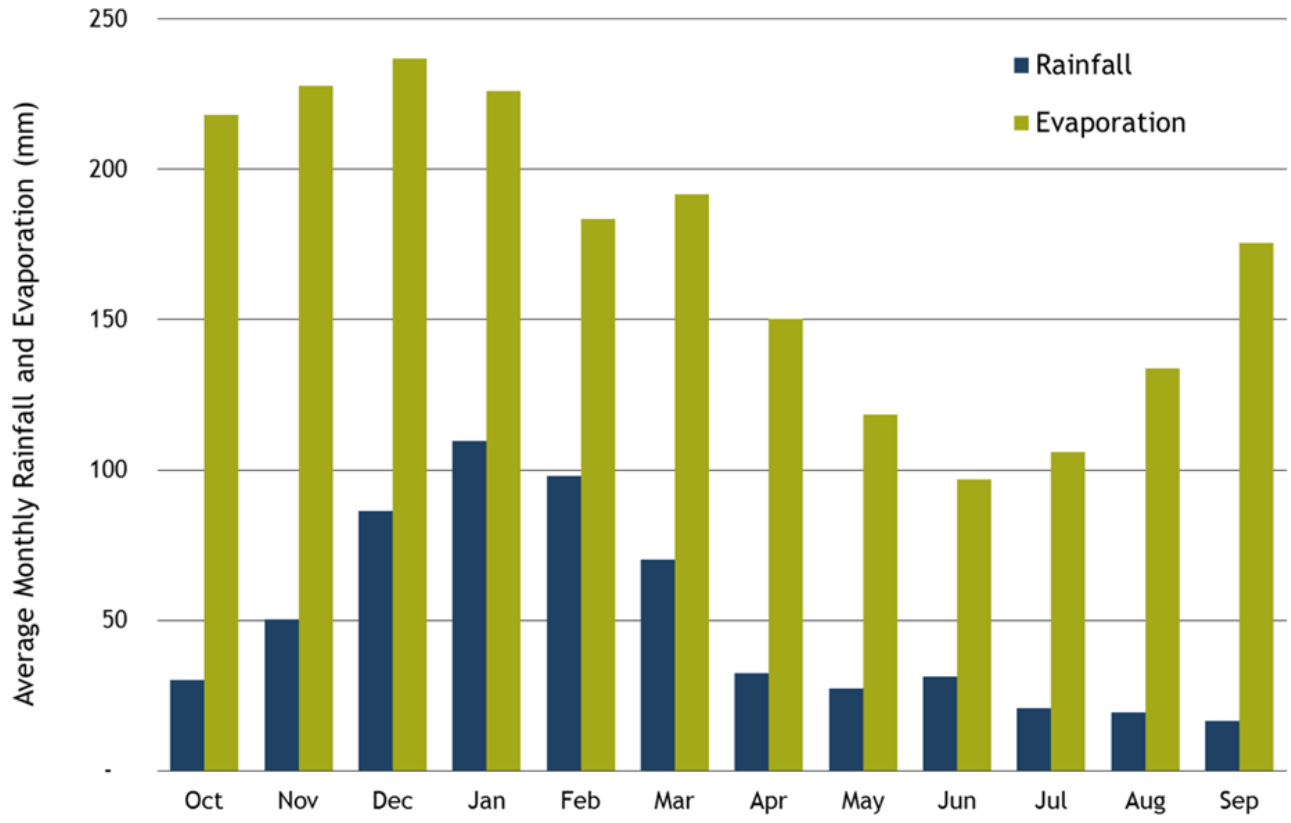

Figure 3 Distribution of Monthly Rainfall & Evaporation

3.1.1.3 Geological setting

The Codrilla Project is located within the Bowen Basin. The Bowen Basin is divided into a number of tectonic units comprising north/north-west – south/ south-east trending platforms or shelves, separated by sedimentary troughs. The Codrilla Project deposit is located within the Collinsville Shelf of the northern Bowen Basin along the eastern edge of the large regional syncline referred to as Coxendean sub-basin. Four Permo-Triassic units have been intersected during exploration drilling at the Codrilla Project, which have been subjected to geological forces and consequently dip towards the south west, relative to the north easterly position of the Codrilla Project site within the Coxendean sub-basin where the northern extents of the sub-basin alignment have been disrupted by doming caused by the nearby Bundara Intrusive Complex. At this location the coal deposit sediments form a syncline gently dipping to the south-west sub-cropping in a U-shaped zone.

The Moranbah Coal Measures (MCM) consists of labile sandstone, siltstone, mudstone and coal seams. Although extensively mined on the western margin of the Bowen Basin, the unit is as yet unworked on the eastern side of the Bowen Basin. The MCM will not be affected by the Project.

Overlying the MCM is the Fort Cooper Coal Measures (FCCM) which are highly deformed and intruded with local dips up to 70°. The formation consists of labile sandstones and siltstones, and a number of thick seams of interbedded coal, carbonaceous mudstone and tuffaceous claystone. The coal seams typically contain high percentages of inherent ash and have no export potential. The best developed of these seams is the Girrah seam, which consists of inter-banded coal, which can be up to 25 metres thick, tuffs and carbonaceous mudstone, with the stone bands comprising greater than 50% of the seam. The Vermont Lower (VL) seam ranges from 1.0 to 5.4 metres thick and is generally heavily

banded with dirt, and in places splits into the Vermont Lower 1 (VL1) and Vermont Lower 2 (VL2) seams.

The Yarrabee Tuff Bed (YTB) is regarded as the top of the FCCM (Matheson, 1990). At the Codrilla Project site the YTB comprises up to 1m of brown, tuffaceous claystone.

Overlying the YTB is the Rangal Coal Measures (RCM) which comprise 140-195 metres of light grey, lithic sandstones (commonly siderite cemented) inter-banded with layers of siltstone, mudstone, minor carbonaceous shale and low to moderate ash coal seams. Two coal seams, the Vermont Upper (VU) seam and the Leichhardt Lower 2 (LL2) seam, reach economic thickness at the Project site. The VU is a clean, bright, unbanded seam which averages 7.5m within the Codrilla Project area. The Leichhardt LL2 averages 1.75m thickness and is comprised of inter-banded dull and bright coal with no significant stone bands. Other minor splits of the Leichhardt Seam occur intermittently, ranging in thickness to 1.4m of dull, but generally clean coal.

The Rewan Group, which conformably overlies the RCM, comprises distinctive greenish-grey labile sandstones and siltstones and mottled red and green mudstones; however, exploration drilling has shown that no coal is present within this formation. The boundary with the underlying RCM occurs at the top of the uppermost carbonaceous bed or at the colour change from the greenish-grey sediments of the Rewan Group, to the grey sandstones and siltstones of the RCM.

The Permo-Triassic sediments are unconformably overlain by unconsolidated Tertiary and Quaternary sediments comprising mainly clays, fine to coarse-grained sands and gravel. Strongly lithified silcrete and ferricrete layers mark buried surfaces. Exploration undertaken indicates that the depth of weathering is generally greater than 55m.

Table 4 Summary of Geology & Stratigraphic Sequence of the Codrilla Project

Geological Sequence and Age (Million Years (My))	Geological Unit	Description of Lithology	Thickness (m)
Quaternary 0 – 1.75 My	Quaternary Alluvium (Qa)	Soils, clays, silts, sands and gravels	0-14
Tertiary and Quaternary 0 to 65 My	Tertiary – Quaternary Sediments (TQa)	Clay, silt, sand and gravel: high level alluvium and colluvium	30-60
Triassic 203 to 250 My	Rewan Formation (Rr)	Coarse green lithic sandstone, pebbles, fine and pebble conglomerate and red and green mudstone	0 – 700
Upper Permian 250 – 295 My	Rangal Coal Measures (Pwj)	Coal seams, carbonaceous shales, and mudstone, light grey litho fieldspathic sandstone, grey to dark grey siltstones and mudstones	140 – 195
	Fort Cooper Coal Measures (Pwt)	Labile sandstones and siltstones with thick seams of interbedded coal, carbonaceous mudstone and tuffaceous claystone	400
	Moranbah Coal Measures	Labile sandstone, siltstone, mudstone and coal seams	400 – 450

The coal seams of the Codrilla Project area are cupped into a syncline dipping southwest, forming a U-shaped crop zone on the far north-eastern flank of the Coxendean Sub-basin. To the north, the Coxendean Sub-basin has been disrupted by doming caused by intrusions related to the Bundarra Intrusive Complex associated with the Flora Range. No intrusions have been intersected in the targeted seams within the Codrilla Project area; however, given the major topographic highs to the north associated with the Flora Range, dykes emanating from this structure could be expected to transect the deposit.

Large displacement faults trending north north-west along the axis of the Coxendean Sub-basin have been detected by two dimensional (2D) seismic traverses undertaken to the west of the Codrilla Project area. These faults are truncated by the doming associated with the Bundarra Intrusive Complex. The current fault regime is based on interpretation of the structure contours and the 2D seismic survey sections.

3.1.1.4 Site hydrology and fluvial networks

The Codrilla Project is located within the Devlin Creek catchment area, forming part of the Isaac-Connors sub catchment of the Fitzroy Basin. The Devlin Creek catchment area covers approximately 1,200km^2, with the major tributaries draining into the catchment including:

- *Swampy Creek;*
- *Bundarra Creek;*
- *An unnamed tributary of Bundarra Creek;*
- *Birdies Gully;*
- *Duck Creek;*
- *Scrubby Creek; and,*
- *South* Creek.

The nearest operational mine to the Codrilla Project is the Moorvale Mine located some 30km to the west and located at the headwaters of Devlin Creek.

The Codrilla Project footprint covers approximately 230km^2 of the Devlin Creek catchment, with Devlin Creek, Bundarra Creek, the unnamed tributary of Bundarra Creek and a tributary of Swampy Creek flowing through the Project areas. Due to the very flat topography of the Devlin Creek floodplain, flow paths for local stormwater drainage are poorly defined. There are also no well-defined watercourses across the floodplain. Devlin Creek has an incised channel with a base width of 5-10m and is 3-5m deep. The creek banks are steep and vegetated with a mixture of native species. Creek bank erosion is evident in areas and old meander bends that are now cut off from the main channel are evident. The floodplain is characteristically wide and flat and, as a result, stormwater flow paths are not distinctly apparent. Creeks in the locality of the Codrilla Project are ephemeral in nature.

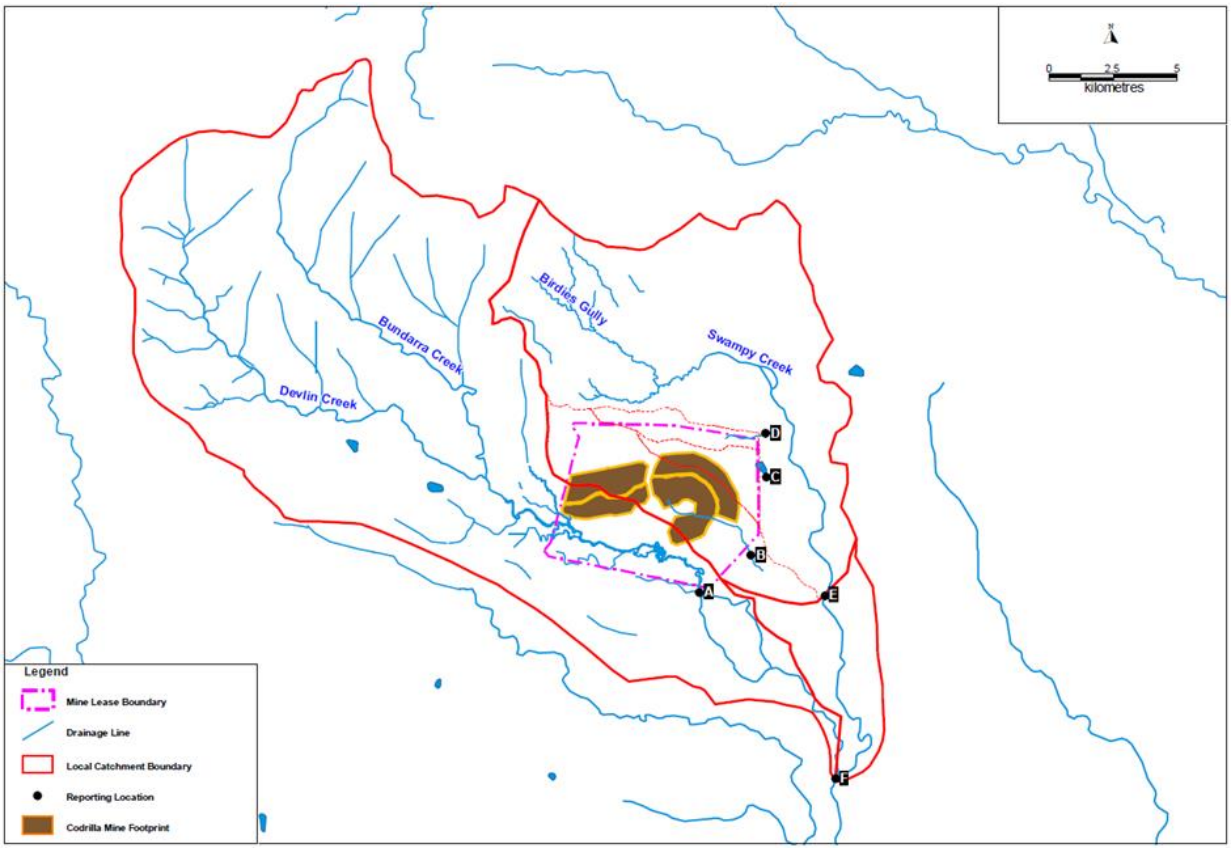

Figure 4 Site Hydrology & Fluvial Networks

Streams in the vicinity of the Codrilla Project are shown in Figure 4 (above).

There are currently no formal water use entitlements along Devlin Creek; however, DERM (now DES) provided advice for the EIS that the owners of Lot 9 on KL119 (located about 23km south-east of the MLs) hold a permit to source water from Devlin Creek for stock and domestic supply. It is also possible that other landholders and livestock may access small volumes of water from Devlin Creek on an informal basis.

Average rainfall in the region surrounding the Codrilla Project occurs primarily in the summer months, with distinct wet and dry seasons. Consequently, stream flow data in the area is limited to historical downstream monitoring due to the ephemeral nature of watercourses in the Devlin Creek catchment.

Data from water sampling conducted at the locations shown in Figure 8 indicate that Devlin Creek, both upstream and downstream of the mining lease, has pH and salinity levels that are lower than the recommended DES Regional Guideline Values. Levels for hardness, total suspended solids, total nitrogen and phosphorus naturally exceed the recommended Regional Guideline Levels. The majority of metal levels in Devlin Creek are below recommended DES Release Contaminant Trigger Levels; however, levels for aluminium, chromium, copper, cadmium, iron, uranium and zinc naturally exceed the Trigger Levels.

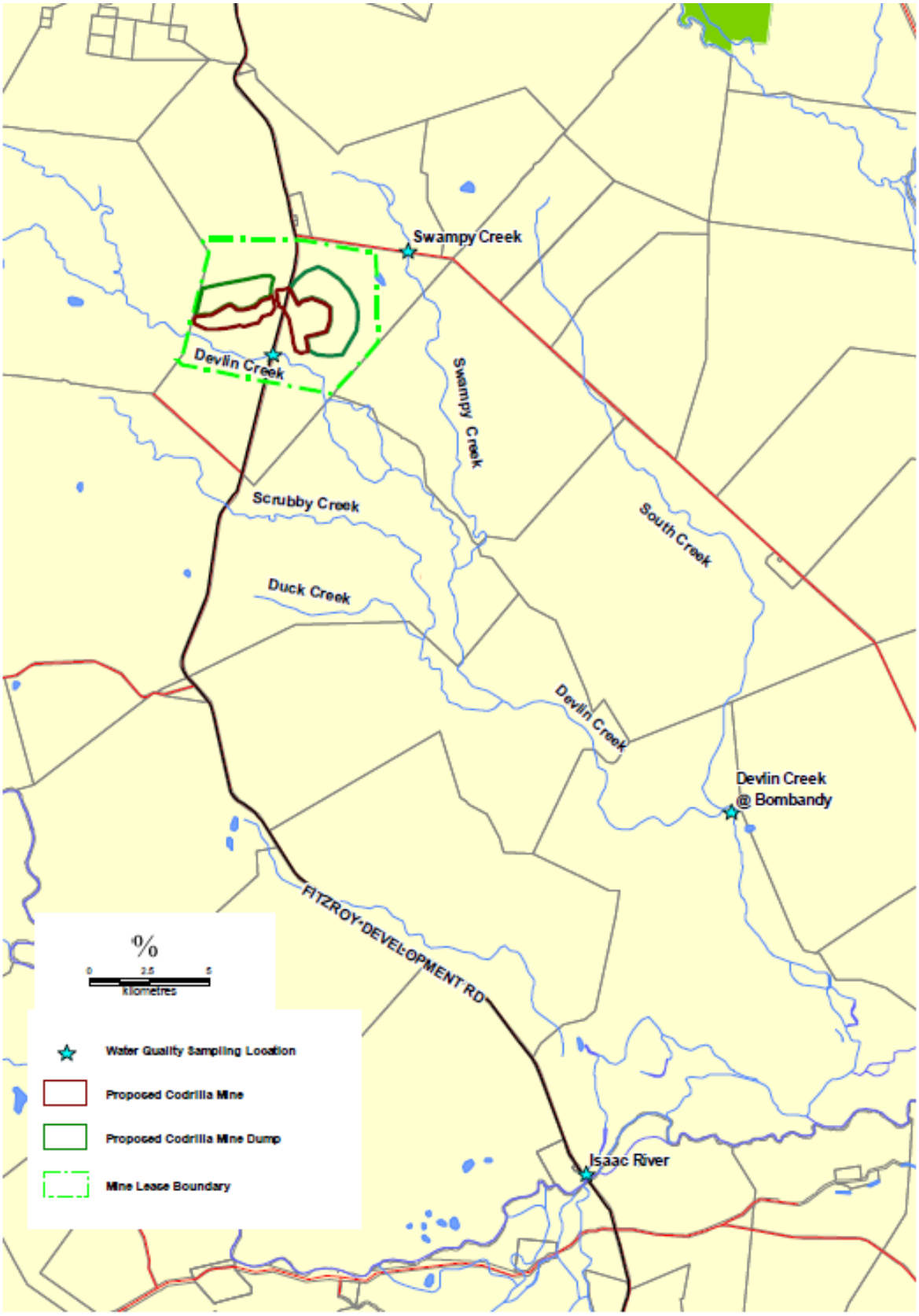

Figure 5 Water Quality Sampling Locations

Sampling results, shown in Table 5 and Table 6 below, demonstrate that the primary environmental values applicable to surface water are biological integrity and agricultural uses.

Table 5 Recorded water quality data, Swampy Creek, Devlin Creek and the Isaac River

Parameter	Units	Mean Water Quality^				DERM Regional Guideline Values
		Swampy Creek at Valkyrie Road	Devlin Creek at FDR	Devlin Creek at Bombandy	Isaac River	
pH	pH Units	6.7 (4)	7.1 (4)	7.4 (21)	7 (3)	6.5-7.5
Temperature	℃	26.4 (4)	26.3 (4)	23.4 (16)	26.7 (3)	-
Conductivity	µS/cm	118.1 (4)	323.4 (4)	152 (21)	234.7 (3)	720
Turbidity	NTU	>322 (4)	>435 (4)	85 (4)	>1000 (3)	25
Dissolved Oxygen	mg/L	5 (4)	5.3 (4)	NA (-)	3.5 (3)	90-110 (%)
Hardness	mg/L	30.3 (4)	40.3 (4)	44.6 (18)	67.7 (3)	-
Total Suspended Solids	mg/L	101 (4)	161.5 (4)	125.5 (14)	166.3 (3)	-
Total Nitrogen	mg/L	<1.3 (4)	<1.5 (4)	NA (-)	1.3 (3)	0.25
Total Phosphorus	mg/L	<0.4 (4)	0.1 (4)	NA (-)	0.2 (3)	0.03
Sulphate	mg/L	<1.6 (4)	<6.5 (4)	3.9 (8)	6.3 (3)	-
Fluoride	mg/L	<0.2 (4)	<0.2 (4)	0.1 (14)	0.2 (3)	-

^ Number in brackets is the number of samples on which the mean value is based.

Table 6 Trace metal water quality data, Swampy Creek, Devlin Creek and the Isaac River

Parameter	Units	Mean Water Quality				DERM Release Contaminant Trigger Levels
		Swampy Creek at Valkyrie Road	Devlin Creek at FDR	Devlin Creek at Bombandy	Isaac River	
Aluminium	µg/L	3460 (4)	3817.5 (4)	NA (-)	12400 (3)	100
Antimony	µg/L	<5 (4)	<5 (4)	NA (-)	<5 (3)	-
Arsenic	µg/L	<5 (4)	<5.8 (4)	NA (-)	<5.3 (3)	13
Beryllium	µg/L	<2 (4)	<2.3 (4)	NA (-)	<1 (3)	-
Boron	µg/L	40 (4)	52.25 (4)	0.04 (4)	<36.7 (3)	370
Cadmium	µg/L	<1.6 (4)	<1.6 (4)	NA (-)	<0.5 (3)	0.2
Chromium	µg/L	<7.8 (4)	<5.5 (4)	NA (-)	<17.3 (3)	1
Cobalt	µg/L	<6.3 (4)	<7.8 (4)	NA (-)	<9 (3)	90
Copper	µg/L	<7.5 (4)	<5.1 (4)	NA (-)	12.7 (3)	2
Lead	µg/L	<6.4 (4)	5.15 (4)	NA (-)	<5.3 (3)	10
Manganese	µg/L	177.5 (4)	161.75 (4)	NA (-)	<171 (3)	1900
Molybdenum	µg/L	<5 (4)	<5 (4)	NA (-)	<5 (3)	34
Nickel	µg/L	<7 (4)	<9.3 (4)	NA (-)	<21.3 (3)	11
Selenium	µg/L	<5 (4)	<5 (4)	NA (-)	<5 (3)	10
Uranium	µg/L	<1.6 (4)	<1.6 (4)	NA (-)	<0.5 (3)	1
Vanadium	µg/L	<13.8 (4)	<14.2 (4)	NA (-)	<23.3 (3)	10
Zinc	µg/L	18.75 (4)	32.5 (4)	NA (-)	<45 (3)	8
Iron	µg/L	3377.5 (4)	3532.5 (4)	1600 (5)	15733.3 (3)	300
Mercury	µg/L	<0.1 (4)	<0.1 (4)	NA (-)	<0.1 (3)	0.2

^ Number in brackets is the number of samples on which the mean value is based.

Flooding

Flood modelling was conducted as part of the EIS (see Appendix 4.6) and existing flood levels in the Codrilla Project area were simulated using the URBS and TUFLOW models. The URBS model was the preferred flood forecast model used by the Bureau of Meteorology. The URBS model estimates the peak flood discharges by modelling how runoff moves through the catchment. Once the peak flood discharges were determined for 2, 10, 100, 2000-year ARI and Probable Maximum Flood (PMF) events, the TUFLOW model was used to estimate flood extents, velocities and behaviour.

The flood modelling was conducted adopting the Australian Rainfall and Runoff (ARR) (1987) and its terminology. The new edition of ARR (2019) adopts probability terminology that differs from that used in ARR87. The adopted terminology meets the requirements of the Engineers Australia's National Committee on Water Engineering. Changes have been summarised as follows:

- The term Annual Exceedance Probability (AEP) will be used for design events (rainfalls and floods) including and rarer (less frequent) than those with a 10% AEP;
- AEPs are to be expressed as an exceedance probability using percentage probability, for example, a design rainfall will be described as having a 1% AEP;
- Events that are more frequent than those with a 50% AEP will be expressed as X Exceedances per Year (EY). For example, a design event (rainfall or flood) with a 6-month recurrence interval will be expressed as having 2 Exceedances per Year (2EY); and,
- The use of Average Recurrence Interval (ARI) is discouraged as it is problematic for frequent events in seasonal climates and leads to confusion with the public for rare events.

Existing flood levels modelled show the following results:

- The 2-year ARI design flood is mostly contained within the Devlin Creek main channel and does not impact on the mine footprint;
- The 10-year, 100-year and 2,000-year ARI design floods do not impact on the eastern pit and overburden dump of the mine; and,
- The western end of the open cut pit is subject to partial backwater flooding during all events of 10-year ARI and larger.

Figure 6 below shows the extent of the existing Devlin Creek in a 2000 Year ARI, which is equivalent to a 0.05% AEP under the ARR Guideline (2019) and is consistent with the requirements under section 126D (3) of the EP Act.

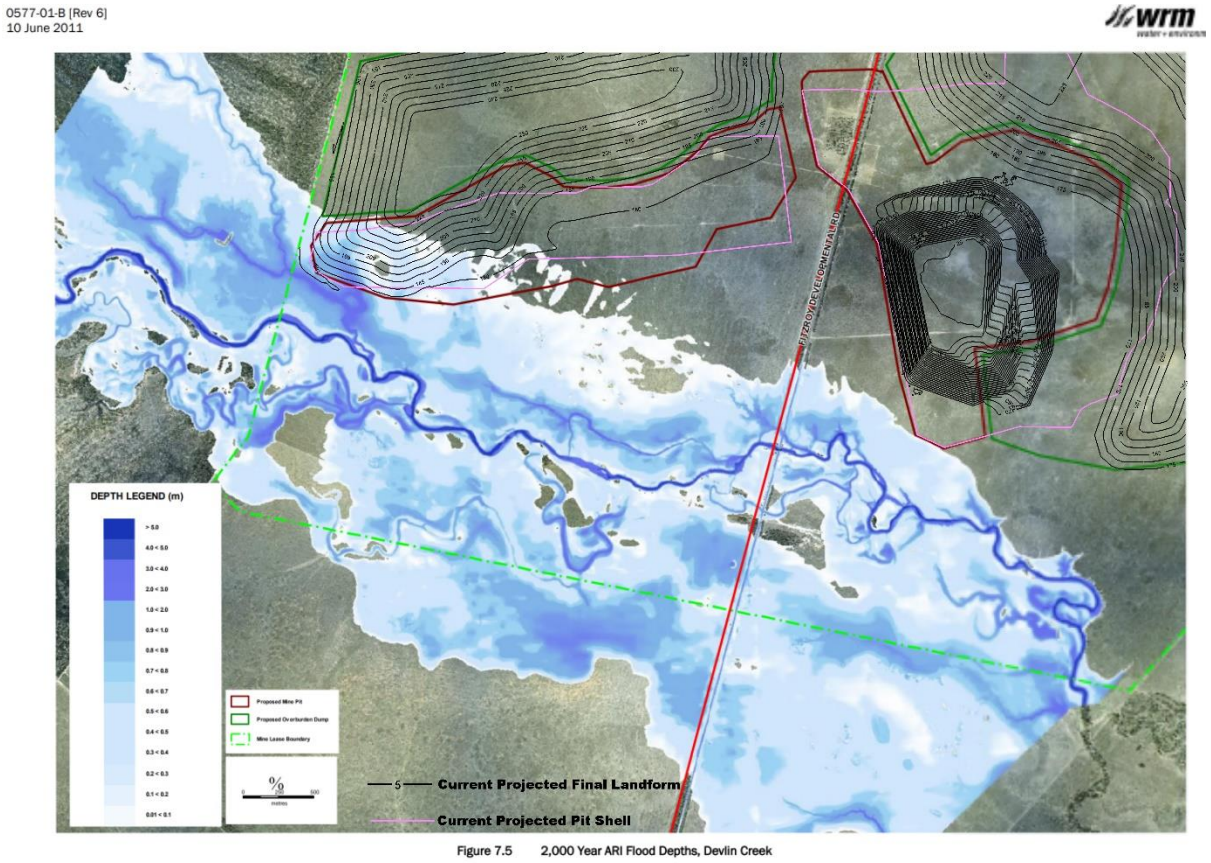

Figure 6 2000 Year ARI Flood Depths, Devlin Creek

3.1.1.5 Groundwater levels and properties

Four aquifer systems have been identified in the area of the Project. Each system is associated with discrete features of the stratigraphic sequence in the area, being:

- Shallow alluvium aquifers which recharge primarily associated with direct infiltration from the surface during rainfall and ephemeral creek flow events. Yields and permeability are expected to be very low, variable and unreliable in these aquifers;
- Tertiary sediment aquifers which recharge and discharge via direct inflow from surface influences such as rainfall and runoff, via inflow from the perched alluvial aquifers and inflow and discharge to and from the underlying Permian / Triassic and Coal Seam aquifers. Yield and permeability are low to moderate within the aquifers;
- Permian and Triassic aquifers which recharge via direct infiltration of rainfall/surface water runoff and groundwater flow into and from the overlying Tertiary aquifer. These aquifers showed significant variability in permeability and yield; and,
- Coal seam aquifers which recharge via direct infiltration of rainfall/surface and groundwater flow into and from the overlying aquifers. These aquifers showed significant variability in permeability and yield.

Generally the alluvial aquifers are associated with watercourses and form a localised perched system above the Tertiary, Permian and Triassic and Coal seam aquifers. The Tertiary, Permian and Triassic and Coal seam aquifers are collectively considered to be the regional aquifer system. The regional aquifer system is believed to be geologically isolated from other mining operations of the region.

The creeks within the Codrilla Project area are ephemeral and recharge of the alluvium is by direct infiltration of rainfall and infiltration of surface water during creek flow. It is likely that water drains to the base of the alluvium relatively quickly after rainfall events with its saturation governed by the lateral extent, depth and interconnection of sandy sediments extending below the base of the creek invert. Groundwater discharge from the alluvium occurs through:

- Evapo-transpiration from vegetation growing in the creek beds and along the banks;
- Baseflow in the permeable sands and gravels; and
- Infiltration and recharge to the underlying older formations where the creeks cross more permeable zones within these units.

Groundwater levels within the alluvium would be sustained principally by rainfall infiltration, whilst those within the regional aquifer by interconnection with the deeper underlying Triassic and Permian aquifers. The regional groundwater levels would therefore be considered a subdued reflection of the ground surface topography being generally flat within the Codrilla Project area to more elevated beneath hill areas. Groundwater discharge within the alluvial aquifer would be from base flows within the more permeable sediments, evaporation and evapo-transpiration through vegetation where the water table is within a few metres of the ground surface (and via extraction from water bores where present).

Groundwater discharge from the deeper regional aquifer would be expected to be into incised creeks/rivers that intersect the regional groundwater surface, considered to occur south-east of the Codrilla Project area.

The general flow of groundwater in the area is towards the south east with piezometric level contours indicating a gradient and direction generally similar to the surface topography of the mine project area catchment.

Figure 7 shows a conceptual cross section of the groundwater regime located in approximately the centre of the Codrilla Project.

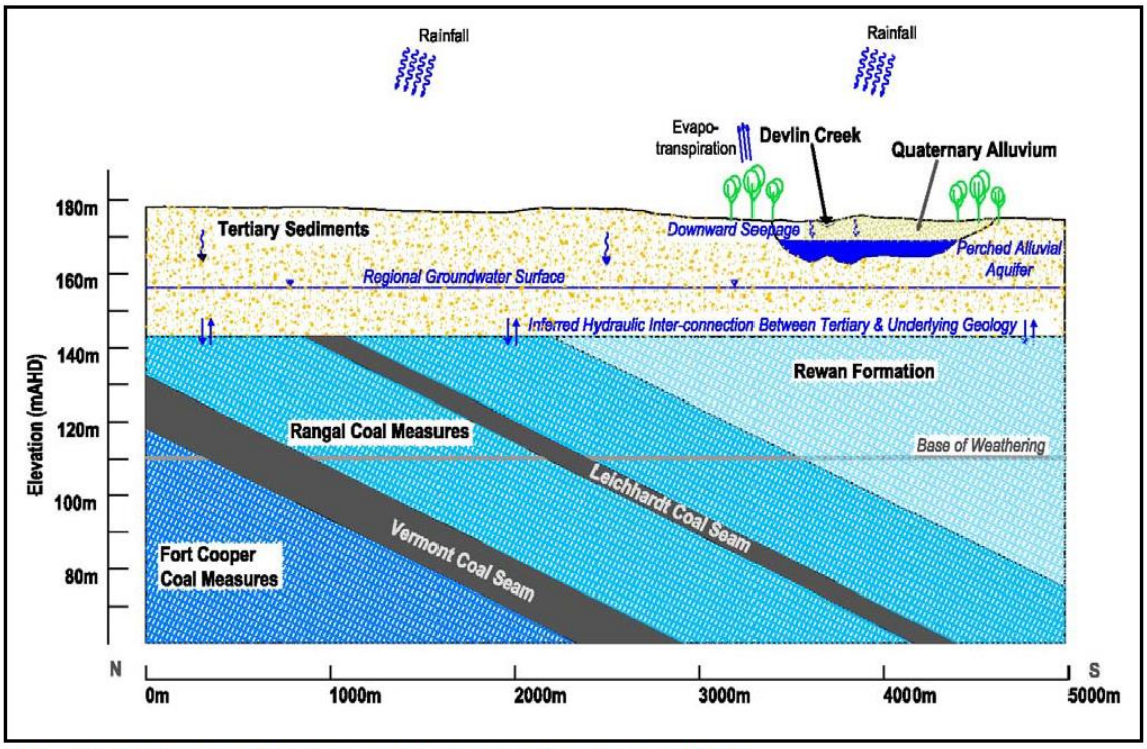

Figure 7 Conceptual Cross section of Groundwater regime

A network of 11 monitoring bores has been established in the Project area. The bores were strategically located outside of the mining footprint and targeted a broad spatial distribution across the Project area, including locations upstream and downstream of the mining activities. Representation of the specific aquifers of the Project area was also targeted.

Table 7 GW monitoring bores

Bore ID	Latitude S (-ve) ° ' " (MGA94)	Longitude E °' " (MGA94)	Ground elevation Metres – Australian Height Datum (mAHD)	Bore Depth Metres Below Ground Level (mBGL)	Aquifer \ Material	Post Construction Standing Water Level (SWL)	
						mBGL	mAHD
MB1	22°5'32.13"	148°32'30.15"	182.890	76	Permian & Triassic	18.90	164.00
MB2	22°5'32.19"	148°32'30.25"	182.859	32	Tertiary Sediments	19.40	163.46
MB3	22°6'13.84"	148°32'16.40"	179.727	130	Permian & Triassic	68.60	111.13
MB4	22°6'13.78"	148°32'16.43"	179.787	12	Alluvium	5.00	174.78
MB5	22°6'3.36"	148°33'36.99"	176.740	84	Permian & Triassic	22.03	154.71
MB6	22°4'48.44"	148°36'17.87"	169.810	86	Coal Seam	16.47	153.34
MB7	22°4'48.57"	148°36'17.94"	169.775	34	Tertiary Sediments	16.54	153.24
MB8	22°5'22.34"	148°34'22.45"	177.730	88	Coal Seam	19.40	158.34
MB8B	22°5'22.24"	148°34'22.56"	177.702	34	Tertiary Sediments	18.50	159.21
MB9	22°7'9.49"	148°34'48.35"	171.117	106	Coal Seam	17.61	153.51
MB10	22°7'9.49"	148°34'48.45"	171.168	7.5	Alluvium	Dry	Dry

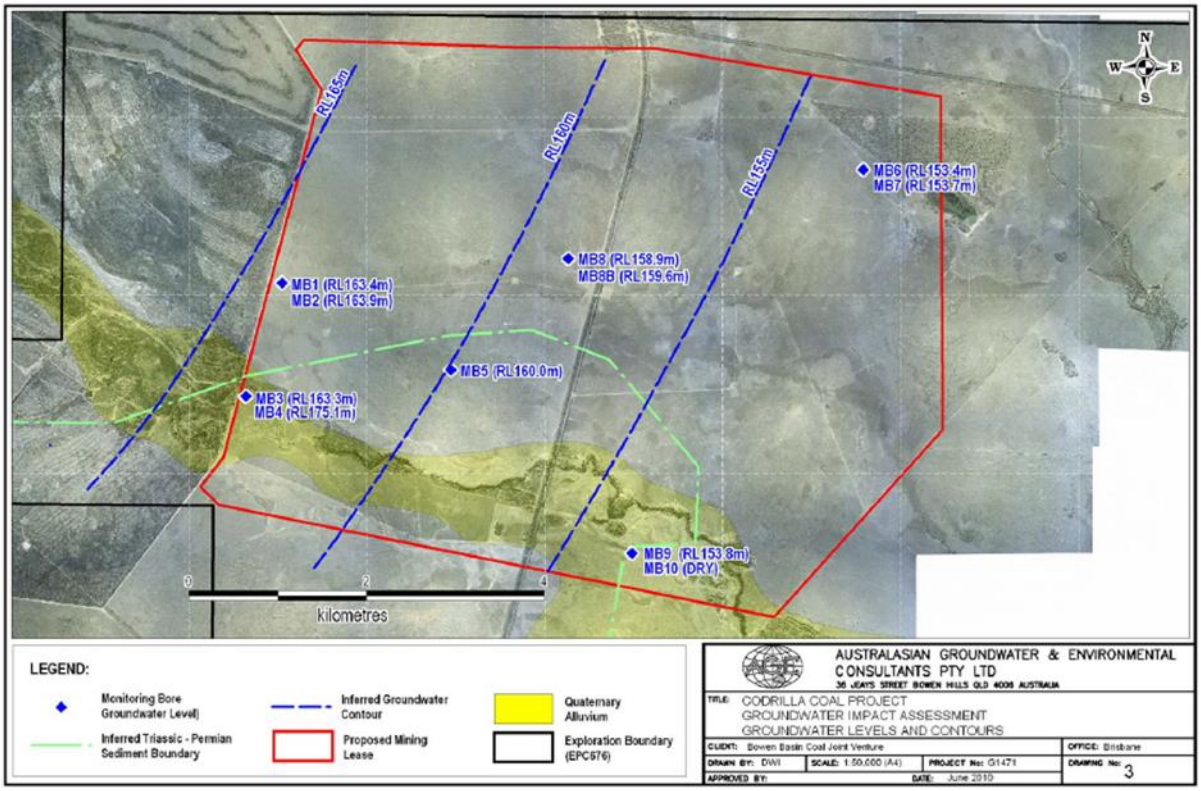

Figure 8 GW Monitoring Bores, Levels and Contours

Water samples were collected from the monitoring bores following their construction and samples were analysed for pH, electrical conductivity a suite of major ions, metals and petroleum hydrocarbons. Water quality results for each aquifer are summarised below. More details can be found in Appendix

.

Alluvium

The analyses indicate that the alluvial groundwater has a slightly alkaline pH and is fresh with total dissolved solids (TDS) less than 500mg/L within ANZECC 2000 livestock watering guidelines. Total petroleum hydrocarbon levels were all below the laboratory detection limits for the fractions analysed.

Tertiary

The analyses indicate that the Tertiary groundwater has a slightly alkaline pH and is dominated by sodium and chloride making it saline with total dissolved solids (TDS) in excess of 13,000mg/L. Metal concentrations were either below the laboratory detection limit or below the relevant livestock guideline. Total petroleum hydrocarbon levels were generally below the laboratory detection limits for the fractions analysed.

Triassic/Permian

The analyses indicate that the Triassic/Permian overburden/interburden aquifer groundwater has a slightly alkaline pH and is dominated by sodium and chloride making it saline with total dissolved solids (TDS) in excess of 19,500mg/L exceeding the guideline levels for cattle. Levels for selenium exceeded the livestock threshold in bore MB1. Other metal concentrations were either below the laboratory detection limit or below the relevant livestock guideline. Total petroleum hydrocarbon levels were all below the laboratory detection limits for the fractions analysed.

Permian Coal Seam

The analyses indicate that the Permian aquifer groundwater has a slightly alkaline pH and is dominated by sodium and chloride making it saline with TDS levels in excess of 24,500mg/L which exceed the guideline levels for cattle. Relatively high sulphate levels were recorded in bore MB6, however these were still within the range for livestock. Total petroleum hydrocarbon levels in all bores other than one (likely sample contamination) were all below the laboratory detection limits for the fractions analysed.

No users of the groundwater in the area were identified. It is considered that one or more of water quality and yield inconsistency and variability in the aquifers precludes their use as a beneficial water source. The alluvial aquifer is considered to have value to aquatic ecosystems, including stygofauna.

3.1.1.6 Soil types, properties and productivity

A soil survey was conducted over the extent of the Codrilla Project by GSS Environmental (GSSE), as part of the baseline study for Soil, Overburden and Land Use, included in Appendix

4.4 Attachment – Supplementary EIS Groundwater Report (AGE Consultants – April 2011)

4.5 Attachment - EIS Soil, Overburden and Land Use Report.

The soil survey identified five key soil types within the Codrilla Project area which are classified as:

- Brown Yellow Duplex;
- Brown Grey Duplex;
- Brown Duplex;
- Yellow Duplex; and,
- Skeletal Soils.

Brown Yellow Duplex Soil:

This soil unit is characterised by a gradual change between the light pale brown sandy loam surface soil and the yellow clay subsurface soil. These moderately structured soils range from neutral to slightly acidic to slightly alkaline at depth. The soils are non-saline and have low to moderate fertility. The topsoil is generally non-sodic whilst the subsoil exhibits non-sodic to moderately sodic characteristics.

Table 8 Brown Yellow Duplex Soil description

Layer	Depth (m)	Description
1	0.00 to 0.25	Pale Brown (10YR 6/3), moderate consistence sandy loam. A moderate pedality (angular blocky 10-50mm) soil, neutral (pH 6.7 to 7.5), low dispersion (EAT 3(1) to 8/3(2)), non-saline (<0.01 – 0.02dS/m), roots common to many and nil stones. Approximate sample depth 0.15m. Gradual even boundary to Layer 2.
2	0.25 to 0.55+	Yellow (10YR 7/6), moderate consistence sandy clay. A moderate pedality (angular blocky 5-50mm) soil with neutral to slight alkalinity (pH 7.3 to 7.6), low to moderate dispersion (EAT 3(2) & 3(3)), non-saline (0.01dS/m), roots few to common and <5% stones (<5mm). Approximate sample depth 0.40m.

Brown Grey Duplex Soil

This soil unit is characterised by an abrupt change between the light pale to brownish grey sandy loam surface soil and the light yellowish to brown sandy clay loam and clayey subsurface soil. These weakly to moderately structured soils range from slightly acidic to moderately alkaline at depth. The topsoil is generally non-sodic whilst the subsoil exhibits moderate to high sodicity.

Table 9 Brown Grey Duplex Soil description

Layer	Depth (m)	Description
1	0.00 to 0.35	Light Brownish Grey (10YR 6/2) moderate consistence sandy loam. A weak pedality (angular blocky 0-10mm) soil, slightly acidic to neutral (pH 6.0 to 7.7), low dispersion (EAT 3(1)), non-saline (<0.01 – 0.02dS/m), roots common to many and <5% stones (<5-10mm). Approximate sample depth 0.25m). Clear and even boundary to Layer 2.
2	0.35 to 0.65+	Light Yellowish Brown (10YR 6/4) moderate consistence sandy clay loam. An apedal massive soil that is neutral to strongly alkaline (pH 7.5 to 9.0), high to very high dispersion (EAT 2(3) & 1), non-saline to moderately saline (0.01 to 0.56dS/m), roots none and stones 10-50% (<10mm). Approximate sample depth 0.50m.

Brown Duplex Soil

The Brown Duplex soil unit generally consists of light brown loam and clay loam surface soils which overlie a texture contrast to pale brown to light yellowish-brown clay subsurface soils. These moderately structured soils range from neutral to strongly alkaline at depth. The soils are non-saline in the upper layers ranging to moderately saline at depth. The topsoil varies in sodicity (low to moderate) and becoming increasingly dispersive at depth.

Table 10 Brown Duplex Soil description

Layer	Depth (m)	Description
1	0.00 to 0.20	Brown (10YR 5/3) moderate consistence loam. A moderate pedality (angular blocky 10-50mm) soil, slightly acidic to neutral (pH 6.4 to 7.4), low dispersion (EAT 3(1)), non-saline (<0.01 to 0.03dS/m), roots common to many and nil stones. Approximate sample depth 0.15m. Boundary is clear and even to Layer 2.
2	0.20 to 0.60	Pale Brown (10YR 6/3) strong consistence clay. A weak pedality (angular blocky 10-20mm) soil, slightly to strongly alkaline (pH 7.8 to 9.2), moderate to high dispersion (EAT 2(2) – 2(3)), non-saline to moderately saline (0.04 - 0.60dS/m), roots few and nil stones. Approximate sample depth 0.40m. Boundary is clear and even to Layer 3.
3	0.60 to 1.00+	Light Yellowish Brown (10YR 6/4) strong consistence medium clay. An apedal massive soil that is generally slightly to strongly alkaline (pH 8.0 – 9.3), high dispersion (EAT 2(3)), moderately saline (0.53 – 0.62dS/m), roots and stones nil. Approximate sample depth 0.80m.

Yellow Duplex Soil

The Yellow Duplex soil unit generally consists of light yellowish brown and greyish brown sandy loam surface soils which overlie a texture contrast to yellowish brown sandy clay and sandy clay loam

subsurface soils. These soils range from moderately acidic in the upper layers to neutral at depth. The soils are non-saline. The surface soils are non-sodic ranging to moderate and high at depth.

Table 11 Yellow Duplex Soil description

Layer	Depth (m)	Description
1	0.00 to 0.05	Greyish brown (10YR 5/2) sandy loam. A weak pedality soil with neutral to moderate acidity (pH 7.0 to 5.9). Low to very low dispersion (EAT 3(1) – 8/3(1)), non-saline (0.01- 0.03dS/m), roots common and nil stones. Approximate sample depth 0.02. Boundary is clear and even to layer 2.
2	0.05 to 0.45	Yellowish brown (10YR 5/4) loamy sand. A weak pedality soil with neutral to moderate acidity (pH 6.8 to 5.9). Low dispersion (EAT 3(1)), non-saline (<0.01dS/m), roots few and nil stones. Approximate sample depth 0.30m. Boundary is clear and even to layer 3.
3	0.45 to 1.00+	Yellowish Brown (10YR 5/6) sandy clay. An apedal massive soil that is strongly acidic to neutral (pH 9.2 to 7.0) and low to moderately dispersive (EAT 3(1) to 2(1)). Non saline (0.03 – 0.36dS/m), roots and stones nil. Approximate sample depth 0.80m.

Skeletal Soil

This soil unit is characterised by shallow greyish brown stony sandy clay soils associated with the steeper eroded side slopes and ridgelines throughout the western area of the Codrilla Project site. These soils were sampled; however, they were not analysed for the EIS due to high stone content.

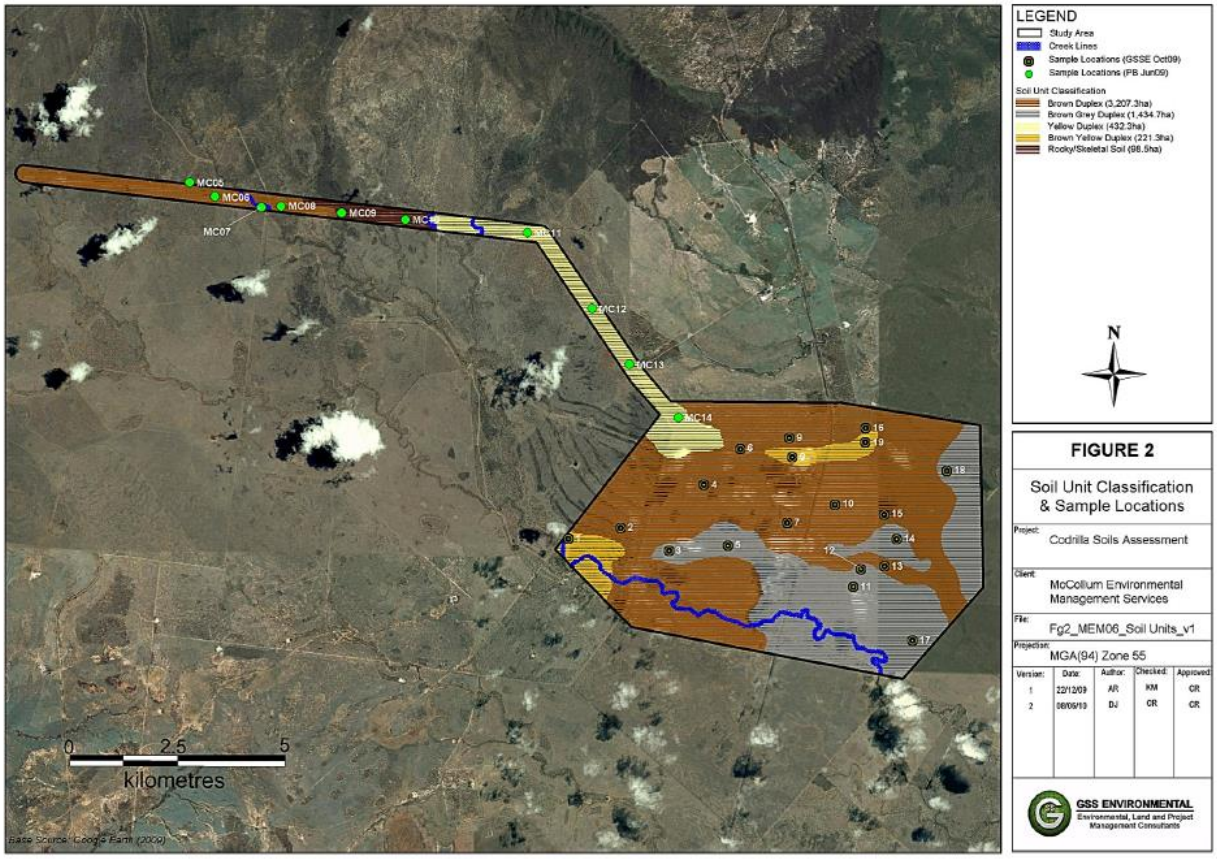

Figure 9 Soil Unit Classification and Sample Locations

Soil testing and analysis was conducted according to the procedure devised by Elliot and Veness (1981). Analysis included:

- Colour;
- Particle Size Analysis (PSA);
- Emerson Aggregate Test (EAT);
- pH;
- Electrical Conductivity (EC); and,
- Cation Exchange Capacity (CEC) and exchangeable cations.

The results of the analysis were used to determine the suitability of the soils for reuse in rehabilitation programs to be carried out as part of the Project.

Pre-mining Land Capability

A land capability assessment was conducted by GSSE (2010) as part of the EIS. Land capability was categorised into eight classes according to a range of naturally limiting factors, as detailed in Table 12 below. Land capability classifications provide a ranking of the capacity of individual sections of a land resource to sustain a broad range of land use classes. GSSE (2010) describe land capability assessment as generally applicable for large areas of land where broad land use choices are to be determined, such as farming, grazing or non-agricultural activities.

Table 12 Land Capability Classifications

Category	Class	Description
Suitable for Cultivation	Class I	No special practices required
	Class II	Simple management practices required
	Class III	Complex or intensive practices required to sustain cropping
	Class IV	Occasional or limited cultivation but with severe management inputs required to prevent degradation
Not Suitable for Cultivation	Class V	Suitable soil and topography for crops but economically not viable. High quality grazing land
	Class VI	Moderately susceptible to degradation requiring proper management to sustain use
	Class VII	Highly susceptible to degradation requiring severe restrictions on use; grazing may be conducted with rigorous management inputs required to prevent degradation
Not Suitable for Grazing	Class VIII	Wildlife reserves, bushland, recreation or water supply catchments

The existing land within the Codrilla Project area comprises capability classes, V, VI and VIII. All of the Codrilla property area located within the ML 70450 has been assessed as Class V. The balance of the Codrilla property assessed is within the easterly extent of ML 70455. This section comprises capability classes V and VI. The existing land use of the Codrilla property is related to cattle grazing only and therefore property management is within the identified capabilities.

The section of ML 70455 to the west of the Codrilla property has been assessed as predominantly Class VI with a small amount of Class VIII land associated with rocky hills and ridgeline sections of the Codrilla to Moorvale Haul Road corridor. Land use within ML 70455 (West of the Codrilla Property) is associated with three properties and comprises grazing related activities. Although it is understood that cattle have access to the class VIII land identified on the affected properties, due to the limited extent of this category and its competent substrate structure it is not anticipated that the interference from cattle would cause additional degradation to this land class. Therefore, existing land use within ML 70455 area is primarily within the identified capabilities.

Pre-mining Land Suitability

A land suitability assessment was conducted by GSSE (2010) as part of the Codrilla Project EIS. Land suitability classifies agricultural land into five suitability classes, as detailed Table 13. The rankings used in land suitability assessment are more refined than the land capability categories. The land suitability rankings apply to the capacity of land resources to sustain specific forms of agricultural land uses within the broader categories offered in land capability assessment. Such uses may include arable farming, irrigated agriculture, forestry, rainfed cropping, beef cattle grazing and conservation areas.

Table 13 Land Suitability Classes

Class	Description
Class 1	Land with negligible limitations, which is highly productive requiring only simple management practices to maintain economic production
Class 2	Land with minor limitations which either reduce production or require more than the simple management practices of Class 1 land to maintain economic production
Class 3	Land with moderate limitations which either further lower production or require more than those management practices of Class 2 land to maintain economic production

Class 4	Marginal lands with severe limitations which make it doubtful whether the inputs required to achieve and maintain production outweigh the benefits in the long term (presently considered unsuitable due to the uncertainty of the land to achieve sustained economic production)
Class 5	Unsuitable land with extreme limitations that preclude its use for the proposed purpose

The GSSE (2010) land capability assessment focused on rainfed broadacre cropping and beef cattle grazing as the two primarily applicable potential uses in the area. The assessment calculated plant available water capacity and effective rooting depth of the surveyed soil types and also considered the soil's Exchangeable Sodium Percentage (ESP), salinity and pH. The results indicate that none of the surveyed soil types are suitable for rainfed broadacre cropping due to low plant available water capacity. Consistent with the existing land uses within the local area, the assessment has determined that the land within the Codrilla Project area is suitable for beef cattle grazing.

Erosion Potential of Soil Types

Figure 9 shows the location of the twenty-eight (28) soil profiles that were assessed at selected sites throughout the project area to enable soil profile descriptions to be made. Subsurface exposure was generally undertaken by backhoe excavation of test pits to 1.2 m deep.

The test pit locations were chosen to provide representative profiles of the soil types encountered during the survey. All soil samples were laboratory tested for dispersion, using the Emerson Aggregate Test (EAT) and sodicity, using the Exchangeable Sodium Percentage (ESP). These tests indicate the susceptibility of a soil to losing its structure and binding capacity when wet, and therefore the erosion potential of the soil. The results showed a similar pattern indicating that soils across the project area are generally sodic.

The middle and lower layers within the Brown Grey Duplex, Brown Duplex and Yellow Duplex soil units generally displayed a moderate to very high potential for erosion with Emerson Aggregate Test ratings of 3 to 1, which indicates a moderate to very high potential for dispersion and surface hardsettingness. Once this material is disturbed, the potential for erosion may be increased. If this disturbance occurs within the vicinity of a drainage line, this could impact on the health of downstream watercourses, through an increase in the sediment load. These soils should, therefore, be managed to ensure that the soils are not disturbed without suitable erosion and sediment controls being implemented. These measures include the construction of structural soil conservation works such as contour, graded and diversion banks and drop structures together with sediment control dams. The use of cover crops and/or organic ameliorants will reduce soil dispersion and surface crusting thereby reducing runoff and increasing infiltration, which will subsequently reduce erosion and sedimentation. The appropriate erosion and sediment control measures should be in place prior to surface disturbance of these soils, as the risk of erosion is high once the subsoil is exposed.

Potential erosion rates

The Revised Universal Soil Loss Equation (RUSLE) has been used in this assessment to estimate the long-time average soil loss rates that may result from sheet and rill flow during various levels of disturbance. The soil erodibility factor (K) has been adjusted for dispersive soil by +20% to take into consideration the test results, which indicated a moderate to very high potential for erosion. It must be noted that wind and gully erosion is discussed separately in the section below. The RUSLE calculates annual erosion rates based on the following equation:

$A = R \cdot K \cdot LS \cdot C \cdot P$

Where: A = annual soil loss due to erosion [t/ha/yr]
R = rainfall erosivity factor
K = soil erodibility factor
LS = topographic factor derived from slope length and slope gradient
C = cover and management factor
P = erosion control practice factor

The following table offers a comparison of disturbance levels which aims to highlight the higher risk activities in regard to erosion rates. It must be noted that assumptions have been made as to the specific values of soil and overburden characteristics, vegetation establishment success, climatic conditions, slope gradients and lengths and various management practices, and therefore the following values should only be used for comparison purposes. The calculations were made with the 'worst case' scenarios used consistently for all disturbance levels.

Table 14 Estimated Erosion Rates using the RUSLE

Disturbance Level	Rainfall Erosivity Factor (R)	Raw Soil Erodibility Factor	Adjusted* Soil Erodibility Factor (K)	Topographic Factor (LS)	Cover and Management Factor (C)	Erosion Control Practice Factor (P)	Annual Soil Loss (A) (t/ha/yr)
Undisturbed Surface Pre Mining	1804	0.030	0.030	1.00	0.01	1.0	0.54
Surface cleared of vegetation and topsoil	1804	0.017	0.020	1.00	1.00	1.3	47.84
Unshaped Overburden Dumps	1804	0.025	0.030	8.22	1.00	0.8	355.89
Shaped Overburden Dumps with Graded Banks	1804	0.025	0.030	3.07	1.00	0.8	132.92
Newly Rehabilitated Shaped Overburden Dumps	1804	0.030	0.036	3.07	0.45	0.8	71.78
Established Rehabilitated Shaped Overburden Dumps	1804	0.030	0.036	3.07	0.03	0.8	4.79

* Adjusted for dispersive soil by +20%

Table 14 above shows the disturbance level during mining with the highest risk of severe erosion rates is the unshaped overburden scenario. The key factor to observe in this result is the topographic factor (LS) where the overburden is free dumped and left at the angle of repose albeit benched in some cases. This practice is unlikely to be modified due to cost effectiveness and practicalities of dumping activities. However, it is recommended that these areas and times of highest risk should have adequate sedimentation controls in place downstream to capture any material eroded from these slopes. The shaped overburden dumps with graded banks (but without topsoil or vegetation) was the second highest predicted rate of erosion which indicates the need for the reshaping, grading,

topdressing and seeding of overburden dumps to be undertaken in the quickest possible timeframe in order to minimise the risk of severe rainfall events impacting on these exposed slopes over a long period of time.

Gully erosion is not considered within the RUSLE equation above, however given the succession of erosion severity from rill to gully erosion, it is predicted that the same disturbance levels will contain the same risk rankings for gully erosion rates as the RUSLE equation has displayed. Once overburden dumps have been shaped and graded banks established, any gully erosion should be repaired and rehabilitated as soon as possible to reduce further erosion and sedimentation downstream.

Wind erosion has the potential to cause loss of material from overburden dumps during the mining process, especially given the raised elevation of the dumps within the landscape. Management practices during mining may limit the extent of wind erosion, by reducing truck movements and earthworks on highly exposed dumps during periods of extreme wind conditions. Furthermore, mine planning considerations for minimising exposed surfaces and timely rehabilitation activities may protect surface soil from wind erosion of overburden dumps.

3.1.1.7 Land stability

Chemical and physical characterisation of overburden and reject materials (coal and partings) undertaken to support the Codrilla Project EIS suggest that these materials are relatively inert and are not likely to present significant management issues in regard to water quality, landform stability and rehabilitation. The materials are generally sodic and alkaline, indicating that conventional planning and management strategies will be required to ensure operational and post-mining impacts are minimised relative to landform stability and water quality. The topsoils of the Codrilla Project area are generally suitable for harvesting for use in rehabilitation.

The EIS provided the following assessment regarding the waste rock characterisation of overburden and inter-burden material:

- All 26 overburden and inter-burden samples are classified as Non-Acid Forming (NAF);
- the total sulphur content of all samples was below 0.1% and is considered inert relative to acid producing potential;
- The concentration of metals in overburden and inter-burden solids is unlikely to present any significant environmental issues associated with rehabilitation of the materials or water quality;
- The pH of leachate from overburden material at the Codrilla Project site is likely to range from slightly acidic to moderately alkaline; however, the majority of material is likely to be neutral;
- The range of EC values in the samples is considered slightly to moderately saline;
- the overburden material is within the moderate to high ranges for Cation Exchange Capacity (CEC) and should therefore provide a reasonable growth medium for vegetation;
- Overburden material is considered to be extremely sodic;
- the overburden and inter-burden material is not expected to require specific management strategies in relation to PAF, metals, pH, Electrical Conductivity (EC) and Cation Exchange Capacity (CEC); and,
- The overburden and inter-burden material is expected to require specific management strategies in relation to Sodicity.

The characterisation of reject and co-disposal analysis involved obtaining, fresh samples of material from above coal seams (roof), within the coal seams and below the coal seams (floor), during

exploration drilling and groundwater bore construction. These samples were composited to form two roof samples, one coal sample and two floor samples. The five roof and floor, coal, and floor samples analysed for acid producing characteristics were classified as either 'Uncertain' or 'Uncertain–Potentially Acid Forming', the total sulphur results being in excess of 0.2% for each of the samples analysed. Due to the limited characterisation of coal and partings (coal seam roof and floor) a commitment was made in the Environmental Management Plan (EMP) of ongoing characterisation of overburden, interburden and partings materials to enable selective handling. This commitment has been captured within the site's EA.

In order to obtain additional information, a drilling programme of four fully cored geotechnical boreholes was carried out in 2011. These holes were cored from close to ground level, to enable engineering geological logs to be compiled for the soft overburden strata and coal seams and to provide samples for geomechanical testing. The laboratory program focused on improving the reliability of material properties used for slope stability modelling. This was achieved by targeting specific soft overburden units (Tertiary and weathered Permian) for sampling and testing. In addition to this, a separate program of testing was conducted on samples recovered from the soft overburden units and the sandstone unit below the VU seam, which was aimed at assessing the dispersive characteristics of the soft overburden and sandstone as a potential spoil cover material. All samples were preserved and dispatched to the laboratory in accordance with nominated procedures. Routine soil classification (Atterberg limits), shrinkage, slake durability, unconfined compressive strength (UCS) were conducted on overburden, roof and floor samples by Cardno (Ullman & Nolan Technical Services Pty Ltd) at their Mackay laboratory. Triaxial testing was carried out by Trilab Pty Ltd in Brisbane.

Soil classification testing indicated the soft overburden to comprise primarily silty or sandy clay or clayey silt of low to intermediate plasticity, with minor occurrences of high plasticity clay.

Triaxial testing was conducted on selected samples of soft overburden and one sample of the Yarrabee Tuff to determine shear strength values. These comprised back-saturated, consolidated multistage tests with pore water pressure measurement. A further sample of the Yarrabee Tuff was tested by direct shear. Shear strength parameters derived from these tests indicate significant variability in the shear strength of material at the site. These are also dependent on the nature of the material tested. In this case, soft clayey materials and more competent, highly weathered rock
would show variability in shear strength.

Unconfined Compressive Strength (UCS) tests were conducted on rock samples from target coal seam roof and floor with slake durability tests on the latter. This mainly focused on the Leichardt and Vermont Upper seams.

Uniaxial compressive strength (UCS) testing indicated the roof units for all seams to be low strength, averaging approximately 10MPa. The predominant roof material was laminite. Similarly, UCS testing indicated the floor units to be low strength, averaging approximately 8MPa. Floor units generally comprised mudstone, laminite and siltstone, with the occasional occurrence of sandstone.

Specific testing requirements completed for the spoil cover assessment included:

- Emerson Class - conducted to assess the dispersive nature of the material, essentially with respect to rehabilitation of spoil and where the overburden (particularly the Tertiary clay) contained slake susceptible clay or mudstone;
- Atterberg Limits - determines the liquid and plastic limits of clayey materials, which is useful indicator of reactivity. An example of a reactive soil would be volcanically derived clay;

- Slake Durability - indicates of rock degradability, which measures changes in rock properties due to chemical and mechanical breakdown; and
- UCS - the unconfined compressive strength of the material

The sampling undertaken to inform the EIS is considered to be adequate for a site where mine development has not commenced. Additional waste characterisation will be undertaken when the mine is developed and throughout the mining and processing phase of the mine's life as per conditions stipulated within the EA. Further details of the results can be found in Appendix 4.7.

3.1.1.8 Flora and Fauna

The Codrilla Project area is situated on grazing properties approximately 30km southeast of Coppabella in the Isaac Regional Council of Central Queensland and lies within the Northern Bowen Basin of the Brigalow Belt Bioregion. A large portion (89%) of Codrilla Project area has been historically cleared for grazing and most of the Brigalow communities cleared with few scattered remnants remaining in these cleared areas.

During flora, fauna and freshwater biota surveys of both sites two hundred and fifty-eight plant species and one hundred and sixty-three terrestrial vertebrate species were recorded across the entire study area. This included one conservation listed species (the Black Orchid, *Cymbidium canaliculatum*) and one 'vulnerable' reptile (Ornamental Snake, *Denisonia maculata*), one 'vulnerable' bird species (Squatter Pigeon, *Geophaps scripta*) and one Queensland 'near threatened' mammal (Little Pied Bat, *Chalinolobus picatus*) along with three Garnett and Crowley near threatened bird species (Grey-crowned Babbler, *Pomatostomus temporalis*; Australian Bustard, *Ardeotis australis*; and Bush Stone-curlew, *Burhinus grallarius*). Five pest species were also observed on site.

Field Flora assessment

Survey results indicate that the majority of the vegetation (81%) is non-remnant, with a small portion 'endangered' vegetation (2.04%) and 'of concern' vegetation (3.46%). The remainder of the vegetation was listed as 'least concern' (13.47%,).

The Regional Ecosystems and their status are listed in Table 15 below:

Table 15 Regional Ecosystems and their status

Geology	Regional Ecosystem	Vegetation Description	Specht Classification (Specht 1970)	Vegetation Management / Biodiversity Status	Protected Areas: a) within bioregion b) within 150 km	Area in Codrilla A Study Area (ha)	Area in Codrilla B Study Area (ha)	Spp. Rich	Assoc. Fauna Sites
a) Cainozoic alluvial plains with loams or clay soils	11.3.4	*Eucalyptus tereticornis, Corymbia tessellaris, C. clarksoniana* and *E. platyphylla* with sparse understorey	Open forest	Of concern / Of concern	a) 27 b) Dipperu NP(S), Homevale NP, Homevale RR	89.26		75	
	11.3.25	*Eucalyptus tereticornis, Corymbia tessellaris* and *Casuarina cunninghamii* with a grassy understorey on Creek banks	Woodland	Least concern / Of concern	a) 40 b) Dipperu NP(S), Eungella NP, Homevale NP, Homevale RR, Peak Range NP, Tooloombah Creek CP	61.09	49	100	Riparian
	11.3.27	Freshwater wetlands	Wetland	Least concern / Of concern	a) 14 b) None	23.22	1.31		

Geology	Regional Ecosystem	Vegetation Description	Specht Classification (Specht 1970)	Vegetation Management / Biodiversity Status	Protected Areas: a) within bioregion b) within 150 km	Area in Codrilla A Study Area (ha)	Area in Codrilla B Study Area (ha)	Spp. Rich	Assoc. Fauna Sites
b) Cainozoic clay plains not associated with alluvium	11.4.8	*Eucalyptus cambageana* woodland to open forest with *Acacia harpophylla* or *A. argyrodendron* on Cainozoic clay plains	Woodland	Endangered / Endangered	a) 7 b) Dipperu NP(S), Junee NP	94.6	9.71	91	Dawson Gum
	11.4.9	*Acacia harpophylla* shrubby open forest to woodland with *Terminalia oblongata* on Cainozoic clay plains	Woodland	Endangered / Endangered	a) 12 b) Dipperu NP(S), Junee NP, Mazeppa NP, Peak Range NP, Tooloombah Creek CP	3.74	27.81	75	
c) Cainozoic sediments on flat to gently undulating plains	11.5.2	*Eucalyptus crebra, Corymbia* spp., with *E. moluccana* on lower slopes of Cainozoic sand plains/remnant surfaces		Least concern / No concern	a) 6 b) Junee NP		86.03	81	

Geology	Regional Ecosystem	Vegetation Description	Specht Classification (Specht 1970)	Vegetation Management / Biodiversity Status	Protected Areas: a) within bioregion b) within 150 km	Area in Codrilla A Study Area (ha)	Area in Codrilla B Study Area (ha)	Spp. Rich	Assoc. Fauna Sites
	11.5.3	*Eucalyptus populnea* open forest with grassy or shrubby understorey	Woodland	Least concern / No concern	a) 8 b) Dipperu NP(S), Junee NP, Mazeppa NP	314.37	213.79	108	Poplar Box
f) Brown cracking clays on undulating hills	11.9.7/9	*Eucalyptus populnea*, *Eremophila mitchellii* shrubby woodland mixed with *Eucalyptus crebra* woodland on fine-grained sedimentary rocks	Woodland	Of concern/ Of concern mixed with Least concern / No concern	a) 2 / 4 b) None / Homevale NP, Homevale RR		136.7		
g) Hills and lowlands on metamorphic rocks	11.11.1	*Eucalyptus crebra* ± *Acacia rhodoxylon* woodland on old sedimentary rocks with varying degrees of metamorphism and folding		Least concern / No concern	a) 2 b) Homevale NP		143.85	86	
	11.11.9	*Eucalyptus populnea* or *E. brownii* woodland on deformed and metamorphosed sediments and interbedded volcanics		Least concern / No concern	a) 4 b) none		3.09		
	11.11.16	*Eucalyptus cambageana*, *Acacia harpophylla* woodland on old sedimentary rocks with varying degrees of metamorphism and folding		Of concern/ Of concern	b) 3 b) none		3.99	52	
Cleared with some regrowth vegetation	Non-remnant	Grassland with emergent *Acacia harpophylla*, *Lysiphyllum carronii* and *Eucalyptus* spp.	Grassland			4486.68	900.49	47	Cleared
Road Way	Non-remnant					22.45			

Areas of conservation value in the vicinity of the Project consist of remnant vegetation. State values are associated with Devlin Creek riparian vegetation and some sections of the remnant vegetation within the Codrilla to Moorvale Haul Road corridor. Regional values are associated with most of the

remaining remnant vegetation within the MLs, with a small amount of Local value vegetation intersecting the Codrilla to Moorvale Haul Road corridor in two sections.

The remnant vegetation associated with Devlin Creek is listed as important wildlife corridor of 'State' and 'Regional' significance linking the vegetation remnants along the waterway to the large areas of remnant vegetation associated with Mount Marion in the North to the Isaac and Connors Rivers. There are existing gaps within this corridor where roads (including the Fitzroy Development Road), tracks, property fence line clearing and firebreaks cross the waterways. Typically, these intersecting gaps are narrow and would not be expected to significantly impede movement of wildlife along the corridor. No freshwater wetlands were present within 150km of the mining lease.

Two small areas of Endangered Regional Ecosystems *Acacia harpophylla* and *Eucalyptus cambageana* woodlands on dark clay soils (11.4.8 and 11.4.9) are present within the mining footprint but they are isolated and degraded and do not represent a significant loss of these REs.

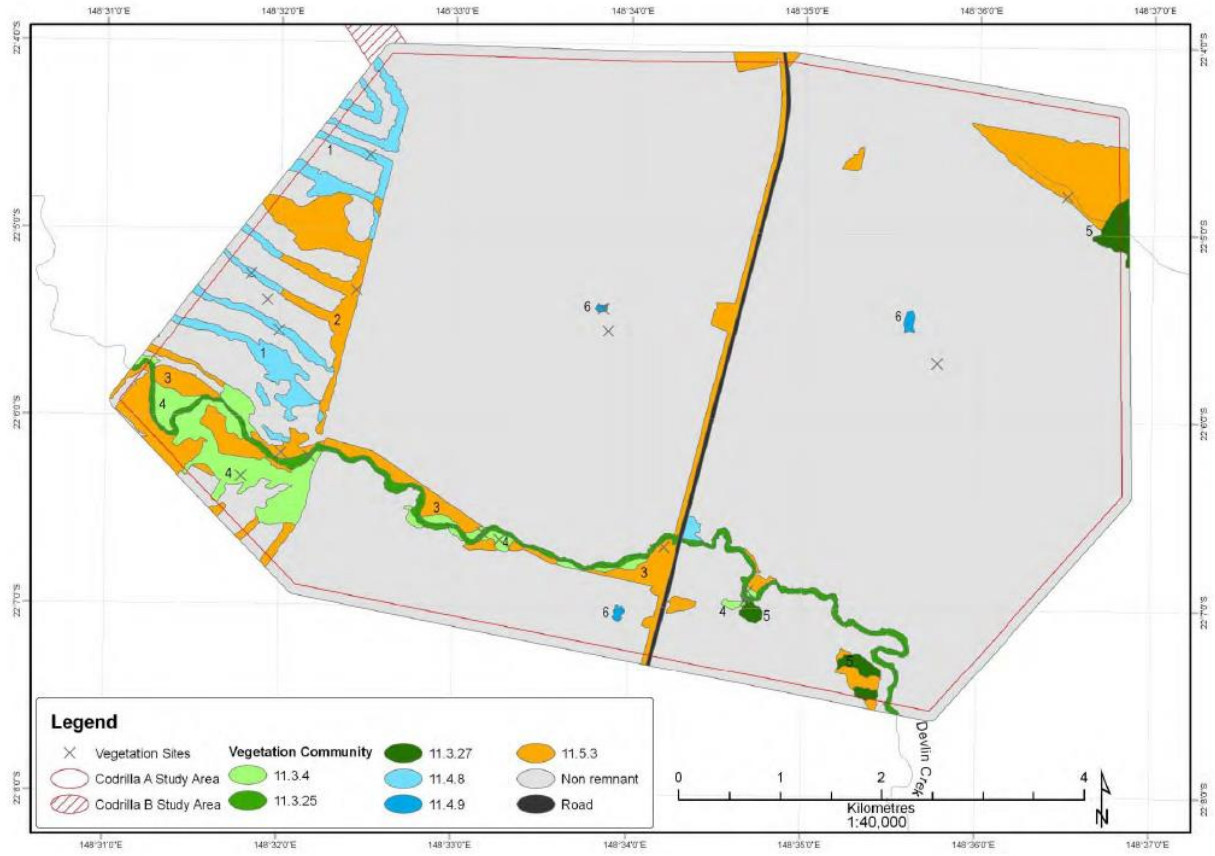

Figure 10 Vegetation Communities – Regional Ecosystems (REs) on ML70450

The areas of sensitive vegetation types within the ML 70455 area were also relatively small, with areas of 'endangered' vegetation making up 2.58%. There were no 'of concern' REs and areas 'not of concern' made up 40.21% of the ML 70455 study area. All vegetation types were represented in protected areas within the Brigalow Belt Bioregion with only 'not of concern' RE Freshwater Wetland not represented in protected areas within 150km of the ML.

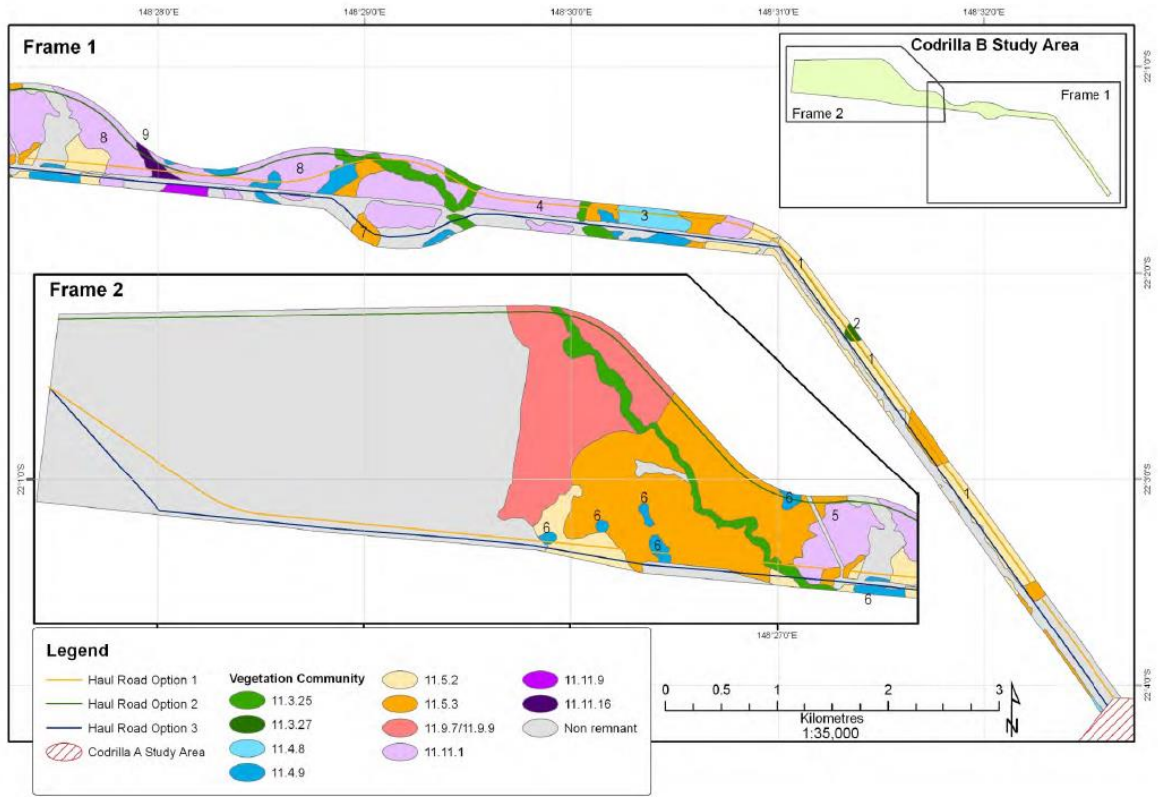

Figure 11 Vegetation Communities – REs on ML70455

Field Fauna Assessment

Four major REs on three different Land Zones (3, 4 & 5) were sampled within ML70450 and three REs on three Land Zones (4, 5 & 11) were sampled within ML70455. Sampling occurred over two field trips with sites varying between sampling trips for the Poplar Box and Riparian due to access restrictions to the original sites on the second field trip. The Poplar Box and Riparian sites used in the second field trip were Vegetation sites from the first field trip and had similar structure and habitat features to the original sites. Locations of sampling sites are shown in Figure 12 and Figure 13 and trap site details of sampling schedule, land zone, soil type and vegetation type are shown in Table 16.

Table 16 Trap site details

Field Site (year sampled)	Regional Ecosystem	Land Zone	Soil	Habitat Description
ML 70450				
Cleared (2009)	Non-remnant	5	brown sandy loam	Non-remnant grassland with scattered shrubs
Dawson Gum (2009 & 2010)	11.4.8	4	brown sandy loam	Eucalyptus cambageana dominated woodland with some Casuarina cristata and shrubby understorey

Poplar Box A (2009) Poplar Box B (2010)	11.5.3	5	light brown sandy loam	Eucalyptus populnea dominated open woodland with a shrubby understorey
Riparian A (2009) Riparian B (2010)	11.3.25	3	light brown sandy loam	Eucalyptus tereticornis dominated riparian zone with abundant Melaleuca leucadendra over a grassy understorey on an alluvium channel
ML 70455				
Brigalow (2010)	11.4.9	4	dark brown clay	Acacia harpophylla dominated woodland with shrubby midstorey over sparse grasses
Woodland LZ5 (2010)	11.5.2	5	light brown sandy loam	Eucalyptus crebra woodland with shrubby midstorey and grassy ground cover on open plans
Woodland LZ11 (2010)	11.11.1	11	light brown sandy loam	Eucalyptus crebra woodland with little midstorey and sparse grassy ground cover on low hills

Survey methods

Vertebrate fauna associated with each site in a 3 ha area (approximately a 100 m radius around each trap site within the same habitat, or a linear shape in the case of riparian habitats) was surveyed using standard techniques over a five day survey period in the first of two seasons:

- a 30 m drift fence incorporating 3 shaded 20 litre buckets and eight reptile traps placed on either side of the drift fence at each end and between the buckets;
- twenty-three Elliot A and two Elliot B traps for small mammals baited with a mixture of peanut butter, rolled oats and pet jerky were placed at 5 to 20 m intervals depending on the terrain;

- two large Mawbey Traps for possums, quolls and bandicoots baited with jam coated apple and pet jerky were placed at the base of trees in woodland sites and under grass clumps at the grassland site;
- intensive diurnal searches for reptiles and animal traces such as scats, tracks, skeletal remains, scratch marks on trees and carcasses (2 person hours during the middle part of the day at each site);
- intensive nocturnal searches for nocturnal mammals, birds, geckos, snakes and frogs (1 person hour at each site) and spotlighting from vehicles along the roads and tracks of the property for nocturnal mammals and birds;
- diurnal bird observations based on a minimum of two searches in the early morning (totalling 2 person hours at each site);
- owl audio observations using recorded calls to elicit calls from nearby birds (3 minutes replay of relevant species calls and two minutes listening time); and
- insectivorous bats were recorded for an entire night at each site using ANABAT equipment. These were analysed by Greg Ford using the appropriate referencing (Churchill 1998; Reinhold et al. 2001).

All traps were checked twice daily to avoid trap losses of fauna. In addition, opportunistic sightings were made during the day and night from the vehicle or on foot transects while traversing the study area.

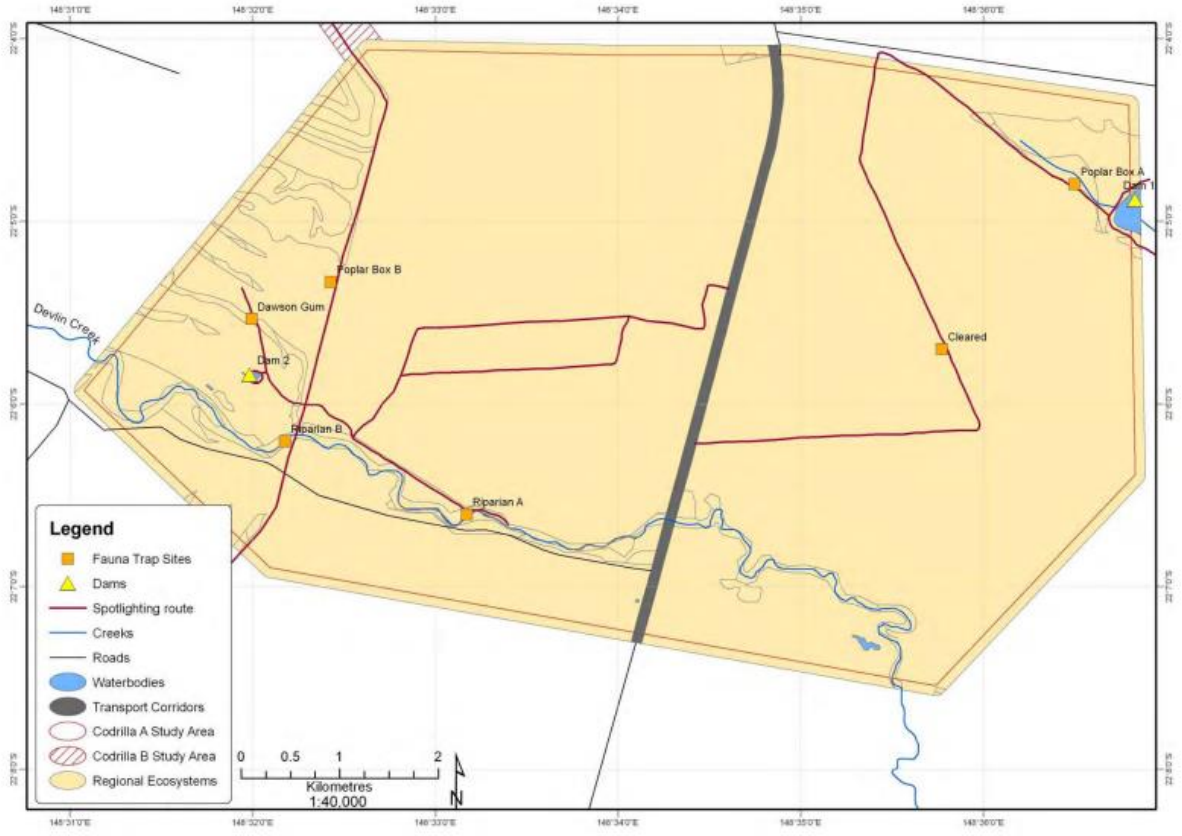

Figure 12 Fauna sites, spotlighting routes and features of ML 70450

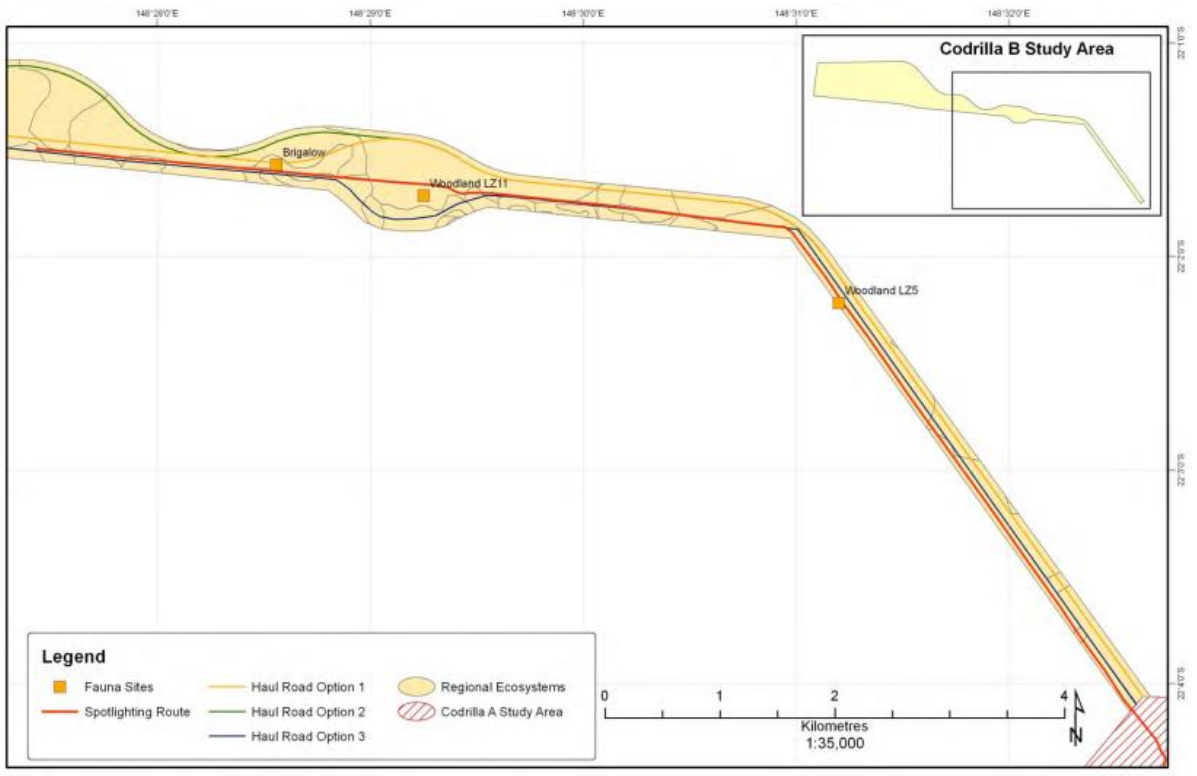

Figure 13 Fauna sites, spotlighting routes and features on ML 70455

Abundance

Estimates of the abundance of species within the study area were made, definitions of abundance class differed for birds and other vertebrates:

- Birds were defined as uncommon (U) - one or two individuals; common (C) - three to 19 individuals at more than one site or locally common (LC) three to 19 individuals at one site only; abundant (A) - 20 to 49 individuals; and very abundant (VA) - ≥50 individuals;
- Abundance classes of other vertebrates were based on a combination of frequency of occurrence at trap sites and abundance (1 trap site only was uncommon (U) while an abundance ≥10 individuals was abundant (A) with the remainder common (C)).
- The trace of a vertebrate or the registering of a bat species by ANABAT at a site was counted as '1' at that site.
- The abundance of any species at a particular site was determined by the most of that species recorded at the site at one time.

Incidental observations of fauna were recorded over the whole study area with additional searches at two dams within the study area done in both 2009 and 2010.

Significant Species

Three threat-listed species of fauna were recorded in the Project Area during surveys completed in 2009 and 2010 (Centre for Environmental Management 2010).

- Squatter Pigeon (*Geophaps scripta scripta*)
- Ornamental Snake (*Denisonia maculata*)

- Little Pied Bat (*Chalinolobus picatus*).

A review of biodiversity databases and literature undertaken for the Project (Centre for Environmental Management 2010) identified an additional 20 threat-listed fauna species as potentially occurring on site. Based on the availability and condition of potential habitat within the Project Area, 14 of these species are considered to occur on site with a moderate or higher likelihood.

Two Migratory birds were recorded within the Project Area during surveys completed in 2009 and 2010 (Centre for Environmental Management 2010):

- Rainbow Bee-eater (*Merops ornatus*)
- Eastern Great Egret (*Ardea modesta*).

Desk-based assessments have nominated an additional 35 species as potentially occurring with the locality; however, the majority of these comprise Migratory shoreline birds, with no habitat in the Codrilla Area.

Table 17,

Table 19 Presence and abundance of non-bird ground-active and arboreal vertebrate fauna (Mammals)

Taxon	Common Name	Status	I.D.	Abund.	Survey	Cleared	Brig	Daw	PB	Rip	Wood LZ5	Wood LZ11	Inc.	Inc. Hab.	Total
MAMMALS															
Monotremes															
Tachyglossidae															
Tachyglossus aculeatus	Echidna		T	C-3	2010			1	1		1				3
Marsupials															
Peramelidae															
Isoodon macrourus	Northern Brown Bandicoot		T	C-3	2009/10			1	1		1				3
Phalangeridae															
Trichosurus vulpecula	Common Brushtail Possum		T	U-2	2009			1	1						2
Petauridae															
Petaurus norfolcensis	Squirrel Glider		F	U-1	2010					1					1
Potoroidae															
Aepyprymnus rufescens	Rufous Bettong		F	U-1	2009								1	C	1
Macropodidae															
Macropus	Eastern Grey		F,	A-6	2009/10		1	4	3	6	4	2			20
giganteus	Kangaroo		T												
Macropus dorsalis	Black-striped Wallaby		T	C-2	2009			2	1						3
Wallabia bicolor	Swamp Wallaby		T	U-1	2010			1							1
Petrogale inornata.	Unadorned Rock Wallaby		T	U-1	2010				1						1
Placentals															
Muridae															
Mus musculus	House Mouse	*	C	U-1	2009					1					1
Rattus rattus	Black Rat	*	C	U-1	2009					1					1
Canidae															
Canis lupus dingo	Dingo		T	U-1	2010					1					1
Leporidae															
Oryctolagus cuniculis	European Rabbit	*	F	A-5	2009/10			1	3		2		6	PB,C	12
Suidae															
Sus scrofa	Feral Pig	*	F	A-3	2009/10				8				10	PB, SW	18

Emballonuridae															
Saccolaimus flaviventris	Yellow-bellied Sheathtail Bat		A	A-8	2009/10	1	1	1	1	1		1	2	D, SW	8
Taphozous troughtoni	Troughton's Sheathtail Bat		B	U-1	2009								1	D	1
Molossidae															
Tadarida australis	White-striped Freetail Bat		A	U-1	2009	1									1
Chaerephon jobensis	Northern Freetail Bat		A	A-7	2009/10	1	1	1	1	1		1	1	D	7
Mormopterus beccarii	Beccari's Freetail Bat		A	C-3	2009/10			1				1	1	D	3
Mormopterus sp. 2	Eastern Freetail Bat		A	C-4	2009/10	1		1	1				1	D	4
Miniopteridae															
Miniopterus orianae oceanensis	Common Bentwing Bat		C	U-2	2009					1			1	D	2
Vespertilionidae															
Chalinolobus picatus	Little Pied Bat	Q-NT	A	C-3	2010		1						2	D, SW	3
Chalinolobus nigrogriseus	Hoary Wattled Bat		A	U-2	2009/10				1				1	D	2
Chalinolobus gouldii	Gould's Wattled Bat		A	C-3	2009/10				1	1			1	D	3
Chalinolobus morio	Chocolate Wattled Bat		A	U-2	2009/10			1					1	D	2
Vespadelus troughtoni	Eastern Cave Bat		C	U-2	2009			1					1	D	2
Vespadelus baverstocki	Inland Forest Bat		A	C-4	2009/10		1			1			2	D, SW	4
Scoteanax rueppellii	Greater Broad-nosed Bat		C	U-2	2009					1			1	D	2
Scotorepens balstoni	Inland Broad-nosed Bat		A	C-4	2009/10			1		1			2	D, SW	4
Scotorepens greyii	Little Broad-nosed Bat		A	C-4	2009/10			1	1	1			1	D	4
Scotorepens sanborni	Northern Broad-nosed Bat		B	U-1	2010								1	D	1

Table 20 Presence and abundance of non-bird ground-active and arboreal vertebrate fauna (Species)

Taxon	Common Name	Status	I.D.	Abund.	Survey	Cleared	Brig	Daw	PB	Rip	Wood LZ5	Wood LZ11	Inc.	Inc. Hab.	Total
Species						**7**	**16**	**31**	**29**	**30**	**15**	**14**	**25**		**65**
Abundance						**18**	**33**	**72**	**87**	**188**	**41**	**35**	**253**		**727**
Abundance - minus *Rhinella marina* (Cane Toads)						18	26	52	70	175	34	27	84		486
Frog Species						1	4	5	8	7	6	4	6		11
Lizard Species						2	5	10	6	5	5	5	0		16
Snake Species						0	2	1	1	4	0	1	0		6
Mammals (Non Micro-bat species)						0	1	7	8	5	4	1	3		14
Micro-bat Species						4	4	8	6	8	0	3	16		17

Status = Conservation status: * - introduced species; Q-E, Q-NT or Q-V – endangered, near threatened or vulnerable under Qld Government legislation; F-V - vulnerable under Federal legislation

ID = Identification category: T - trace only and abundance uncertain, C - specimen captured, positively identified and released; F - specimen positively identified in field; Sc - specimen positively identified from animal traces (scats, hairs contained in predator scats or other sources, tracks, diggings, burrows, scratch marks on trees); AN - Anabat identification

Abund = Abundance: A - abundant, C - common, U – uncommon (with number of sites recording the species)

Habitat: Inc.- Incidental; Hab.-Habitat; C-Cleared Grassland; Brig-Brigalow; Daw-Dawson Gum; PB-Poplar Box, Rip-Riparian, D-Dam; SW-Sedge Wetland; Wood-Ironbark Woodland; LZ-Land Zone

Table 21,

Table 19, Table 20 and Table 21 below details the combined sightings, trap catches, Anabat detection and traces of non-bird ground-active and arboreal vertebrate fauna and birds.

Table 17 Presence and abundance of non-bird ground-active and arboreal vertebrate fauna (Amphibians)

Taxon	Common Name	Status	I.D.	Abund.	Survey	Cleared	Brig	Daw	PB	Rip	Wood LZ5	Wood LZ11	Inc.	Inc. Hab.	Total
AMPHIBIANS															
Bufonidae															
Rhinella marina (Bufo marinus)	Cane Toad	*	C	A-8	2009/10		7	20	17	13	7	8	169	D	241
Hylidae															
Cyclorana alboguttata	Striped Burrowing Frog		C	A-7	2009/10		2	2	4	56	5	1	13	D	83
Cyclorana novaehollandiae	Giant Waterholding Frog		C	C-3	2010		2		5	4					11
Litoria caerulea	Green Tree Frog		C	A-7	2009/10	11		3	4	6	6	2	2	C	34
Litoria inermis	Floodplain Frog		C	A-3	2009/10					9			27	D	36
Litoria rothii	Roth's Tree Frog		C	U-1	2010						1				1
Litoria rubella	Desert Tree Frog		C	C-3	2009				3				4	Rip, D	7
Myobatrachidae															
Opisthodon (Limnodynastes) ornatus	Ornate Burrowing Frog		C	A-7	2009/10		3	8	4	64	3	10	1	Rip	93
Limnodynastes salmini	Salmon-striped Frog		C	U-1	2009				2						2
Limnodynastes tasmaniensis	Spotted Grass Frog		C	C-3	2009/10			1	10	1					12
Limnodynastes terraereginae	Northern Banjo Frog		C	U-1	2010						1				1

Table 18 Presence and abundance of non-bird ground-active and arboreal vertebrate fauna (Reptiles)

REPTILES															
Chelidae															
Emydura macquarii krefftii	Krefft's River Turtle		F	U-1	2009					1					1
Gekkonidae															
Gehyra catenata			C	U-1	2010		2								2
Gehyra dubia	Dubious Dtella		C	A-5	2009/10		1	4	2	3	2				12
Heteronotia binoei	Bynoe's Gecko		C	4	2009/10		4	4	4		3				15
Nephrurus asper	Prickly Knob-tailed Gecko		C	C-2	2010			1				3			4
Strophurus williamsi	Eastern Spiny-tailed Gecko		C	U-1	2009			1							1
Pygopodidae															
Lialis burtonis	Burton's Snake-lizard		C	U-1	2009					1					1
Scincidae															
Carlia pectoralis			C	A-5	2009/10		4	3		3	2	2			14
Cryptoblepharus pulcher			C	C-3	2009/10			1	1	2					4
Ctenotus robustus	Eastern Striped Skink		C	C-6	2009/10	2	1	1	3		2	1			10
Ctenotus taeniolatus	Copper-tailed Skink		C	U-1	2009			1							1
Menetia greyii			C	U-1	2009				1						1
Morethia taeniopleura			C	C-3	2009/10	1					1	1			3
Tiliqua scincoides	Eastern Blue-tongue		C	U-2	2010					1		1			2
Agamidae															
Amphibolurus nobbi	Nobbi Dragon		C	U-1	2009			1							1
Pogona barbata	Eastern Bearded Dragon		C	U-1	2010			1							1
Varanidae															
Varanus tristis	Freckled Monitor		C	U-1	2010				1						1
Pythonidae															
Antaresia maculosa	Spotted Python		C	C-2	2009				1	1					2
Elapidae															
Cryptophis boschmai	Carpentaria Snake		C	U-2	2010		1	1							2
Demansia psammophis	Yellow-faced Whipsnake		C	C-1	2010					3					3
Demansia vestigiata	Lesser Black Whipsnake		C	U-1	2009/10					1					1
Denisonia maculata	Ornamental Snake	Q-V, F-V	C	U-2	2010		1					1			2
Pseudonaja textilis	Eastern Brown Snake		C	U-1	2009					1					1

Table 19 Presence and abundance of non-bird ground-active and arboreal vertebrate fauna (Mammals)

Taxon	Common Name	Status	I.D.	Abund.	Survey	Cleared	Brig	Daw	PB	Rip	Wood LZ5	Wood LZ11	Inc.	Inc. Hab.	Total
MAMMALS															
Monotremes															
Tachyglossidae															
Tachyglossus aculeatus	Echidna		T	C-3	2010			1	1		1				3
Marsupials															
Peramelidae															
Isoodon macrourus	Northern Brown Bandicoot		T	C-3	2009/10			1	1		1				3
Phalangeridae															
Trichosurus vulpecula	Common Brushtail Possum		T	U-2	2009			1	1						2
Petauridae															
Petaurus norfolcensis	Squirrel Glider		F	U-1	2010					1					1
Potoroidae															
Aepyprymnus rufescens	Rufous Bettong		F	U-1	2009								1	C	1
Macropodidae															
Macropus	Eastern Grey		F,	A-6	2009/10		1	4	3	6	4	2			20
giganteus	Kangaroo		T												
Macropus dorsalis	Black-striped Wallaby		T	C-2	2009			2	1						3
Wallabia bicolor	Swamp Wallaby		T	U-1	2010			1							1
Petrogale inornata.	Unadorned Rock Wallaby		T	U-1	2010				1						1
Placentals															
Muridae															
Mus musculus	House Mouse	*	C	U-1	2009					1					1
Rattus rattus	Black Rat	*	C	U-1	2009					1					1
Canidae															
Canis lupus dingo	Dingo		T	U-1	2010					1					1
Leporidae															
Oryctolagus cuniculis	European Rabbit	*	F	A-5	2009/10			1	3		2		6	PB,C	12
Suidae															
Sus scrofa	Feral Pig	*	F	A-3	2009/10				8				10	PB, SW	18

Emballonuridae															
Saccolaimus flaviventris	Yellow-bellied Sheathtail Bat		A	A-8	2009/10	1	1	1	1	1		1	2	D, SW	8
Taphozous troughtoni	Troughton's Sheathtail Bat		B	U-1	2009								1	D	1
Molossidae															
Tadarida australis	White-striped Freetail Bat		A	U-1	2009	1									1
Chaerephon jobensis	Northern Freetail Bat		A	A-7	2009/10	1	1	1	1	1		1	1	D	7
Mormopterus beccarii	Beccari's Freetail Bat		A	C-3	2009/10			1				1	1	D	3
Mormopterus sp. 2	Eastern Freetail Bat		A	C-4	2009/10	1		1	1				1	D	4
Miniopteridae															
Miniopterus orianae oceanensis	Common Bentwing Bat		C	U-2	2009					1			1	D	2
Vespertilionidae															
Chalinolobus picatus	Little Pied Bat	Q-NT	A	C-3	2010		1						2	D, SW	3
Chalinolobus nigrogriseus	Hoary Wattled Bat		A	U-2	2009/10				1				1	D	2
Chalinolobus gouldii	Gould's Wattled Bat		A	C-3	2009/10				1	1			1	D	3
Chalinolobus morio	Chocolate Wattled Bat		A	U-2	2009/10			1					1	D	2
Vespadelus troughtoni	Eastern Cave Bat		C	U-2	2009			1					1	D	2
Vespadelus baverstocki	Inland Forest Bat		A	C-4	2009/10		1			1			2	D, SW	4
Scoteanax rueppellii	Greater Broad-nosed Bat		C	U-2	2009					1			1	D	2
Scotorepens balstoni	Inland Broad-nosed Bat		A	C-4	2009/10			1		1			2	D, SW	4
Scotorepens greyii	Little Broad-nosed Bat		A	C-4	2009/10			1	1	1			1	D	4
Scotorepens sanborni	Northern Broad-nosed Bat		B	U-1	2010								1	D	1

Table 20 Presence and abundance of non-bird ground-active and arboreal vertebrate fauna (Species)

Taxon	Common Name	Status	I.D.	Abund.	Survey	Cleared	Brig	Daw	PB	Rip	Wood LZ5	Wood LZ11	Inc.	Inc. Hab.	Total
Species						**7**	**16**	**31**	**29**	**30**	**15**	**14**	**25**		**65**
Abundance						**18**	**33**	**72**	**87**	**188**	**41**	**35**	**253**		**727**
Abundance - minus *Rhinella marina* (Cane Toads)						18	26	52	70	175	34	27	84		486
Frog Species						1	4	5	8	7	6	4	6		11
Lizard Species						2	5	10	6	5	5	5	0		16
Snake Species						0	2	1	1	4	0	1	0		6
Mammals (Non Micro-bat species)						0	1	7	8	5	4	1	3		14
Micro-bat Species						4	4	8	6	8	0	3	16		17

Status = Conservation status: * - introduced species; Q-E, Q-NT or Q-V – endangered, near threatened or vulnerable under Qld Government legislation; F-V - vulnerable under Federal legislation

ID = Identification category: T - trace only and abundance uncertain, C - specimen captured, positively identified and released; F - specimen positively identified in field; Sc - specimen positively identified from animal traces (scats, hairs contained in predator scats or other sources, tracks, diggings, burrows, scratch marks on trees); AN - Anabat identification

Abund = Abundance: A - abundant, C - common, U – uncommon (with number of sites recording the species)

Habitat: Inc.- Incidental; Hab.-Habitat; C-Cleared Grassland; Brig-Brigalow; Daw-Dawson Gum; PB-Poplar Box, Rip-Riparian, D-Dam; SW-Sedge Wetland; Wood-Ironbark Woodland; LZ-Land Zone

Table 21 Presence and abundance of birds

Common Name	Scientific Name	Status	Abund.	Survey	Cleared	Brig	Daw	PB	Rip	Wood. LZ5	Wood. LZ11	Inc.	Inc. Hab.	Total
Emu														
Emu	*Dromaius novaehollandiae*		C-3	2009/10		1			4			5	C	10
True Quails														
Brown Quail	*Coturnix ypsilophora*		C-2	2009/10					4			4	Rip	8
Swans, Geese & Ducks														
Black Swan	*Cygnus atratus*		U-1	2010								2	D	2
Australian Wood Duck	*Chenonetta jubata*		C-2	2009/10					10			10	D	20
Pacific Black Duck	*Anas superciliosa*		C-2	2009/10					10			10	D	20
Australasian Shoveler	*Anas rhynchotis*		U-1	2009					1			1	D	2
Grey Teal	*Anas gracilis*		A-2	2009/10					20			23	D	43
Hardhead	*Aythya australis*		U-1	2010								2	D	2
Grebes														
Australasian Grebe	*Tachybaptus novaehollandiae*		C-1	2009					5			5	D	10
Cormorants														
Little Pied	*Microcarbo*		U-1	2010								1	D	1
Cormorant	*melanoleucos*													
Little Black Cormorant	*Phalocrocorax sulcirostris*		C-1	2010								3	D	3

Common Name	Scientific Name	Status	Abund.	Survey	Cleared	Brig	Daw	PB	Rip	Wood. LZ5	Wood. LZ11	Inc.	Inc. Hab.	Total
Herons, Egrets & Bitterns														
White-faced Heron	*Egretta novaehollandiae*		C-3	2009/10				1	2			2	D	5
White-necked Heron	*Ardea pacifica*		U-1	2009					2			2	D	4
Eastern Great Egret	*Ardea modesta*	M*	C-1	2009					9			9	D	18
Ibis & Spoonbills														
Straw-necked Ibis	*Threskiornis spinicollis*		C-2	2009					5			5	Wood, D	10
Royal Spoonbill	*Platalea regia*		C-1	2009					6			6	D	12
Yellow-billed Spoonbill	*Platalea flavipes*		C-1	2009					4			4	D	8
Raptors														
Pacific Baza	*Aviceda subcristata*		U-1	2009		2								2
Black-breasted Buzzard	*Hamirostra melanosternon*		U-1	2009			1							1
Black Kite	*Milvus migrans*		C-3	2009/10		1			2			2	PB	5
Whistling Kite	*Haliastur sphenurus*		C-4	2009/10				1	2		1	2	Rip, PB	6
Brown Goshawk	*Accipiter fasciatus*		U-1	2009					1			1	D	2
Wedge-tailed Eagle	*Aquila audax*		C-3	2009/10					2			2	Rip, W	4
Falcons														
Brown Falcon	*Falco berigora*		C-3	2009/10		1			3			3	C	7
Australian Hobby	*Falco longipennis*		C-4	2009/10				2	3			3	PB, D	8
Nankeen Kestrel	*Falco cenchroides*		C-2	2009/10					4			4	C	8
Cranes														
Brolga	*Grus rubicunda*		C-2	2009/10					2			2	C	4
Crakes & Rails														
Eurasian Coot	*Fulica atra*		C-1	2010								6	D	6
Bustards														
Australian Bustard	*Ardeotis australis*		C-1	2009					3			3	C	6
Waders														
Comb-crested Jacana	*Irediparra gallinacea*		C-1	2010								6	D	6
Stone-Curlews														
Bush Stone-curlew	*Burhinus grallarius*		U-1	2010			2							2
Plovers														
Black-fronted Dotterel	*Elseyornis melanops*		U-1	2010								2	D	2
Masked Lapwing	*Vanellus miles*		C-3	2009/10			3		4			4	D	11

Common Name	Scientific Name	Status	Abund.	Survey	Cleared	Brig	Daw	PB	Rip	Wood. LZ5	Wood. LZ11	Inc.	Inc. Hab.	Total
Pigeons & Doves														
Crested Pigeon	*Ocyphaps lophotes*		A-2	2009/10		6			18			18	Wood	42
Squatter Pigeon	*Geophaps scripta*	Q-NT, F-V	C-2	2010							2	2	Wood	4
Peaceful Dove	*Geopelia placida*		C-3	2009/10					4			4	B, Wood	8
Bar-shouldered Dove	*Geopelia humeralis*		U-1	2010						2				2
Cockatoos														
Galah	*Eolophus roseicapillus*		A-7	2009/10		2	36	2	32		3	32	C	107
Little Corella	*Cacatua sanguinea*		C-1	2010						3				3
Sulphur-crested Cockatoo	*Cacatua galerita*		A-7	2009/10		4	3	2	2		4	10	D	25
Cockatiel	*Nymphicus hollandicus*		C-4	2009/10				2	8			8	Wood, C	18
Parrots														
Rainbow Lorikeet	*Trichoglossus haematodus*		A-7	2009/10		18	21	17	30	2	4	30	Rip	122
Scaly-breasted Lorikeet	*Trichoglossus chlorolepidotus*		C-1	2009					5			5	Rip	10
Red-winged Parrot	*Aprosmictus erythropterus*		A-5	2009/10				2		10		8	Dam	20
Pale-headed Rosella	*Platycercus adscitus*		A-5	2009/10		6	2		5			5	Daw,PB	18
Cuckoos														
Horsfield's Bronze-Cuckoo	*Chalcites basalis*		U-1	2009				1						1
Little Bronze-Cuckoo	*Chalcites minutillus*		U-2	2010							1	1	Wood	2
Pheasant Coucal	*Centropus phasianinus*		C-3	2009/10				2	1		1	1	Rip	5
Owls														
Southern Boobook	*Ninox novaeseelandiae*		C-6	2009/10			1	1				2	C	4
Eastern Barn Owl	*Tyto javanica*		C-?	2009/10					?			?	C	4
Frogmouths														
Tawny Frogmouth	*Podargus strigoides*		C-4	2009/10		3			2		1	2	C	8
Nightjars														
White-throated Nightjar	*Eurostopodus mystacalis*		U-1	2010						1				1
Australian Owlet-nightjar	*Aegotheles cristatus*		U-2	2009/10			1							1
Kingfishers														
Laughing Kookaburra	*Dacelo novaeguineae*		A-6	2009/10			2	6	2	4		2	PB	16
Blue-winged Kookaburra	*Dacelo leachii*		C-4	2009/10		6	4		3			3	C, Daw	16
Forest Kingfisher	*Todiramphus macleayii*		U-2	2009/10				1						1

Taxon	Common Name	Status	I.D.	Abund.	Survey	Cleared	Brig	Daw	PB	Rip	Wood LZ5	Wood LZ11	Inc.	Inc. Hab.	Total
Bee-Eaters															
Rainbow Bee-eater	*Merops ornatus*	M		U-1	2010								2	Wood	2
Treecreepers															
Brown Treecreeper	*Climacteris picumnus*			C-1	2009			4							4
Fairy-Wrens															
Variegated Fairy-wren	*Malurus lamberti*			C-2	2009/10					4		4	4	D	12
Red-backed Fairy-wren	*Malurus melanocephalus*			A-5	2009/10			7	5	2			11	C	25
Pardalotes, Scrubwrens, Gerygones & Thornbills															
Striated Pardalote	*Pardalotus striatus*			A-8	2009/10		3	3	6		2	2			16
Weebill	*Smicrornis brevirostris*			A-6	2009/10			4	4		10	3			21
White-throated Gerygone	*Gerygone albogularis*			C-5	2009/10			2	3			1			6
Honeyeaters															
Noisy Friarbird	*Philemon corniculatus*			C-2	2010						2		5	Wood	7
Little Friarbird	*Philemon citreogularis*			A-3	2009/10		3		3	20			20	Rip	46
Blue-faced Honeyeater	*Entomyzon cyanotis*			A-5	2009/10			3	3	8			8	Rip, D	22
Noisy Miner	*Manorina melanocephala*			A-4	2010		5	4	6						15
Yellow-throated Miner	*Manorina flavigula*			A-5	2009/10			5	6	14			14	PB, Rip	39
Singing Honeyeater	*Lichenostomus virescens*			C-3	2009				2	4			4	R, D	10
White-throated Honeyeater	*Melithreptus albogularis*			A-4	2009/10			3	10	4			4	R	21
Robins															
Jacky Winter	*Microeca fascinans*			C-2	2009/10			2					2	Wood	4
Babblers															
Grey-crowned Babbler	*Pomatostomus temporalis*			A-6	2009/10		6	9	8		5				28
Sittellas															
Varied Sittella	*Daphoenositta chrysoptera*			C-1	2009				5						5
Whistlers & Shrike-Thrushes															
Rufous Whistler	*Pachycephala rufiventris*			C-3	2009			1	5	2			2	Rip	10
Monarchs & Flycatchers															
Restless Flycatcher	*Myiagra inquieta*			U-1	2009					2			2	D	4
Magpie-lark	*Grallina cyanoleuca*			A-6	2009/10		4	4	2		2				12

Common Name	Scientific Name	Status	Abund.	Survey	Cleared	Brig	Daw	PB	Rip	Wood. LZ5	Wood. LZ11	Inc.	Inc. Hab.	Total
Grey Fantail	*Rhipidura albiscapa*		A-7	2009/10		2	2	6	4	3		4	Rip	21
Willie Wagtail	*Rhipidura leucophrys*		C-5	2009/10			2	2	2			4	C	10
Spangled Drongo	*Dicrurus bracteatus*		U-1	2009					1			1	Dam	2
Cuckoo-Shrikes & Trillers														
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*		C-6	2009/10			2	2	3			3	C, Wood	10
Ground Cuckoo-shrike	*Coracina maxima*		C-1	2009		4								4
Orioles & Figbirds														
Olive-backed Oriole	*Oriolus sagittatus*		U-1	2009				1						1
Woodswallows														
White-breasted Woodswallow	*Artamus leucorynchus*		C-2	2009/10				6				12	Wood	18
Black-faced Woodswallow	*Artamus cinereus*		C-3	2009/10			3		6			6	C	15
Butcherbirds, Magpies & Currawongs														
Grey Butcherbird	*Cracticus torquatus*		A-8	2009/10		6	2	3	2	2	2	2	Rip	19
Pied Butcherbird	*Cracticus nigrogularis*		A-9	2009/10		2	6	4	2	6	2	2	PB	24
Australian Magpie	*Cracticus tibicen*		A-10	2009/10		7	4	8	6	10	2	6	PB, C	43
Pied Currawong	*Strepera graculina*		U-1	2010							2			2
Ravens & Crows														
Australian Raven	*Corvus coronoides*		U-1	2009		2								2
Torresian Crow	*Corvus orru*		A-7	2009/10		4	2	11	2	2	4	2	PB	27
Mud-Nest Builders														
Apostlebird	*Struthidea cinerea*		A-1	2009/10		16								16
Larks														
Horsfield's Bushlark	*Mirafra javanica*		C-3	2009/10	2				4			5	C	11
Pipits & Wagtails														
Australasian Pipit	*Anthus novaeseelandiae*		C-3	2009/10	2				9			9	C	20
Finches														
Zebra Finch	*Taeniopygia guttata*		A-2	2009			3		22			22	C	47
Double-barred Finch	*Taeniopygia bichenovii*		C-2	2009/10					6			6	D	12
Plum-headed Finch	*Neochmia modesta*		U-1	2009					2			2	D	4
Swallows & Martins														
Tree Martin	*Petrochelidon nigricans*		A-2	2009/10					45			45	C	90
Warblers														
Golden-headed Cisticola	*Cisticola exilis*		C-2	2009/10					2			2	C	4

Taxon	Common Name	Status	I.D.	Abund.	Survey	Cleared	Brig	Daw	PB	Rip	Wood LZ5	Wood LZ11	Inc.	Inc. Hab.	Total
Species						2	24	33	36	61	16	17	76		98
Abundance						4	114	153	151	400	66	39	480		1407

Status = Conservation Status: * - introduced species; Q-C, Q-NT, Q-V or Q-E indicates listed as common, near threatened, vulnerable or endangered under *Queensland Nature Conservation Act (1992)*;

F-V, F-E, M or S indicates vulnerable , endangered, migratory or marine species under Federal legislation *EPBC Act (1999)* (M* indicates 'nomadic migratory' birds);

Abund. = Abundance rating: VA - very abundant, A - abundant, C - common, LC - locally common, U – uncommon (with number of sites recording the species).

Habitat: Inc.- Incidental; Hab.-Habitat; C-Cleared Grassland; Brig-Brigalow; Daw-Dawson Gum; PB-Poplar Box, Rip-Riparian, D-Dam; SW-Sedge Wetland; Wood-ironbark woodland; LZ-Land Zone.

Aquatic ecology

Aquatic surveys completed at Devlin Creek during in 2009 and 2010 recorded four common fish species (Agassiz's Glassfish, Eastern Rainbow Fish, Purple-spotted Gudgeon and Hyrtl's Tandan) and one turtle (Krefft's Turtle) (Centre for Environmental Management 2010). No threat-listed aquatic species have been recorded within the Project Area; however, the Fitzroy River Turtle (*Rheodytes leukops*) and Eungella Day Frog (*Taudactylus eungellensis*) have the potential to occur. Details of macroinvertebrate species identified and abundance are shown in Table 22.

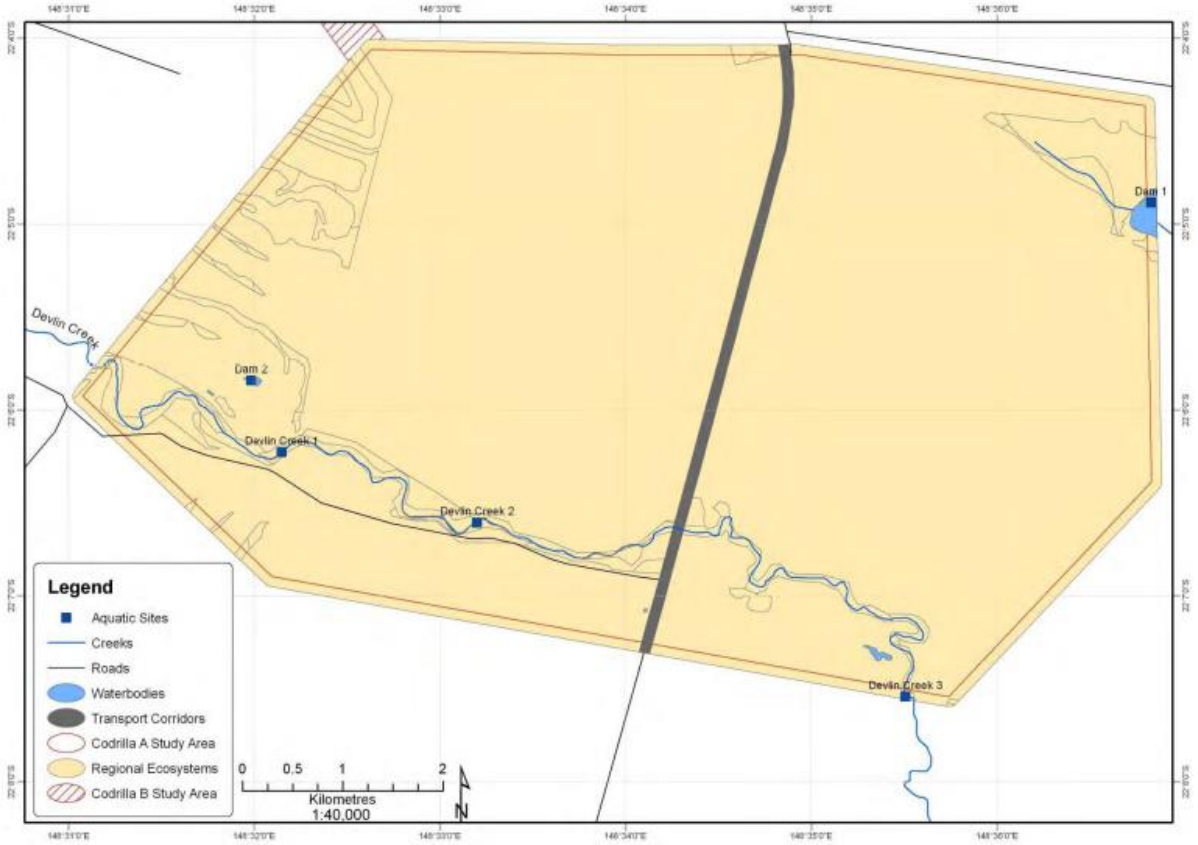

Figure 14 Freshwater sites on ML 70450

Monitoring of groundwater bores during the EIS process identified three taxa of stygofauna within the alluvial aquifer of Devlin Creek (ALS Water Resources Group 2011). The stygofauna specimens collected from inside the Project Area are potentially new species; however, at the taxonomic level of Family or Order, neither are unique to the Project Area. Groundwater monitoring did not record any stygofauna in the non-alluvial aquifers. The absence of stygofauna during sampling and the highly saline groundwater suggests that stygofauna are unlikely to inhabit these aquifers.

Table 22 Macroinvertebrate species identified and abundance

Site/Habitat		DC1		DC2		DC3		Dam 1		Dam 2	
Order	Family	Edge	Pool	Edge	Pool	Edge	Pool	Edge	Pool	Edge	Pool
Gastropoda	Ancylidae	0	0	20	0	0	0	0	0	0	0
	Lymnaea	0	0	0	0	0	0	50	10	0	0
	Petterdiana	0	0	0	0	0	0	0	0	40	0
Hydrozoa	Hydra	0	0	0	0	0	0	0	50	0	170
Oligochaetae	Oligochaetae	120	28	0	70	0	0	80	560	50	500
Acarina	Araenae	0	0	0	0	0	0	0	30	0	10
Decapoda	Atyidae	0	0	20	0	10	0	0	0	0	0
Diptera	Chironomidae	1320	596	1090	375	1410	127	1620	1500	1000	1750
	Ceratopogonidae	0	24	0	25	120	20	430	260	170	710
	Chaoboridae	0	0	0	35	0	13.3	90	0	110	0
	Culicidae	0	0	0	0	0	0	180	0	0	40
	Diptera pupae	0	0	10	0	30	0	0	0	0	0
	Simuliidae	0	0	0	0	0	0	110	40	530	140
	Tabanidae	0	0	10	0	0	0	0	0	0	0
Ephemeroptera	Baetidae	0	0	0	0	0	0	30	90	0	60
	Caenidae	10	0	20	0	150	0	20	70	10	70
	Siphlonuridae	0	0	0	0	0	0	0	0	0	50
Hemiptera	Corixidae	0	0	0	0	10	0	0	0	0	0
	Pleidae	0	0	0	0	0	0	20	160	250	60
	Notonectidae	0	0	0	0	0	0	20	0	0	0
Odonata	Coenagrionidae	0	0	0	0	0	0	70	10	0	150
	Corduliidae	0	0	0	0	0	0	80	20	0	80
	Odonata larvae	0	0	20	5	0	0	0	0	0	0
	Zygoptera	0	0	0	0	0	0	60	0	10	0
Trichoptera	Leptoceridae	0	12	10	30	40	6.67	0	0	0	0
	Ecnomidae	0	0	0	5	10	0	0	0	0	0
Coleoptera	Hydrophilidae	10	0	10	0	0	0	0	10	0	70
Orders		**4**	**3**	**7**	**4**	**6**	**2**	**6**	**9**	**6**	**8**
Families		**4**	**4**	**9**	**7**	**8**	**4**	**14**	**13**	**9**	**14**
Abundance		**1352**	**660**	**1210**	**545**	**1780**	**167**	**2860**	**2810**	**2170**	**3860**

3.1.1.9 Pre-mining land use

Land uses in the vicinity of the Codrilla Project include, coal and gas exploration, public road infrastructure, (including the Fitzroy Developmental Road (FDR) and the Valkyrie Road) and the Valkyrie School and school residence, which are located approximately 800m to the north of the ML boundary. The FDR is also a designated stock route.

The existing land uses of the Codrilla Project area and the area immediately surrounding the project are primarily related to production of beef cattle. Typically, the operating properties in this locality are in the order of 5,000 to 20,000 ha in size. The Codrilla property on which the Codrilla mining

operation, processing facilities and associated infrastructure are to be located, consists primarily of improved pasture with some small isolated areas of remnant vegetation remaining, much of which is associated with significant drainage channels. The haul road corridor from Codrilla to the Moorvale Mining Lease (ML70455) passes through three additional cattle properties, being Twenty Mile, Bundarra and Devlin Creek. The areas within and adjacent to the haul road corridor are a combination of cleared areas consisting of improved pastures and remnant native vegetation with an understorey of native and introduced grasses.

The pre-existing and surrounding land use is a mixture of grazing and remnant native vegetation.

The Broadsound Shire Planning Scheme, which was in effect at the time of the approval, identified the preferred use for the Codrilla area as Key Resource Area and within it as a coal/mineral resource as shown in Figure 15.

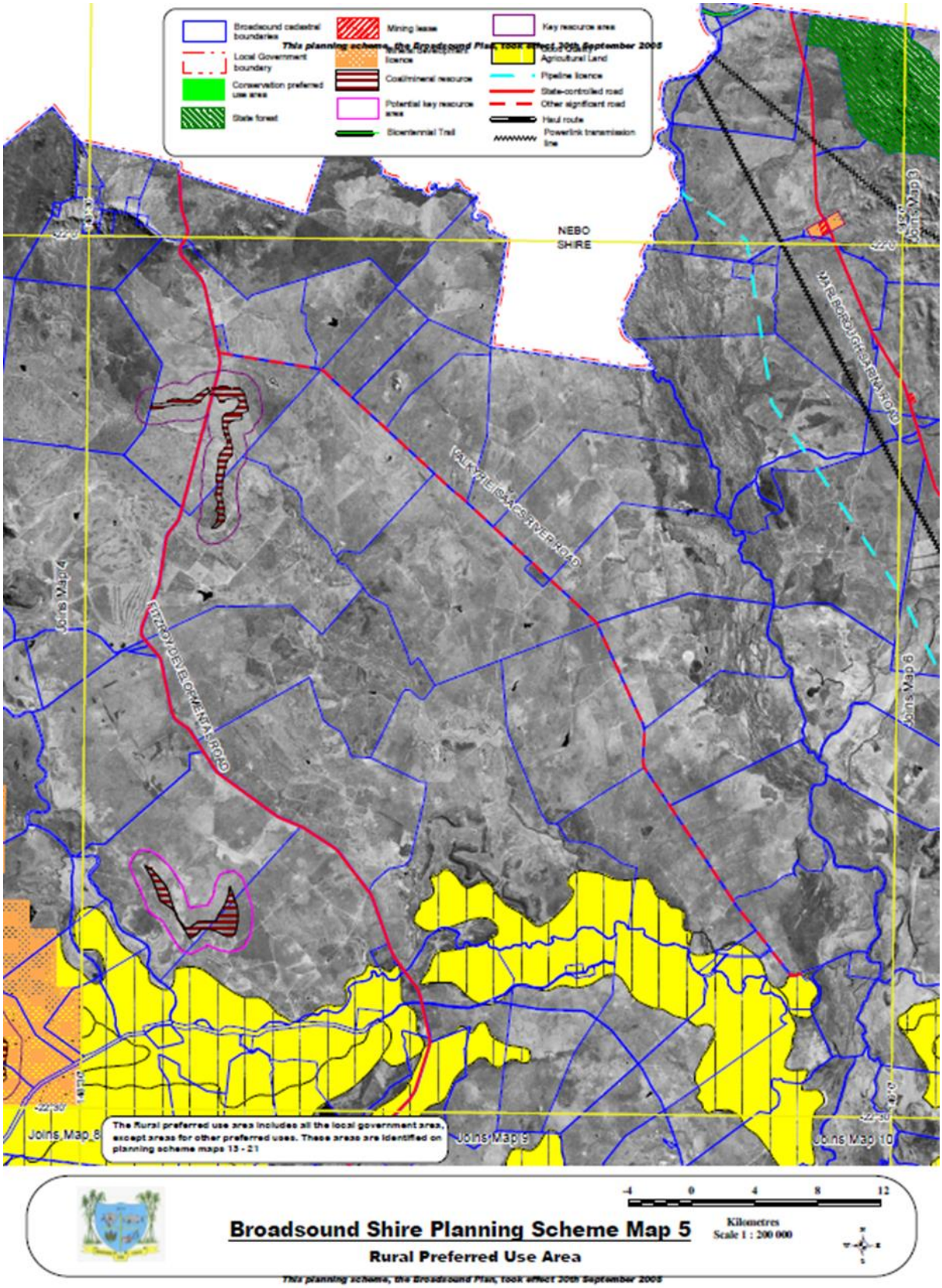

Figure 15 Broadsound Shire Planning Scheme

3.1.1.10 Underlaying landholders

Table 23 and Table 24 below identify the property description details for ML70450 and ML70455 respectively. Bistrotel Pty Ltd, which is a subsidiary of Peabody Energy Australia PCI Pty Ltd, owns most of the land covered by the Project.

Table 23 Property Details for ML70450

RP Description	Landholder	Tenure Type	Parish	ML/Property Area (ha)
Lot 16 on RP845112	Bistrotel Pty Ltd	Freehold	Kerlong	4238 (12722)
Road Reserve Fitzroy Development Road	DTMR	Road Reserve	Kerlong	N/A

Table 24 Property Details for ML70455

RP Description	Landholder	Tenure Type	Parish	Area (ha)
Lot 16 on RP845112	Bistrotel Pty Ltd	Freehold	Kerlong	12,722
Lot 5 on SP113322	Bistrotel Pty Ltd	Freehold	Kerlong	41,529
Lot 20 on KL168 (GHPL 30/4104)	Private Owner	Leasehold	Kerlong	11,900
Lot 1 on RP848589	Private Owners	Freehold	Ilsington	5,558

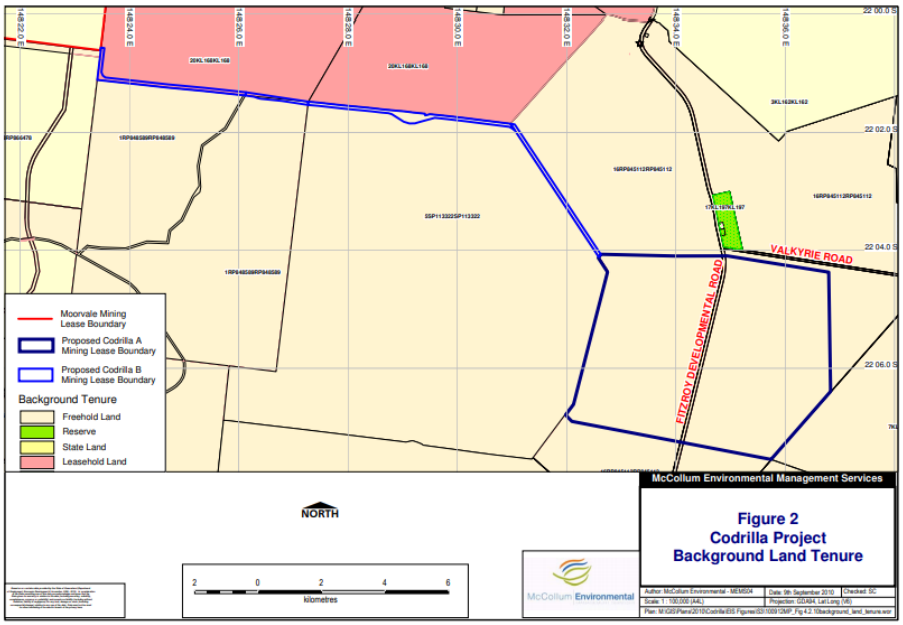

Figure 16 Underlaying tenure

3.1.2 Project Description

3.1.2.1 Resource tenure

The Codrilla Project consists of two mining leases (MLs). Details are shown below in Table 25 below.

Table 25 Codrilla Mining Leases

Mining Lease No.	Area (ha)	Grant Date	Local Government Area	Purpose
ML70450 (Codrilla A)	4252	28/06/2012	Isaac Regional Council	Mining & Infrastructure
ML70455 (Codrilla B)	213	28/06/2012	Isaac Regional Council	Infrastructure

The Codrilla Coal Mine Project is now owned by the participants in the Coppabella and Moorvale Joint Venture (the CMJV), being:

- Peabody Coppabella Pty Ltd (73.3%);
- CITIC Australia Coppabella Pty Ltd (14%);
- Winchester Coal Operations Pty Ltd (7%);
- KC Resources Pty Ltd (3.7%);
- and NS Coal Pty Ltd (2%).

The CMJV have appointed Peabody Energy Australia (C&M Management) Pty Ltd (Peabody) as the manager and operator of the Codrilla Project. Peabody is also the manager and operator for the Coppabella and Moorvale Coal Mines.

3.1.2.2 Primary mine features/infrastructure on site

The primary mine features are shown in Figure 17 and Figure 18 below.

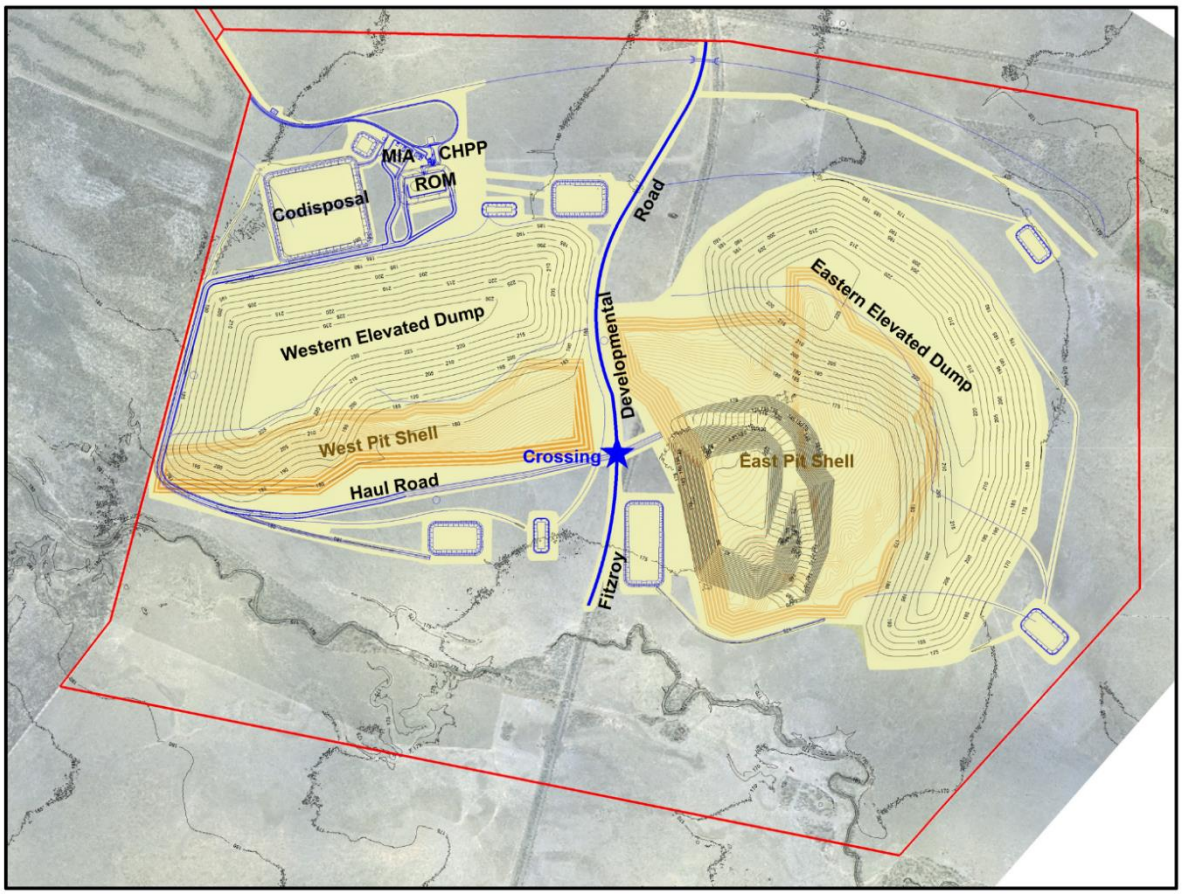

Figure 17 Primary mine features/Infrastructure

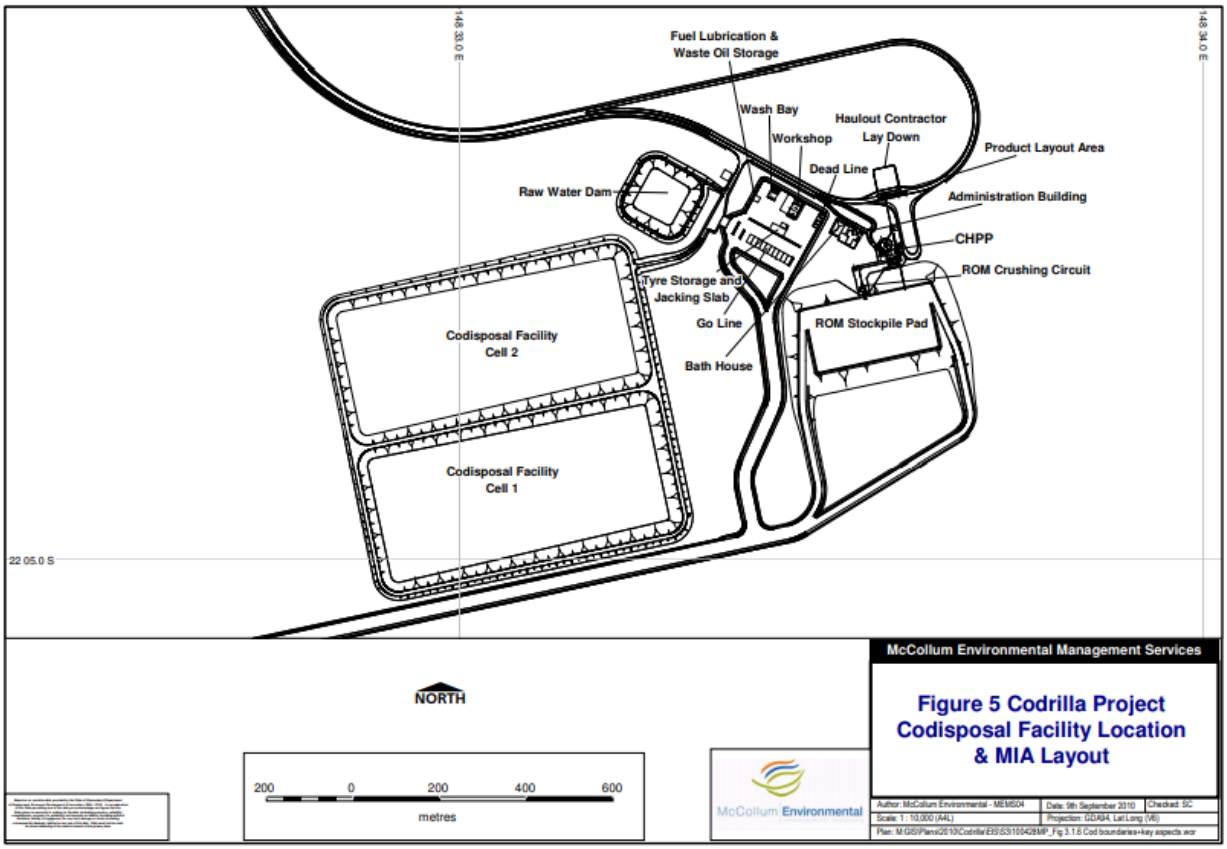

Figure 18 Co-disposal & MIA layout

3.1.2.3 Type of mining operation

The Codrilla Project involves development of a conventional truck and excavator/shovel open cut coal mine which may produce up to 5 million tonnes a year of Run of Mine Coal (ROM) with an average processing yield of 77% generating Pulverised Coal Injection (PCI) product for export. Run of mine coal would be processed on-site using conventional coal handling and preparation plant technologies. Process waste would be co-disposed with tailings, slurry and course rejects at on-site facilities. Product coal would be transported approximately 31 km to the existing Moorvale Mine train loading facility using road trains on a purpose-built private haul road. Coal would then be railed to Dalrymple Bay Coal Terminal for export.

Mining operations are currently proposed to commence in the Western pit progressing in an Easterly direction, after which mining would commence at the northern end of East pit and progress westwards before mining the southern end of the Eastern Pit, also in a westerly direction. The Southern end of the final pit area will be advanced and productively backfilled to ensure there is no residual void wholly or partially in the floodplain. Ongoing exploration activities may result in additional resources being defined and subsequent extension of the mine life. The currently planned ROM coal production rate will remain at approximately three million tonnes (Mt) per annum over the production phase of the operation, however favourable market conditions may see this rate rise to 5Mtpa, which is the approximate design capacity of the planned CHPP.

The selected method of mining is truck and shovel / excavator incorporating throw blasting where appropriate. The nature of the coal resource is such that it is best suited to this method of mining.

Furthermore, experience has been gained in truck / excavator and throw blasting methods within a similarly formed resource at Moorvale Mine.

Typical pit development will be undertaken utilising a dip-line approach which involves overburden excavation in a block perpendicular to the strike of the coal. Overburden within the blocks will be stripped in layers suitable for the size of the excavator being used. Coal seams exposed during this operation will be extracted by the mining fleet. Overburden will initially be transported to the out of pit dump until sufficient room is available to backfill available mined-out sections of pit. Once a block has been completely mined of all overburden and coal, then overburden from the next block in the mining sequence will be used to fill the completed block to final landform levels.

The dip-line method of mining results in the coal seams being mined as they are encountered during each successive section of pit development to final depth. This method has the additional advantage of greater Highwall and Lowwall stability compared to other mining methods.

Water management

The mine's water management system has been designed to divert water from undisturbed areas away from the site whilst preventing discharge from disturbed areas from entering undisturbed areas by capturing and storing runoff from disturbed areas for reuse in activities such as dust suppression and coal processing.

Co-disposal

The processing of coal generates a waste stream that has the potential to produce poor quality leachate that may contain elevated levels of salts, acid and metals. The current preferred option for processing waste storage and encapsulation is co-disposal deposition. Waste will be pumped to the co-disposal area (CDA) from the CHPP. The site for the CDA has been selected due to its proximity to the CHPP and industrial areas, the favourable topographic elevation relative to overland flow, and the location being an area of pasture that was historically cleared of remnant vegetation.

Due to the flat topography of the selected location, the facility will be constructed using a raised turkeys nest configuration. Construction will involve a staged two cell configuration, with the first cell constructed at the commencement of operations and the second cell constructed as co-disposal material storage within the first cell approaches capacity.

The facility is proposed to be constructed as a lined storage to protect against seepage into the surrounding substrate and groundwater. It is proposed that the liner be constructed from suitable clay which is sourced locally, preferably from within the mining footprint. Suitable materials are expected to be available, but if insufficient clay is available a synthetic liner will be installed, most likely from High Density Polyethylene (HDPE).

The facility will contain a dewatering collection sump to which decant water will be directed for return to the CHPP process water system.

The deposited co-disposal material is expected to be in the order of 25 to 40% solids. Given this slurry density and the range of the material sizes the co-disposal will be stackable which will enable deposition strategies to focus on beaching around the internal perimeter of the storage to optimise water drainage and recovery for reuse in the CHPP. Figure 18 shows the proposed location and design of the co-disposal facility. The detailed design will be undertaken by an experienced and RPEQ qualified engineer.

3.1.2.4 Proposed duration of operation

The life of the project depends heavily on the rate of mining, which is influenced by many external factors. Currently, the project is anticipated to produce coal continuously over a period of 19 years, although that may be extended if the ongoing exploration program identifies additional resources, or if the annual mining rate is reduced. Should the prevailing market support a higher production rate, the project duration may be shortened.

3.1.3 Design for closure

Transitional PRC plans are not required to demonstrate how aspects of the mine have been designed for closure; however, wherever possible the refined mine design has been optimised for closure when preparing this Plan.

3.1.4 Rehabilitation/Improvement Planning

3.1.4.1 Relevant activities on site

EPML00916813 is an environmental authority for a resource activity and was granted on the 29th of February 2012 after going through a Voluntary Environmental Impact Statement (EIS) process. A revised EA was issued on the 6th April 2016. Table 26 shows each approved Environmentally Relevant Activity (ERA), all other ancillary activities are carried out under the EA as part of a resource activity.

Table 26 Approved Environmentally Relevant Activities

Activity	Environmentally Relevant Activity
Mining black coal	ERA 13
Chemical storage	ERA 8
Sewage treatment	ERA 63

Mining activities that result in land disturbance include land clearing, topsoil stripping, pit excavation, overburden dump development, infrastructure development, coal hauling, hydrocarbon storage and handling, waste disposal and exploration activities. The Disturbance domains and sub-domains that will require rehabilitation, the predicted duration, size and availability for progressive rehabilitation are shown in Table 27 below as per requirements under sections 126C(1) (b) and (c) (ii).

Table 27 Disturbance domains and sub-domains that will require rehabilitation

Relevant Activity Disturbance Domain	Disturbance Sub-domain	Predicted Duration	Size/Extent of Activity (ha)	Availability for Progressive Rehabilitation
Elevated Landform – Overburden Dumps	Spoil landforms above original ground level (OGL) - Upper Surface Spoil landforms above original ground level (OGL) - Slopes	Western Spoil Landforms are established from 2026 and active for 10 years. Eastern Spoil Landforms commence in 2029 and active for 19 years.	170.1 804.9	Typically 1 year after dump area reaching final design grade with the exception of areas identified for topsoil stockpiling or capping material.

Relevant Activity Disturbance Domain	Disturbance Sub-domain	Predicted Duration	Size/Extent of Activity (ha)	Availability for Progressive Rehabilitation
Backfilled Pits – Overburden Dumps	Spoil landforms to original ground level (OGL)	Western Pit backfill commences from 2027 and active for 9 years with the last 4 years being hauled from East Pit. Eastern Pit backfill commences in 2030 and active for 18 years.	291.3	Typically 1 year after dump area reaching final design grade with the exception of areas identified for topsoil stockpiling or capping material
Infrastructure Areas	1. Haul Roads & access tracks 2. ROM 3. CHPP General Area 4. Mine Infrastructure Area (includes hydrocarbon storage & handling area)	Infrastructure Areas commence in 2026 and active for 20 years	232.3 16.8 3.2 8.1	Roads and Access Tracks are available from 2051 ROM, CHPP General Area and Mine Infrastructure Area are available from 2049
Elevated Landform - Co-disposal	Upper Horizontal Surface Slopes	Co-disposal Landforms commence in 2026 and remain in active operation for 20 years	31 34	Co-disposal Landforms are available from 2049 (4 years following active operation to allow for settling and drainage)
Residual Void including Ramps & Abandonment safety bund	Void includes Highwall and Low wall & Pit Lake	Life of the mine	171.56 (total)	Ramps and bund available to be re-vegetated prior to fencing
Water Management Structures	Surface Water Storages (clean water and sediment dams) Worked Water Storages Temporary drains, levees and erosion control structures Permanent diversions, drains or levees	Water Management Structures commence in 2026 remain active for 26 years	314 (total)	Water Management Structures are available from 2047. Availability is dependent on the rehabilitation upstream of the structures.
Exploration	Drill sites and drill holes			As soon as drill sites and drill holes completed

3.1.4.2 Rehabilitation Strategy

In accordance with condition A15 of the EA "All land subject to mining activities must be rehabilitated to a non-polluting, safe, stable and self-sustaining landform". In addition, conditions F27 to F30 of the EA specify the rehabilitation landform criteria and the requirements of the rehabilitation management plan, which also include defining rehabilitation objectives and completion criteria.

The key features of the land disturbance are described in the EIS assessment report (page 11), which include residual voids that would be about 150m deep (total area ~ 130ha), different elevated landforms such as the out of pit overburden dumps (974ha) elevated co-disposal (79ha) and the elevated ROM pad (16ha).

The landform design criteria captured by the EA seems to have captured the projective surface area of the voids (130ha), the out of pit overburden dumps (974ha) but missed the design criteria for the elevated co-disposal and elevated ROM pad which are captured in the EIS assessment report. Furthermore, projective surface disturbance for Ramps into Voids and Infrastructure Areas described under Table F1 of the EA were to be provided.

The EIS Assessment report (page 49) refers to the Environmental Management Plan (EMP) dated 12 October 2011 to describe the rehabilitation strategy as outlined below:

The rehabilitation strategy for the mine considers the following integrated measures:

- Detailed planning prior to disturbance, such as topsoil harvesting depth, identification of optimum topsoil stockpile locations, minimisation of disturbance footprint, selective handling of waste rock, erosion & sediment control requirements, etc;
- Implementation of practical landform designs, to prevent erosion and establish final erosional and geotechnical landform stability;
- Identification of species and habitat requirements required to create an appropriate post-mine land use consistent with local environmental constraints and values;
- Revegetation trials for the selection of appropriate species and methodology;
- Progressive rehabilitation of disturbed areas, using appropriate rehabilitation procedures for the area having been disturbed;
- Implementation of best practice erosion control measures;
- A rehabilitation monitoring program to assess success, or potential for improvement, of rehabilitation practices; and
- A corrective action program to address failed areas of rehabilitation.

The EIS Assessment report (page 50) also refers to the EMP commitment that rehabilitation areas would be designed to meet specific final rehabilitation design criteria, which are consistent with the criteria in conditions F27 to F30 and also address the design criteria specific to co-disposal and ROM pad outlined in the next section.

Rehabilitation areas are designed to meet the final rehabilitation design criteria outlined below:

- Out of pit overburden dumps;
  - elevated landform will have a maximum 50 m vertical height
  - outer batter slope angle will be a maximum of 5.7°
  - crest slope will be a maximum 2.3°

- Co-disposal and ROM Pad;
  - elevated landform will have a maximum vertical height of 18 m
  - outer batter slope will be 8° or less
  - crest slope will be a maximum of 2.3°
- Coal stockpile areas;
  - flat to undulating with a slope of <4.6°
- In pit overburden backfill;
  - flat to undulating will be a slope of <4.6°
- Infrastructure areas;
  - flat to undulating slope of 2.3°
- Final void;
  - maximum depth of 150m
  - highwall as mined weathered average slope angle of 1V and 0.7H (55°)
  - low wall as backfilled at angle of repose at 1V to 1.35H (36°)
- Design and install perimeter stormwater diversion;
- Fence the perimeter of the residual void to restrict access; and,
- Surface runoff from all rehabilitated areas will be directed to sediment control structures to reduce the amount of final sediment loads reporting to watercourses until vegetation has established and erosion rates are assessed to be acceptable (nominally <40 tonnes / ha / annum).

The EIS Assessment report (page 50) also refers to the EMP commitment to developing a residual void plan that will be developed to manage the residual void and will be based on operational experience and geotechnical assessment. The residual void plan will include consideration of:

- minimisation of the size of the residual void
- development of a detailed plan for post mining management of the void
- groundwater draw down
- long term water quality
- ensuring the void is geotechnical stable
- ensuring exposed coal seams do not present a potential fire risk
- provision of reasonable permanent safety measures to prevent accidental entry to the void by persons, vehicles, stock or wildlife
- provision of water diversion structures to avoid flooding.

As part of the provision of reasonable permanent safety measures to prevent accidental entry to the void by persons, vehicles, stock or wildlife, the construction of a permanent, non-traversable abandonment bund around the perimeter of the residual void will be required. The final ramps into the pit will be inside the fenced area to enable easier construction of the bund and fencing and reduce access to these relatively steep landforms. The ramp grades will be kept in order to facilitate rapid establishment of emergency access to the pit bottom should the need arise. No permanent access will be maintained and to promote long term stability of the lowwall and pit ramp structures, vegetation of native species through ground and aerial methods will be completed. These areas will be accessible

to birds, insects and small mammals, however due to the safety risks associated with the steep slopes and water quality, entry by persons, vehicles, stock or other wildlife will be restricted and as a result are considered part of a NUMA.

3.1.4.3 PMLU Rehabilitation goals and objectives

Table 28 and

Table 29 describe the Rehabilitation goals and objectives to achieve the PMLU of Native Bushland and Grazing respectively.

Table 28 PMLU Native Bushland

PMLU	Disturbance domain	Rehabilitation goal	Rehabilitation Objectives
Native Bushland	Elevated overburden dumps & Co-disposal Area	Safe to humans and wildlife	Safety hazards in rehabilitation areas are not significantly different to surrounding undisturbed areas with similar post-mine land use
			Stock are excluded
		Non-polluting	Runoff or seepage discharge water will have acceptable characteristics for the receiving environment
			Seepage does not adversely impact groundwater aquifer quality to the point that renders it unfit for use (where the pre-mining groundwater quality was fit for use)
			Sediment runoff does not impede offsite assets from their intended purpose
		Stable	Final landform slopes are at an angle suitable for the post mine land use of bushland and conform with slope angles and dump height specified in the EA
			Water control structures do not require ongoing maintenance
			Surface erosion does not impede the slopes ability to support native vegetation
		Self-sustaining	Ground cover is sustainable and considered acceptable for support of the designated post- mine land use

PMLU	Disturbance domain	Rehabilitation goal	Rehabilitation Objectives
			Native vegetation species established have sufficient diversity and density to support native bushland ecosystem function, including providing fauna habitat
			The density of declared weed plants does not compromise the rehabilitated area being used for the intended post-mine land use
			Growth medium (surface 20cm) used in conservation areas can support desired native vegetation community

Table 29 PMLU Grazing

PMLU	Disturbance domain	Rehabilitation goal	Objectives
Grazing	Infrastructure	Safe to humans and wildlife	Safety hazards in rehabilitation areas are not significantly different to surrounding undisturbed areas with similar post-mine land use
			Any hazardous material present does not compromise safety for the intended post-mine land use
			All bore holes are rehabilitated or are converted to water bores or groundwater monitoring points
		Non-polluting	Manage any hazardous material that could compromise the intended post-mine land use
			Runoff or seepage discharge water will have acceptable characteristics for the receiving environment
			Seepage does not adversely impact groundwater aquifer quality to the point that renders it unfit for use
		Stable	Rehabilitation is structurally safe for the intended post-mine land use
			Rehabilitation is erosionally stable
			Final landform slopes are at an angle suitable for the post-mine land use of grazing
		Self-sustaining	Rehabilitation is suitable for sustaining grazing

PMLU	Disturbance domain	Rehabilitation goal	Objectives
			The density of invasive plants (weeds) does not compromise the rehabilitated area being used for the intended post-mine land use of grazing
			Growth medium (surface 30cm) used in grazing areas is capable of supporting grazing pasture

3.1.4.4 Rehabilitation areas and milestones

The Rehabilitation Areas and the Rehabilitation Milestones used for the Codrilla Project are summarised in the following tables:

Table 30 Rehabilitation Areas

Rehabilitation Area	
RA1	Elevated Landform - Overburden Dumps - Upper
RA2	Elevated Landform - Overburden Dumps - Slopes
RA3	Backfilled Pits - Overburden Dumps
RA4	Infrastructure Areas - Access Tracks and Haul Roads
RA5	Infrastructure Areas - ROM
RA6	Infrastructure Areas - CHPP General Area
RA7	Infrastructure Areas - Mine Infrastructure Area
RA8	Water Management Structures
RA9	Elevated Landform Co-disposal - Upper
RA10	Elevated Landform Co-disposal - Slopes

Table 31 Rehabilitation Milestones & Milestone Criteria

Milestone reference	Rehabilitation milestone	Milestone criteria
RM1	Infrastructure decommissioning & removal	a). All services disconnected. Underground services will remain buried and surface points will be sealed b). All buildings either demolished and removed or relocated off site c). Concrete slabs and footings removed or buried within overburden dump final rehabilitation areas d). Sumps or dams that do not form part of final landform as sediment control structures will be dewatered and where applicable contaminated silt will be removed for licensed disposal e). Sealed asphalt roads, car parks and hardstand areas will have the asphalt removed for reuse or burial within overburden dump final rehabilitation areas and unsealed road, car parks and hardstands will have any contamination removed for licenced disposal f). Hydrocarbon and chemical storage areas will be removed and/or remediated by on-site treatment if required g). All carbonaceous material will be collected from haul roads and disposed in the co-disposal area or buried within the

		overburden dump final rehabilitation areas h). The contaminated land assessment report prepared by an AQP confirms that the land is not contaminated and is suitable for any use
RM2	Landform design, reshaping and final contouring, inclusive of drainage features	a). Stable landform and slope angles for out of pit overburden dumps areas as follows: outer batter slopes equal to or less than 5.7°and crest slope a maximum of 2.3° b) Stable landform and slope angles for Co-disposal elevated landform and ROM pads as follows: outer batter slopes equal to or less than 8° and crest slope a maximum of 2.3° c.) Stable landform and slope angles for coal stockpiles and in pit overburden backfill flat to undulating with slopes equal to or less than 4.6° crest slope a maximum of 2.3° d). Stable landform and slope angles for infrastructure areas flat to undulating with slopes equal or less than 2.3° e). Maximum vertical height of out of pit overburden dumps elevated landforms up to 50m f). Maximum vertical height of Co-disposal elevated landform and ROM pad areas up to 18m g). All major earthworks completed h). Contour drains and rock lined drop structures installed as per appropriate design criteria i). Landforms such as the Co-disposal facility have been signed-off as constructed to design
RM3	Install cover system/cap	a). Cover installed over reject/coal stockpile surfaces (nominally 1m inert overburden)
RM4	Surface preparation (e.g. topsoil, fertiliser, amelioration agents, mulch or woody debris)	a). Topsoil spread to a minimum depth of 150mm b). Gypsum applied at rates determined by an AQP c). Cultivation and keying of topsoil to subsoil with suitable multi-type ripper and performed parallel to slope contours d). Addition of rock and/or log cover to assist erosion resistance of eventual vegetative ground cover
RM5	Revegetation (grazing)	a). Pasture seed applied in accordance with rehabilitation specification, i.e. seeding rate, seed composition and cultivation to incorporate seed into the uppermost layer of the growth media b). Seed mix contains a range of native and introduced grass and legume species consistent with surrounding pastural areas (as per seed mix table in PRC plan)
RM6	Revegetation & habitat development (native bushland)	a). Native seed applied in accordance with rehabilitation specification b). Seed mix contains a suitable range of native tree, shrub and grass species to achieve brigalow and eucalyptus habitat type (as per seed mix table in PRC plan)
RM7	Achievement of surface requirements (grazing)	a). Species density and diversity achieved is consistent with the sown seed mix, reference sites and surrounding pastural areas b). 80% of the area has a vegetative groundcover >70% for areas of low rock and logs, >50% for areas of high rock and log content c). Growth medium (surface 30cm) pH >5.5 and <9.5; Conductivity <1.0dS/m and ESP<15% d). No new invasive plants and infestation density of invasive plants that were originally present or in low abundance within the area is contained or reduced and consistent with reference sites and surrounding pastoral areas

		e). Water control structures are either removed or free of active erosion and integrated into permanent landforms f). No severe erosion gullies (<4m² in cross section) and erosion rates are less than 40tonnes/ha/year g). pH and EC indicators for surface water runoff demonstrate the water quality is suitable for the receiving environment and are consistent with water quality indicators of the upstream reference site h). The NEPM assessment confirms areas are free of hazardous materials or have been rendered safe
RM8	Achievement of surface requirements (native bushland)	a). 80% of the area achieves species density and diversity that is greater than 60% of the reference sites and surrounding areas b). 80% of the area has a vegetative groundcover >70% for areas of low rock and logs, >50% for areas of high rock and log content c). Growth medium (surface 20cm) pH >5.5 and <9.5; Conductivity <1.0dS/m and ESP<15% d). No new invasive plants and infestation density of invasive plants that were originally present or in low abundance in the area is contained or reduced e). Key invertebrate groups such as ants and soil faunal communities are re-establishing f). Bird, mammal, reptile and frog communities are becoming established in the rehabilitated sites g). Evidence of food and shelter opportunities for invertebrate and vertebrate species h). Water control structures are either removed or free of active erosion and integrated into permanent landforms i). No severe erosion gullies (<4m² in cross section) and erosion rates are less than 40tonnes/ha/year j). pH and EC indicators for surface water runoff demonstrate the water quality is suitable for the receiving environment and are consistent with water quality indicators of the upstream reference site k). The NEPM assessment confirms areas are free of hazardous materials or have been rendered safe
RM9	Achievement of a stable condition for the land described as a post-mining land use of grazing	a). Rehabilitation has been certified by an AQP to be: • structurally stable (FoS ≥ 1.5) and slopes are designed in accordance with EA criteria • erosionally stable: no severe erosion gullies (<4m² in cross section) and erosion rates are less than 40tonnes/ha/year and groundcover established and meets criteria in RM7 b). pH and EC indicators for surface water runoff demonstrate the water quality is suitable for the receiving environment and are consistent with water quality indicators of the upstream reference site c). The rehabilitated land meets Class 4 land suitability for grazing using the Guidelines for agricultural land evaluation in Queensland (2nd edn) (DSITI & DNRM, 2015).
RM10	Achievement of a stable condition for the land described as a post-mining land	a). Rehabilitation has been certified by an AQP to be: • structurally stable (FoS ≥ 1.5) and slopes and dump heights are designed in accordance with EA criteria • erosionally stable: no severe erosion gullies (<4m² in cross section) and erosion rates are less than 40tonnes/ha/year and groundcover established and meets criteria in RM9

	use of native bushland	b). pH and EC indicators for surface water runoff demonstrate the water quality is suitable for the receiving environment and are consistent with water quality indicators of the upstream reference site c). The established native ecosystem has a similar composition to the previous existing woodland ecological communities comprising RE 11.4.8, RE 11.4.9 and RE 11.5.3 and provides habitat opportunities for invertebrate and vertebrate species
RM11	Install fencing or other infrastructure to support the PMLU	a). Fencing / bunding installed to exclude stock

3.1.4.5 NUMA Rehabilitation goals and objectives

Table 32 describes the Rehabilitation goals and objectives to manage the NUMA to achieve best practice management and minimise environmental harm.

Table 32 NUMA

NUMA	Disturbance domain	Rehabilitation goal	Objectives
Residual Void, Ramps into Voids & Abandonment safety bund	Mine void, inclusive of highwall, low walls and pit lake	Safe to humans and wildlife	Safe for managing the site, post-mining and does not pose an unacceptable risk to the community or environment
			Safety barriers will not be impacted by erosional or geotechnical failures
		Non-polluting	Pit waters are contained on-site
			Avoidance of creek flooding into pit
			Seepage of pit waters does not impact groundwater aquifer quality to the point that renders it unfit for use
		Stable	Pit stability does not compromise the post-mine land use or surrounding environment
		Self-sustaining	Pit waters are contained on-site
			Seepage of pit waters does not impact groundwater aquifer quality to the point that renders it unfit for use

3.1.4.6 Improvement areas and milestones

The Improvement Areas and the Management Milestones used for the Codrilla Project are summarised in the following tables:

Table 33 Improvement Areas

Improvement Area

IA1	Residual Void, Ramps into Voids & Abandonment safety bund

Table 34 Management Milestones

Milestone reference	Management milestone	Milestone criteria
MM1	Highwall treatment	a). Highwall crest battered back where required to achieve a stable slope angle as specified by an AQP (geotechnical engineer)
MM2	Achievement of landform design and surface requirements	a). Highwall as mined weathered average slope angle of 1V and 0.7H (55°) and low wall as backfilled at angle of repose at 1V to 1.35H (36°) b). Abandonment safety bund setback distance is in accordance with calculated geotechnical factor of safety c). Abandonment safety bund constructed of competent rock and to geometry specified to prevent traversing by vehicles d). Residual void maximum depth of 150m e). Residual void outside of PMF f). Abandonment safety bund and ramp into voids revegetated with seed mix containing a suitable range of native tree, shrub and grass species to achieve brigalow and eucalyptus habitat type (as per seed mix table in PRC plan)
MM3	Achievement of sufficient improvement not to cause environmental harm and that will be safe and structurally stable	a). Access to highwall, low wall and ramp batter is restricted by physical barriers and fencing is erected on the outside of the abandonment safety bund to specification (nominally five strand barbed stock fencing) b). Safety signage (design in accordance with Australian Standard) is erected at specified intervals along the fence line (nominally one sign every 100m) c). Certification from an AQP that the level of final void water is significantly below the crest of the pit to avoid the risk of overtopping and causing environmental harm d). Certification from an AQP that the water quality (pH & EC) in the final void does not show a statistically significant change when compared to background data and will not cause environmental harm to the surrounding environment

3.1.5 Spatial Information

The following spatial information is being provided as part of this PRC plan:

- the location and maximum extent of disturbance footprint for the mine life
- the PMLU and NUMAs for the area within the resource tenures
- any sensitive receptors
- all spatial information outlining the rehabilitation and improvement areas that correspond to the PRC Plan schedule
- extent of a floodplain

3.2 Community Consultation

Legislative requirement

In accordance with section 126C(1)(c)(iii) and (iv) of the EP Act, the rehabilitation planning part of the PRC plan must include:

- details of the consultation undertaken by the applicant in developing the proposed PRC plan, and
- details of how the applicant will undertake ongoing consultation in relation to the rehabilitation to be carried out under the plan.

3.2.1 Background

Stakeholder engagement is a critical component of successful mine closure planning. Through effective stakeholder engagement, organisational and community perspectives, goals and knowledge are gathered to inform closure processes.

An initial community consultation program was conducted as part of the EIS process. Its purpose was to provide a forum for information gathering about social and environmental matters, associated with the development of the Codrilla Project, from those who reside in proximity to, or have an interest in, the area.

Engagement with the community and stakeholders occurred through a number of different mediums, such as:

- One on one meetings;
- Community forums;
- Public notices and newsletters; and,
- Fact sheets.

In addition to the secondary data and quantitative methods and tools used to understanding potential impacts of the project, community forums and stakeholder interviews were the qualitative methods used to gather primary data and assist in understanding the depth and breadth of potential impacts upon the community.

The community comments were categorised into five groups of concern, being community values and attitude, business opportunities and constraints and compensation, community and human services, environmental impacts and issues, and mine closure and rehabilitation.

Specific issues relating to mine closure and rehabilitation raised during consultation included potential long-term impacts on soil quality and the physical environment, the need to rehabilitate properly, discussions about planning requirements and design for the mine closure and a rehabilitation plan. The sentiment expressed was a desire to maintain the ecology and economy of the region in the hope that they will have something to pass onto the next generation. Intergenerational transfer of agricultural enterprises was a concept that was mentioned frequently. The community suggested that the Company had to state what shape the land would be after the mine finishes, so that long-term residual land use could be planned. They also suggested that many more things needed to be done compared to the current practice of rehabilitation in the area, such as local 'open box forest' trees need to be replanted in the reclamation areas. Rehabilitation drawn from local knowledge was seen as a preferred way of planning.

3.2.2 Community consultation register

Details of community consultation carried out in relation to the Project are shown in Table 35 below. Consultation that influenced the post-mining land uses, rehabilitation, final landform and closure design aspects was conducted between 2009 and 2012. The Project was put on hold in 2013 and since then there has been ongoing consultation mostly providing updates on the status of the Project.

Table 35 Community consultation register

Consultation date	Consultation method	Stakeholder	Location	Information provided	Issues raised	Outcomes	Ongoing commitments
15/06/2009	Community Forum	Potentially affected landholders, local community members, planners and managers from Isaac Regional Council, lawyers, members of the Fitzroy Basin Association and staff from Department of Education and Department of Mines and Energy	Valkyrie State School	Overview of the likely impact of the Project	EIS to address water and the effect on both water quantity and quality, land values, consideration of surrounding land uses for closure, Valkyrie School, FDR, animal welfare and impacts from dust and noise.	Included information in EIS	N/A
16/06/2009	Community Forum	Potentially affected landholders, local community members, planners and managers from Isaac Regional Council, lawyers, members of the Fitzroy Basin Association and staff from Department of Education and Department of Mines and Energy	Nebo State School	Overview of the likely impact of the Project	Same as above	Same as above	N/A
28/08/2009	Community Forum	Potentially affected landholders, local community members, planners and managers from Isaac Regional Council, lawyers, members of the Fitzroy Basin Association and staff from Department of Education and Department of Mines and Energy	Valkyrie State School	Overview of the likely impact of the Project	Same as above	Same as above	N/A
08/09/2009	Community Forum	Potentially affected landholders, local community members, planners and managers from Isaac Regional Council, lawyers,	Nebo State School	Overview of the likely impact of the Project	Same as above	Same as above	N/A

		members of the Fitzroy Basin Association and staff from Department of Education and Department of Mines and Energy					
09/2009	Written submissions	Various Government Departments, Fitzroy Basin Association, Isaac Regional Council, Capricorn Conservation Council, Robert & Michelle Duckett, Pam MacGibbon, Di Pullen, Ron Pullen, James Pullen, Geoff Bethel, Mel Nelson, Craig Bethel, Donald & Kaye Black, Ross & Jo-Ellen Banks and Ruth Bethel		Draft Terms of References	EIS to address water and the effect on both water quantity and quality, land values, consideration of surrounding land uses, Valkyrie School, FDR, animal welfare and impacts from dust and noise.	Included in draft EIS	N/A
08/09/2009-15/10/2009	Face-to face interviews	15 interviewees (4 landholders or land managers and others drawn from the following: businesses, community/volunteer associations/clubs, emergency services, local/state government, mining, primary industries and youth/education)	At a residence, a workplace or in the local park or club (depending on the preference of the informants) in the Codrilla, Nebo, Moranbah and Mackay areas		The community comments were categorised into five groups of concern, being community values and attitude, business opportunities and constraints and compensation, community and human services, environmental impacts and issues, and mine closure and rehabilitation	Addressed in draft EIS	N/A
	Telephone interviews	6 landholders or land managers			Same as above	Same as above	N/A
	Structured paper survey response	1			Same as above	Same as above	N/A
2010-2011	Phone calls, face-to-face meetings	Sharon Atkinson; Small family; DTMR		Compensation agreements negotiations			N/A
01/2011	Public Forum	Community		Update on Codrilla Project and findings from draft EIS			Ongoing consultation
14/11/2011	Face-to-face meeting	Barada Barna	Woora Consulting Office – Farleigh	Update on Codrilla Project and CHMP			Ongoing consultation
15/12/2011	Face-to-face meeting	Isaac Regional Council		Update on Codrilla Project			Ongoing consultation
06/01/2012	Email/phone call	Affected landholders		Notified that Certificate of Application and Certificate of Public Notice had been issued		Provided copies	Ongoing consultation
10/01/2012	Face-to-face meeting	Ron & Di Pullen	Property		Timing for destocking of property concern with the proposed firebreak on his property (bordering the Bundarra property) as he is of the view it will cause significant erosion on Codrilla	When it comes time to discuss the firebreak with DERM in more detail, we will mention Ron's concerns re erosion	Ongoing consultation

16/01/2012	Phone call	Ron & Di Pullen; Brian & Leigh Small; Craig Bethel; Mike & Leonor Cole		Offered one-on-one briefings on the Codrilla Project			Ongoing consultation
20/01/2012	Phone call	Sharon Atkinson; Ruth and Geoff Bethel;		Offered one-on-one briefings on the Codrilla Project			Ongoing consultation
23/01/2012	Newspaper	Public	Daily Mercury & CQ News	Public Notice MLAs & EA			N/A
24/01/2012	Phone call	Alistair and Pamela Davison		Offered one-on-one briefings on the Codrilla Project			Ongoing consultation
15/03/2012	Phone call	Russell Bailey			Inspect stock route	Organised for an inspection	Ongoing consultation
26/03/2012	Face-to-face meeting	Geoff and Ruth Bethel (owners of Regalo) Craig Bethel (son, lives on Regalo) Richard Bethel (son, lives on Willunga) and Monique	Property		Various questions and issues raised.	Responded to questions and invited Bethel's to Terowie and Moorvale to see how the following aspects are managed: Dust Water Blasting (noise, vibration and fume) Rehabilitation	Ongoing consultation
26/03/2012	Face-to-face meeting	Ron and Di Pullen	Property		Various questions and issues raised.	Responded to questions and invited Bethel's to Terowie and Moorvale to see how the following aspects are managed: Dust Water Blasting (noise, vibration and fume) Rehabilitation	Ongoing consultation
27/03/2012	Face-to-face meeting	Mick, Lenore and Callum Cole	Property		FDR; size of the exclusion zone for blasting; noise and lighting impacts during the night; Impacts on Devril and Swampy Creeks – increased amount of water down Valkyrie Access Road and Morpeth road.	Provided the responses to the questions and invited the Small's to an open day in October	Ongoing consultation
27/03/2012	Face-to-face meeting	Brian and Leigh Small	Property		Concerned about the water run-off from the road, particularly if using water from the mine Concerned about drainage impacts from the road Concerned about the potential for weeds to be transferred on to the property.		Ongoing consultation

28/03/2012	Face-to-face meeting	Alistair Davidson	Property		FDR closure and realignment		Ongoing consultation
28/03/2012	Face-to-face meeting	Sharon Atkinson & Wade Klien	Property		School relocation, construction and maintenance of fire break on Bundarra/Codrilla boundary and if there will be culverts on Devlin Creek and if so what size will they be.	Provided the responses to the questions and invited the Sharon and Wade to an open day in October	Ongoing consultation
05/04/2012	Face-to-face meeting	Pam McGibbon	Property		Requested information on mine plan, water, dust, blasting management and to have a dust monitor at Lillianvale.	Provided the responses to the questions and invited Pam to an open day at Codrilla in October	Ongoing consultation
2013-2021	Emails; Phone; Face-to-face meetings	Landholders, Isaac Regional Council, Barada Barna, Government Agencies	Various locations	Regular updates on Project status			Ongoing consultation

3.2.3 Community consultation plan

In order to comply with section 126C(1)(c)(iv) of the EP Act, the rehabilitation planning part must include a community consultation plan detailing how ongoing consultation will be carried out in relation to the rehabilitation to be carried out under the PRC plan. The following sections describe the objectives for community consultation, how the community will be engaged, the proposed consultation frequency, what information will be released for community consultation and how feedback and comments will be considered.

3.2.3.1 Objectives

The objectives of the community consultation plan (CCP) include:

- Keep identified stakeholders informed of relevant activities and progress at the mine;
- Maintain and develop stakeholder relationships;
- Record and respond to any complaints in a timely manner;
- Identify stakeholder concerns about rehabilitation and closure of the mine;
- Facilitate consultation feedback and input into mine rehabilitation and closure plans;
- Consider and address broader stakeholder concerns where possible, as they arise; and,
- Provide timely, accurate and credible information to the identified stakeholders until relinquishment is achieved.

3.2.3.2 Key stakeholders

Key stakeholders identified for ongoing consultation in relation to rehabilitation to be carried out under the PRC plan are shown in the table below:

Table 36 Key Stakeholders

Affected	Interested

• Directly affected landholders • Indigenous communities (Barada Barna) • Adjacent landholders • Isaac Regional Council • Overlapping tenure holders • DTMR	• Dept Environment & Science • Dept of Resources • Dept Transport & Main Roads • Dept Education and Training • Nebo, Valkyrie and wider Bowen Basin communities • Local businesses • Neighbouring mines • Elected officials

Considering that the final landform and post-mining land uses have been established in response to consultation it is unlikely that there will be significant changes to what is currently included in this proposed PRC Plan.

The ongoing community consultation plan mostly consists of keeping stakeholders informed and up to date with development and operation of the mine and rehabilitation progress against the PRC Plan. Table 37 provides an overview of the key engagement objectives, consultation methods and frequency for ongoing consultation.

Table 37 Ongoing consultation plan

Engagement Objectives	**Keep identified stakeholders informed and up to date with development & operation of the mine and rehabilitation progress and continue consulting and taking feedback into consideration in relation to the rehabilitation to be carried out under the PRC plan**	
Stakeholder	**Consultation method**	**Frequency**
Directly affected landholders	Advise affected stakeholders in writing when the PRC plan is approved and provide a copy of the PRC plan for their information; Meet, email or phone call to provide updates on development & operation of the mine; Meet to provide updates on rehabilitation progress against the PRC Plan and discuss any feedback	One-off Ongoing Annually, once rehabilitation commences
Indigenous communities – Barada Barna	Meet with Barada Barna to provide updates on development & operation of the mine; Meet to provide updates on rehabilitation progress against the PRC Plan and discuss any feedback	Ongoing Annually, once rehabilitation commences
Adjacent landholders	Meet, email or phone call to provide updates on development & operation of the mine and rehabilitation progress against PRC Plan	Ongoing Annually, once rehabilitation commences
DTMR	Meet DTMR to negotiate Infrastructure Agreement	One-off
Isaac Regional Council	Meet to provide updates on development & operation of the mine and rehabilitation progress against PRC Plan	At least annually

Overlapping tenure holder – Arrow Energy	Meet to provide updates on development & operation of the mine and rehabilitation progress against PRC Plan	At least annually
Nebo, Valkyrie and wider Bowen Basin community members and groups and neighbouring mines	Use community forums, community networks, site tours, newsletters to provide updates on development & operation of the mine and rehabilitation progress	Ongoing Annually, once rehabilitation commences
Local businesses and suppliers	Use business networks to provide updates on development & operation of the mine and rehabilitation progress	Ongoing
Elected representatives and departmental personnel	Meetings to provide updates on development & operation of the mine and rehabilitation progress against PRC Plan	As agreed with individual elected representatives and Department personnel

Should any proposed changes to the PRC Plan or schedule be required, stakeholders will be engaged as part of the amendment process. Table 38 provides an overview of the key engagement objectives, consultation methods, frequency, the information that will be released and how feedback will be considered during consultation for proposed changes to the PRC Plan or schedule.

Table 38 Consultation plan for PRC Plan or schedule changes

Engagement Objectives	**Consult affected stakeholders and gather feedback in relation to changes to the PRC Plan or schedule**			
Stakeholder	**Consultation method**	**Frequency**	**Information released for consultation**	**How feedback will be considered**
Directly affected landholders **Indigenous communities – Barada Barna** **Adjacent landholders** **Isaac Regional Council** **Overlapping tenure holders – Arrow Energy**	Meet to discuss proposed changes to PRC Plan or schedule and gather feedback	One or more meetings as required	A fact sheet or a summary document providing an outline of the proposed PRC Plan or schedule changes and any additional information requested by the individual stakeholders	Feedback will be considered in the context of the proposed changes and other relevant feedback and if technically viable and reasonably possible it will be incorporated in the final version of the PRC Plan amendment application
Local community members and groups	Use community forums, community networks, site tours, newsletters to discuss proposed changes to PRC Plan or schedule and gather feedback	At least one-off consultation prior to lodgement of PRC Plan or schedule	A fact sheet or a summary document providing an outline of the proposed PRC Plan	Feedback will be considered in the context of the proposed changes and other relevant feedback and if

		proposed changes	or schedule changes	technically viable and reasonably possible it will be incorporated in the final version of the PRC Plan amendment application

3.3 Post-mining land use (PMLU)

Legislative requirements

In accordance with section 126C(1)(d) of the EP Act, the rehabilitation planning part of the PRC plan must state the extent to which each post-mining land use for land identified in the PRCP schedule for the plan is consistent with:

a) the outcome of consultation with the community in developing the plan, and
b) any strategies or plans for the land of a local government, the State or the Commonwealth.

Mining lease conditions relating to rehabilitation are described within the site's Environmental Authority. The EA under condition F27 requires all areas significantly disturbed by mining activities to be rehabilitated to a stable landform with self-sustaining vegetation cover in accordance with Table F1 Landform Criteria. The EA does not specify post-mining land use(s), but the EIS Assessment Report (page 49) states that "the EIS included a progressive rehabilitation strategy that generally consists of the development of a stable, self-sustaining final landform, with appropriate post-mining land uses applied". Post-mining land uses have been determined based on the assessed post-mining land capabilities and suitability and input from consultation and primarily consist of native bush land/vegetation for wildlife usage and managed low intensity beef cattle grazing. In the EIS assessment report (page 12) it is noted that some land disturbed by mining would be rehabilitated to support grazing; however, some land would be permanently alienated from productive grazing due to the presence of the residual voids (approximately 130ha). In addition to the void, and in line with commitments under the EMP cited by the EIS Assessment report, additional area will be required for the access ramps and an appropriate offset around the perimeter of the void to provide for geotechnical factor of safety and access exclusion features (fencing, bunds and signage).

This abandonment bund area, together with the residual void and the ramps into voids, will be designated as a NUMA.

The post mining land use for each domain will be as follows:

- Elevated overburden dumps: native bushland for wildlife usage;
- Elevated co-disposal area: native bushland for wildlife usage;
- Areas with a similar gradient to surrounding undisturbed landform, including infrastructure areas: grazing; and
- Stabilised final void areas: NUMA, with some opportunistic use by wildlife

The PMLU of native bushland for the elevated landforms and the backfilled voids recognise that these constructed landforms will have physical and productivity constraints that preclude the use of these areas for grazing.

Should alternate land use options be considered (e.g. installation of commercial solar generation or industrial use of workshop facilities), any required approvals will be sought prior to implementing the alternate land use.

Table 39 PMLU by domain and sub-domain

Domain	Sub-domain	Post mine land use	Projected Area (ha)
Elevated Landform – Overburden Dumps	Upper Surface	Native bushland	170
	Slopes	Native bushland	805
Backfilled Pits – Overburden Dumps	N/A	Native bushland	291
Infrastructure Areas	Access Tracks and Haul Roads	Grazing	232
	ROM	Grazing	17
	CHPP General Area	Grazing	3
	Mine Infrastructure Area	Grazing	8
Elevated Landform Co-disposal	Upper surface	Native bushland	31
	Slopes	Native bushland	34
Residual Void, Ramps into Voids & Abandonment safety bund	N/A	NUMA	172
Water Management Structures	N/A	Grazing	314

3.3.1 Consistency with outcome from community consultation

Stakeholders raised some specific issues in relation to mine closure and rehabilitation such as the need for a final landform that allowed for cattle to be re-introduced, the establishment of a post-mining land use to allow for long term planning, ensuring that the void locations were outside the Probable Maximum Flood (PMF) level, the co-disposal facility design, construction & management of Potentially Acid Forming co-disposal material, and the need to have a mix of vegetation cover, including trees to support a diversity and abundance of flora and fauna typical of the surrounding region. DERM (now DES) provided comments relating to the design of the CDA and characterisation

of material to be deposited in the CDA. DERM also requested inclusion of objectives relating to the strategies and methods for progressive and final rehabilitation of disturbed areas.

Issues raised during community consultation were addressed in the Supplementary EIS. The rehabilitation objectives were amended to reflect the changes sought by DERM, Capricorn Conservation Council, Fitzroy Basin Association and other stakeholders.

3.3.2 Consistency with Local, State and Commonwealth land use requirements

The PMLU of low intensity grazing and native bushland habitat, as described in the EIS, does not require any further State or Local Government approval prior to being implemented. These land uses are compatible with existing surrounding land uses, with the locality dominated by low intensity cattle grazing. These land use options are considered to have the lowest risk of failure as both land uses are prevalent in the region and ongoing management requirements will be minimal.

3.4 Non-use management areas (NUMAs)

Legislative requirements

In accordance with sections 126C(1)(d), (g) and (h) of the EP Act, for each proposed non-use management area, the rehabilitation planning part of the PRC plan must:

- state the reasons the applicant considers the area cannot be rehabilitated to a stable condition
- include copies of reports or other evidence relied on by the applicant for each proposed non-use management area
- state the extent to which the proposed non-use management area is consistent with the outcome of consultation with the community in developing the plan, and
- state the extent to which the non-use management area is consistent with any strategies or plans for the land of a local government, the State or the Commonwealth.

3.4.1 Description of the NUMAs

Pursuant to section 754 (3) of the EP Act and section 6.3.2 of the PRC Plan Guideline, a NUMA will be taken to be pre-approved if a land outcome, the same or substantially similar to a NUMA, is contained in a 'land outcome document'. Land outcome documents are defined in section 750 of the EP Act.

For the Codrilla Project, a residual void is authorised under the EA (Conditions F34 and F35) and the final void is established as a NUMA also within the EIS Assessment Report, which states that approximately 130ha of land "*comprising the residual voids, would be permanently alienated from productive grazing*" (EIS Assessment Report, page 12). Table F1 of the EA also describes the maximum Projected Surface Disturbance for Voids as 130 ha and for Ramps into Voids, which was to be provided and included in the EA. The area is approximately 37ha.

Furthermore, the EIS Assessment report (page 50) refers to the EMP commitment to developing a residual void plan that will be developed to manage the residual void and will be based on operational experience and geotechnical assessment. As part of the provision of reasonable permanent safety measures to prevent accidental entry to the void by persons, vehicles, stock or wildlife, the construction of a permanent, non-traversable abandonment bund around the perimeter of the residual void will be required. The abandonment safety bund is approximately 4ha.

Overall, the pit lake, high walls, end walls, low walls, ramps and protective bunding will be NUMAs and the total area is 171.56ha.

Where a NUMA has been pre-approved and is being translated into the PRC plan, the EA holder is not required to:

- Justify the proposed NUMA;
- Provide evidence to support the justification of the NUMA;
- Go through the Public Interest Evaluation process; or,
- Comply with the prohibition of voids located within a flood plain having to be rehabilitated to a stable condition

However, pursuant to section 754 (4) (b) if the EA or any other LOD does not state sufficient detail to identify the location of the land to which the outcome relates, in this instance the residual void, the proposed PRC plan must state how the EA holder will ensure the location of the land to which the outcome relates minimises risks to the environment.

In order to minimise risks to the environment, the mine design has been optimised and the mine sequencing has been adjusted so that the location of the residual void (East Pit Void) is outside of the Devlin Creek PMF and the area of the void that is closest to the floodplain is backfilled.

Following completion of mining operations, water levels in the East Pit Void are expected to recover to equilibrium within the first 120 years post mining and water levels will remain more than 50 m below the crest of the pit. The water levels within the overburden and voids are expected to recover to levels below pre-mining conditions because the average daily evaporation is around four times the average daily rainfall within the local region. Given the evaporative influences the water level is expected to remain below surface and given the saline nature of groundwater recovering to pits and salt leaching from backfilled overburden, it is expected that over time, the water within East Pit Void will progressively become more saline and eventually approach salinity levels similar to those observed within the regional aquifer system.

Storage of saline water in the East Pit Void will not result in adverse environmental impacts due to the lack of connectivity to any alluvial freshwater deposits; the saline nature of naturally occurring groundwater within coal measures; and, the long-term containment of the water within the pit.

The limited catchment area of where the East Pit Void is located will ensure that it remains as a permanent 'sink', with no potential for overtopping and release of contaminated water to the surrounding environment and to Devlin Creek.

Erosion of the low wall slopes within the residual void may occur over time; however, rates of erosion should reduce over time as slopes naturally self-armour, preferential flow paths develop, and vegetation establishes on the slopes. Erosion of the low wall will not give rise to environmental harm as any sediment will be contained within the void area.

Highwall stability has been addressed via the geotechnical appraisal that accompanied the EIS. Upon cessation of mining an abandonment bund will be constructed at a setback distance from the pit edge that complies with the requisite geotechnical factor of safety. Permanent fencing and signage will be erected to prevent access by people or livestock.

Low wall areas within the residual void, ramps into the voids and the abandonment safety bund will be revegetated and even though no use is assigned they may provide a limited use to wildlife.

One of the options considered for the future is that the provision of final voids in the final landform provides potential coal seam access for highwall mining or underground activities which may become economically viable in the future (EIS Assessment Report, page 12).

3.4.2 Consistency with outcome from community consultation

The Capricorn Conservation Council and other stakeholders during the EIS process raised concerns regarding void size, dump heights and the potential for Devlin Creek to inundate the final void. This resulted in changes in the mine plan to decrease the proposed size of the final void and verification that the void(s) will be outside the Probable Maximum Flood (PMF) level.

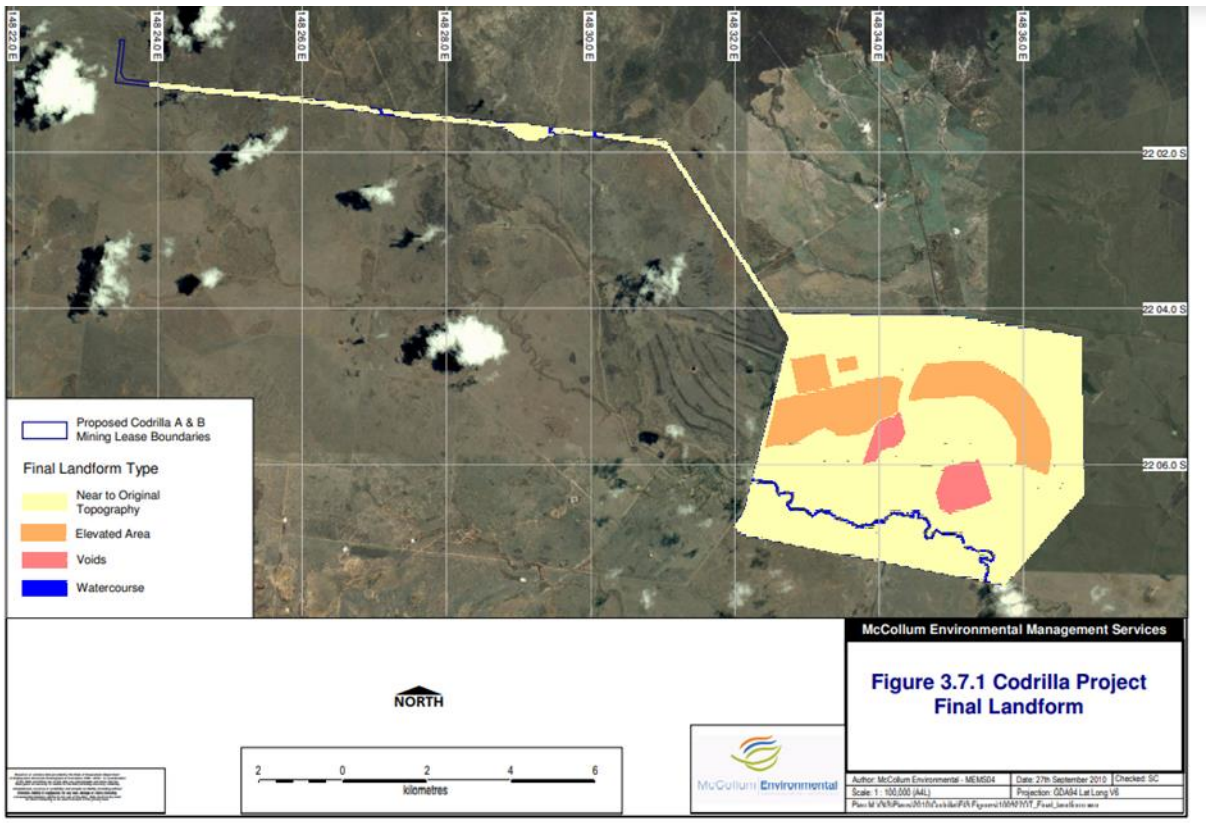

Figure 19 Draft EIS Final Landform

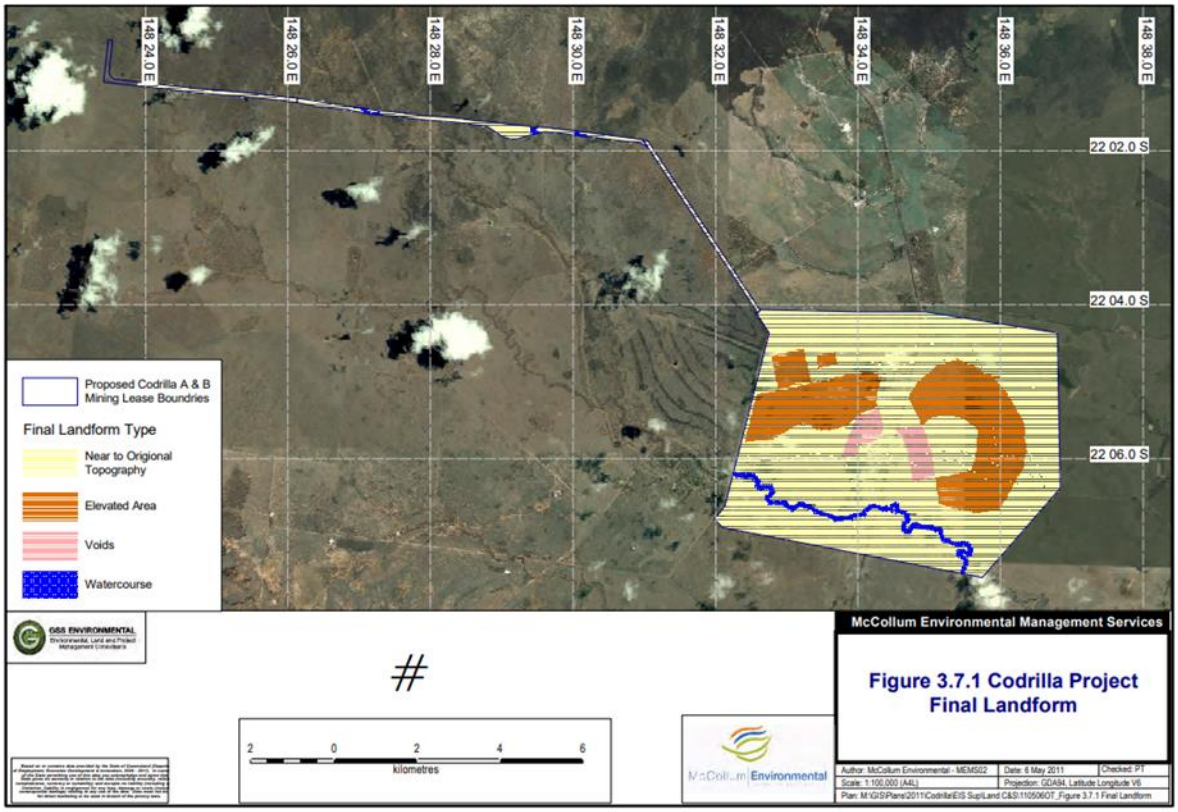

Figure 20 Supplementary EIS Final Landform

3.4.3 Consistency with Local, State and Commonwealth requirements

The NUMA is authorised by the EA and is therefore pre-approved under the EP Act and does not require any further State or Local Government approval.

3.4.4 Voids in flood plains

Legislative requirement

In accordance with section 126D(3) of the EP Act, if land the subject of the proposed PRCP schedule will contain a void situated wholly or partly in a flood plain, the schedule must provide for the rehabilitation of the land to a stable condition.

The Codrilla Project does not contain any void in flood plains. The mapped flood plain extent has been modelled to a 0.05% AEP, meeting the modelling requirements under the PRC Plan guideline and section 41C (3) of the *Environmental Protection Regulations 2019* (EP Regs).

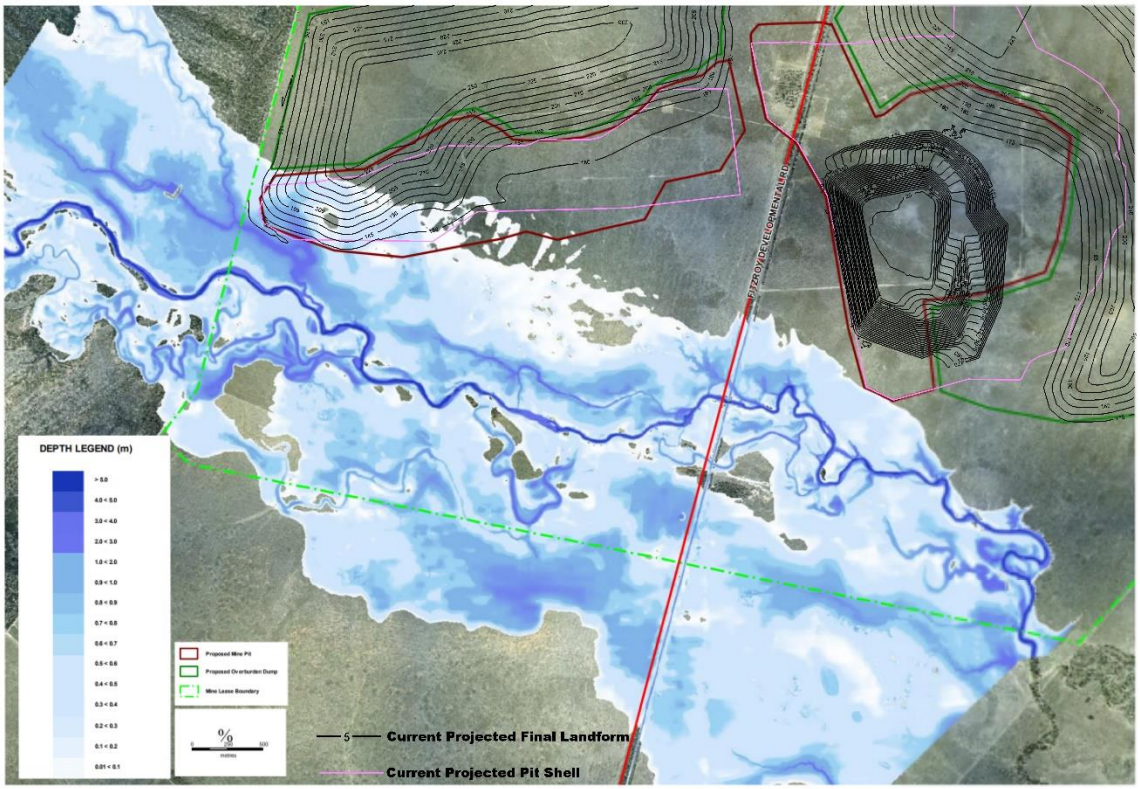

Figure 7.5 2,000 Year ARI Flood Depths, Devlin Creek

Figure 21 Final void location and 2000 Year ARI Flood

3.5 Rehabilitation management methodology

Legislative requirement

In accordance with section 126C(1)(e) and (i), the rehabilitation planning part of the PRC plan must:

- For each proposed post-mining land use for land, state the proposed methods or techniques for rehabilitating the land to a stable condition in a way that supports the rehabilitation milestones under the proposed PRCP schedule.
- For each proposed non-use management area, state the proposed methodology for achieving best practice management of the area to support the management milestones under the proposed PRCP schedule for the area.

The proposed rehabilitation or management methodologies underpin the development of the milestone criteria and support how the proposed PMLU will be achieved or the NUMA will be managed. As per section 126C(1)(j) of the EP Act, the administering authority requires information describing how the proposed rehabilitation or management methodologies have been developed and will be implemented.

3.5.1 General rehabilitation practices

In accordance with condition A15 of EPML00916813 "*All land subject to mining activities must be rehabilitated to a non-polluting, safe, stable and self-sustaining landform*". The PMLUs for the land are grazing and native bushland with one NUMA.

The basic process that will be adopted for each PMLU to rehabilitate the land to a stable condition and for each NUMA for achieving best practice management in a way that supports respectively the rehabilitation milestones and the management milestones under the PRC Plan schedule are:

3.5.1.1 Progressive rehabilitation process

Progressive rehabilitation is very important in stabilising landforms against erosion. The rehabilitation process consists of several stages which progressively occur concurrent to the mining process including:

Topsoil harvesting:

- Topsoil resources will be characterised and mapped ahead of disturbance to inform stripping depths so as to avoid dilution of valuable topsoil will dispersive, sodic or saline sub-soil;
- Soil moisture will be assessed, and the timing of topsoil harvesting scheduled to avoid soil stripping when soils are saturated or when the soil resource is excessively dry to avoid degradation of the soil resource's physical properties;
- Topsoil recovery will occur ahead of disturbance and either stockpiles or, wherever possible, directly used in rehabilitation;

Landform design & preparation:

- Landform construction will be designed to ensure that any potentially acid forming or carbonaceous waste material is encapsulated within the centre of the dump to minimise exposure to moisture or oxygen;
- Landform designs will seek to maximise the flow of surface water and shallow groundwater seepage originating from the dump footprint towards the final void to ensure potentially saline, sediment laden or non-neutral drainage does not flow offsite;
- Competent rock will be sourced and stockpiled for use in armouring slopes and for construction of drainage structures where erosion modelling predicts that slopes are susceptible to erosion;
- Any carbonaceous or salt affected surface material shall be scalped from affected areas prior

to rehabilitation, with the contaminated material to be buried in the final void or the CDA;

- Sediment dams will be dewatered, and any carbonaceous material, salts or sediment removed and disposed of within the in-pit dumps prior to decommissioning;
- Regrading will be undertaken to shape the surface of disturbed areas so that it conforms to the final landform design, with machine guidance systems used to assist in achieving the desired landform contours;
- Drainage construction will follow regrading to ensure protection from erosion whilst vegetation establishes and allow stability of the landform;
- Re-shaping and contouring of overburden dumps;
- Landforms will be signed-off as constructed to design at completion of earthworks;

Topsoil/growth media application:

- Topsoil will be spread over the surface of the final landform following regrading, contouring and drainage construction;
- Organic matter such as straw, hay, mulched native vegetation or cane mulch may be applied and incorporated into the soil to build organic matter content and provide some protection against raindrop-initiated erosion. Where these materials are to be used, they shall be certified as being free of invasive plants. The applied mulch may be 'keyed in' to the topsoil via use of a tractor mounted crimping roller, light harrow or scarrifier;
- Topsoil will be 'keyed' into the underlying spoil or subsoil via light scarification to a depth no greater than 30cm, with cultivating occurring parallel with the slope contours to maximise retention of rainfall and limit erosion arising from uncontrolled overland flow;

Vegetation & fauna habitat establishment:

- Seedbed preparation will occur after the topsoil has been spread and will typically involve ripping along the contour using a dozer with three tynes mounted behind the machine;
- Seeding, fertilising and addition of any other ameliorants will be undertaken as soon as practicable following the preparation of the seedbed. Application of post- mining land use site-specific seed mix and fertiliser blend, which will be progressively developed based on trials and rehabilitation success;
- Seed shall be sourced from local prominence species where possible to improve success of establishment and reduce the potential for the introduction of invasive plants species;
- Seed application shall occur immediately following cultivation to ensure that a friable seed bed has been created to provide for seed lodgement. If a hard crust has formed due to rainfall, application of gypsum and re-cultivation will be carried out prior to seeding. Light scarification with a harrow or similar implement drawn behind the seeding unit will be utilised to achieve partial burial of the seed to enhance seed/soil contact, noting that burial at depths greater than the diameter of the seed may prevent the germinant from successfully emerging;
- Seeding shall be scheduled to occur during optimum establishment times, based on local experience. Nominally, seeding will be conducted in either March/April or September/October. Seeding during summer months should generally be avoided as germinating seedlings may be burnt off due to excessively hot and dry conditions. For native bushland post-mining land use, if required, revegetation will also be augmented by tube stock planting;
- Logs from trees that must be cleared in advance of mining will be stockpiled and subsequently scattered across sections of the CDA and WRD horizontal surfaces to provide habitat for fauna and organic matter to support soil biota and plant growth;
- Areas where stock need to be excluded will be fenced permanently;

Monitoring & maintenance:

- Monitoring and assessment of rehabilitation success through the rehabilitation monitoring program. Monitoring will focus on key indicators relevant to the post-mining land uses of grazing and native bushland and of the NUMA; and,
- Maintenance of rehabilitation and undisturbed areas as required, which may include the need to repair erosion areas, reseeding, supplementary planting with tube stock, additional fertiliser or other ameliorant application and repair to drainage structures.

3.5.1.2 Hydrogeology

The pre-existing groundwater conditions are described in section 3.1.1.5.

An assessment of groundwater impacts was undertaken by Australasian Groundwater and Environmental Consultants Pty Ltd as part of the development of the EIS for the Codrilla Project. A subsequent addendum to that report was made in response to changes in the mine plan for submission with the Supplementary EIS (see Appendix 4.4). These reports deal with groundwater impacts on ML70450 (the Codrilla mining area) only. Impacts on ML70455 (Moorvale haulroad) are considered to be negligible.

Numerical modelling of the groundwater regime was undertaken with consideration of mining specifics to assess potential impacts of the mine development. A 3D representation of the numerical groundwater model is shown in Figure 22 below.

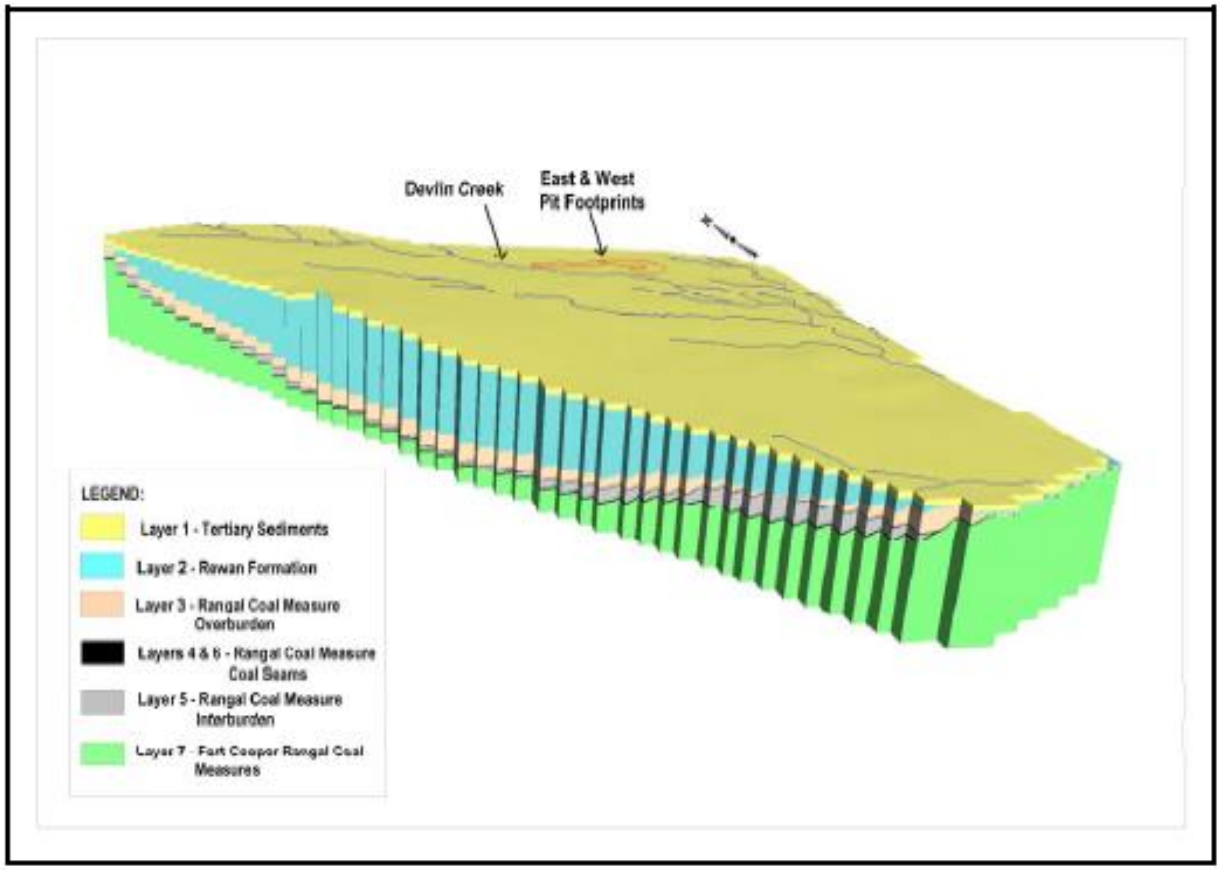

Figure 22 Groundwater Model 3D Representation

Model hydraulic parameters for each of these layers were developed from permeability testing conducted on the monitoring bores, and modified through a 'Steady State' calibration process - comparing modelled with actual groundwater levels observed in the boreholes. The figure below shows the differences between the modelled and actual pre-mining water levels.

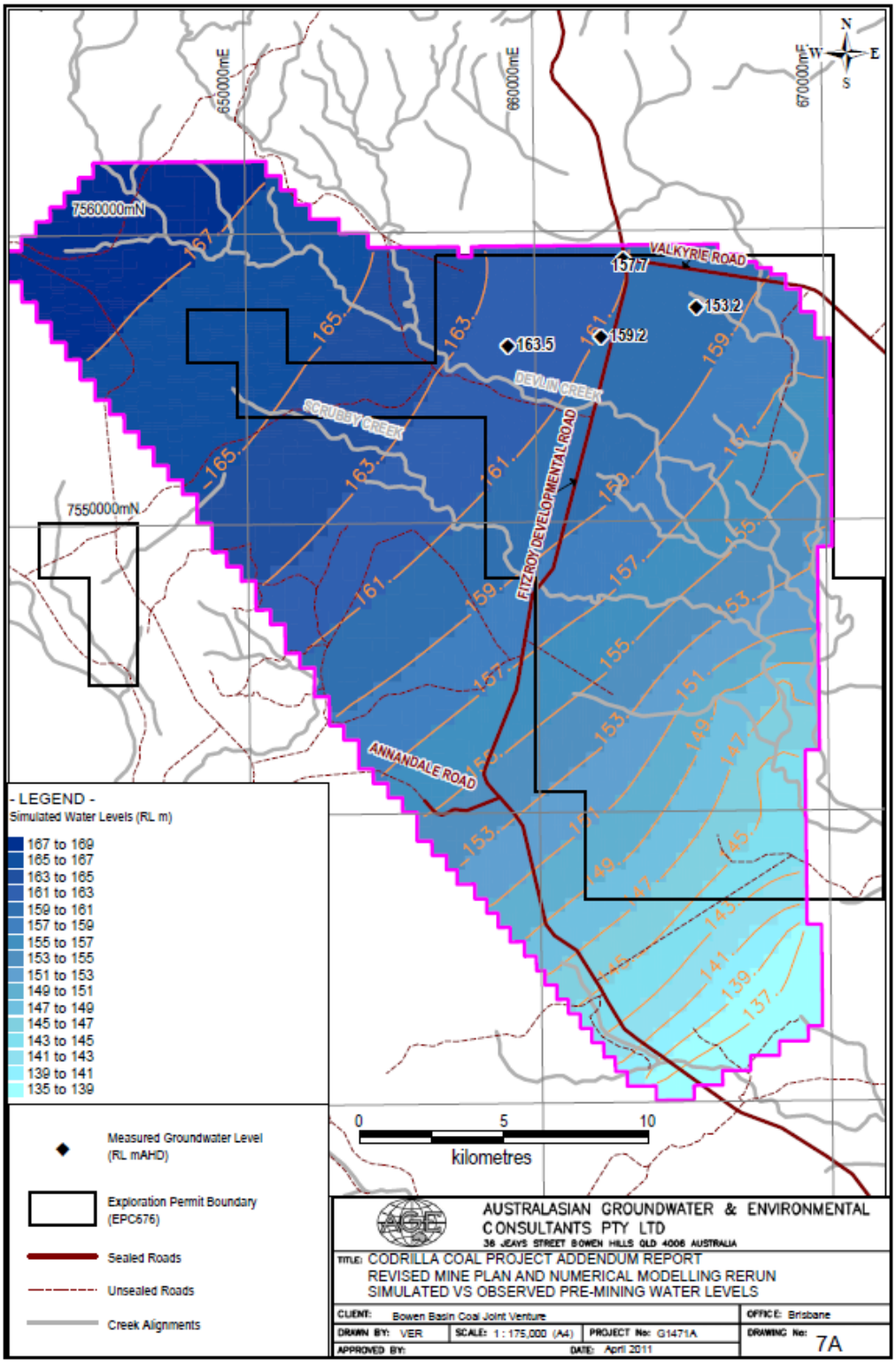

Figure 23 Observed and Simulated Pre-Mining Groundwater Levels

The mining induced impacts on regional and local groundwater were modelled using the mining footprint illustrated below (shaded areas). This footprint is similar to the current plan (shown as contours and magenta outline), except that the West Pit Void has been completely backfilled in the current plan final landform, and the East Pit Void is larger, extending further East than the modelled void.

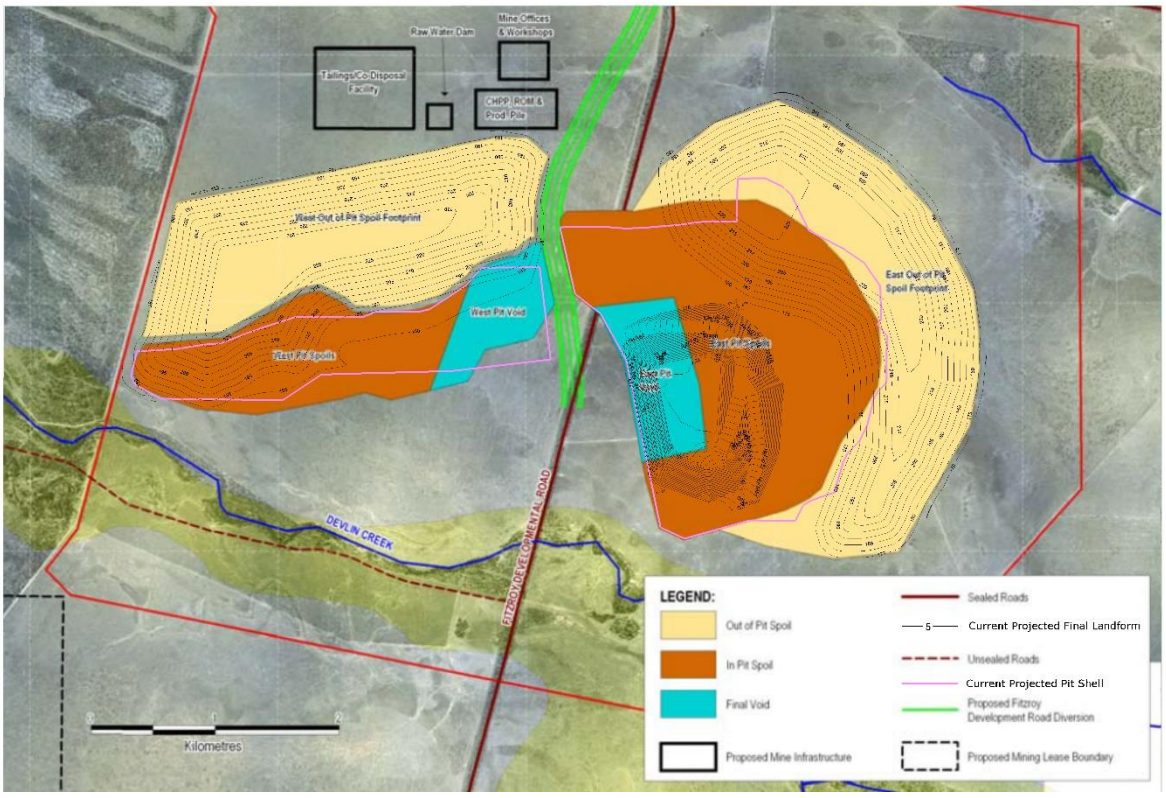

Figure 24 Current Projected Landform (contours) over Groundwater Model Assumed Landform (shaded)

Potential impacts may include drawdown of the regional aquifer and contamination of aquifers resulting from onsite activities such as the storage and handling of chemicals and hydrocarbons and waste materials, (both process and non-process wastes).

The mine development and operation will depressurise the Tertiary, deeper Triassic/ Permian and coal seam aquifers by groundwater inflows into the East and West Pits which will lower the elevation of the piezometric surface of these aquifers and create a cone of depression around the mine. The model simulated extent of the cone of depression in the overburden at the end of mining is shown on Drawing No. 9A (Figure 25 below). The drawdown due to mining is shown in Drawing No. 10A (Figure 26 below).

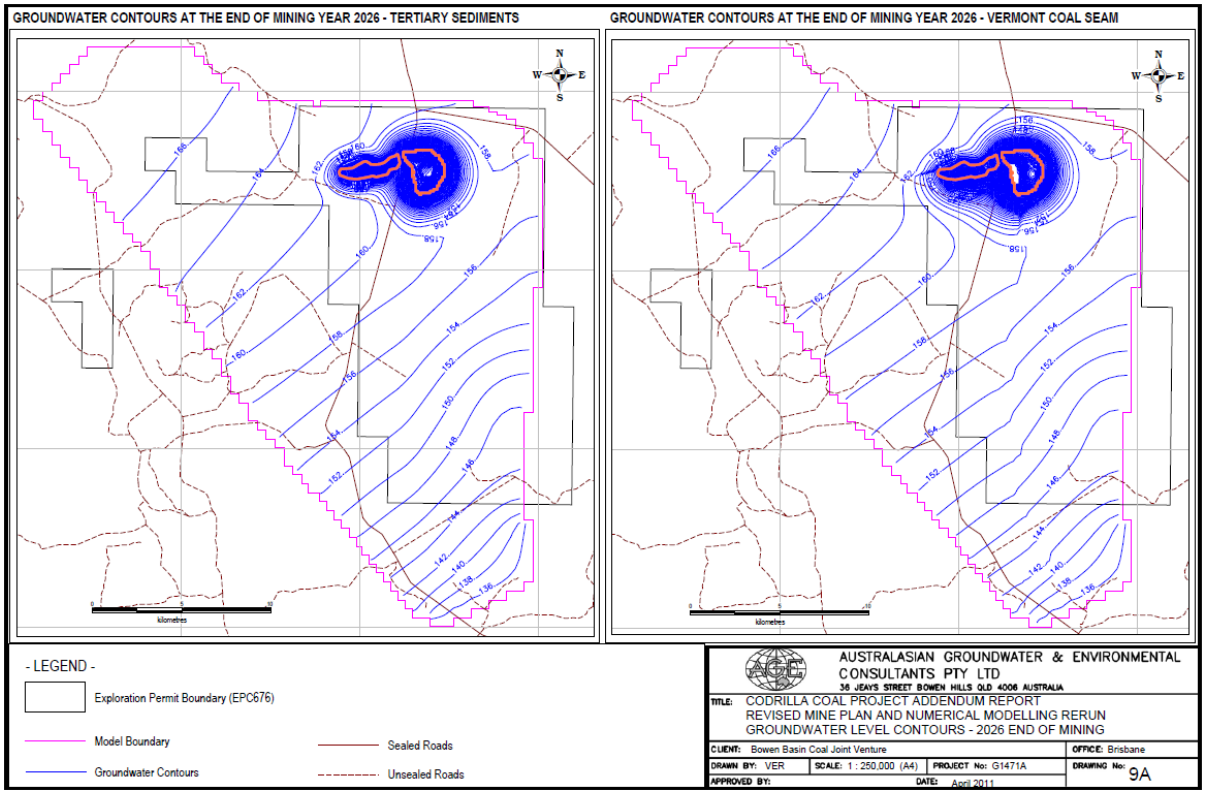

Figure 25 Post Mining Predicted Groundwater Levels

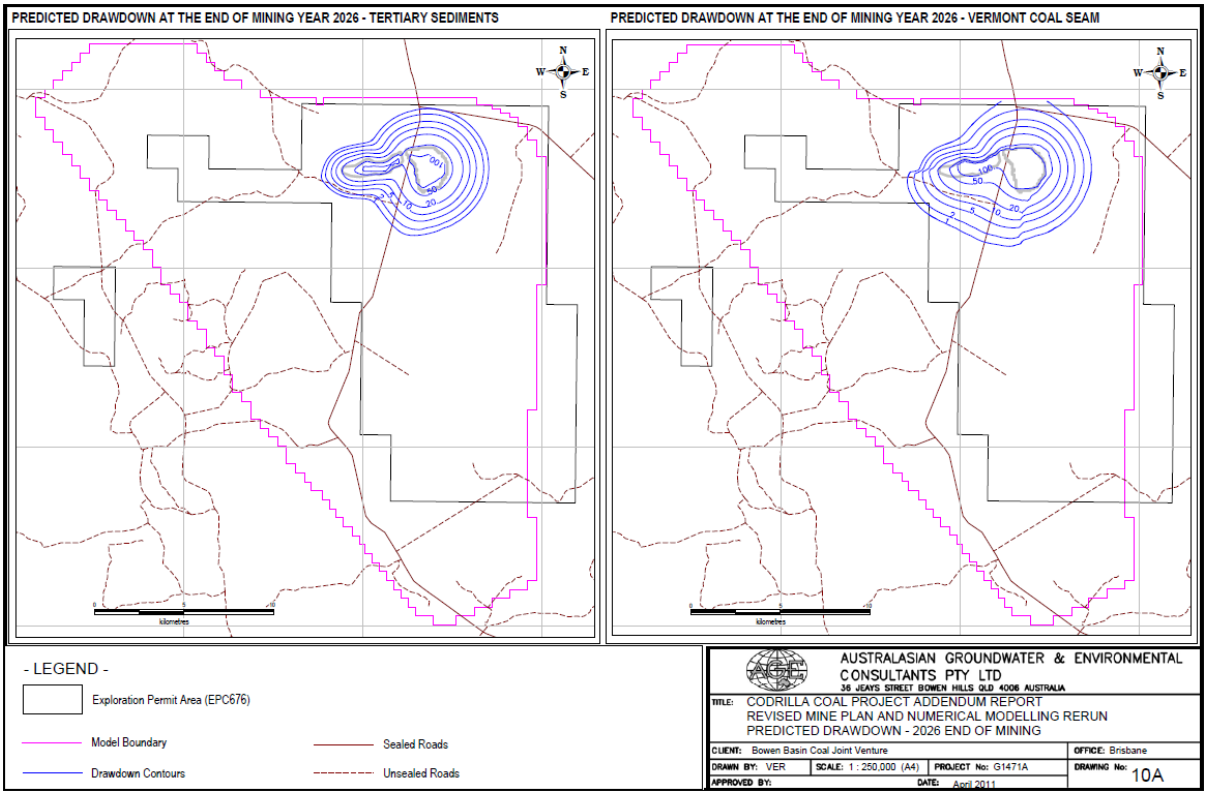

Figure 26 Post Mining Groundwater Predicted Drawdown using EIS Groundwater Model

The drawings indicate that the zone of significant drawdown at the end of mining (i.e., greater than 5m) is limited to the area immediately surrounding the East and West Pits. That is, a generally steep drawdown curve develops a cone of depression up to approximately 4km radius of the northern, southern, eastern and western extents of the mined area. Based on these simulated drawdown levels, the extent of impact on groundwater levels is more prevalent on a local scale immediately adjacent to the mine site, but less so on a regional scale. As there are no other mines within the regional extents of the study area, there will be no cumulative drawdown impacts on the regional aquifer.

It is possible the extent of the simulated drawdown could be less than that predicted, as the numerical model does not include faulting on a local scale which could act as additional hydraulic barriers and limit the effects of aquifer drawdown.

Groundwater inflow to mining pits during operations and post mining were assessed. Predicted inflow volumes are considered manageable within the proposed water management system.

The estimated recovery in water levels in the final voids and spoils is shown in Figure 27.

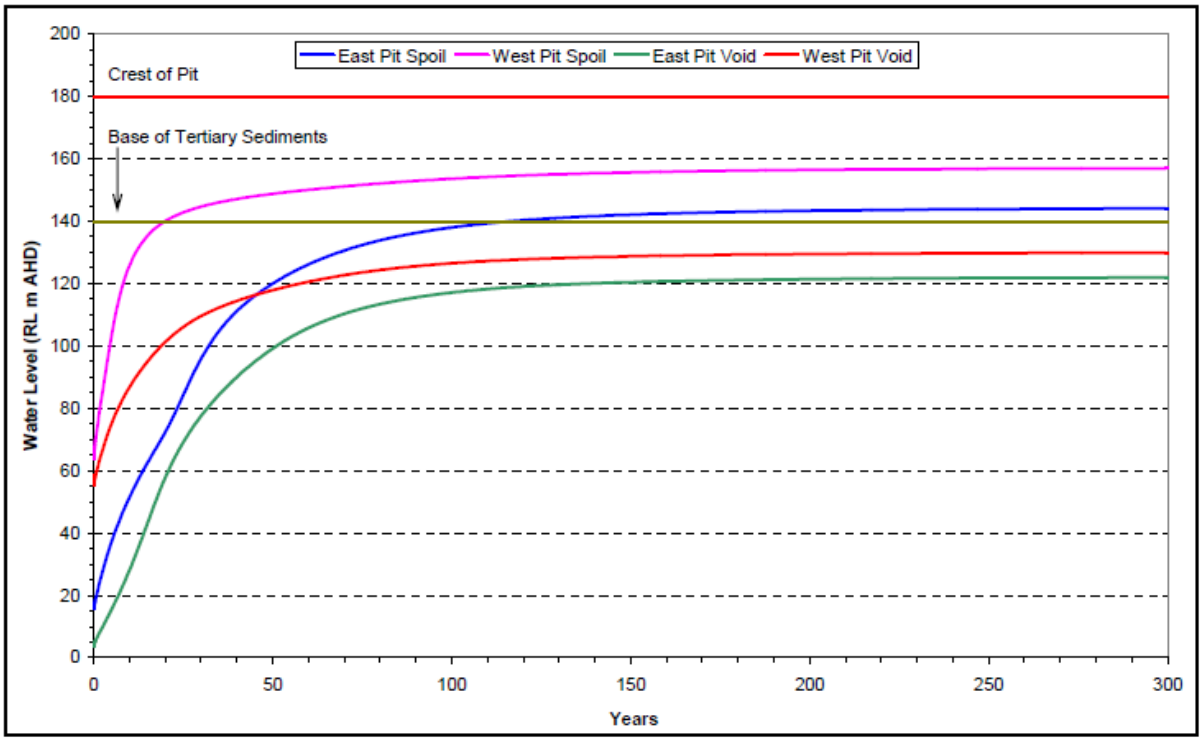

Figure 27 Predicted Long-term Groundwater Levels

The assessment (using the SEIS Mine Plan) indicates groundwater levels in both the East and West Pit voids show a slow recovery rate with water levels rising to a pseudo-equilibrium level around RL120m in East Pit (~60m below the Pit Crest) and RL128m in West Pit after 120 years post mining. Thereafter the water levels still continue to recover but at a very slow rate only reaching RL122m and RL130m in East and West Pit voids respectively after 300 years post mining. Using the current mine plan, long term standing water levels in the East Pit Void are expected to be lower than modelled due to the larger evaporative footprint of the current design, whereas the West Pit Void has been removed from the current design.

Similarly, the water levels within the spoil in each pit initially recover relatively quickly to a pseudo-equilibrium level of around RL120m in East Pit spoil and RL149m in West Pit spoil after 50 years post mining. Thereafter the water levels in East Pit spoil rise very slowly to around RL157m and in West Pit to RL144m after 300 years post mining, generally levelling out after around 100 years.

The evaporative pumping effect in conjunction with the slow rainfall recharge potential for this area will result in the final equilibrium recovered void water levels being somewhere between that predicted for pit void and spoil water levels, which will probably be close to the base of the Tertiary Sediments. Hence the voids will most likely act as a local sink for groundwater and result in a gradual increase in the salinity of the void water over time. The quality of the water will be controlled by the groundwater seepage quality, leaching of salts from the spoil piles and evaporative concentration of rainfall inputs. The salinity of the water would be expected to be brackish, becoming saline over time. The void will act as a sink for the local groundwater and therefore attract water from the surrounding coal measures, with the hydraulic gradients preventing any migration of pit water back into the coal measures. Groundwater contamination is not anticipated as the coal seam aquifers are naturally saline and are not utilised for water supply purposes. The EIS determined that the pit void will not be connected to localised shallow aquifers which contain better quality water and may be utilised for stock water supply in the future.

The water of the alluvial aquifer has aquatic ecosystem values of significance to the local ecology. As no mining activities are planned to intersect the alluvium associated with the aquifer, impacts to water levels within the aquifer are not expected. No potentially contaminating activities are proposed to be undertaken in areas of the Codrilla Project containing alluvium.

The water level in the void is expected to remain below surface with no risk of spillage to local water courses. With the void filled with groundwater and rainfall the risk of spontaneous combustion is minimised because the lower seams will have oxygen exposure excluded.

Relationship with PRC Plan schedule

The information in this section is relevant to the following **Rehabilitation Areas** and **Rehabilitation Milestones** and **Improvement Areas** and **Management Milestones** in the PRC Plan Schedule:

RA1, RA2, RA3, RA7, RA8, RA9 & **RA10 and IA1**

The following **Milestone Criteria** will demonstrate achievement of the Rehabilitation Milestones and Management Milestones:

RM2	Landform design, reshaping and final contouring, inclusive of drainage features	a). Stable landform and slope angles for out of pit overburden dumps areas as follows: outer batter slopes equal to or less than 5.7°and crest slope a maximum of 2.3° b). Stable landform and slope angles for Co-disposal elevated landform and ROM pads as follows: outer batter slopes equal to or less than 8° and crest slope a maximum of 2.3° c). Stable landform and slope angles for coal stockpiles and in pit overburden backfill flat to undulating with slopes equal to or less than 4.6° and crest slopes a maximum of 2.3° d). Stable landform and slope angles for infrastructure areas flat to undulating with slopes equal or less than 2.3° e). Maximum vertical height of out of pit overburden dumps elevated landforms up to 50m f). Maximum vertical height of Co-disposal elevated landform and ROM pad areas up to 18m g). All major earthworks completed

		h). Contour drains and rock lined drop structures installed as per appropriate design criteria i). Landforms such as the Co-disposal facility have been signed-off as constructed to design
RM9	Achievement of a stable condition for the land described as a post-mining land use of grazing	a). Rehabilitation has been certified by an AQP to be: • structurally stable (FoS ≥ 1.5) and slopes are designed in accordance with EA criteria • erosionally stable: no severe erosion gullies (<4m² in cross section) and erosion rates are less than 40tonnes/ha/year and groundcover established and meets criteria in RM7 b). pH and EC indicators for surface water runoff demonstrate the water quality is suitable for the receiving environment and are consistent with water quality indicators of the upstream reference site c). The rehabilitated land meets Class 4 land suitability for grazing using the Guidelines for agricultural land evaluation in Queensland (2nd edn) (DSITI & DNRM, 2015).
RM10	Achievement of a stable condition for the land described as a post-mining land use of native bushland	a). Rehabilitation has been certified by an AQP to be: • structurally stable (FoS ≥ 1.5) and slopes and dump heights are designed in accordance with EA criteria • erosionally stable: no severe erosion gullies (<4m² in cross section) and erosion rates are less than 40tonnes/ha/year and groundcover established and meets criteria in RM9 b). pH and EC indicators for surface water runoff demonstrate the water quality is suitable for the receiving environment and are consistent with water quality indicators of the upstream reference site c). The established native ecosystem has a similar composition to the previous existing woodland ecological communities comprising RE 11.4.8, RE 11.4.9 and RE 11.5.3 and provides habitat opportunities for invertebrate and vertebrate species
MM1	Highwall treatment	a). Highwall crest battered back where required to achieve a stable slope angle as specified by an AQP (geotechnical engineer)
MM2	Achievement of landform design and surface requirements	a). Highwall as mined weathered average slope angle of 1V and 0.7H (55°) and low wall as backfilled at angle of repose at 1V to 1.35H (36°) b). Abandonment safety bund setback distance is in accordance with calculated geotechnical factor of safety c). Abandonment safety bund constructed of competent rock and to geometry specified to prevent traversing by vehicles d). Residual void maximum depth of 150m e). Residual void outside of PMF f). Abandonment safety bund and ramp into voids revegetated with pasture seed
MM3	Achievement of sufficient improvement not to cause environmental harm and that will be safe and structurally stable	a). Access to highwall, low wall and ramp batter is restricted by physical barriers and fencing is erected on the outside of the abandonment safety bund to specification (nominally five strand barbed stock fencing) b). Safety signage (design in accordance with Australian Standard) is erected at specified intervals along the fence line (nominally one sign every 100m) c). Certification from an AQP that the level of final void water is significantly below the crest of the pit to avoid the risk of overtopping and causing environmental harm d). Certification from an AQP that the water quality (pH & EC) in the final void does not show a statistically significant change when compared to

3.5.1.3 Flooding

Flood modelling results for Devlin Creek under existing (pre-mining) conditions show that part of the western pit and some eastern mine infrastructure may be subject to some flood inundation for larger and extreme flood events. The modelling assesses flooding impacts on ML70450 (the Codrilla mining area) only. Impacts on ML70455 (Moorvale haulroad) are considered to be minor.

Modelled flood events include 2, 10, 100 and 2000 year ARI, as well as Probable Maximum Flood (PMF).

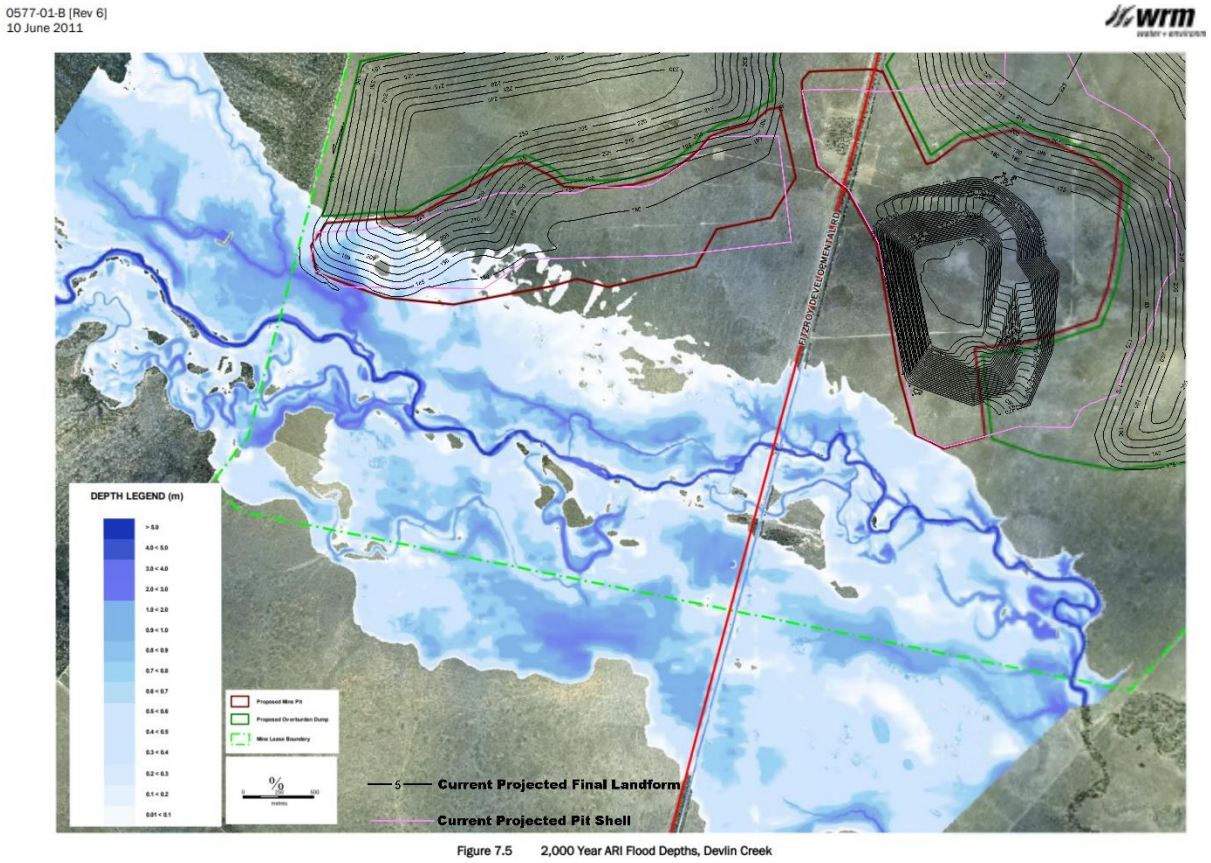

Figure 28 Devlin Creek 2000 Year ARI Flood Depths

To reduce flooding risks while the mine is operational, levees will be constructed to the south of the western and eastern pits to prevent inundation from a 10-year ARI or larger. The proposed levees were included in the hydraulic model and the results showed that impacts of levee construction on flood levels in the vicinity of the Codrilla Project will be minimal, with increases in flood levels over 0.1m restricted to just upstream of the western levee (see Figure 29 below). The Codrilla Project will have no impact on regional flooding in waterways downstream of ML 70450.

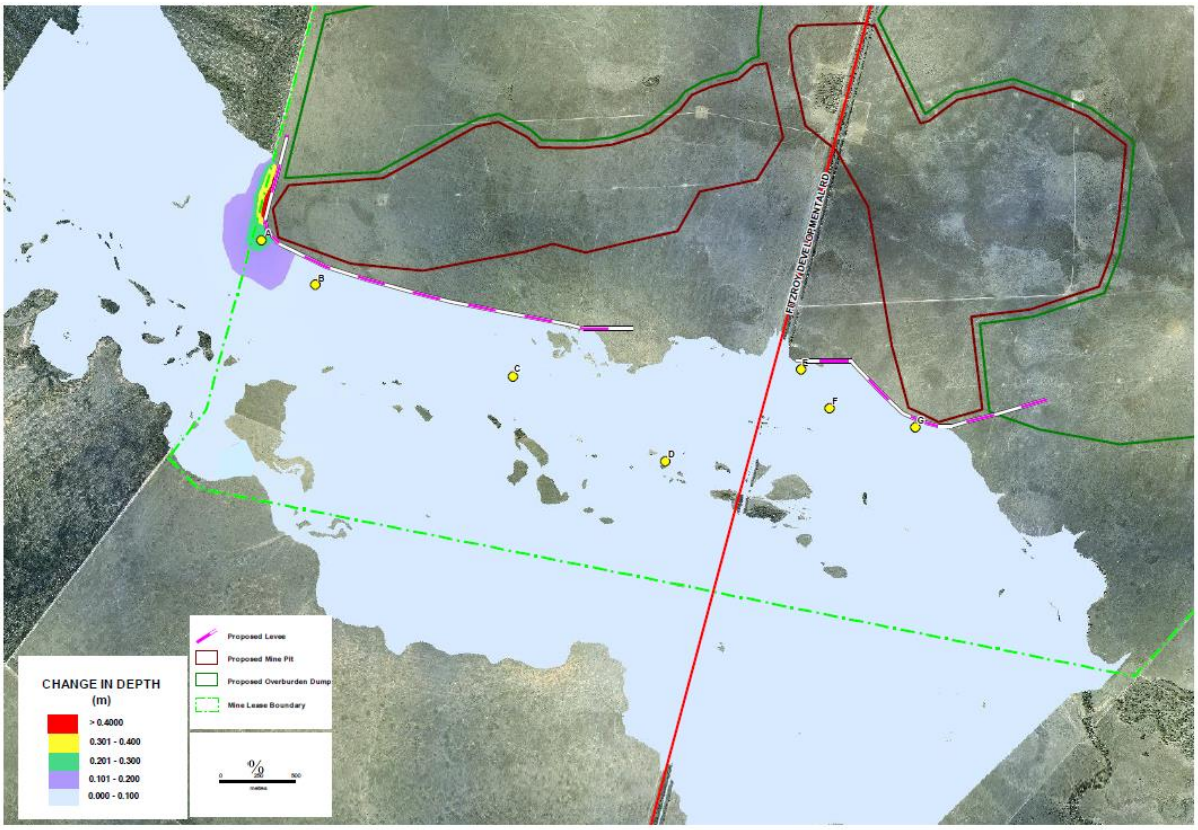

Figure 7.9 Change in Flood Depth, 2,000 Year ARI, Devlin Creek

Figure 29 Levee induced Change in Flood Depth 2000 Year ARI

Probable Maximum Flood levels in Devlin Creek range from approximately 0.5m higher than the 2,000 year ARI flood levels to a maximum of 1.5m higher than the 2,000 year ARI flood levels. As it is proposed that the western mine pit will be rehabilitated to at least the pre-mining natural surface level following cessation of mining activities, levee bank protection for the rehabilitated mine pits will not be required. The eastern residual void will be located outside of the PMF and because the water level in the void is expected to remain below surface there is no risk of spillage into Devlin Creek.

Further details of the model are included in Appendix

4.6 Attachment - Supplementary EIS Surface Water Report (WRM - 10 June 2011).

Relationship with PRC Plan schedule

The information in this section is relevant to the following **Rehabilitation Areas** and **Rehabilitation Milestones** and **Management Milestones** in the PRC Plan Schedule:

RA1, **RA2**, **RA3**, **RA4** and **RA8**

The following **Milestone Criteria** will demonstrate achievement of the Rehabilitation Milestones and Management Milestones:

RM2	Landform design, reshaping and final contouring, inclusive of drainage features	a). Stable landform and slope angles for out of pit overburden dumps areas as follows: outer batter slopes equal to or less than 5.7°and crest slope a maximum of 2.3° b) Stable landform and slope angles for Co-disposal elevated landform and ROM pads as follows: outer batter slopes equal to or less than 8° and crest slope a maximum of 2.3° c.) Stable landform and slope angles for coal stockpiles and in pit overburden backfill flat to undulating with slopes equal to or less than 4.6° crest slope a maximum of 2.3° d). Stable landform and slope angles for infrastructure areas flat to undulating with slopes equal or less than 2.3° e). Maximum vertical height of out of pit overburden dumps elevated landforms up to 50m f). Maximum vertical height of Co-disposal elevated landform and ROM pad areas up to 18m g). All major earthworks completed h). Contour drains and rock lined drop structures installed as per appropriate design criteria i). Landforms such as the Co-disposal facility have been signed-off as constructed to design
RM9	Achievement of a stable condition for the land described as a post-mining land use of grazing	a). Rehabilitation has been certified by an AQP to be: • structurally stable (FoS ≥ 1.5) and slopes are designed in accordance with EA criteria • erosionally stable: no severe erosion gullies (<4m² in cross section) and erosion rates are less than 40tonnes/ha/year and groundcover established and meets criteria in RM7 b). pH and EC indicators for surface water runoff demonstrate the water quality is suitable for the receiving environment and are consistent with water quality indicators of the upstream reference site c). The rehabilitated land meets Class 4 land suitability for grazing using the Guidelines for agricultural land evaluation in Queensland (2nd edn) (DSITI & DNRM, 2015).

RM10	Achievement of a stable condition for the land described as a post-mining land use of native bushland	a). Rehabilitation has been certified by an AQP to be: • structurally stable (FoS ≥ 1.5) and slopes and dump heights are designed in accordance with EA criteria • erosionally stable: no severe erosion gullies (<4m² in cross section) and erosion rates are less than 40tonnes/ha/year and groundcover established and meets criteria in RM9 b). pH and EC indicators for surface water runoff demonstrate the water quality is suitable for the receiving environment and are consistent with water quality indicators of the upstream reference site c). The established native ecosystem has a similar composition to the previous existing woodland ecological communities comprising RE 11.4.8, RE 11.4.9 and RE 11.5.3 and provides habitat opportunities for invertebrate and vertebrate species
MM3	Achievement of sufficient improvement not to cause environmental harm and that will be safe and structurally stable	a). Access to highwall, low wall and ramp batter is restricted by physical barriers and fencing is erected on the outside of the abandonment safety bund to specification (nominally five strand barbed stock fencing) b). Safety signage (design in accordance with Australian Standard) is erected at specified intervals along the fence line (nominally one sign every 100m) c). Certification from an AQP that the level of final void water is significantly below the crest of the pit to avoid the risk of overtopping and causing environmental harm d). Certification from an AQP that the water quality (pH & EC) in the final void does not show a statistically significant change when compared to background data and will not cause environmental harm to the surrounding environment

3.5.1.4 Soil and capping material assessment

An assessment of required capping was completed as part of the EIS. The two largest areas requiring capping are the Overburden/Interburden dumps and the Co-disposal area. The conclusions for each area are summarised below (from Appendix

4.4 Attachment – Supplementary EIS Groundwater Report (AGE Consultants – April 2011)

4.5 Attachment - EIS Soil, Overburden and Land Use Report (GSSE – Sept 2010)

Overburden / Interburden

The results from the Acid Base testing indicates that the overburden material will initially generate neutral to slightly alkaline runoff and seepage due to the current pH of the material. All overburden samples had very low sulphur content of <0.1% and are considered inert. The ANC generally exceeded the MPA for overburden samples indicating that the material has sufficient buffering capacity to neutralise the small amount of acidity that may be generated from sulphide oxidation. All overburden samples were classified as NAF with majority of NAPP values being negative, whilst only 3 samples were slightly positive being 0.6, 0.7 and 1.3 kg H2SO4/t.

The salinity levels of the runoff and seepage water are expected to be moderate. This may cause some vegetation species to be slower growing once the roots penetrate the moderately saline overburden material. Over time it is expected that salinity levels near the surface layers of overburden will lower due to leaching further into the dump profile.

The presence of extremely sodic material throughout the overburden profiles gives rise to the need for implementing appropriate erosion and sediment controls on site prior to and during the development of the overburden emplacements. This sodic material is prone to severe surface crusting, gully erosion and tunnelling. The sodic overburden material will be covered with an inert topdressing sourced from the sites topsoil. The addition of gypsum over the surface may provide an effective reduction of surface crusting and dispersion. The addition of organic matter as an ameliorant into the soil should also reduce the effects of sodicity.

The best suited final land use for the overburden emplacements at Codrilla is native bushland. The final slope of the overburden emplacement will not exceed 10 percent, and graded banks will be constructed at 1.2-1.5 % grade to minimise the chances of ponding and resultant tunnelling.

Co-disposal

CHPP reject is to be stored in the main in a co-disposal facility, that is, the coarse and fine reject streams will be combined at the CHPP and pumped as slurry to the disposal area.

In the context of rehabilitation, the CHPP reject appears to be not particularly saline but poor fertility and combustion risk (from the included coal) dictate that an inert cover will be necessary. The main characteristics required of this cover are low potential to draw moisture out of the co-disposed reject; favourable growth medium properties and erosion resistance appropriate to the landform design.

Existing soil characterisation (including soil quality) is described in Section 3.1.1.6 Soil types, properties and productivity. The total quantity of topsoil planned to be stripped from ML70450 is estimated in the following table:

Table 40 Estimated Available Topsoil Quantities

		Area (ha)	Topsoil Available Thickness Insitu (m)	Topsoil Removed Thickness Removed (m)	Topsoil Volume Removed (m3)	Minimum Topsoil Thickness Placed on Rehab (m)	Topsoil Volume Placed on Rehab (m3)	Topsoil Stockpile Inventory (m3)
RA1	Elevated Landform - Overburden Dumps - Upper	**170.1**	0.25	0.25	425,198	0.10	170,079	255,119
RA2	Elevated Landform - Overburden Dumps - Slopes	**804.8**	0.25	0.25	2,012,078	0.10	804,831	1,207,247
RA3	Backfilled Pits - Overburden Dumps	**291.1**	0.25	0.25	727,835	0.10	291,134	436,701
RA4	Infrastructure Areas - Access Tracks and Haul Roads	**227.9**	0.25	0.25	569,825	0.10	227,930	341,895
RA5	Infrastructure Areas - ROM	**16.8**	0.25	0.25	41,930	1.00	167,720	-125,790
RA6	Infrastructure Areas - CHPP General Area	**3.2**	0.25	0.25	7,933	0.10	3,173	4,760
RA7	Infrastructure Areas - Mine Infrastructure Area	**8.1**	0.25	0.25	20,145	0.10	8,058	12,087
RA8	Water Management Structures	**313.9**	0.25	0.25	784,863	0.10	313,945	470,918
RA9	Elevated Landform Co-disposal - Upper	**31.1**	0.25	0.25	77,750	1.00	311,000	-233,250
RA10	Elevated Landform Co-disposal - Slopes	**34.2**	0.25	0.25	85,465	1.00	341,860	-256,395
IA1	Residual Voids, Ramps into Voids & Abandonment safety bund	**171.6**	0.25	0.25	428,908	0.10	171,563	257,345
	Total	**2,072.8**	**5,181,928**		**5,181,928**		**2,811,293**	**2,370,635**

The total required topsoil to cover the rehabilitation footprint is 2,811,293, indicating a surplus of topsoil. Please note that this table assumes Topsoil placement on the Co-disposal and ROM is done to a 1m thickness. The requirement for these areas is for a minimum 1m cap of *inert material*. The calculations assume the unlikely scenario that no inert overburden material will be available at the time of rehabilitation, so is conservative.

A conceptual plan of Topsoil Stockpile areas has been developed and is shown in Table 41 below. The locations have been designed to ensure that both topsoil stripping and placement activities can be done with reasonable haulage distances.

Table 41 Stockpile Area Required (ha)

	Stockpile Area Required (ha)	
	Available to Remove	**Placed on Rehab**
RA1	25	10
RA2	118	47
RA3	43	17
RA4	34	13
RA5	2	10
RA6	0	0
RA7	1	0
RA8	46	18
RA9	5	18
RA10	5	20
IA1	25	10

Total	**305**	**165**

The topsoil resource in Table 40 has been defined by testing to identify the material which is suitable for use as a plant growth medium on rehabilitated surfaces. Although this testing demonstrates the current soil capability to support plant growth, continued sampling and analysis of topsoil resources, whether stockpiled or in-situ, will be undertaken prior to respreading. This will assist in identifying potential soil deficiencies and estimating required rates of fertiliser or ameliorant (i.e. gypsum or lime) application.

Topsoil spreading

Following regrading and the construction of graded banks and rock lined waterways, topsoil will be spread over the surface of the final landform. Topsoil spreading will involve use of various types of mining machinery, which may include:

- scrapers, which are able to directly spread topsoil transported from insitu recovery operations where applicable, or recover the topsoil from stockpiles into the bowl of the equipment and transport to available rehabilitation areas for direct spreading;
- loaders, which will be used to recover topsoil from insitu recovery or stockpile and load to rear dump trucks;
- rear dump trucks, which would used to transport the topsoil to available rehabilitation areas; and
- dozers, which are used to spread topsoil dumped by rear dump trucks to the nominated depth and also to provide final trim to nominated spreading depth where scraper spread has been used.

The equipment type selected will depend on a number of factors, including:

- availability of specific equipment;
- ground conditions of the insitu recovery area, or stockpile area, and ground conditions of the haul route; and
- source to destination haul distance. Scheduling of topsoil spreading activities will be dependent on the availability of regraded areas and where relevant, construction of drainage controls, equipment availability, direct reuse opportunities, existing soil moisture conditions and seasonal influences and proposed timing of surface preparation and seeding activities.

Generally, topsoil spreading will be scheduled as closely as possible to the seedbed preparation and seeding activities to minimise spread topsoil exposure to erosion potential

Relationship with PRC Plan schedule

The information in this section is relevant to the following **Rehabilitation Areas** and **Rehabilitation Milestones** in the PRC Plan Schedule:

RA1, **RA2**, **RA3**, **RA4**, **RA5**, **RA6**, **RA7**, **RA8**, **RA9** & **RA10**

The following **Milestone Criteria** will demonstrate achievement of the Rehabilitation Milestones:

RM4	Surface preparation (e.g. topsoil, fertiliser, amelioration agents, mulch or woody debris)	a). Topsoil spread to a minimum depth of 150mm b). Gypsum applied at rates determined by an AQP c). Cultivation and keying of topsoil to subsoil with suitable multi-type ripper and performed parallel to slope contours

d). Addition of rock and/or log cover to assist erosion resistance of eventual vegetative ground cover

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3.5.1.5 Waste characterisation

Chemical and physical characterisation of overburden and reject materials (coal and partings) undertaken to support the Codrilla Project EIS suggest that these materials are relatively inert and are not likely to present significant management issues in regard to water quality, landform stability and rehabilitation. The materials are generally sodic and alkaline, indicating that conventional planning and management strategies will be required to ensure operational and post-mining impacts are minimised relative to landform stability and water quality. The topsoils of the Codrilla Project area are generally suitable for harvesting for use in rehabilitation.

The EIS provided the following assessment regarding the waste rock characterisation of overburden and inter-burden material:

- All 26 overburden and inter-burden samples are classified as Non-Acid Forming (NAF);
- the total sulphur content of all samples was below 0.1% and is considered inert relative to acid producing potential;
- The concentration of metals in overburden and inter-burden solids is unlikely to present any significant environmental issues associated with rehabilitation of the materials or water quality;
- The pH of leachate from overburden material at the Codrilla Project site is likely to range from slightly acidic to moderately alkaline; however, the majority of material is likely to be neutral;
- The range of EC values in the samples is considered slightly to moderately saline;
- the overburden material is within the moderate to high ranges for Cation Exchange Capacity (CEC) and should therefore provide a reasonable growth medium for vegetation;
- Overburden material is considered to be extremely sodic;
- the overburden and inter-burden material is not expected to require specific management strategies in relation to PAF, metals, pH, Electrical Conductivity (EC) and Cation Exchange Capacity (CEC); and,
- The overburden and inter-burden material is expected to require specific management strategies in relation to Sodicity.

The characterisation of reject and co-disposal analysis involved obtaining, fresh samples of material from above coal seams (roof), within the coal seams and below the coal seams (floor), during exploration drilling and groundwater bore construction. These samples were composited to form two roof samples, one coal sample and two floor samples. The five roof and floor, coal, and floor samples analysed for acid producing characteristics were classified as either 'Uncertain' or 'Uncertain–Potentially Acid Forming', the total sulphur results being in excess of 0.2% for each of the samples analysed. Due to the limited characterisation of coal and partings (coal seam roof and floor) a commitment was made in the Environmental Management Plan (EMP) of ongoing characterisation of overburden, interburden and partings materials to enable selective handling. This commitment has been captured within the site's EA.

In order to obtain additional information, a drilling programme of four fully cored geotechnical boreholes was carried out in 2011. These holes were cored from close to ground level, to enable

engineering geological logs to be compiled for the soft overburden strata and coal seams and to provide samples for geo-mechanical testing. The laboratory program focused on improving the reliability of material properties used for slope stability modelling. This was achieved by targeting specific soft overburden units (Tertiary and weathered Permian) for sampling and testing. In addition to this, a separate program of testing was conducted on samples recovered from the soft overburden units and the sandstone unit below the VU seam, which was aimed at assessing the dispersive characteristics of the soft overburden and sandstone as a potential spoil cover material. All samples were preserved and dispatched to the laboratory in accordance with nominated procedures. Routine soil classification (Atterberg limits), shrinkage, slake durability, unconfined compressive strength (UCS) were conducted on overburden, roof and floor samples by Cardno (Ullman & Nolan Technical Services Pty Ltd) at their Mackay laboratory. Triaxial testing was carried out by Trilab Pty Ltd in Brisbane.

Soil classification testing indicated the soft overburden to comprise primarily silty or sandy clay or clayey silt of low to intermediate plasticity, with minor occurrences of high plasticity clay.

Triaxial testing was conducted on selected samples of soft overburden and one sample of the Yarrabee Tuff to determine shear strength values. These comprised back-saturated, consolidated multistage tests with pore water pressure measurement. A further sample of the Yarrabee Tuff was tested by direct shear. Shear strength parameters derived from these tests indicate significant variability in the shear strength of material at the site. These are also dependent on the nature of the material tested. In this case, soft clayey materials and more competent, highly weathered rock
would show variability in shear strength.

Unconfined Compressive Strength (UCS) tests were conducted on rock samples from target coal seam roof and floor with slake durability tests on the latter. This mainly focused on the Leichardt and Vermont Upper seams.

Uniaxial compressive strength (UCS) testing indicated the roof units for all seams to be low strength, averaging approximately 10MPa. The predominant roof material was laminite. Similarly, UCS testing indicated the floor units to be low strength, averaging approximately 8MPa. Floor units generally comprised mudstone, laminite and siltstone, with the occasional occurrence of sandstone.

Specific testing requirements completed for the spoil cover assessment included:

- Emerson Class - conducted to assess the dispersive nature of the material, essentially with respect to rehabilitation of spoil and where the overburden (particularly the Tertiary clay) contained slake susceptible clay or mudstone;
- Atterberg Limits - determines the liquid and plastic limits of clayey materials, which is useful indicator of reactivity. An example of a reactive soil would be volcanically derived clay;
- Slake Durability - indicates of rock degradability, which measures changes in rock properties due to chemical and mechanical breakdown; and
- UCS - the unconfined compressive strength of the material

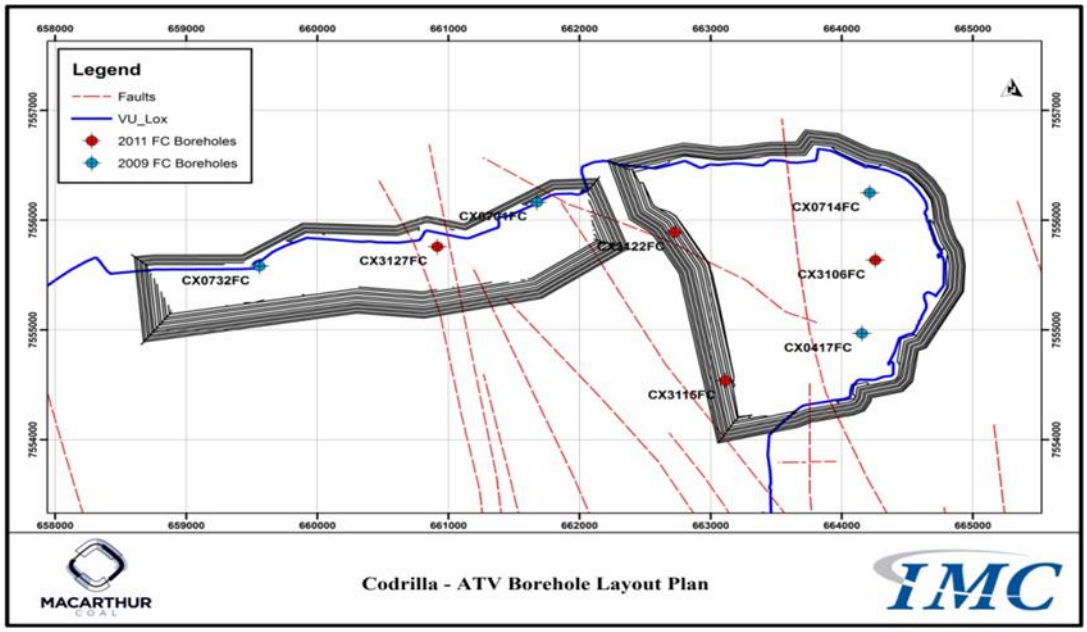

Figure 30 Fully Geotechnical Borehole Plan (2012)

The sampling undertaken to inform the EIS is considered to be adequate for a site where mine development has not commenced. Additional waste characterisation will be undertaken when the mine is developed and throughout the mining and processing phase of the mine's life as per conditions stipulated within the EA.

Sodicity of the overburden and interburden material is the primary limiting factor of potential rehabilitation success due to the risk of erosion and landform destabilisation. In order to minimise risks to the landform and erosion potential the following landform design and rehabilitation criteria are as follows:

- Create overburden dumps as water shedding structures: by reducing the amount of water that will infiltrate the material the risks of tunnel erosion will be minimised.
- Limit batter slope gradient: Although GSSE (2010) recommend slopes of less than 10°, regrading will target a maximum slope gradient of 5.7° for overburden dumps.
- Construction of drainage control structures: by constructing appropriately spaced graded banks and rock lined water ways on batters, surface runoff velocities will be limited and infiltration opportunity will be reduced by removing runoff water from the dump surface.
- Covering of the surface of the regraded overburden with topsoil: this will limit surface exposure of material to runoff and rainfall thus reducing surface erosion risks.
- Establish vegetation cover on the dumps: the root systems of established vegetation will stabilise the surface of the dumps.
- Limit cattle access: by limiting cattle access on the batters of the dumps surface destabilisation will be reduced.

Conceptual landform design is focused on constructing overburden dumps with weathered finer grained material encapsulated within the coarser unweathered material, see Figure 31. The principles of the concept are based on the unweathered material having a higher portion of coarse particles (as indicated by material characterisation to date) and there being no apparent relationship between material location within the overburden profile and distribution of sodicity and or EC. The

ongoing characterisation program will further refine the understanding of overburden material distributions within the pit areas and enable selective placement of materials.

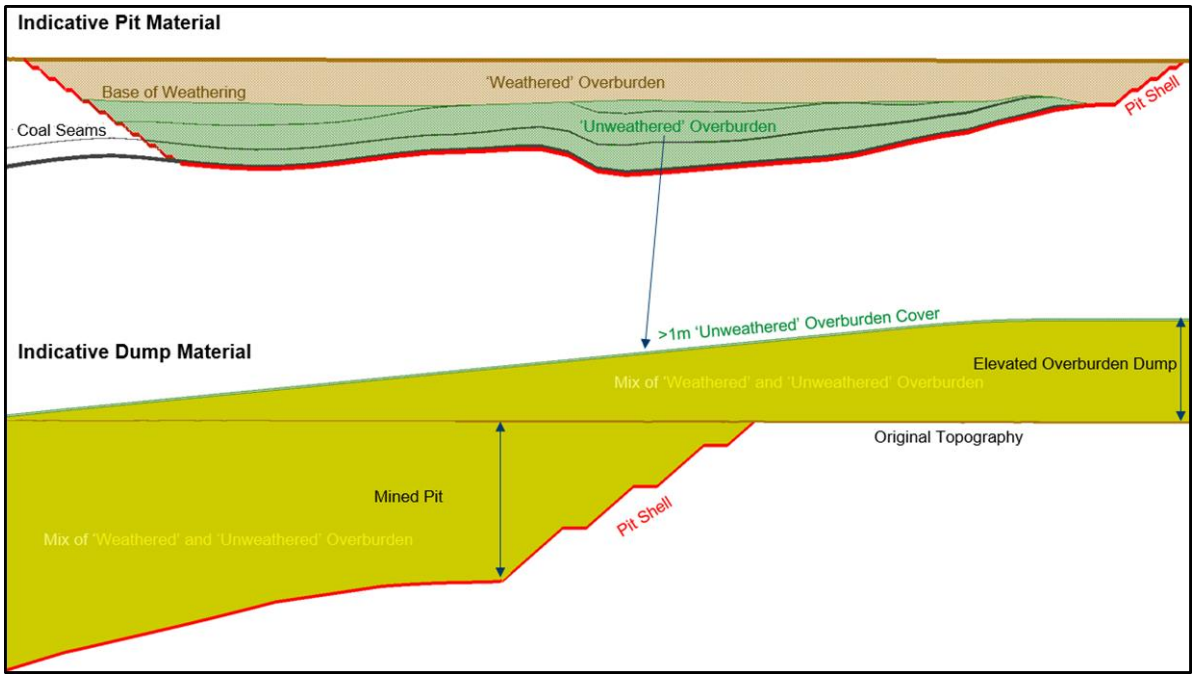

Figure 31 Conceptual Waste Dump Encapsulation Strategy

Relative to coarse reject, co-disposal, ROM pad and coal stockpile and handling areas, the potential for acid production and low fertility of the materials are considered the primary limiting factors. In order to minimise risks to the rehabilitation of these areas the landform design and rehabilitation criteria are as follows:

- Where possible encapsulate materials within overburden dumps with at least 1m of cover: this will limit infiltration of water and oxygen to the materials and reduce the potential for acid production.
- Cover co-disposal, ROM pad and coal stockpile areas with a minimum of 1m inert overburden capping: this will limit infiltration of water and oxygen to the materials and reduce the potential for acid production. Furthermore, the overburden capping will provide a more fertile growth medium than the underlying materials which have poor fertility.
- Create the landforms as water shedding structures: by reducing the amount of water that will infiltrate the underlying material the potential for production of poor quality leachate will be minimised.
- Limit batter slope gradient: regrading will target a maximum slope gradient of equal or less than 8° for the outer batters of the co-disposal facility and ROM pad.
- Construction of drainage control structures: by constructing appropriately spaced graded banks and rock lined water ways on batters, surface runoff velocities will be limited and infiltration opportunity reduced.
- Covering the surface of the overburden capping with topsoil: this will limit surface exposure of overburden material to runoff and rainfall, and provide a more fertile growth medium for vegetation.
- Establish vegetation cover on the landforms: the root systems of established vegetation will stabilise the capping and topsoil surface of the landforms.
- Limit cattle access on slopes exceeding 4.6°: by limiting cattle access on landform batters exceeding 4.6°, surface destabilisation and erosion will be reduced.

The construction of the Haul Road on ML70455 will require cut and fill of material to form a competent subgrade. Geotechnical investigations have identified sections of insitu material that will not be mechanically suitable as a sub grade for the road. This material will be excavated and where necessary replaced with suitable cut material from elsewhere in the Haul Road development. Overall there will be an excess of cut material which will require disposal. The excess excavated material will be chemically and physically characterised and disposed of according to the results of the characterisation. If the material is found to be non-acid forming, generally chemically inert and not highly susceptible to erosion it will spread within the boundary of the haul road Mining Lease (ML70455) and rehabilitated. Alternatively, it will be transported to the Codrilla West Pit overburden dump for incorporation.

Relationship with PRC Plan schedule

The information in this section is relevant to the following **Rehabilitation Areas** and **Rehabilitation Milestones** in the PRC Plan Schedule:

RA1, **RA2**, **RA3**, **RA4**, **RA5**, **RA6**, **RA7**, **RA8**, **RA9** & **RA10**

The following **Milestone Criteria** will demonstrate achievement of the Rehabilitation Milestones:

RM2	Landform design, reshaping and final contouring, inclusive of drainage features	a). Stable landform and slope angles for out of pit overburden dumps areas as follows: outer batter slopes equal to or less than 5.7°and crest slope a maximum of 2.3° b). Stable landform and slope angles for Co-disposal elevated landform and ROM pads as follows: outer batter slopes equal to or less than 8° and crest slope a maximum of 2.3° c). Stable landform and slope angles for coal stockpiles and in pit overburden backfill flat to undulating with slopes equal to or less than 4.6° crest slope a maximum of 2.3° d). Stable landform and slope angles for infrastructure areas flat to undulating with slopes equal or less than 2.3° e). Maximum vertical height of out of pit overburden dumps elevated landforms up to 50m f). Maximum vertical height of Co-disposal elevated landform and ROM pad areas up to 18m g). All major earthworks completed h). Contour drains and rock lined drop structures installed as per appropriate design criteria i). Landforms such as the Co-disposal facility have been signed-off as constructed to design
RM3	Install cover system/cap	a). Cover installed over reject/coal stockpile surfaces (nominally 1m inert overburden)
RM9	Achievement of a stable condition for the land described as a post-mining land use of grazing	a). Rehabilitation has been certified by an AQP to be: • structurally stable (FoS ≥ 1.5) and slopes are designed in accordance with EA criteria • erosionally stable: no severe erosion gullies (<4m² in cross section) and erosion rates are less than 40tonnes/ha/year and groundcover established and meets criteria in RM7 b). pH and EC indicators for surface water runoff demonstrate the water quality is suitable for the receiving environment and are consistent with water quality indicators of the upstream reference site c). The rehabilitated land meets Class 4 land suitability for grazing using the Guidelines for agricultural land evaluation in Queensland (2nd edn) (DSITI & DNRM, 2015).

RM10	Achievement of a stable condition for the land described as a post-mining land use of native bushland	a). Rehabilitation has been certified by an AQP to be: • structurally stable (FoS ≥ 1.5) and slopes and dump heights are designed in accordance with EA criteria • erosionally stable: no severe erosion gullies (<4m² in cross section) and erosion rates are less than 40tonnes/ha/year and groundcover established and meets criteria in RM9 b). pH and EC indicators for surface water runoff demonstrate the water quality is suitable for the receiving environment and are consistent with water quality indicators of the upstream reference site c). The established native ecosystem has a similar composition to the previous existing woodland ecological communities comprising RE 11.4.8, RE 11.4.9 and RE 11.5.3 and provides habitat opportunities for invertebrate and vertebrate species
RM11	Install fencing or other infrastructure to support the PMLU	a). Fencing / bunding installed to exclude stock

3.5.1.6 Landform design

Transitional PRC plans are not required to demonstrate how aspects of the mine have been designed for closure; however, section 3.6.1 outlines the range of information requirements to be provided, including landform design. The following section includes a summary of design elements considered during the development of the proposed final landform.

3D Design Final Landform

The final landform has been developed in 3-dimensional CAD packages, and the design outcomes are presented as a contour map in Figure 32.

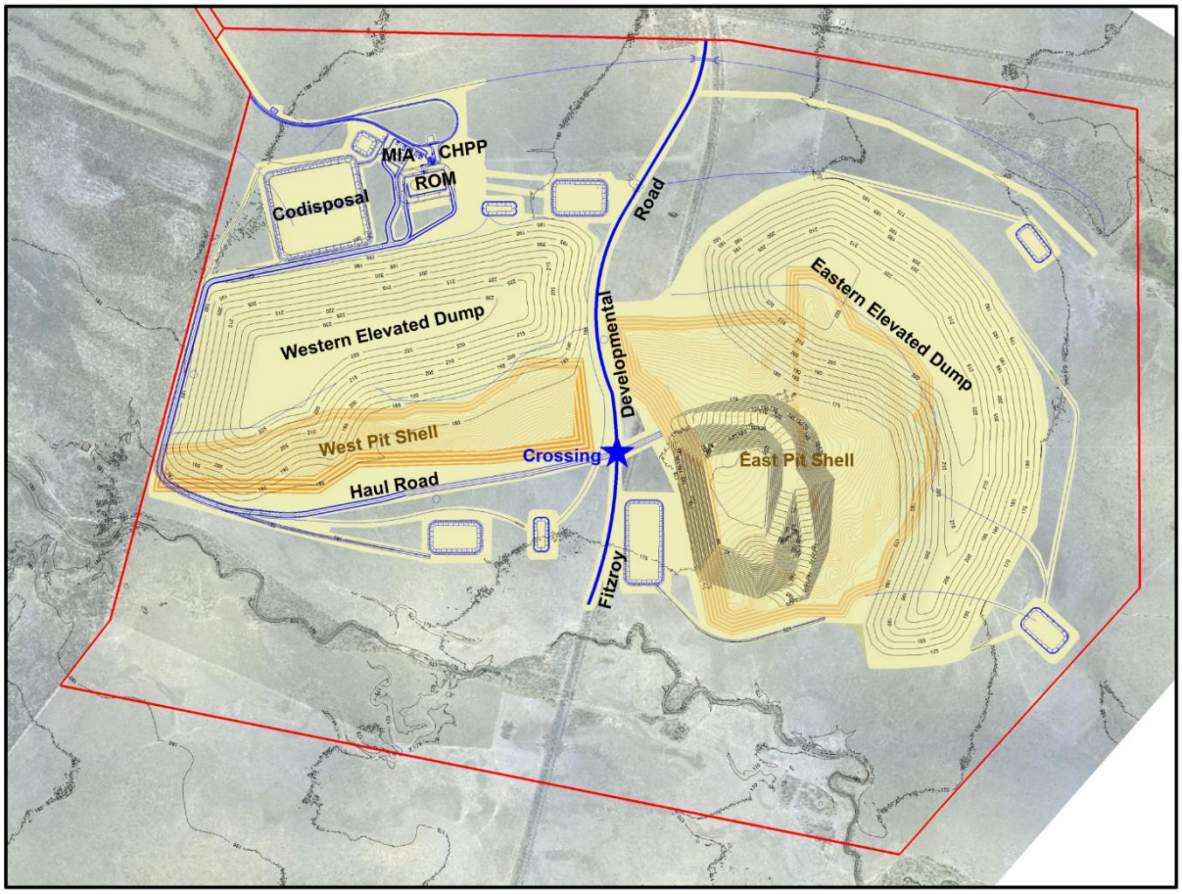

Figure 32 Current Proposed Final Landform Design

Landform Design Method

To determine the final landform a mine schedule was first developed utilising the SPRY software package. The model used to develop this schedule includes 'Destination Scheduling', which enables the planner to place excavated material into logical 3-D dumping locations in a sequence relative to a practical mining excavation sequence.

After the 'as-dumped' landform has been determined, a landform smoothing process has been undertaken using the 3D-Dig Reshape software tool to create 'convex-concave' surfaces that mimic 'natural' stable slope profiles, while staying within the maximum slope criteria specified in the EA. This surface is then inspected visually in 3-D to ensure the software has created an appropriate outcome, and final volumetric checks are performed to ensure that sufficient material is available to construct the overall landform.

Modelling of long-term stability

The Revised Universal Soil Loss Equation (RUSLE) has been used to estimate the long-time annual erosion rate. The soil erodibility factor (K) has been adjusted for dispersive soil by +20% to take into consideration the test results of the samples taken within the Codrilla Project area, which indicated a moderate to very high potential for erosion.

Modelling shows that the unshaped landforms are the scenario of highest risk of erosion, but once the landforms have been regraded to produce the final slope angles, lengths and shapes and rehabilitation is established the erosion rate is low. Further details are discussed in section 3.1.1.6 and in Appendix 4.4.

Proposed Construction Method

The landforms will be constructed using the mine overburden, placed in lifts by haul trucks being loaded by excavator / shovel units. The final surface profile will generally be established utilising large earthmoving bulldozers (e.g. Caterpillar D10, D11, etc…) to regrade these 'as-dumped' lifts according to the final landform design.

Environmentally, the method has advantages in providing for more controlled planning of overburden dump construction, maximising efficiency in landform development and rehabilitation. Additionally, the truck and excavator / shovel method offers advantages for selective encapsulation of potentially problematic materials that may be identified through operational material characterisation and monitoring programs.

Quality Assurance / Quality Control (QA/QC)

Operator and supervisor training will be provided to personnel undertaking rehabilitation earthworks, including the importance of conforming to the design specifications. Works will be supervised to ensure compliance with design specifications and relevant procedures.

High-precision GPS tools may be used on-board construction equipment (or by surveyors) to assist in the development of the landform.

In addition, constructed landforms shall be inspected regularly during the construction phase and signed-off as constructed to design following completion of earthworks. Records shall be retained to demonstrate quality assurance and quality control processes have been met.

Trial Methodology

Once mining activities have commenced, the site is committed to establishing 3 reference sites, and 3 rehabilitation monitoring sites (a requirement of the Environmental Authority) to verify the success of the landform design. As part of the trials to verify the success of the landform design, additional studies will be undertaken, and data will be gathered. Monitoring will be conducted annually.

Limitations and Assumptions

The results of the landform design work are heavily influenced by several assumptions, particularly the assumption relating to the swell factor of the excavated and dumped material.

The mining process involves the removal of overburden and interburden materials from above the coal seams prior to coal extraction. This excavation process results in the "loosening" of the material, which has been compacted insitu by geological processes over time. The "loosening" results in an increase in the volume that a unit of overburden or interburden will occupy once excavated when compared to the un-excavated (insitu) volume. The increase in the overburden and interburden volume from the insitu to excavated state is known as the swell factor. The swell factor adopted for planning at Codrilla is 25%. This has been based on the material characteristics of the Project and experience at Coppabella and Moorvale Coal Mines.

Furthermore, the overburden and interburden removal and coal mining operations require sufficient room to safely undertake activities and minimise the risk of material encroaching into operational areas. Therefore, to account for the swell factor of excavated material and maintain adequate working room in the operating pit, out of pit overburden dumps are required in conjunction with progressive backfilling of the mined pits.

Small variations in this swell factor assumption can result in differences in the as-dumped profile, including the size and shape of the void. Additionally, mine sequence changes in response to market

demands or operational challenges may result in similar differences. As the mine progresses, some variation in the current proposed landform can be expected and will be updated as required via a PRC Plan amendment process.

Key Landform Features

The proposed post-mining landform contains the following key features:

• Elevated areas associated with out of pit overburden dumps, being 50m high and having external batter slopes between 4.6° and 5.7° and crests less than 2.3° slope;

• Elevated co-disposal facility, being up to 10m high with external batter slopes of equal or less than 8° a crest slope of less than 2.3°;

• Elevated ROM pad, being 15 to 18m high with external batter slopes equal or less than 8° and a crest slope of less than 2.3°;

• Areas of similar gradient to the surrounding undisturbed landform such as backfilled pits and areas from where infrastructure is removed; and

• Stable final void areas.

Post-mining land uses have been determined based on the assessed post-mining land capabilities and suitability. The post-mining land uses primarily consist of native bushland for wildlife usage and managed low intensity beef cattle grazing.

Lining Requirements

No lining is required for overburden / interburden dump landforms. The co-disposal is designed to have a 1m inert overburden cap to limit infiltration of water and oxygen to the contained materials. All landforms are designed to be water shedding to reduce infiltration and seepage.

Surface Water Consideration

The landform design has been developed to be generally water-shedding, with only the areas in close proximity to the final void area being water-retaining. During construction of the landform, as part of the operational management of water on-site, much of the surface run-off water will be retained. As the rehabilitation objectives of the landform are achieved, runoff on these areas will be eventually returned to the natural receiving waterways.

Materials Available for Rehabilitation

Materials to be rehabilitated and/or used in the rehabilitation process have been assessed to determine their suitability relative to vegetation establishment, erosion and landform stability and potential for pollution. The assessments provided information regarding potentially limiting factors which were considered in the development of the proposed final landform and post-mining land use.

Erosion Assessments to determine Landform and Material Placement

Operational experience at Coppabella and Moorvale Coal Mines has demonstrated success with graded banks spaced between 75m and 88m respectively for slopes of 8° on landforms in the order of 50m height. Slopes considered at Codrilla have been reduced to a maximum of 5.7° (<10%) to reduce erosion rates, particularly while vegetative cover is developing.

Codrilla overburden and interburden materials are sodic and susceptible to dispersion and erosion. Broadly, relative to sodicity and erosion susceptibility, the overburden and interburden material at Codrilla is similar to overburden and interburden at Coppabella Coal Mine. Based on experience at

Coppabella Mine, a graded bank spacing of 75m is considered appropriate for the maximum design slope of 5.7°. Detailed design and construction, of graded banks and rock lined waterways will be dependent on site specific factors, and will be based on the most relevant industry standards available.

Slope Profile Design

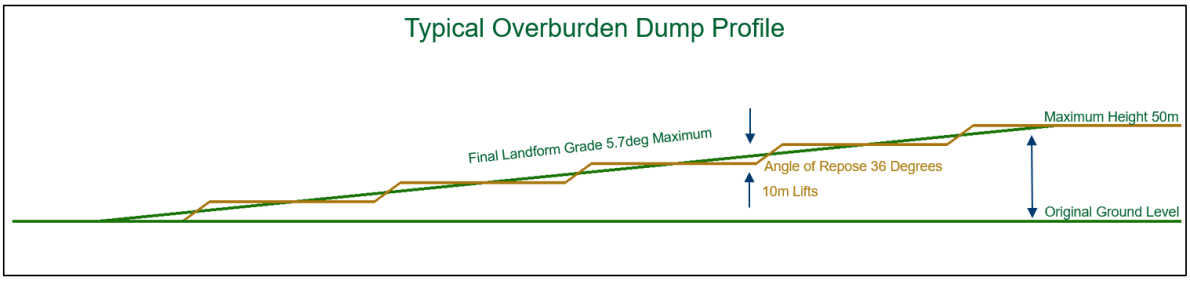

Figure 33 Typical Overburden / Interburden Waste Dump Profile

Settling and Subsidence

There has been no formal study on the impacts of subsidence / settling over time for the design landforms at Codrilla. The main area where settlement is likely to impact the availability for rehabilitation is the co-disposal area. This area will only be active for the first 6-8 years of operation, so an allowance has been made to rehabilitate this towards the end of the mine life to ensure maximum settlement has occurred. The settlement of area will be monitored over time to identify any opportunity to commence rehabilitation earlier.

Hydrological and Hydrogeological Assessments

No formal assessment of the current design final landform surface hydrology has been completed, however the landform and surface water management system has been designed to contain surface water runoff while the mine is operational, but release to the natural receiving waterways on completion of suitable rehabilitation activities.

A hydrogeological assessment has been done on the landform which was considered as part of the development of the EIS. Although the size and location of the final voids have changed, it is believed that the effect of the groundwater in the spoils will be negligible, with the western pit spoil achieving an equilibrium level of ~RL155 (approx. 25m below surface level) and the eastern spoils groundwater levelling off at ~RL145 (approx. 35m below the surface level).

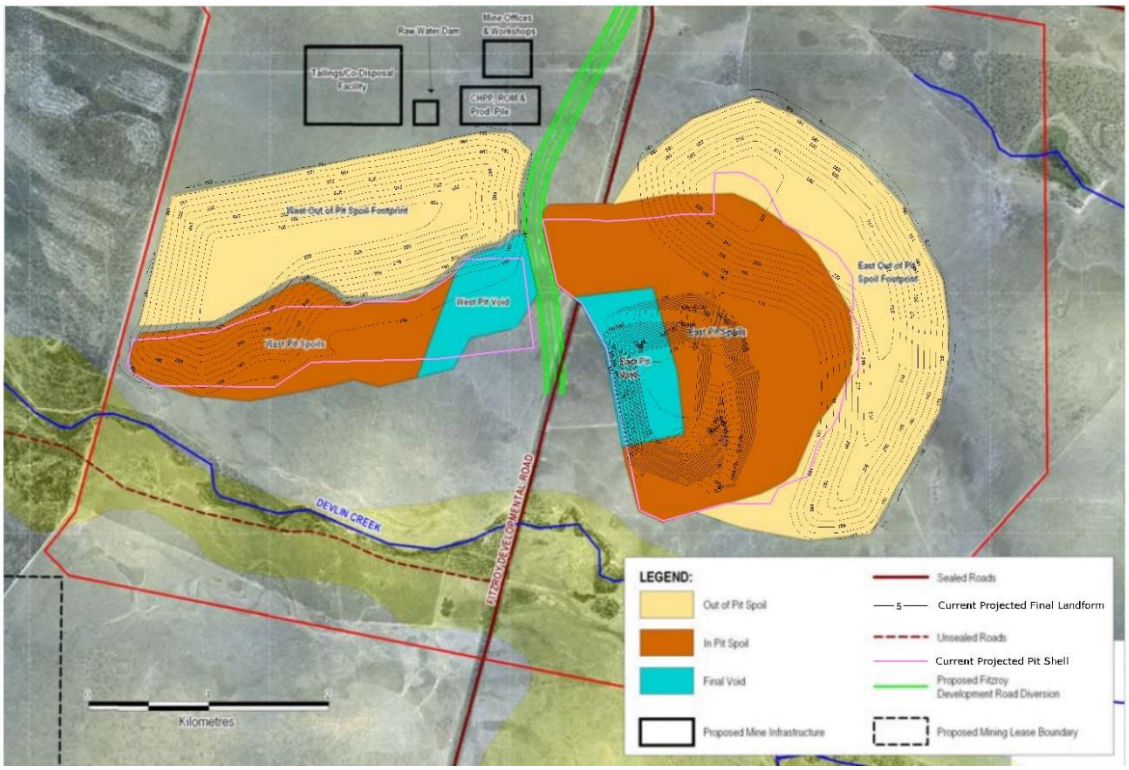

Figure 34 Groundwater Modelled Void (blue shade) versus Current Proposed East Void (contours)

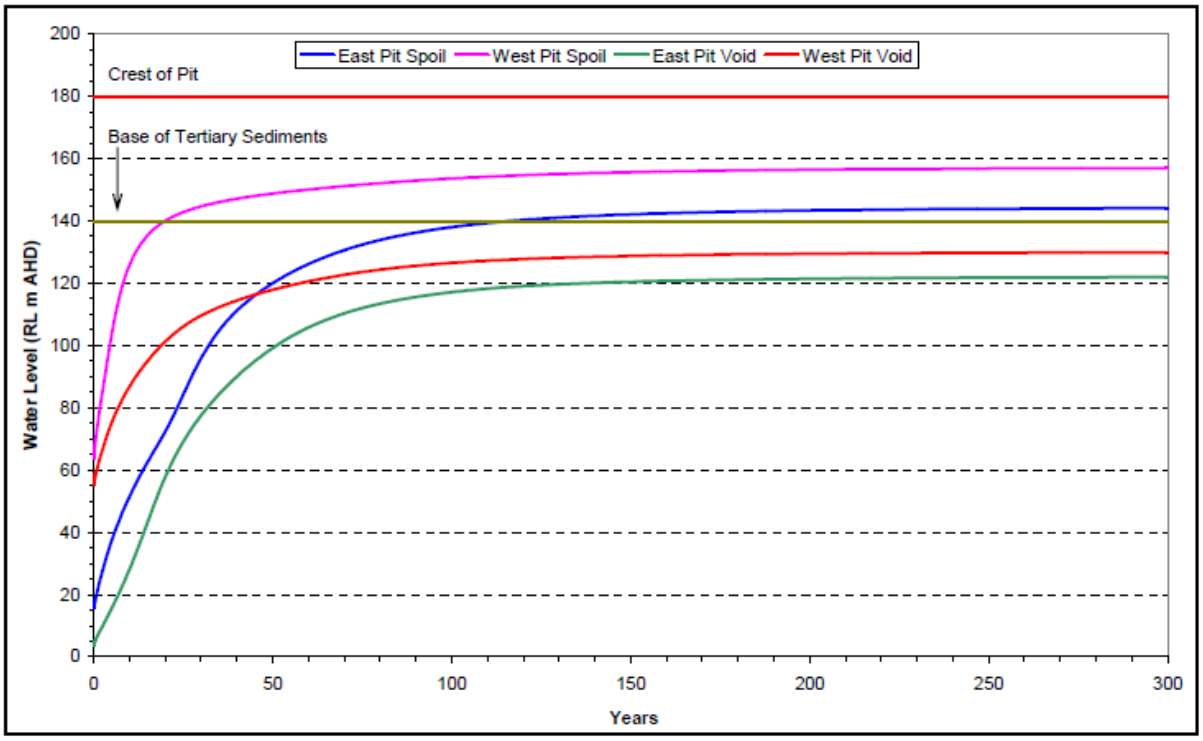

Figure 35 Predicted Groundwater Level Recovery

Note: Long term standing water levels in the Eastern Pit Void are expected to be lower than currently modelled due to the larger evaporative footprint of the current final landform design, whereas the Western Pit Void has been removed from the current design.

Waste Placement Strategy

The landform construction through designed placement and re-shaping of overburden/interburden, and co-disposal will largely be undertaken while the mine is operational, with impacts on the receiving environment limited by conditions contained within the site's Environmental Authority. An initial waste placement strategy, designed to encapsulate finer materials in lower sections of the dump, is illustrated in Figure 31.

Sediment-laden surface water runoff will be managed, with most water retained on-site until rehabilitation objectives have been met.

Relationship with PRC Plan schedule

The information in this section is relevant to the following **Rehabilitation Areas** and **Rehabilitation Milestones** in the PRC Plan Schedule:

RA1, RA2, RA3, RA4, RA5, RA6, RA7, RA8, RA9 & RA10

The following **Milestone Criteria** will demonstrate achievement of the Rehabilitation Milestones:

RM2	Landform design, reshaping and final contouring, inclusive of drainage features	a). Stable landform and slope angles for out of pit overburden dumps areas as follows: outer batter slopes equal to or less than 5.7°and crest slope a maximum of 2.3° b). Stable landform and slope angles for Co-disposal elevated landform and ROM pads as follows: outer batter slopes equal to or less than 8° and crest slope a maximum of 2.3° c). Stable landform and slope angles for coal stockpiles and in pit overburden backfill flat to undulating with slopes equal to or less than 4.6° crest slope a maximum of 2.3° d). Stable landform and slope angles for infrastructure areas flat to undulating with slopes equal or less than 2.3° e). Maximum vertical height of out of pit overburden dumps elevated landforms up to 50m f). Maximum vertical height of Co-disposal elevated landform and ROM pad areas up to 18m g). All major earthworks completed h). Contour drains and rock lined drop structures installed as per appropriate design criteria i). Landforms such as the Co-disposal facility have been signed-off as constructed to design

3.5.1.7 Cover Design

There are two cover design systems proposed for the Codrilla Project, related to the nature of the materials being covered. These are summarised below.

Overburden / Interburden Dumps

- Minimum 0.1m of topsoil
- Vegetation Cover >70% for areas of low rock and logs, >50% for areas of high rock and log content

Coal Stockpiles / ROM Pad / Co-disposal

- Minimum 1m of Inert Material

- Minimum 0.15m of topsoil
- Vegetation Cover >70% for areas of low rock and logs, >50% for areas of high rock and log content

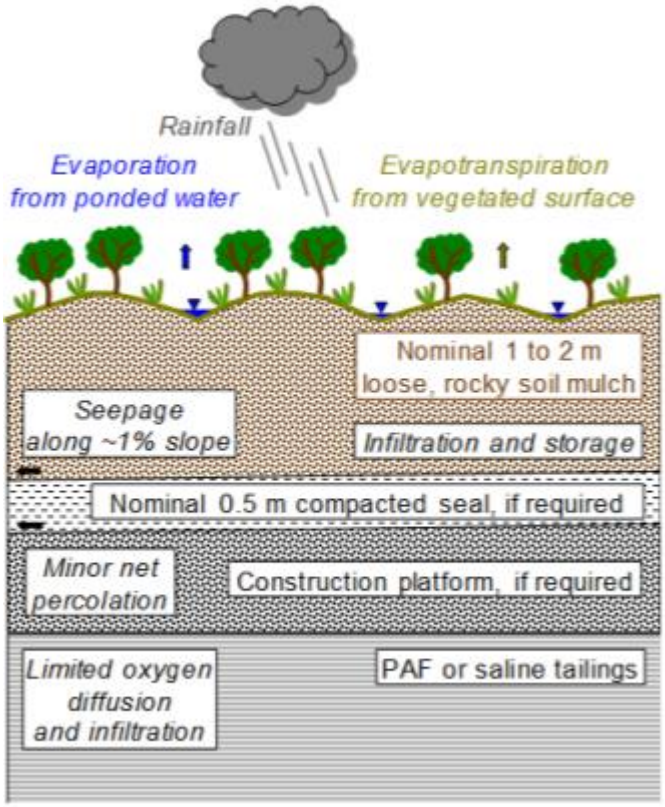

Figure 36 Schematic of typical soil cover systems suitable for use on potentially contaminating tailings

The vegetation ground cover species will vary depending on the land use – these are described in other sections.

The information in this section is relevant to the following **Rehabilitation Areas** and **Rehabilitation Milestones** in the PRC Plan Schedule:

RA1, **RA2**, **RA3** & **RA5**, **RA6**, **RA9 & RA10**

The following **Milestone Criteria** will demonstrate achievement of the Rehabilitation Milestones and Management Milestones:

RM3	Install cover system/cap	a). Cover installed over reject/coal stockpile surfaces (nominally 1m inert overburden)
RM4	Surface preparation (e.g. topsoil, fertiliser, amelioration agents, mulch or woody debris)	a). Topsoil spread to a minimum depth of 150 mm b). Gypsum applied at rates determined by an AQP c). Cultivation and keying of topsoil to subsoil with suitable multi-type ripper and performed parallel to slope contours d). Addition of rock and/or log cover to assist erosion resistance of eventual vegetative ground cover

3.5.1.8 Water Management

Generally final landform surfaces have been designed or created with the existing soil stockpiles, drains, diversion structures and lay down areas removed to create free flowing landforms removing the requirement for water diversion structures or dams. Part of the design criteria is to keep as much clean water out of the pits as possible to reduce the long-term East Pit Void water levels and return as much water as possible to natural drainage.

Key features of the surface water management system include:

- Overland flow of clean water originating from up-gradient of the dump footprint will be diverted away from the dump to minimise the potential for both surface water contamination and erosion of the dump slopes
- Elevated areas associated with out of pit overburden dumps will be designed to have external batter slopes between 4.6° (8%) and 5.7° (10%) and crests less than 2.3° slope. These areas will have drainage control structures installed and will be topsoiled and revegetated using native tree and shrub species
- Precise construction of drainage paths and networks, including temporary contour drains and engineered drop structures, will be undertaken using survey controls and machine guidance systems. Care will be taken to ensure that machinery does not track downslope over cultivated areas or over drainage features as this may compromise the drainage control performance. Inspection of these features will be undertaken following intense rainfall events to identify areas where remedial actions such as removal of sediment or erosion repairs may be required
- Overland flow of clean water originating from up-gradient of the CDA footprint will be diverted away from the CDA to minimise the potential for both surface water contamination and erosion of the CDA outer slopes
- The final landform will be shaped to shed rainfall and only allow rainfall infiltration to the extent that it can be removed via evapotranspiration
- Allowance will be made for ongoing drainage of water from the CDA following cessation of waste deposition. Measures may include filling of drains with high permeability coarse sand and/or gravel above the underdrain outlets before covering the drains with buttressing material

Key drainage features to avoid impacts on the residual void

- Modelling of overland flow will be used to identify opportunities to construct permanent clean water diversions to direct overland flow away from the residual void. Where this isn't possible, coarse rubble will be installed at low points along the abandonment bund to allow diffused flow through the bund without compromising safety or the integrity of the bund
- Geotechnical and erosional stability appraisals will be completed to assess the potential for any concentrated water flow paths into the void to cause pit slope instability. Where a risk requiring mitigation is identified, appropriate measures such as placement of coarse rock to dissipate flows or directing flows over the most geotechnically stable sections of the highwall will be adopted. The setback of the abandonment bund from the pit crest will allow for any minor erosion of the pit crest

Figure 37 shows the final landform conceptual drainage direction and streams.

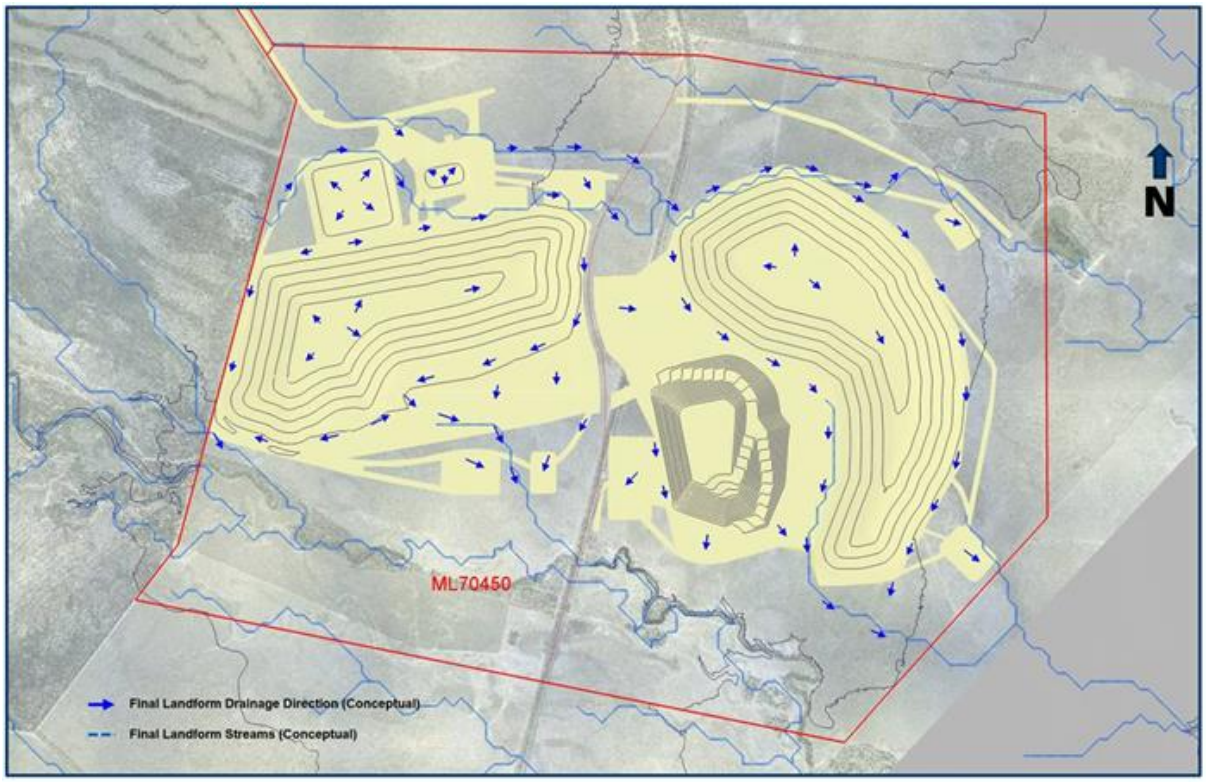

Figure 37 Final landform conceptual drainage direction

Upon establishment of the final landforms and removal of all infrastructure, no ongoing water management requirements are foreseen.

Relationship with PRC Plan schedule

The information in this section is relevant to the following **Rehabilitation Areas** and **Rehabilitation Milestones** in the PRC Plan Schedule:

RA1, RA2, RA3, RA4, RA5, RA6, RA7, RA8, RA9 & RA10

The following **Milestone Criteria** will demonstrate achievement of the Rehabilitation Milestones:

RM2	Landform design, reshaping and final contouring, inclusive of drainage features	a). Stable landform and slope angles for out of pit overburden dumps areas as follows: outer batter slopes equal to or less than 5.7°and crest slope a maximum of 2.3° b). Stable landform and slope angles for Co-disposal elevated landform and ROM pads as follows: outer batter slopes equal to or less than 8° and crest slope a maximum of 2.3° c). Stable landform and slope angles for coal stockpiles and in pit overburden backfill flat to undulating with slopes equal to or less than 4.6° crest slope a maximum of 2.3° d). Stable landform and slope angles for infrastructure areas flat to undulating with slopes equal or less than 2.3° e). Maximum vertical height of out of pit overburden dumps elevated landforms up to 50m f). Maximum vertical height of Co-disposal elevated landform and ROM pad areas up to 18m g). All major earthworks completed h). Contour drains and rock lined drop structures installed as per appropriate design criteria i). Landforms such as the Co-disposal facility have been signed-off as constructed to design

3.5.1.9 Revegetation

Following the spreading of topsoil on the surface of rehabilitation areas, seedbed preparation will be undertaken. Seedbed preparation will typically involve ripping along the contour using a dozer with three tynes mounted behind the machine. Ripping depth will be between 0.4m and 1m. Ripping along the contour reduces the potential for erosion by creating a key between the topsoil and underlying material, promoting infiltration and providing a barrier to down slope runoff. During the ripping process tynes will be lifted for a distance of approximately two metres following every 200m (approximate) of ripping. This will reduce the potential for channel erosion to develop within rip lines. Seed bed preparation will be undertaken as soon as practicable following the spreading of topsoil on the rehabilitation area to minimise the potential for topsoil loss through erosion.

Timing of seedbed preparation will be dependent on machinery availability, ground conditions and weather conditions. Seeding, fertilising and addition of any other soil ameliorants will be undertaken as soon as practicable following the preparation of the seedbed.

There are several methods available for spreading of seed, fertiliser and other ameliorants, these include:

- direct application at the same time as seedbed preparation using appropriately modified machinery;
- casting over an area of prepared seedbed using ground-based spreaders, mounted either on conventional agricultural equipment or mining machinery; and
- aerial application over the prepared seedbed using light aircraft.

The methods selected for seed and fertiliser application will depend on a number of factors including:

- terrain and ground conditions to be seeded and fertilised;
- availability of equipment and or contractors;
- nature of the seed mix; and
- quantity of fertiliser and or other ameliorants to be applied.

The proposed species mix and seeding rates for establishment of pasture to support the post-mining land use of grazing are as per Table 42:

Table 42 Pasture Species Mix

Common Name or Variety	Scientific Name	Recommended Sowing Rate (kg/ha)
Kangaroo Grass	*Themeda triandra*	3
Japanese Millet	*Echinochloa esculenta*	4
Sabi Grass	*Urochloa mosambicensis*	2
Fine Cut Rhodes Grass	*Chloris gayana*	2
Indian Blue / Indian Couch	*Bothriochloa petusa*	2
Butterfly Pea	*Clitoria ternatea*	3
Seca Stylo	*Stylsanthes scabra*	4

The seed mix composition and seeding rates may be adjusted based on rehabilitation monitoring results.

The revegetation to achieve the post-mining land use of native bushland will require a combination of direct seeding or tubestock/sucker planting.

The proposed species mix and seeding rates for establishment of vegetation to support the post-mining land use of native bushland for overburden dumps and the co-disposal areas are as per Table 43 below:

Table 43 Native Species Seed Mix

Common Name or Variety	Scientific Name	Recommended Sowing Rate (kg/ha)
Brigalow	*Acacia harpophylla*	2
Dawson Gum	*Eucalyptus cambageana*	2
Poplar Box	*Eucalyptus populnea*	2
Red Bauhinia	*Lysiphyllum carronii*	2
Yellowwood	*Terminalia oblongata*	5
Sally Wattle	*Acacia salicina*	2
Soft Acalypha	*Acalypha eremorum*	0.1
Scrub Boonaree	*Alectryon diversifolius*	0.5
Queensland Ebony	*Diospyros humilis*	2
Peach Bush	*Ehretia membrandifolia*	0.2
False Sandlewood	*Eremophila mitchellii*	0.1
Orange Thorn	*Pittosporum spinescens*	0.1
Canthium	*Psydrax odorata*	0.3
Wilga	*Geijera parviflora*	0.3
Scrub Leopardwood	*Flindersia dissosperma*	0.2
Conkerberry	*Carissa ovata*	1.2
Bush Caper	*Capparis lasiantha*	0.3
Kangaroo Grass	*Themeda triandra*	1

The goal is to establish a native ecosystem that has a similar composition to the previous existing woodland (Specht, 1970) ecological communities comprising RE 11.4.8, RE 11.4.9 and RE 11.5.3.

Consideration was given to whether the seed mix was appropriate for the co-disposal area due to the potential for roots to penetrate and physically damage the cap, thereby creating entry points for water, or to open fissures in the protective barrier by excessive moisture reduction. However, ongoing research and a growing body of experience indicate that, if it is properly designed and implemented, the integrity of the co-disposal surface can be maintained while it supports a variety of plants. Root growth depends on the characteristics of the soil, and the presence of a clay liner or geomembrane influences its growth. The key factors that affect the feasibility of planting on a containment system include the characteristics of the landform surface (such as soil depth and soil quality), the desired plant habitat, and the physical setting of the site (for example, topography and climate) (US EPA, 2006). Brigalow has a well-developed lateral (horizontal) root system, and plants are often joined together by these roots, forming colonies (Johnson 1964). Similarly, poplar box has an extensive lateral root development (Philips et al., 2014).

Native plant seed and tubestock will be sourced locally where practicable to optimise results as local provenance species will be more suited to establishment and survival under local climatic and soil conditions. If brigalow seed or tubestock are scarce, transplanting small suckers could be an option. If the new brigalow plants are slow to establish via natural regeneration, then mechanical disturbance could be used to promote brigalow suckering.

The establishment of the native bushland will provide habitat and habitat features used by many species including the significant species that were identified on site such as the little pied bat, the ornamental snake and the squatter pigeon.

The trees and shrubs will provide nesting, shelter and feeding sites for wildlife and particularly for birds, invertebrates, reptiles, frogs and parasitic plants like mistletoe; tree hollows, cracks and crevices will provide shelter, nesting and feeding sites for parrots, treecreepers, bats, gliders and reptiles; fallen timber, leaf litter and rocks will provide a beneficial use for many species. (P.J. Peeters and D.W. Butler, 2014).

Relationship with PRC Plan schedule

The information in this section is relevant to the following **Rehabilitation Areas** and **Rehabilitation Milestones** in the PRC Plan Schedule:

RA1, RA2, RA3, RA4, RA5, RA6, RA7, RA8, RA9 & RA10

The following **Milestone Criteria** will demonstrate achievement of the Rehabilitation Milestones:

RM5	Revegetation (grazing)	a). Pasture seed applied in accordance with rehabilitation specification, i.e. seeding rate, seed composition and cultivation to incorporate seed into the uppermost layer of the growth media b). Seed mix contains a range of native and introduced grass and legume species consistent with surrounding pastural areas (as per seed mix table in PRC plan)
RM6	Revegetation & habitat development (native bushland)	a). Native seed applied in accordance with rehabilitation specification b). Seed mix contains a suitable range of native tree, shrub and grass species to achieve brigalow and eucalyptus woodland habitat type (as per seed mix table in PRC plan)

3.5.2 Tailings storage facilities

The characterisation of reject and co-disposal analysis involved obtaining, fresh samples of material from above coal seams (roof), within coal seams and below coal seams (floor), during exploration drilling and groundwater bore construction. These samples are considered representative of the reject and co-disposal materials. The samples were composited to form two roof samples, one coal sample and two floor samples. An additional 12 samples of coal seam roof, coal and floor were sourced from exploration inventory. The analysis of the samples included a similar suite to the overburden samples for the solids. Metals leachate analysis was also performed on the samples for the same suite as solids plus some additional metals. The roof, coal and floor samples sourced from exploration inventory were not analysed for acid producing characteristics due to the likelihood of inherent sulphur compound oxidation over the 12 months that they had been stored.

Co-disposal was selected as the preferred option for process waste disposal. Waste from the co-disposal tank will be pumped to a dedicated co-disposal facility.

Although the available material characterisation results are limited, they indicate that the co-disposal material may be potentially acid forming (PAF). Therefore, the conceptual design and operation of the co-disposal facility assumes that the co-disposal material will be acid forming. Should further characterisation of materials indicate otherwise, designs and operational strategies may be revised.

The co-disposal facility will be located to the west of the CHPP - this location was selected based on:

- its proximity to the CHPP and mine industrial area;
- favourable topographic elevation relative to management of stormwater flows; and
- the location being an area of pasture historically cleared of remnant vegetation.

Due to the flat topography of the selected location, the facility will be constructed using a raised turkeys nest configuration. The detailed design of the facility will be undertaken by an experienced and RPEQ qualified engineer.

Construction will involve a staged, two-cell configuration, with the first cell constructed at the commencement of operations and the second cell constructed as co-disposal material storage within the first cell approaches capacity.

The facility is proposed to be constructed as a lined storage to protect against seepage into the surrounding substrate and groundwater. It is proposed that the liner be constructed from suitable clay sourced locally and preferably from within the mining footprint. The clay material would be placed and compacted to appropriate engineering specifications. Geotechnical investigations will determine if suitable quality material is available in sufficient quantities for the co-disposal facility. Suitable materials are expected to be available in areas of the site. However, if insufficient quantities of suitable clay material are identified, a synthetic liner will be installed as part of the facility construction. Such a liner would most likely be constructed from High Density Polyethylene (HDPE). Both clay and synthetic liner options are illustrated in Figure 38.

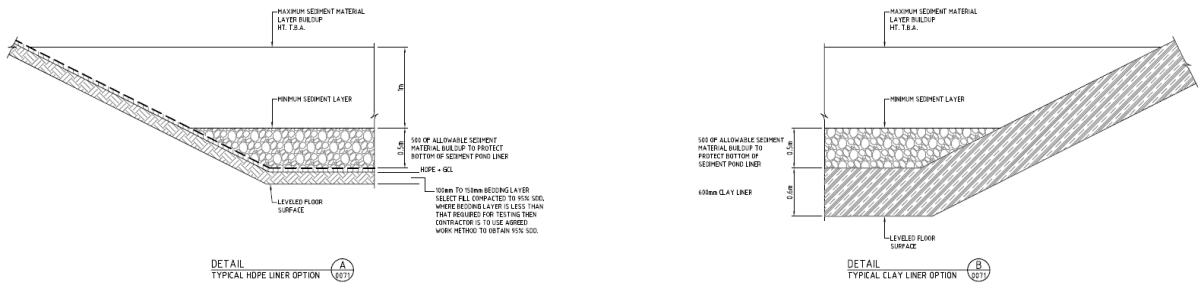

Figure 38 Co-disposal Cell Liner Options

Each cell of the facility will contain a dewatering collection sump to which decant water will be directed for return to the CHPP process water system. Allowance will be made for a lime batching and dosing plant to be installed at the operating sump should the decant water be acidic and require treatment prior to transfer from the facility back into the process water system. The option for lime dosing at the co-disposal collection sump is preferred as it reduces the environmental risk associated with transferring and storing untreated acidic water.

Decant water will be returned to an Environmental Dam for supply to the CHPP. This dam will also receive water pumped from mining pits which results from rainfall runoff inflow and or groundwater inflow to the pits. The Environment Dam will be appropriately lined with either clay or synthetic material to minimise seepage to surrounding substrate and groundwater.

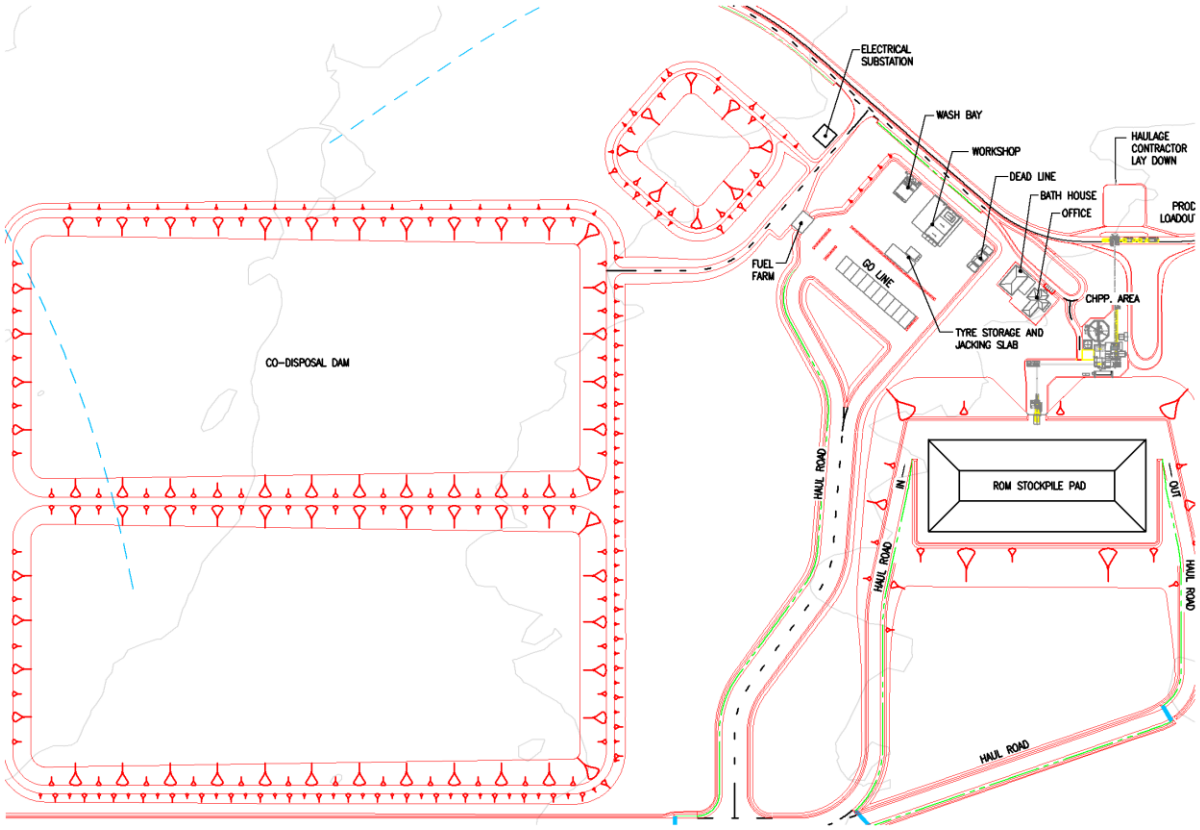

Figure 39 Infrastructure Area showing Co-Disposal Dam site

The footprint of the facility will cover a total of approximately 64 hectares. The total storage capacity of the facility will initially be constructed to approximately 3 million m^3 with the capacity of each cell being ~1.5 million m^3. This equates to a total storage capacity of approximately six years based on expected average co-disposal production rates, or three years per cell. To cater for the post year six storage requirements, a number of options will be considered based on material characterisation information, operational experiences, available construction material, regulatory considerations and design criteria. Potential options include:

1. excavate the dried co-disposal material from the first cell prior to year six and encapsulate the material at depth within in pit overburden dumping operations, reusing the first cell and to be repeated prior to year nine and year 12, and 15 for the second cell;
2. construct smaller internal cells within the facility which may be dried more rapidly and excavated for encapsulation within in pit overburden dumping operations;
3. construct an additional lift on the existing co-disposal facility to provide the required additional capacity; and
4. construct additional cells adjacent to the original facility.

For the purposes of this PRC Plan, the first option is considered most likely, and has been used to develop the Final Landform design which includes a capped co-disposal area in the north west corner of the lease.

The mass balance for Codrilla on the finest feed suggests coarse to fine co-disposal ratios between 1.2:1 and 3.2:1. Generally within the coal industry, co-disposal systems have been successfully managed at coarse to tailings ratios ranging from 1:1 to 6:1. The Moorvale co-disposal facility has operated successfully with coarse to fine ratios varying from 1.2:1 to 2.2:1. Therefore , the Codrilla co-

disposal facility is be expected to operate effectively with adequate beach formation and water drainage, as well as retention of fines within the material matrix. The fines retention will aid in PAF management by minimising void space in the matrix which would provide potential reaction sites. In the situations where coarse reject material is required to be placed into the co-disposal facility, (for example, following a plant upset) it will placed in such a manner that it forms a small embankment upon which regular feed to the facility will encapsulate the coarse material within the co-disposal matrix and aid in dewatering and management of the facility.

The deposited co-disposal material is expected to in the order of 25 to 40% solids. Given this slurry density and the range of material sizes the co-disposal will be stackable which will enable deposition strategies to focus on beaching around the internal perimeter of the storage to optimise water drainage and recovery for reuse in the CHPP as discussed above.

Relationship with PRC Plan schedule

The information in this section is relevant to the following **Rehabilitation Areas** and **Rehabilitation Milestones** in the PRC Plan Schedule:

RA9 & RA10

The following **Milestone Criteria** will demonstrate achievement of the Rehabilitation Milestones:

RM2	Landform design, reshaping and final contouring, inclusive of drainage features	a). Stable landform and slope angles for out of pit overburden dumps areas as follows: outer batter slopes equal to or less than 5.7°and crest slope a maximum of 2.3° b). Stable landform and slope angles for Co-disposal elevated landform and ROM pads as follows: outer batter slopes equal to or less than 8° and crest slope a maximum of 2.3° c). Stable landform and slope angles for coal stockpiles and in pit overburden backfill flat to undulating with slopes equal to or less than 4.6° crest slope a maximum of 2.3° d). Stable landform and slope angles for infrastructure areas flat to undulating with slopes equal or less than 2.3° e). Maximum vertical height of out of pit overburden dumps elevated landforms up to 50m f). Maximum vertical height of Co-disposal elevated landform and ROM pad areas up to 18m g). All major earthworks completed h). Contour drains and rock lined drop structures installed as per appropriate design criteria i). Landforms such as the Co-disposal facility have been signed-off as constructed to design
RM3	Install cover system/cap	a). Cover installed over reject/coal stockpile surfaces (nominally 1m inert overburden)

3.5.3 Voids

A key focus of recent mine planning work has been to develop a suitable Post Mining Landform that satisfies all of the conditions contained within the EA while maintaining a safe and efficient mining operation. The result of this work has reduced the number of voids (from two to one), while maintaining a total final pit area extent approximating to the projected area stated in the EA. Operating with a smaller pit size is neither safe or practical at the depths of the proposed development.

The current planned final pit void is to be located in the south-central western part of the Eastern Pit, and will be in accordance with condition F35 “protected from the Probable Maximum Floods (PMFs) such that the protection is sustainable for the foreseeable future”.

To determine the final landform (including the extent of the final void), a mine schedule was developed utilising the SPRY software package. The model used to develop this schedule included ‘Destination Scheduling’, which enables the planner to place excavated material into logical dumping locations in a sequence relative to a practical mining excavation sequence. After the ‘as-dumped’ landform has been determined, a landform smoothing process is undertaken to create ‘convex-concave’ surfaces that mimic ‘natural’ slope profiles.

The results of this work are heavily influenced by several assumptions, particularly the assumption relating to the swell factor of the excavated and dumped material. Small variations in this assumption can result in significant differences in the as-dumped profile, including the size and shape of the void. Additionally, mine sequence changes in response to market demands or operational challenges may result in similar differences. As the mine progresses, some variation in the current proposed landform can be expected.

The EA contains a condition limiting the void depth to 150m, although the coal can be found at depths greater than that (up to 185m). The current proposed landform assumes a volume of spoil material is rehandled back into the pit void to limit the depth to 150m in line with the EA requirement; however, this exercise will not likely result in any measurable improvement in the environmental outcomes associated with the final void. The benefits of this backfill will be assessed as the mine nears completion.

The PRC Plan Guideline seeks information on the relative cost for each PMLU rehabilitation option. The transitional provisions apply to this PRC Plan. As such, an evaluation of PMLU option costs is not required; however, a high-level evaluation of the cost associated with backfilling the entire void has determined that this option would be extremely cost prohibitive. The total void volume is expected to be in the order of 100 million cubic metres. With a relatively modest bulk earthmoving cost of ~$3/cubic metre, the total cost would be in the order of $300M.

3.5.3.1 Highwall Slope Design

IMC Mining Group prepared a geotechnical assessment for the Codrilla Project as a component of the EIS. The feasibility level assessment considered overburden and interburden conditions and generic slope stability analysis. An updated feasibility level geotechnical study was completed in March 2012. Operational geotechnical data is not available as development of the mining project has not commenced.

The Codrilla Project coal resource is characterised by a thick cover of soft overburden comprising Tertiary and weathered Permian that is basically a sandy clay or claystone. The nature of this material means that soft highwall and end wall slope batters are required down to at least the base of weathering to ensure a stable cut slope design. The underlying unweathered rock is generally moderately strong to strong; however, based on seismic interpretation, is expected to contain structural discontinuities and associated defects. Consequently, the unweathered material could present areas of instability in cut slopes if appropriate slope angles are not adopted.

A generic slope design has been developed from the report in Appendix

4.7 Attachment - Updated Feasibility Level Geotechnical Study for Codrilla (IMC – 23 March 2012), and operational experience from the Moorvale and Coppabella Mines where areas of similar material stability are encountered. The adopted generic slope angles for highwalls and end walls is characterised by benching and variable slopes, generally resulting in an overall slope angle of 35° from the surface to base of weathering and a maximum 65° slope angle from the base of weathering to pit floor in unweathered rock. The generic highwall and end wall slope profile is presented in Figure 40 below. This design is consistent with the final rehabilitation design criteria outlined in the 2011 EMP referred to in the EIS Assessment Report (page 50).

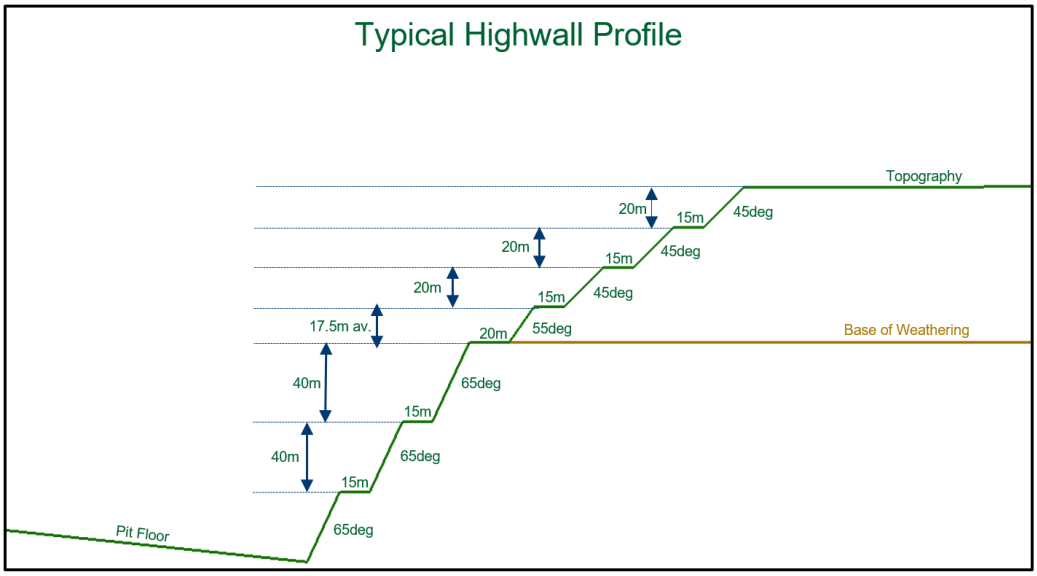

Figure 40 Generic Cut Slope Design for Highwalls and End Walls

To ensure that the final void area is safe, a durable Exclusion Bund will be established behind the final highwall crest. To ensure that this bund will not be impacted by the long-term effects of localised slope erosion and degradation, the bund will be located 10m behind a line defined by a 30° slope from the highwall at the base of weathering as shown below in Figure 41. The design criteria for this bund is based on parameters established for a similar bund considered for the nearby Millennium Mine (see Appendix

4.8 Attachment - Millennium Mine Residual Void Slope Stability Study (GCS - August 2017). The highwall materials at Codrilla are similar to those at Millennium, with both mines extracting the same coal seams from the Rangal Coal Measures. Although the bund and the unmined surface the excavated highwall crest will be topsoiled and revegetated to reduce potential erosion, the location of the bund (and associated fencing) defines the extent of the NUMA as depicted in Figure 41.

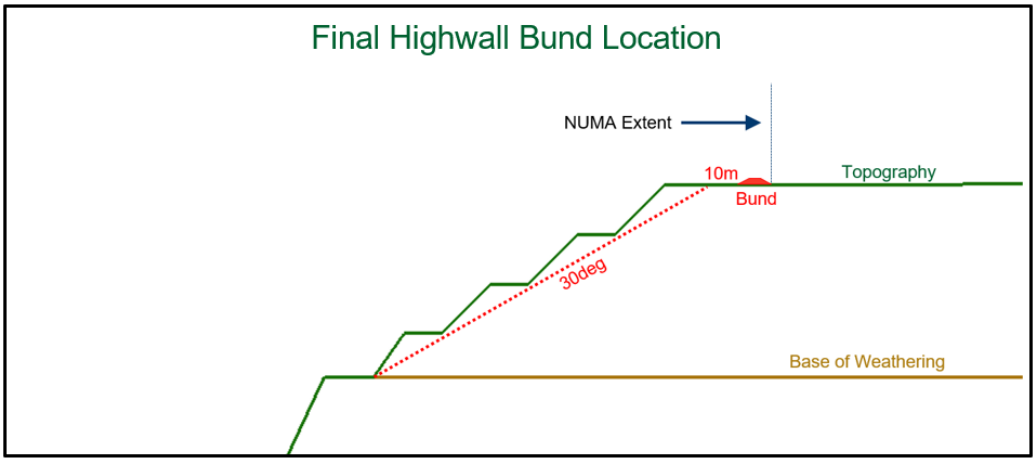

Figure 41 Final Highwall Bund Location

3.5.3.2 Low Wall Slope Design

The initial low wall will be cut into natural Tertiary material and will be constructed to a similar profile as the highwall above the base of weathering. The profile will be constructed in 20m stages with a 10m bench between each stage and batter slopes of 45°. The overall batter angle will be in the order of 35° as a result of the 10m step back between each 20m section. The generic low wall slope profile is presented in Figure 42 below.

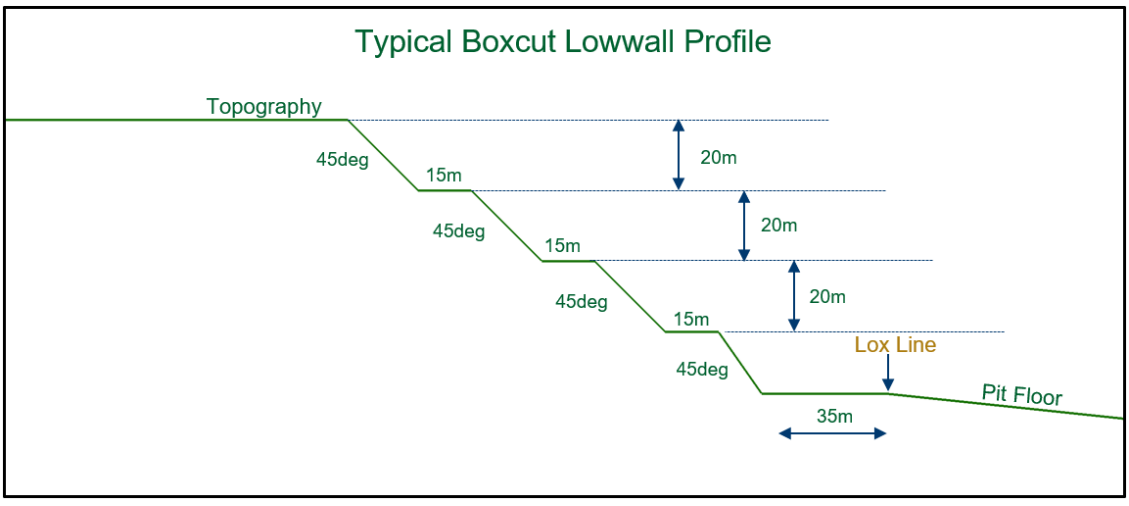

Figure 42 Generic Cut Slope Design for Low Walls

As mining progresses and sufficient room becomes available for pit backfilling with overburden, the initial low wall will be replaced by a dumped low wall. As the selected mining method is dip-line

mining, the IMC (2009) report suggests that the dumped in pit low wall will be stable at the angle of repose (approximately 35° to 36°) as it is not prone to basal slippage due to competent floor conditions. The IMC (2009) assessment was based on conservative inputs and incorporated a continuous crest to toe low wall. For safe and practical operation purposes, the dumped in pit low wall will be developed in lifts of approximately 20m until the original topographic level is reached. The batter of each lift will remain at angle of repose. A step back bench in the order of 30m wide will be incorporated between each lift, this effectively further stabilises the low wall, reducing the average slope angle to between 20 and 22 °. Although the floor of the pit is expected to be competent for dumped low wall development, it will be further stabilised by blasting ahead of backfill dumping to increase stability and enhance operational safety. Ramps will be constructed diagonally along the face of the low wall batter at a slope of approximately 6°. The generic dumped Low wall slope profile is presented in Figure 43 below. This design is consistent with the final rehabilitation design criteria outlined in the 2011 EMP referred to in the EIS Assessment Report (page 50).

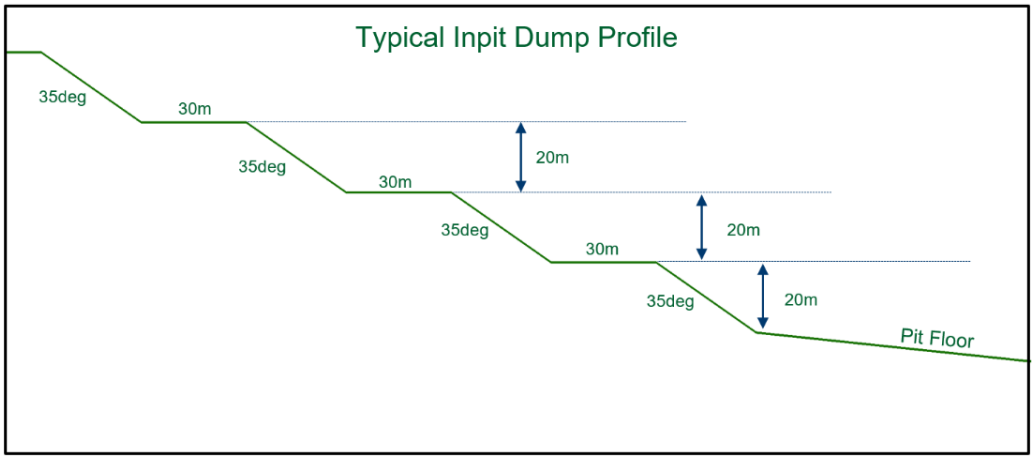

Figure 43 Generic Profile for In Pit Dumped Low Wall

Following completion of mining operations, water levels are expected to recover to equilibrium within the first 120 years post mining and water levels in the void will remain more than 50m below the crest of the pit. Initially two final voids were planned and modelled and the final water level in the voids were predicted to remain between 10 m to 19 m below the base of the Tertiary sediments for the West and East pits respectively and therefore; as the base of the Tertiary sediments is the upper level of the regional aquifer system, the voids will create a groundwater sink. Due to the hydraulic gradient associated with the final void groundwater sink, recharge of the aquifer system from the final void is not expected. The current final landform has reduced the number of voids from two to one. Long term standing water levels in the East Pit Void are expected to be lower than originally modelled due to the larger evaporative footprint of the current design, whereas the West Pit Void has been removed from the current design.

The principle reason that the water levels within the overburden and voids will recover to levels below pre-mining conditions is that average daily evaporation is around four times the average daily rainfall within the local region. Given the evaporative influences, the saline nature of groundwater recovering to pits and salt leaching from backfilled overburden, it is expected that over time, the water within the final void will progressively become more saline and eventually approach salinities similar to those observed within the regional aquifer system.

Relationship with PRC Plan schedule

The information in this section is relevant to the following **Improvement Areas** and **Management Milestones** in the PRC Plan Schedule:

IA1

The following **Milestone Criteria** will demonstrate achievement of the Management Milestones:

MM1	Highwall treatment	a). Highwall crest battered back where required to achieve a stable slope angle as specified by an AQP (geotechnical engineer)
MM2	Achievement of landform design and surface requirements	a). Highwall as mined weathered average slope angle of 1V and 0.7H (55°) and low wall as backfilled at angle of repose at 1V to 1.35H (36°) b). Abandonment safety bund setback distance is in accordance with calculated geotechnical factor of safety c). Abandonment safety bund constructed of competent rock and to geometry specified to prevent traversing by vehicles d). Residual void maximum depth of 150m e). Residual void outside of PMF f). Abandonment safety bund and ramp into voids revegetated with pasture seed
MM3	Achievement of sufficient improvement not to cause environmental harm and be safe and structurally stable	a). Access to highwall, low wall and ramp batter is restricted by physical barriers and fencing is erected on the outside of the abandonment safety bund to specification (nominally five strand barbed stock fencing) b). Safety signage (design in accordance with Australian Standard) is erected at specified intervals along the fence line (nominally one sign every 100m) c). Certification from an AQP that the level of final void water is significantly below the crest of the pit to avoid the risk of overtopping and causing environmental harm d). Certification from an AQP that the water quality (pH & EC) in the final void does not show a statistically significant change when compared to background data and will not cause environmental harm to the surrounding environment

3.5.4 Underground Mining

There is no Underground Mining contemplated for the Codrilla Mining Lease for the purposes of the development of this PRC Plan. Should Underground Mining be required in the future, appropriate approval requests will be submitted.

3.5.5 Built infrastructure

Where infrastructure is not required by the post mining landholder or forms part of the final landform, it will be decommissioned in line with the following processes. The general principles of waste management hierarchy will apply, with materials directed in priority to sources of:

- reuse
- recycling

- energy recovery, and
- disposal

3.5.5.1 Services

Services such as power, communications cabling, water and sewerage pipelines, will be disconnected and terminated to make them safe. Underground services will remain buried and surface interface points will be sealed. Above ground and overhead services will be removed and managed in accordance with the waste management hierarchy. Areas disturbed by decommissioning of the installed services will be regraded to near original land form, topsoiled and revegetated for grazing as the post-mining land use.

3.5.5.2 Buildings

Buildings will be deconstructed, removed from site and managed in accordance with the waste management hierarchy. It is expected that there will be opportunity to generate reuse of buildings in particular the CHPP components. Concrete footings will be broken down and stripped of reinforced steel for recycling, with the concrete either directed to a reuse source or buried within overburden dump final rehabilitation areas. The areas will be regraded to near original land form, topsoiled and revegetated for grazing as the post-mining land use.

3.5.5.3 Water Management Structures

Sumps and dams that do not form part of the final landform as sediment control structures will be dewatered and where applicable, contaminated silt material will be removed for licensed disposal. Dam walls, levees, and drains will be regraded to near original land form, topsoiled and revegetated for grazing as the post-mining land use.

3.5.5.4 Access roads, car parks and hardstands

Sealed asphalt roads, car parks and hardstand areas will have the asphalt removed for reuse or burial within overburden dump final rehabilitation areas. Unsealed roads, car parks and hardstands will have any contamination removed for licensed disposal, prior to being topsoiled and revegetated for grazing as the post-mining land use.

3.5.5.5 Hydrocarbon and chemical storage areas

Bulk storage tanks will be emptied of contents and directed to reuse or appropriately cleaned and decontaminated prior to recycling or disposal of materials. Concrete footings and bunding will be broken down and depending on contamination status, either directed to a licensed disposal source, or broken down and stripped of reinforced steel for recycling, with the concrete either directed to a reuse source or buried within overburden dump final rehabilitation areas. Any contamination will be removed for licensed disposal or on-site remediation in the case of hydrocarbons. The areas will be regraded to near original land form, topsoiled and revegetated for grazing as the post-mining land use.

3.5.5.6 Haul roads

All carbonaceous material will be collected through scraping and disposed of to the codisposal, or via burial within overburden dump final rehabilitation areas if the codisposal has been decommissioned and rehabilitated. Culverts will be removed and the drainage lines reinstated. Where required, regrading will be undertaken prior to being topsoiled and revegetated for grazing or native bushland (in the case of sections of the Codrilla to Moorvale Haul Road) as the post-mining land use. As an alternative to scraping of material, depending on the depth of carbonaceous material, some areas may be capped with a minimum 1m inert overburden layer following the regrading.

Relationship with PRC Plan schedule

The information in this section is relevant to the following **Rehabilitation Areas** and **Rehabilitation Milestones** in the PRC Plan Schedule:

RA4, RA6, RA7 & RA8

The following **Milestone Criteria** will demonstrate achievement of the Rehabilitation Milestones:

RM1	Infrastructure decommissioning & removal	a). All services disconnected. Underground services will remain buried and surface points will be sealed b). All buildings either demolished and removed or relocated off site c). Concrete slabs and footings removed or buried within overburden dump final rehabilitation areas d). Sumps or damps that do not form part of final landform as sediment control structures will be dewatered and where applicable contaminated silt will be removed for licensed disposal e). Sealed asphalt roads, car parks and hardstand areas will have the asphalt removed for reuse or burial within overburden dump final rehabilitation areas and unsealed road, car parks and hardstands will have any contamination removed for licenced disposal f). Hydrocarbon and chemical storage areas will be removed and/or remediated by on-site treatment if required g). All carbonaceous material will be collected from haul roads and disposed in the co-disposal area or buried within the overburden dump final rehabilitation areas h). The contaminated land assessment report prepared by an AQP confirms that the land is not contaminated and is suitable for any use

3.6 Risk assessment

Legislative requirement

In accordance with section 126C(1)(f) of the EP Act, the rehabilitation planning part of the PRC plan must identify the risks of a stable condition for land described as a post-mining land use not being achieved, and how the applicant intends to manage or minimise the risks.

In accordance with the legislative requirements, a risk assessment was conducted for the Codrilla Project following the Peabody risk management framework and using the Peabody risk matrix and definitions and conducted in accordance with Recognised Standard 02 "Control of Risk Management Practices" (QLD) and AS/NZ ISO 31000 – Risk Management – Principles and Guidelines to identify:

- the risks of a stable condition for the land described as a post-mining land use not being achieved (section 126C(1)(f)); and
- the risks of the NUMA causing environmental harm and not being safe and structurally stable (section 126C(1)(j)).

Under section 111A of the *Environmental Protection Act 1994* a stable condition is defined as:

111A Meaning of *stable condition*

Land is in a ***stable condition*** if—

(a) the land is safe and structurally stable; and

(b) there is no environmental harm being caused by anything on or in the land; and

(c) the land can sustain a post-mining land use.

The risk management process is shown in Figure 44 below:

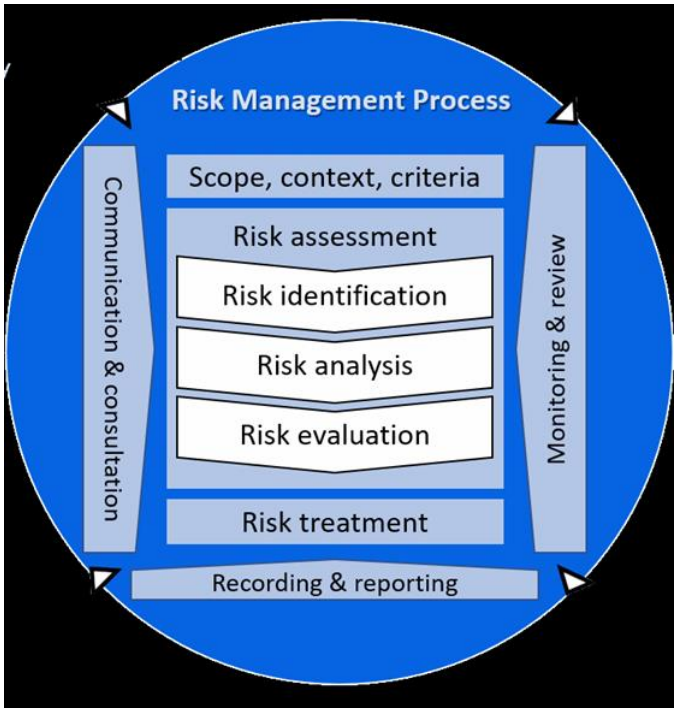

Figure 44 Risk Management Process

Risks were identified for each rehabilitation and management milestone that occur both progressively throughout the mine life, and at the cessation of mining and processing. The post closure monitoring period was also considered along with any potential legacy items that may not be completely rehabilitated and/or remediated.

3.6.1 Risk Identification

The risk identification step was used to:

- Identify and define risks to land being safe and structurally stable;
- Identify and define risks which have the potential to adversely affect environmental values (EVs); and
- Identify and define risks to land sustaining the PMLU.

3.6.2 Risk Analysis & Risk Evaluation

The Peabody Scoring System to assess risks are provided in Table 44.

Table 44 Scoring system used to assess risk

			Consequence					
Likelihood	Likelihood description	Probability	1 - Low	2 - Minor	3 - Moderate	4 - Significant	5 - Major	6 - Catastrophic
5 - Very Likely	Likely to occur repeatedly – Expected in the work team	10% - 100%	5	10	25	50	125	250
4 - Likely	Probably will occur several times - Expected at this location	1% - 10%	4	8	20	40	100	200
3 - Possible	Could occur intermittently - Expected within Peabody	0.1% - 1%	3	6	15	30	75	150
2 - Unlikely	Could occur but hardly ever - Expected within the mining industry	0.01% - 0.1%	2	4	10	20	50	100
1 - Rare	Improbable or unrealistic - Not expected in the mining industry but seen in other industries	< 0.01%	1	2	5	10	25	50

The Risk Assessments required under section 126C(1)(f) and section 126C(1)(j) are presented in Table 45 and Table 46 below.

Table 45 Risk Assessment PMLU

Milestone	Risk / threat	Consequence category	Impact	Risk evaluation			Proposed controls	Justification of treatment option	Resource requirements	Performance measures	Reporting and monitoring	Residual risk		
				Consequence	Likelihood	Risk score						Consequence	Likelihood	Risk score
RM1 - Infrastructure decommissioning and removal	Inadequate removal of infrastructure	Safe and stable	- Infrastructure may create erosion points causing instability - Remnant infrastructure is a hazard to fauna or grazing animals -Soil/water contamination from infrastructure such as workshops is a hazard to fauna or grazing animals	2	3	6	- Current mine plans show locations of planned infrastructure - PRC plan & ERC include infrastructure removal - Infrastructure may only be retained with written landholder approval - Contaminated land assessment	Including in PRC and ERC ensures a documented and auditable record of infrastructure removal requirements and provides direction for planning and provisioning.	- Survey support - GIS support	Removal checklist (to be developed)	Visual inspection as per Section 3.7.1.8	2	2	4
	Residual contamination of land	Impact to EV's	Contaminated soil and / or impacts to downstream water quality	4	2	20	- PRC plans for identification, assessment and proper disposal of contaminated soil - Allow for contaminated soil disposal in ERC - Monitor incidents involving hydrocarbon or chemical spills - Develop site Spill Response Plan and implement - AS1940 audits and inspections - Contaminated land assessment - Areas included in the contaminated site register	The inclusion in PRC/ERC allows for proper budgeting and planning of contaminated soil disposal/treatment. Effective spill controls and auditing allows for high-risk areas to be identified and prioritised for treatment. A contaminated land assessment will verify if contamination has been appropriately remediated	- SAP ESHMS system (incident recording) - Spill response procedure - Auditing and inspection tools - Contaminated land assessment (by AQP)	Contaminated land assessment	Contaminated land assessment to be completed post operations and included in the final relinquishment report as per Section 3.7.1.8	2	2	4
		PMLU	Contamination impacts PMLU	3	2	10						2	2	4

RM2 - Landform design, reshaping and final contouring	Excessive slope on landform	Safe and stable	- Increased erosion risk if slope exceeds material limits - Loss of growth medium leading to limited vegetation establishment	4	2	20	- Current final landform slope designs within material limitations - GPS guidance and survey control during landform construction - GPS guidance and survey control during landform reshaping - Landform designed by AQP	Current slopes have been designed with regard to material limitations. GPS and survey controls will ensure the landform is constructed as per design.	- Survey support - GPS machine guidance	Review of survey data vs design by an AQP	LiDAR monitoring as per Section 3.7.1.2	3	2	10
		PMLU	Steep slopes not suitable for cattle and / or landholder access	3	2	10	- Current design slope within accepted limits for grazing / landholder access - GPS guidance and survey control during landform reshaping - Rehabilitation trials	Landform slopes of equal to or less than 4.6° for grazing is well within limits for cattle and landholder access. GPS and survey controls will ensure the landform is constructed as per design. Rehabilitation trials to demonstrate suitability	- Survey support - GPS machine guidance - Rehabilitation trial data	Review of survey data vs design by an AQP	LiDAR monitoring as per Section 3.7.1.2	2	2	4
	Structural stability of landforms not achieved	Safe and stable	Constructed landforms not geotechnically stable	4	2	20	- Current design assessed as geotechnically stable - Geotechnical monitoring during operations - Ensure deviations from design are reassessed by a geotechnical engineer (AQP)	Landforms slopes are designed to be geotechnically stable for the construction (dumped) material. Monitoring during operations can be used to validate the proposed design and update if required.	- Geotechnical monitoring data	As per Section 3.7.1.2	As per Section 3.7.1.2	3	2	10
	Ineffective drainage on final landform	Safe and stable	- Damage to previously completed rehabilitation - Increased likelihood of erosion - Ponding causes instability - Concentrated flows result in erosion, loss of growth medium and incision of slopes	3	3	15	- Drainage requirements included in final landform design - Rehabilitation monitoring - Erosion and sediment control (ESCP) monitoring - Receiving environment monitoring program (REMP)	Rehabilitation planning and methodology includes effective drainage. Rehabilitation and ESCP monitoring will monitor effectiveness of landform drainage	- Rehabilitation monitoring program - ESCP monitoring program	As per Section 3.7.1.2	As per Section 3.7.1.2	3	2	10
		Impact to EV's	Increased risk of downstream sedimentation	3	3	15			- Rehabilitation monitoring program - ESCP monitoring program - REMP monitoring	As per Section 3.7.1.2 & 3.7.1.3	As per Section 3.7.1.2 & 3.7.1.3	3	2	10

	Geochemical & geotechnical unsuitable tailings and reject materials	Safe and stable	Nature of tailings and reject material causes landform instability	5	3	75	- CDA landform design based on known material characteristics - Ongoing material characterisation during operations - Selective handling of materials during operations -Progressive rehabilitation of CDA cells as they become available	Design includes capping and reshaping to a slope suitable for the material type. Material characterisation during operations will determine if material is consistent with design parameter assumptions and allow for selective handling	- Materials characterisation and handling program	Material characterisation results and as per Section 3.7.1.2	As per Section 3.7.1.2	4	3	30
RM3 - Install cover system/cap	Failed or inadequate capping on CDA or overburden dumps	Safe and stable	Landform instability and / or excessive erosion	5	2	50	- Capping thickness based on initial materials characterisation - GPS guidance and survey control during capping - Capping material topsoiled and vegetation established - Ongoing material characterisation during operations - Selective handling of materials during operations - Surface and GW monitoring -Landform (including capping) designed by an AQP	GPS and survey guidance will ensure design capping thickness is achieved. Material characterisation during operations will determine if material is consistent with design parameter assumptions and allow for selective handling. Topsoiling and vegetation establishment on capping material will enhance erosional stability. Surface and GW monitoring will identify potential release of contaminants	- Materials characterisation and handling program - Surface and GW monitoring program	Material characterisation results and as per Section 3.7.1.2 & 3.7.1.3	As per Section 3.7.1.2 & 3.7.1.3	4	3	30
		Impact to EV's	Release of contaminants to surface or GW	5	2	50						4	3	30
	Failed or inadequate lining of CDA	Impact to EV's	Seepage from CDA causes surface or GW contamination	4	3	30	- CDA will be lined to prevent seepage as per design - Surface and GW monitoring -Liner will be designed by AQP	Internal CDA liner designed to prevent seepage to the receiving environment. Water monitoring during operations will demonstrate effectiveness of the liner.	- Surface and GW monitoring program	Section 3.7.1.3	Section 3.7.1.3	3	3	15
RM4 - Surface preparation	Insufficient topsoil reserves	PMLU	Inadequate topsoil to establish vegetation and support PMLU	4	3	30	- Projected inventory of stripped topsoil adequate for rehabilitation - Topsoil inventory and mapping to be maintained during operations - Review of topsoil inventory against rehabilitation requirements - Topsoil volumes and requirements will be included in ERC	Available volume of topsoil is adequate for rehabilitation of disturbed areas. Maintaining a topsoil inventory and mapping allows for regular checks against requirements including ERC.	- Survey support - Topsoil inventory tool - ERC calculator	Topsoil inventory tool and ERC volumes	As per Section 3.7.1.2	3	2	10

	Inadequate topsoil cover	PMLU	Failed vegetation establishment not supporting PMLU	3	2	10	- Projected inventory of stripped topsoil adequate for rehabilitation - GPS and survey control during topsoiling - Supervision during topsoiling - Test-pitting of topsoil depths prior to seeding	Survey and test -pitting checks to ensure minimum topsoil depth is applied	- Survey support - Topsoil inventory tool	- Topsoil depths (field verified) - Survey data (eg. LiDAR)	As per Section 3.7.1.2	2	2	4
	Topsoil not suitable for target vegetation	PMLU	Topsoil unable to support target rehabilitation species	3	2	10	- Topsoil management plan outlines topsoil stripping, handling and storage requirements - Amelioration rates determined by an AQP - Rehabilitation monitoring includes soil analysis - Rehabilitation trials	Rehabilitation species selected grow in surrounding areas and are suitable for the soil type. Appropriate management will maintain the integrity of the topsoil resource. Rehabilitation monitoring and trials will inform success	- Topsoil management plan - Survey support - Topsoil inventory tool - Rehabilitation monitoring program - Rehabilitation trials	- Rehabilitation monitoring data	As per Section 3.7.1.1	2	2	4
	Inadequate ripping (not completed, downslope or insufficient depth)	Safe and stable	Topsoil not keyed into subsoil allows excessive erosion or downslope rip lines create erosion channels	3	2	10	- Rehabilitation methodology includes cross slope ripping - Supervision during ripping operations - Visual inspection of ripped surface - ESCP monitoring	Supervision during ripping to ensure correct direction and depth is achieved. Inspections following ripping provide visual confirmation.	- Rehabilitation monitoring program - ESCP monitoring	- Rehabilitation monitoring data - ESCP monitoring data	As per Section 3.7.1.1 & 3.7.1.2	2	2	4
RM5 & RM6 - Revegetation & habitat development (native bushland) and revegetation (grazing)	Heavy rainfall prior to vegetation establishment	PMLU, safe and stable	Loss of topsoil resource preventing adequate vegetation establishment, excessive erosion and instability of slope	3	3	15	- Seeding to be scheduled immediately following surface preparation - Seeding not scheduled prior to large rain events - Cover crop included in seed mix	Appropriate timing of topsoiling/seeding reduces the risk of weather impacting vegetation establishment	- PRC schedule	PRC schedule audits	As per Section 3.7.1.1	2	3	6
	Seed quality or application not suitable for vegetation establishment	PMLU	Vegetation does not adequately establish to support PMLU	3	3	15	- Seed mix and rate based on local conditions - Seed quality and viability testing included in procurement - Rehabilitation monitoring	Seeding mix and application rate is consistent with local conditions and other mine rehabilitation in the Bowen Basin. Testing of seed ensures viability prior to seeding.	- Seed quality and validation tests - Rehabilitation monitoring program	- Test results	As per Section 3.7.1.1	2	3	6
RM7 & RM8 - Achievement of surface requirements (native bushland and grazing)	Inadequate vegetation cover for native bushland	PMLU	- Vegetation not sufficient for / consistent with the PMLU - Excessive grass growth inhibits tree and shrub establishment -Key invertebrate and vertebrate communities are not re-establishing	3	3	15	- Seed mix and rate based on local conditions and PMLU - Minimal grass in seed mix - Rehabilitation monitoring to inform potential changes to mix or application rate or further planting	Seeding mix is specific to the establishment of native bushland. Monitoring will inform success and potential changes to methodology.	- Rehabilitation monitoring program	- Rehabilitation monitoring data	As per Section 3.7.1.1	2	3	6

	Inadequate vegetation cover for grazing	PMLU	Vegetation cover insufficient to support the PMLU	3	3	15	- Seed mix and rate based on local conditions and PMLU - Rehabilitation monitoring to inform potential changes to mix or application rate	Seed mix is consistent with surrounding grazing land and other mine rehabilitation in the Bowen Basin.	- Rehabilitation monitoring program	- Rehabilitation monitoring data	As per Section 3.7.1.1	2	3	6
	Groundcover not sufficient for surface stabilisation	Safe and stable	Inadequate groundcover establishment causes excessive erosion rates	3	2	10	- Seed mix and rate based on local conditions - Cover crop included in seed mix - Rehabilitation monitoring	Species selection includes appropriate groundcover species. Rehabilitation monitoring will inform success.	- Rehabilitation monitoring program	- Rehabilitation monitoring data	As per Section 3.7.1.1 & 3.7.1.2	2	3	6
	Revegetated areas dominated by weeds (invasive plants)	PMLU	Weeds (Invasive Plants)	3	3	15	- Seed testing requirement is included in procurement - Weed inspections of rehabilitation machinery - Rehabilitation monitoring - Weed management plan to be implemented	Seed testing to verify the quality of seed and the absence of invasive plant species. Inspection and cleaning of equipment to help stop spread of invasive plant species. Weed management plan to outline management options.	- Rehabilitation monitoring program - Equipment inspection checklist - Weed management plan	- Rehabilitation monitoring data	As per Section 3.7.1.1	2	3	6
		Impact to EV's	Untreated invasive plants outbreaks impact surrounding land	3	2	10	- Weed inspections of rehabilitation machinery - Rehabilitation monitoring					2	2	4
RM9 & RM10 - Achievement of a stable condition (native and grazing)	Lack of rehabilitation maintenance ie. repair of significant erosion	Safe and stable	Excessive erosion progressively impacts stability of final landform	4	3	30	- Rehabilitation monitoring determines maintenance requirements - Rehabilitation maintenance program	Regular monitoring and maintenance of rehabilitation allows issues to be addressed promptly.	- Rehabilitation monitoring and maintenance program	As per Section 3.7.1.7	As per Section 3.7.1.7	3	3	15
	Inappropriate final land use	PMLU	Loss of land resource and conflict with stakeholder engagement outcomes	3	2	10	- Soils and rehabilitation design assessed as suitable for the PMLU's - PMLU's compatible with surrounding land uses - Rehabilitation monitoring	The selected PMLU's are consistent with surrounding land uses and would be expected to be suitable	- Rehabilitation monitoring program	As per section 3.7.1.1 & 3.7.1.4	As per section 3.7.1.1 & 3.7.1.4	2	2	4
	Rehabilitation vegetation lost or damaged due to bushfire	Impact to EV's	- Loss of biodiversity - Damage to previously completed rehabilitation	3	3	15	- Rehabilitation monitoring - Bushfire management - Selective grazing	Rehabilitation monitoring will identify areas requiring grazing or fire management to reduce fuel load	- Rehabilitation monitoring program - Bushfire management plan	As per section 3.7.1.1	As per section 3.7.1.1	2	3	6
	Surface water runoff causes environmental harm	Impacts to EV's	Environmental harm from contaminated runoff	4	2	20	- Surface water monitoring -Run off water either treated to eliminate off site impacts or retained on site	Monitoring to provide early indication of potential contamination	Surface water monitoring program	As per Section 3.1.7.3	As per Section 3.1.7.3	3	2	10

	GW contamination from rehabilitated area	Impacts to EV's	Contamination of groundwater	4	3	30	- GW monitoring	Monitoring to confirm modelling predictions of low risk to groundwater or to provide an early indication of potential issues	GW monitoring program	As per Section 3.1.7.3	As per Section 3.1.7.3	3	2	10
RM11 - Fencing / bunding install	Fencing / bunding not installed or ineffective	PMLU	Grazing of native bushland areas impacts PMLU	3	2	10	- Areas progressively fenced during operations (where possible) - Development of a property management plan for transfer to future landholder - Bunding included in PRC / ERC - Safety bunding in placed during operations - Closure risk assessment	Final fencing requirements will be considered when fencing during operational phase including communication with the future landholder where possible. Property management plan will include requirements for fencing and not grazing native bushland areas. Safety bunding will be in place around operational pits. Operational bunds may be repurposed for final bunds.	Property management plan	Visual assessment and mapping	As per Section 3.1.7.2	2	2	4
		Safe and stable	Un-bunded / unfenced areas pose a risk to humans or livestock	5	3	75						5	2	50

Table 46 Risk Assessment NUMA

Milestone	Risk / threat	Consequence category	Impact	Risk evaluation			Proposed controls	Justification of treatment option	Resource requirements	Performance measures	Reporting and monitoring	Residual risk		
				Consequence	Likelihood	Risk score						Consequence	Likelihood	Risk score
MM1 – Highwall treatment	Highwall (HW) and / or low wall (LW) does not achieve geotechnical stability	Safe and stable	HW and LW not geotechnically stable and not considered safe	5	3	75	- Current design angles assessed as geotechnically stable - Pit floor blasted ahead of backfill dumping to enhance stability (LW) - Dip-line mining methodology increases HW and LW stability over other mining methods - Geotechnical monitoring during operations to validate HW and LW design parameters -Landform designed by AQP	Current designs are based on geotechnical assessment, materials characterisation, mining methodology and experience with similar materials at surrounding mines. Ongoing monitoring during operations will validate modelling or provide information for updates.	- Geotechnical monitoring program	As per Section 3.7.1.2	As per Section 3.7.1.2	4	2	20

	Ineffective HW drainage	Safe and stable	Ineffective drainage degrades erosional stability or impacts bunding	4	3	30	- Final drainage slopes away from HW areas - Area between bunding and HW crest to be left vegetated	Sloping drainage away from HW's will minimise water in area and potential erosion. Vegetated area between bunding and highwall crest to reduce erosion	Final drainage plan	Review of final drainage and rehabilitation designs	As per Section 3.7.1.2	3	3	15
MM2 - Achievement of landform design and surface requirements	Fencing / bunding not installed or ineffective	Safe and stable	Un-bunded / unfenced areas pose a risk to humans or livestock	5	3	75	- Abandonment bund setback distance is in accordance with calculated geotechnical factor of safety - Abandonment bund constructed of competent rock and to geometry specified to prevent traversing by vehicles - Fencing erected on the outside of the abandonment bund to specification (nominally five strand barbed stock fencing) - Safety signage (design in accordance with Australian Standard) erected at specified intervals along the fence line (nominally one sign every 100m) - Property management plan Bunding, fencing and signage provisioned in ERC	Sufficient abandonment bund, fencing and signage is an effective method of reducing potential interaction with the residual void	- Property management plan - Final bunding and fencing plan	Visual inspection	As per Section 3.7.1.2	5	2	50
	Flood impacts on residual void	Impact to EV's	Capture of overland flow and potential release of contaminants	6	2	100	- Residual void is located outside of the PMF flood zone	Flood modelling shows void is not at risk of inundation in a PMF event	Flood modelling	Data from actual flood events	Monitor actual flood events	6	1	50

MM3 – Achievement of sufficient improvement not to cause environmental harm and be safe and structurally stable	Residual void water quality causes environmental harm	Impact to EV's	Residual void water causes harm to environmental values	5	3	75	- Final void water modelling indicates that the level of the final void water is significantly below the crest of the pit to avoid risk to receiving environment - No identified users of groundwater in the area - GW monitoring	Modelling indicates minimal risk which will be validated by ongoing monitoring	GW monitoring program	GW monitoring data	As per Section 3.7.1.3	3	3	15

3.6.4 Rehabilitation trials

Rehabilitation trials are yet to be conducted at the Codrilla Project as mine development has not commenced.

The results of trials conducted at other sites in the Bowen Basin will be utilised to inform the site's rehabilitation methodology as appropriate. Learnings from research, including ACARP funded projects, may also be utilised to improve rehabilitation outcomes.

As the pre and post-mining land use for the majority of the site is low intensity cattle grazing, the objective of future trials will focus on aligning research and trials with sustainable cattle grazing and assessing the suitability or rehabilitated land to support commercial grazing activities.

3.6.4.1 How Trials Will be Carried Out

A successful trial of rotational cattle grazing has been carried out previously at PEA's Burton and Wilkie Creek Mines. The trials have been carried out in collaboration with neighbouring graziers who have put stock onto rehabilitated pastures that have been assessed as being sufficiently well established to support grazing on a rotational (short duration, high intensity) grazing. Cattle are weighed individually before and after grazing on the rehabilitated pasture and the daily weight gain is calculated for comparison with the average weight gain achieved on adjoining natural pasture areas. The physical condition of the cattle is assessed by the grazier upon completion of the trial and reported to the site's environmental manager. The trials were conducted over periods from weeks to months.

The trials that were conducted at Burton employed innovative cattle tracking collar technology. The solar powered collars were fitted to fifty cattle prior to introduction into the grazing trial area. The collars are fitted with GPS tracking collars, which allows for both real time and recorded monitoring of the location of the cattle. This enable the movement and preferential grazing practices of the cattle to be recorded. The trials showed that cattle grazed both flats and undulating topography, inclusive of waste rock dumps. Concentration of cattle movement on 'desire lines' up the dump slope, which could give rise to erosion, was not observed. The cattle collars also provided information on the distance from watering points that cattle were prepared to walk and graze. This information can be used to inform the placement of stock watering points across the rehabilitated landscape.

The condition of the grazed area was assessed regularly by the grazier and the site representative to ensure that overgrazing did not occur. Stock were removed from the trial area when biomass was grazed to a level that was adjudged to be appropriate. Recovery of pasture following grazing was assessed via the methodology described within the rehabilitation monitoring section of this PRC Plan. Over time it is anticipated that grazing trial results will inform sustainable stocking rates for rehabilitated pastures under varying seasonal conditions so that stocking numbers can be aligned with the land's sustainable carrying capacity. The results may also be used to inform species selection and sowing rates for areas where grazing has been nominated as the post-mining land use.

Success will be assessed via cattle weight gain, cattle condition at the conclusion of the trial when compared to pre-trial condition, and resilience of the pasture species and total biomass as assessed during the next annual rehabilitation monitoring program.

3.7 Monitoring and maintenance

In order to determine the success of the rehabilitation and as required under condition F31 of the EA, a Rehabilitation Monitoring Program has been developed and it has been designed to provide information for:

- Environmental personnel who need to understand how rehabilitation is developing so that feedback can be provided to Peabody and the Regulator;
- Review and refinement of rehabilitation methodologies to optimise vegetation establishment and align rehabilitation programs with agreed post-mining land use objectives;
- Operations personnel who require feedback on the effectiveness of rehabilitation operations;
- Identification of areas in need of maintenance and the extent of maintenance and management requirements;
- Management who require detail on rehabilitation liability and whether commitments are being met;
- Development and ongoing refinement of rehabilitation success measures/completion criteria;
- Peabody to enable communication on relevant information to external stakeholders
- Support of progressive rehabilitation certification applications; and
- Regulatory authorities (and other relevant external stakeholders) who may wish to determine whether they believe rehabilitation is developing toward or has met rehabilitation commitments.

The rehabilitation assessments will:

- Provide an understanding of the way in which the rehabilitation develops over time (successional patterns and trends);
- Provide an understanding of the chemical properties of the reconstructed topsoil profile;
- Allow for refinement and supplementation of the re-vegetation process;
- Allow for the development and refinement of land use demonstration studies such as grazing;
- Consider the influence of both internal and external factors on rehabilitation development;
- Consider the rate at which the rehabilitated landscapes approach the agreed final land use;
- Identify and summaries opportunities for improvement in the rehabilitation methodology, monitoring methodology and maintenance of rehabilitated land;
- Enable Peabody to establish or improve completion criteria for each post-mine land use; and
- Identify areas and extent of maintenance and management requirements.

3.7.1 Rehabilitation Monitoring and Maintenance Program

The rehabilitation monitoring and maintenance programs, which also address the requirements of the Post Closure Management Plan under condition F42 of the EA, will enable Peabody to measure and calculate a range of vegetation, faunal colonisation, soil and final landform parameters and indices in the developing rehabilitation. The monitoring and maintenance programs can be split into three components:

a) vegetation and fauna monitoring, inclusive of bushland and pasture establishment, habitat development and faunal colonisation and success as required;
b) final landform monitoring; and
c) water quality monitoring.

The objectives of the monitoring program are described in the next three sections.

3.7.1.1 Vegetation & Fauna Monitoring

- To establish and assess practical and applicable reference plots, if not already established.
- To measure total lower-storey cover (foliage and basal), species density and richness in the rehabilitation block and determine any significant differences when compared to reference plots;
- To measure pasture yield within areas where grazing is the post-mining land use and determine any significant differences when compared to reference plots;
- To measure the cover (foliage and basal), presence/absence of upper-storey (tree) and mid-storey (shrub) species in the rehabilitation block;
- To measure fauna colonisation of invertebrates, vertebrates and habitat development;
- To measure the presence of invasive plants, including invasive plants that are restricted matters under the *Biodiversity Act 2014* and to measure changes to the location, extent and density of the invasive plants to enable informed weed (invasive plants) management decisions and controls to be made and updates to the management plan to reflect the findings;
- To assess the success of sown species by comparing seeding mixes to monitoring data;
- To ensure that vegetation monitoring is undertaken on all rehabilitated landform types, including both elevated landforms (i.e. out-of-pit dumps not typical of the surrounding environment) and other lower-lying rehabilitated areas such as rehabilitated ROM pads, infrastructure areas, etc.;
- To assess similarity to reference plots and/or replication across an elevated landform (i.e. upper, middle, lower sections of a rehabilitated out-of-pit dump);
- To assess parameters that relate to pasture productivity;
    - Density and richness of pasture;
    - Groundcover determination (foliage and basal);
    - Pasture yield, to support grazing trials; and
    - Establishment success and sustainability of sown species;
- To gather data which can be used to support demonstration studies, such as grazing; and
- To obtain sufficient relevant data to statistically indicate trends and demonstrate achievement of success/completion criteria.

Monitoring will demonstrate that **RM5** and **RM7** (grazing PMLU) and **RM6** and **RM8** (native bushland

PMLU) and the relevant Milestone Criteria have been achieved.

3.7.1.2 Final Landform Monitoring

- To assess the chemical properties and soil nutrient status of the reconstructed topsoil profile, identifying potential properties that may contribute to any areas of rehabilitation not meeting the desired objectives or that need maintenance such as the application of ameliorants;

Monitoring will demonstrate that **RM4** and the relevant Milestone Criteria have been achieved.

- Record the location of erosion within, or within the vicinity of the plot as per the *Australian Soil and Land Survey - Field Handbook. 3rd ed (2009)* (i.e. active, stable, depth, type etc). Peabody maintains an Erosion and Sediment Control Plan (ESCP) Procedure.

Monitoring will demonstrate that **RM4**, **RM7** or **RM8** and the relevant Milestone Criteria have been achieved.

- To identify and measure landform stability and specifications on the rehabilitated blocks, using LiDAR (as provided by Peabody), with particular attention paid to:
    - determining the post mine landform stability by measuring year on year settlement/subsidence and/or sediment deposition; and,
    - determining the post mine landform stability by measuring the extent and year on year progression of erosion features

Monitoring will demonstrate that **RM2** and **RM3** and **MM1** and **MM2** and the relevant Milestone Criteria have been achieved.

- Determining compliance with the design and final landform specifications (i.e. constructed as per detailed design, slopes angles, length, aspect and ground surface curvature) detailed within the site EA.

Monitoring will demonstrate that **RM1**, **RM2, RM3, RM4, RM7 or RM8, RM9 or RM10 and RM11** and **MM1**, **MM2** and **MM3** and the relevant Milestone Criteria have been achieved.

3.7.1.3 Water Quality Monitoring

Baseline monthly water quality monitoring as part of the receiving environment monitoring program (REMP) was conducted from 2010 to 2016.

Samples were collected in the locations specified under Table C8 of the EA from both the installed Rising Stage Samplers (RSS) sites at Swampy Creek and Devlin Creek and at Devlin Creek Haul Road (DCHR), Bundarra Creek Haul Road (BCHR), Devlin Creek Fitzroy Development Road (DCFDR) and Downstream Devlin Creek (DSDC). Sample analysis included insitu pH, EC, turbidity; selected total and dissolved metals; hydrocarbons and nutrients.

Similarly, baseline groundwater quality monitoring was conducted commencing 2011 utilising the ten groundwater bores as shown in Figure 20 on the following page. These bores are also included in Table C11 of the EA. Groundwater levels were obtained at a monthly interval between July 2011 and June 2012 and then at quarterly intervals. Groundwater quality sample analysis included insitu pH, EC and suspended solids, metals/metalloids and total petroleum hydrocarbons.

To demonstrate the final landform is non-polluting a water quality monitoring program will be conducted:

a) Surface water monitoring will be undertaken post-establishment of the final landforms until the PMLU is achieved. As the creeks and drainage lines within the project area are ephemeral, surface water monitoring will only be undertaken opportunistically during periods of runoff where safe access to the site can be gained.
b) Groundwater samples will be collected and analysed to achieve milestone criteria.

Monitoring will demonstrate that **RM4**, **RM7, RM8**, **RM9**, **RM10** and **MM3** and the relevant Milestone Criteria have been achieved.

3.7.1.4 Baseline Monitoring & Reference Sites

Pasture reference plots are to be located adjacent to the existing mining operations on the mining lease (ML) or Peabody controlled land, but within an area that will not be impacted by future mining activities. The reference plots will be established based on a pasture grass land use and should consider vegetation and soil attributes similar to those used in the rehabilitation. In addition, past and current grazing pressures must be considered when selecting the pasture reference plot. Multiple reference plots (three or more per mine site) should be established to allow statistical analyses to be undertaken. Note, where reference site requirements are similar between Peabody mines, then it may be possible to utilize the same reference site for multiple Peabody mines.

Native vegetation reference plots are to be located adjacent to the existing mining operations on the ML or Peabody controlled land, but within an area that will not be impacted by future mining activities. The native vegetation reference plots should represent the vegetation communities and fauna habitat similar to those the re-vegetation program is aiming to achieve (e.g. open woodland). The native reference sites should consider vegetation, location and soil attributes similar to those used in the rehabilitation, noting that the seed mix composition should align as closely as practicable with the species composition and density occurring in the reference site. Multiple native vegetation reference sites should be established in each vegetation community to allow statistical analyses to be undertaken. Note, where reference site requirements are similar between Peabody mines, then it may be possible to utilize the same reference site for multiple Peabody mines.

The proposed rehabilitation monitoring methodology is as described in Table 47.

Table 47 Summary of Rehabilitation Monitoring Methodology

Plot Area	Parameter Measured	Description
General Description and Supplementary Information	Plot Characteristics	Record the slope, plot landform location (upper, middle, lower slope), post-mining land use (based on relevant EA conditions) and plot aspect.
	Weed (invasive plants) presence/abundance	List all invasive plants and subjectively record their abundance as low, moderately abundant, or abundant. If the invasive plant outbreak is deemed to be a significant outbreak or in a new location, record the GPS location for reporting to Peabody.

	Erosion	Record the location of erosion within, or within the vicinity of the plot as per the *Australian Soil and Land Survey – Field Handbook. 2nd ed (1990)* (i.e. active, stable, depth, type etc)
	Visual Record	Take one photograph at the start of the cover transect and a second at the finish, in both cases looking along the transect.
	Climatic Variables	Recent rainfall events, intensity, duration, measurement in relation to time of seeding. Potential impacts of other climatic events such as intense rainfall events, cyclones, droughts, floods.
	Other Variables	Note any other factors that have adversely affected rehabilitation areas, including fire, predation by insects, excessive grazing impact of herbivores, instances of vegetation die-back or soil disturbance caused by feral animals, e.g. pigs or rabbits
2m x 2m Quadrats	Lower-storey Density and Richness	At 10m intervals along the cover transect record the number of all lower-storey species in each quadrat to obtain total lower-storey species density and richness.
	Lower-storey Cover	Record total lower-storey cover (i.e. ground cover). The contribution of each of the lower-storey species to the live-standing ground cover assessment will be determined. The proportion of bare ground will be assessed by default.
	Pasture Yield (where grazing is the designated post-mining land use)	Harvest a representative 50 x 50 cm sub-quadrat at ground level and weigh in situ to derive the green herbage biomass. Retain biomass from quadrat 3 for drying and weighing in the laboratory. Note that harvesting shall occur after all other data has been collected from the transect.
	Topsoil Properties	Take five 0-15cm soil samples (i.e. one sample taken from each quadrat) and bulk, to produce one composite sample per transect.
50m Cover Transect	Mid-storey and Upper-storey Cover	Using the 50m cover transect, record the start and finish foliage intercepts. These intercepts are then added and divided by the total length (50m), resulting in a percentage cover for the species along the transect.
	Basal	The contribution of groundcover species basal cover will be measured using the '*point frame method*'. A 50 x 50cm quadrats/frame will be located at 10m intervals along, but adjacent to the cover transect. The contribution of competent rock (rock defined as >50mm in diameter) will also be assessed
10m either side of cover transect	Upper-storey & Mid-storey Density/Richness	Record the total number of trees and shrubs for each species located 10m either side of the cover transect.
	Species Inventory	Separately record lower-storey species noted in the vicinity of the plot but not present within the 2m x 2m quadrats enabling a more comprehensive inventory of what species are present.
LIDAR	Landform Stability and Specifications	Assess landform stability (settlement/subsidence), progression of erosion features and compliance of the 'as built' landform with the specifications (i.e. slopes, length) detailed within the site Environmental Authority (EA).

3.7.1.5 Sampling Intensity

The sampling intensity proposed for the rehabilitation monitoring program takes into account:

- Practicality and cost-effectiveness of monitoring techniques;

- Separation of pit locations and therefore rehabilitated land which will allow for progressive certification or partial relinquishment opportunities (i.e. mines are not often one extended tract of land and may contain a variety of rehabilitation years that can be combined for certification/relinquishment);
- The need to capture different final landforms and disturbance types (i.e. elevation, out of pit dumps, infrastructure areas, underground mining gas drainage 'runways' and subsidence areas) and end land uses;
- Sampling in appropriate seasons (post wet) to best capture all desired components, including the presence of annual species that germinate in response to summer rainfall events; and
- The need for broadscale monitoring, ensuring overall site rehabilitation performance is measured.

3.7.1.6 Frequency

As required under condition F31 of the EA, once rehabilitation as commenced, the rehabilitation monitoring program must be conducted yearly. Rehabilitation monitoring of the initial establishment (i.e. Year 1 and 2) will allow Peabody to identify early on, areas for improvements as well as prescribe remedial action where required. Following completion of coal processing on site, in accordance with condition F41, for at least 30 years or a shorter period if proven to be geotechnically and geochemically stable and non-polluting, the site will require maintenance and monitoring on an ongoing basis. Ongoing monitoring after the initial monitoring on a 2 to 5 yearly intervals thereafter and at 5 yearly intervals from Year 10 to Year 30 to assess any trends and to inform amelioration requirements where required.

Vegetation and Fauna Monitoring will be conducted in Year 1 and 2 & at 2 yearly intervals thereafter.

Final Landform Monitoring, which includes soil monitoring, erosion monitoring, geotechnical monitoring and design assessment will be conducted in Year 1 & at 2 to 5 yearly intervals thereafter.

Water Quality Monitoring will be undertaken in Year 1 and a revaluation of the groundwater monitoring requirements will be undertaken at 2 yearly intervals thereafter.

3.7.1.7 Maintenance

Maintenance activities will be undertaken ongoing on a yearly basis over the post-closure period. Detailed records of rehabilitation maintenance activities and the cost of carrying out such works will be compiled and maintained. These records may be used to refine the rehabilitation methodologies adopted at the site and provide accurate tracking of the cost of any rework.

Scheduled inspections will be undertaken to check that fencing, firebreaks, sediment dams, abandonment bunds, signage and any other related features are fit for purpose and maintained in good order and when rehabilitation monitoring and or routing site inspections determine that rehabilitated areas are impacted by a particular issue i.e. erosion, maintenance works will be undertaken. Table 48 provides maintenance issues and treatments that would be undertaken.

Table 48 Maintenance Issues & Treatments

Issue	Maintenance treatment
Historical rehabilitation	Where maintenance of historical rehabilitation is required augment as per current rehabilitation technical specifications
Gully erosion	Review landform drainage/run on and modify as required. Fill gully and provide appropriate surface protection/armouring
Poor vegetation cover	Adjust fertiliser/soil ameliorant inputs and reseed during appropriate seasonal conditions. If issue persists conduct additional soil sampling and seek input from an AQP
Erosion control device failure	Review design specifications and repair
Sedimentation	Where deemed necessary, excavate sediment build up and repair/reinstate structure rock check dams
Vegetation community developing inconsistent with PMLU	Review rehabilitation strategy and planting lists. Conduct a risk assessment for PMLU not being achieved and develop and implement a treatment response
Poor habitat development & faunal colonisation	Review planting requirements and investigate causes of key groups not recolonising

3.7.1.8 Monitoring and validation methods

The monitoring and maintenance program meet the requirements under section 126C (1) of the EP Act which requires to identify and describe the monitoring systems that will be carried out in order to demonstrate a milestone and milestone criteria have been achieved. Table 49 shows the rehabilitation monitoring and validation methods that will be undertaken once rehabilitation works have been completed in the domains discussed in this plan.

Table 49 Monitoring & Validation methods

Milestone reference	Rehabilitation milestone	Milestone criteria	Monitoring & Validation method	Frequency
RM1	Infrastructure decommissioning & removal	a). All services disconnected. Underground services will remain buried and surface points will be sealed b). All buildings either demolished and removed or relocated off site c). Concrete slabs and footings removed or buried within overburden dump final rehabilitation areas d). Sumps or damps that do not form part of final landform as sediment control structures will be dewatered and where applicable contaminated silt will be removed for licensed disposal e). Sealed asphalt roads, car parks and hardstand areas will have the asphalt removed for reuse or burial within overburden dump final rehabilitation areas and unsealed road, car parks and hardstands will have any contamination removed for licenced disposal f). Hydrocarbon and chemical storage areas will be removed and/or remediated by on-site treatment if required g). All carbonaceous material will be collected from haul roads and disposed in the co-disposal area or buried within the overburden dump final rehabilitation areas h). The contaminated land assessment report prepared by an AQP confirms that the land is not contaminated and is suitable for any use	Visual monitoring Contaminated land assessment	Year 1 Year 1

RM2	Landform design, reshaping and final contouring, inclusive of drainage features	a). Stable landform and slope angles for out of pit overburden dumps areas as follows: outer batter slopes equal to or less than 5.7°and crest slope a maximum of 2.3° b). Stable landform and slope angles for Co-disposal elevated landform and ROM pads as follows: outer batter slopes equal to or less than 8° and crest slope a maximum of 2.3° c). Stable landform and slope angles for coal stockpiles and in pit overburden backfill flat to undulating with slopes equal to or less than 4.6° crest slope a maximum of 2.3° d). Stable landform and slope angles for infrastructure areas flat to undulating with slopes equal or less than 2.3° e). Maximum vertical height of out of pit overburden dumps elevated landforms up to 50m f). Maximum vertical height of Co-disposal elevated landform and ROM pad areas up to 18m g). All major earthworks completed h). Contour drains and rock lined drop structures installed as per appropriate design criteria i). Landforms such as the Co-disposal facility have been signed-off as constructed to design	LiDAR assessment Geotechnical monitoring	Year 1 Year 1 & at 4 yearly intervals thereafter
RM3	Install cover system/cap	a) Cover installed over reject/coal stockpile surfaces (nominally 1m inert overburden)	Soil monitoring	Year 1 & at 2 yearly intervals thereafter
RM4	Surface preparation (e.g. topsoil, fertiliser, amelioration agents, mulch or woody debris)	a) Topsoil spread to a minimum depth of 150mm b) Gypsum applied at rates determined by an AQP c) Cultivation and keying of topsoil to subsoil with suitable multi-type ripper and performed parallel to slope contours d) Addition of rock and/or log cover to assist erosion resistance of eventual vegetative ground cover	Erosion monitoring Soil monitoring	Year 1 & at 2 yearly intervals thereafter Year 1 & at 2 yearly intervals thereafter
RM5	Revegetation (grazing)	a) Pasture seed applied in accordance with rehabilitation specification, i.e. seeding rate, seed composition and cultivation to incorporate seed into the uppermost layer of the growth media b) Seed mix contains a range of native and introduced grass and legume species consistent with surrounding pastural areas (as per seed mix table in PRC plan)	Vegetation rehabilitation monitoring	Year 1 and 2 & at 2 yearly intervals thereafter
RM6	Revegetation *& habitat development* (native bushland)	a). Native seed applied in accordance with rehabilitation specification b). Seed mix contains a suitable range of native tree, shrub and grass species to achieve brigalow and eucalyptus woodland habitat type (as per seed mix table in PRC plan)	Vegetation & habitat development rehabilitation monitoring	Year 1 and 2 & at 2 yearly intervals thereafter
RM7	Achievement of surface requirements (grazing)	a). Species density and diversity achieved is consistent with the sown seed mix, reference sites and surrounding pastural areas b). 80% of the area has a vegetative groundcover >70% for areas of low rock and logs, >50% for areas of high rock and log content c). Growth medium (surface 30cm) pH >5.5 and <9.5; Conductivity <1.0dS/m and ESP<15% d). No new invasive plants and infestation density of invasive plants that were originally present or in low abundance within the area is contained or reduced and consistent with reference sites and surrounding pastoral areas e). Water control structures are either removed or free of active erosion and integrated into permanent landforms f). No severe erosion gullies and erosion rates are less than 40tonnes/ha/year g). pH and EC indicators for surface water runoff demonstrate the water quality is suitable for the	Vegetation rehabilitation monitoring Erosion monitoring Water quality monitoring	At 2 yearly intervals At 5 yearly intervals Year 1 & at 2 yearly intervals thereafter

		receiving environment and are consistent with water quality indicators of the upstream reference site h). The NEPM assessment confirms areas are free of hazardous materials or have been rendered safe	NEPM assessment	
RM8	Achievement of surface requirements (native bushland)	a). 80% of the area achieves species density and diversity that is greater than 60% of the reference sites and surrounding areas b). 80% of the area has a vegetative groundcover >70% for areas of low rock and logs, >50% for areas of high rock and log content c). Growth medium (surface 20cm) pH >5.5 and <9.5; Conductivity <1.0dS/m and ESP<15% d). No new invasive plants and infestation density of invasive plants that were originally present or in low abundance in the area is contained or reduced e). Key invertebrate groups such as ants and soil faunal communities are re-establishing f). Bird, mammal, reptile and frog communities are becoming established in the rehabilitated sites g). Evidence of food and shelter opportunities for invertebrate and vertebrate species	Vegetation & habitat development rehabilitation monitoring	2 yearly intervals
		h). Water control structures are either removed or free of active erosion and integrated into permanent landforms i). No severe erosion gullies (<4m² in cross section) and erosion rates are less than 40tonnes/ha/year	Erosion monitoring	5 yearly intervals Year 1 & at 2 yearly intervals thereafter
		j). pH and EC indicators for surface water runoff demonstrate the water quality is suitable for the receiving environment and are consistent with water quality indicators of the upstream reference site	Water quality monitoring	
		k). The NEPM assessment confirms areas are free of hazardous materials or have been rendered safe	NEPM assessment	
RM9	Achievement of a stable condition for the land described as a post-mining land use of grazing	a). Rehabilitation has been certified by an AQP to be: • structurally stable (FoS ≥ 1.5) and slopes are designed in accordance with EA criteria • erosionally stable: no severe erosion gullies (<4m² in cross section) and erosion rates are less than 40tonnes/ha/year and groundcover established and meets criteria in RM7 b). pH and EC indicators for surface water runoff demonstrate the water quality is suitable for the receiving environment and are consistent with water quality indicators of the upstream reference site c). The rehabilitated land meets Class 4 land suitability for grazing using the Guidelines for agricultural land evaluation in Queensland (2nd edn) (DSITI & DNRM, 2015).	Rehabilitation monitoring	Between Year 15 and Year 30
RM10	Achievement of a stable condition for the land described as a post-mining land use of native bushland	a). Rehabilitation has been certified by an AQP to be: • structurally stable (FoS ≥ 1.5) and slopes and dump heights are designed in accordance with EA criteria • erosionally stable: no severe erosion gullies (<4m² in cross section) and erosion rates are less than 40tonnes/ha/year and groundcover established and meets criteria in RM9 b). pH and EC indicators for surface water runoff demonstrate the water quality is suitable for the receiving environment and are consistent with water quality indicators of the upstream reference site c). The established native ecosystem has a similar composition to the previous existing woodland ecological communities comprising RE 11.4.8, RE 11.4.9 and RE 11.5.3 and provides habitat opportunities for invertebrate and vertebrate species	Rehabilitation monitoring	Between Year 15 and Year 30
RM11	Install fencing or other infrastructure to support the PMLU	a) Fencing / bunding installed to exclude stock	Visual monitoring	Year 1

Milestone reference	Management milestone	Milestone criteria	Monitoring & Validation method	Frequency
MM1	Highwall treatment	a) Highwall crest battered back where required to achieve a stable slope angle as specified by an AQP (geotechnical engineer)	Geotechnical monitoring	Year 1 & at 2 yearly intervals thereafter
MM2	Achievement of landform design and surface requirements	a). Highwall as mined weathered average slope angle of 1V and 0.7H (55°) and low wall as backfilled at angle of repose at 1V to 1.35H (36°) b). Abandonment safety bund setback distance is in accordance with calculated geotechnical factor of safety c). Abandonment safety bund constructed of competent rock and to geometry specified to prevent traversing by vehicles d). Residual void maximum depth of 150m e). Residual void outside of PMF f). Abandonment safety bund and ramp into voids revegetated with pasture seed	LiDAR assessment Geotech monitoring Visual monitoring	Year 1 & at 2 yearly intervals thereafter
MM3	Achievement of sufficient improvement not to cause environmental harm and be safe and structurally stable	a). Access to highwall, low wall and ramp batter is restricted by physical barriers and fencing is erected on the outside of the abandonment safety bund to specification (nominally five strand barbed stock fencing) b). Safety signage (design in accordance with Australian Standard) is erected at specified intervals along the fence line (nominally one sign every 100m) c). Certification from an AQP that the level of final void water is significantly below the crest of the pit to avoid the risk of overtopping and causing environmental harm d). Certification from an AQP that the water quality (pH & EC) in the final void does not show a statistically significant change when compared to background data and will not cause environmental harm to the surrounding environment	Geotech monitoring Water monitoring	Year 1 & at 2 yearly intervals thereafter Year 1 & at 2 yearly intervals thereafter

3.7.1.9 Identification of Actual or Emerging Issues

The scope for annual rehabilitation monitoring includes provision to record actual or emerging issues and make recommendations on potential improvements to the rehabilitation process. This may include refinement to the species mix used in the rehabilitation process, recommendations for spoil amelioration, weed (invasive plants) control or pest management. The report may also make recommendations on potential improvements to the monitoring program. This may include adoption of emerging technologies.

3.7.1.10 Scheduled & Event Based Inspections

Field inspections may be undertaken in response to events that have the potential to adversely impact rehabilitation areas. This may include intense rainfall events occurring prior to establishment of a dense vegetation cover or impacts arising from the uncontrolled spread of fire within rehabilitation areas.

3.7.1.11 Use of Data to Evaluate Rehabilitation Trends / Trajectory

Data obtained from the annual rehabilitation monitoring program will be utilised to verify whether areas of rehabilitation are developing towards the desired targets described within the site's rehabilitation completion criteria. Where the desired trends are not observed, intervention via implementation of remedial actions may be required.

3.7.1.12 Reporting and the identification of Management Requirements

The results of the monitoring program are analysed and as a minimum, the following documented in monitoring reports:

- Trends in the vegetation and soil data (i.e. how rehabilitation is developing against expected growth patterns, trends towards reference communities, rehabilitation soil properties) including identification of any emerging issues that may compromise rehabilitation success;
- An appraisal of each monitoring location's alignment with the PMLU and associated vegetation communities;
- Recommendations on potential improvements to rehabilitation practices;
- Recommendations on improvements to the rehabilitation monitoring methodology; and
- Recommendations for managing erosion and invasive plants.

4 Appendices and attachments

4.1 PRC Plan Schedule

Legislative requirements:

In accordance with section 126D(1) of the EP Act, the PRCP schedule in the PRC plan must:

a) describe the area of each resource tenure either a post-mining land use or non-use management area, and
b) for each post-mining land use state:
   i. each rehabilitation milestone required to achieve a stable condition, and
   ii. when each rehabilitation milestone is to be achieved, and
c) for each non-use management area state:
   i. each management milestone, and
   ii. when each management milestone is to be achieved, and
d) include maps showing the land mentioned in (a), (b) and (c).

4.1.1 Final Site Design

The final site design is a map showing:

- the maximum disturbance footprint
- resource tenure boundaries
- PMLU(s) and NUMA(s) for the land within the resource tenure(s)
- flood plain extent.

The purpose of the final site design is to show the community what the site will look like post surrender.

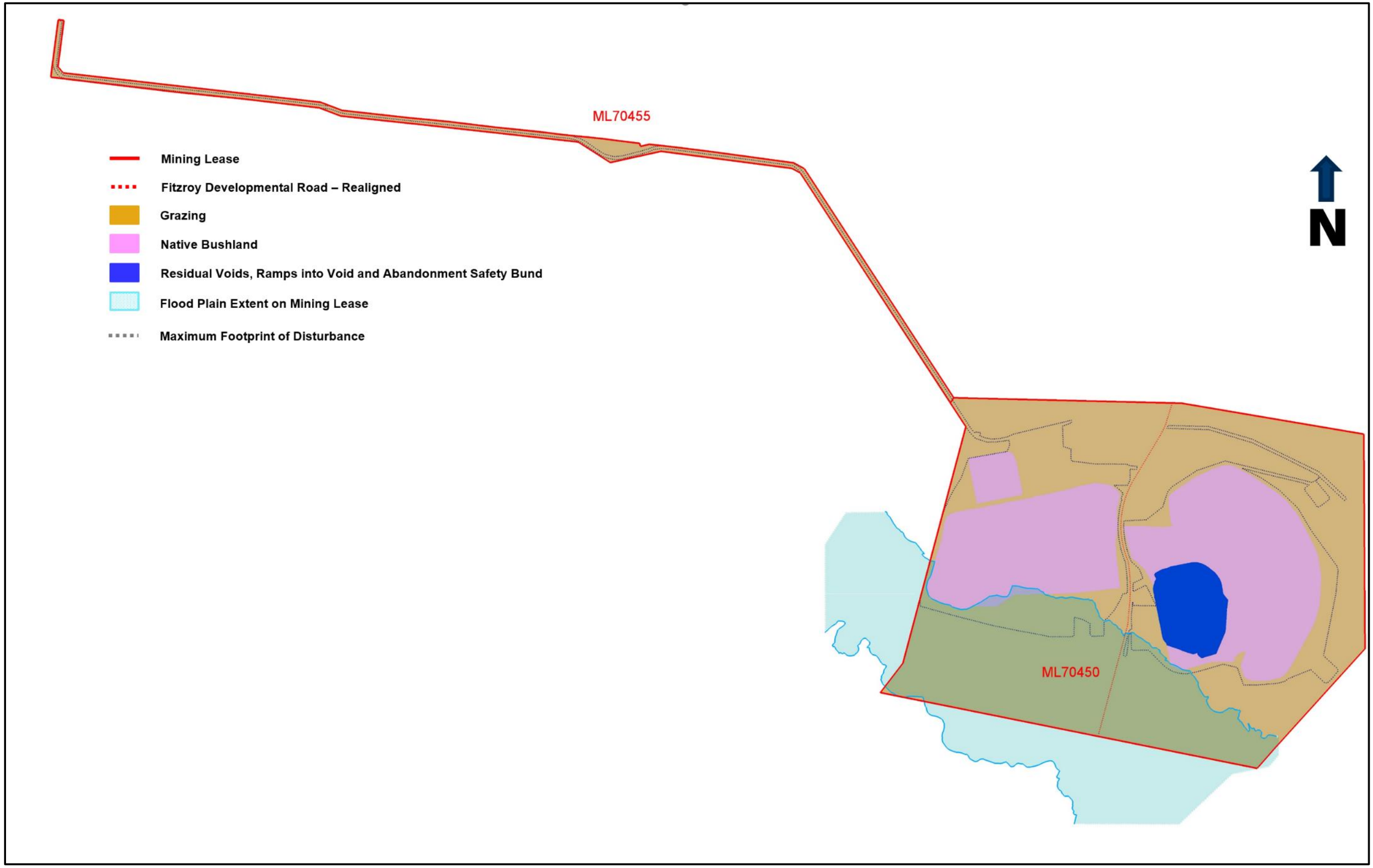

Figure 45 Final Site Design

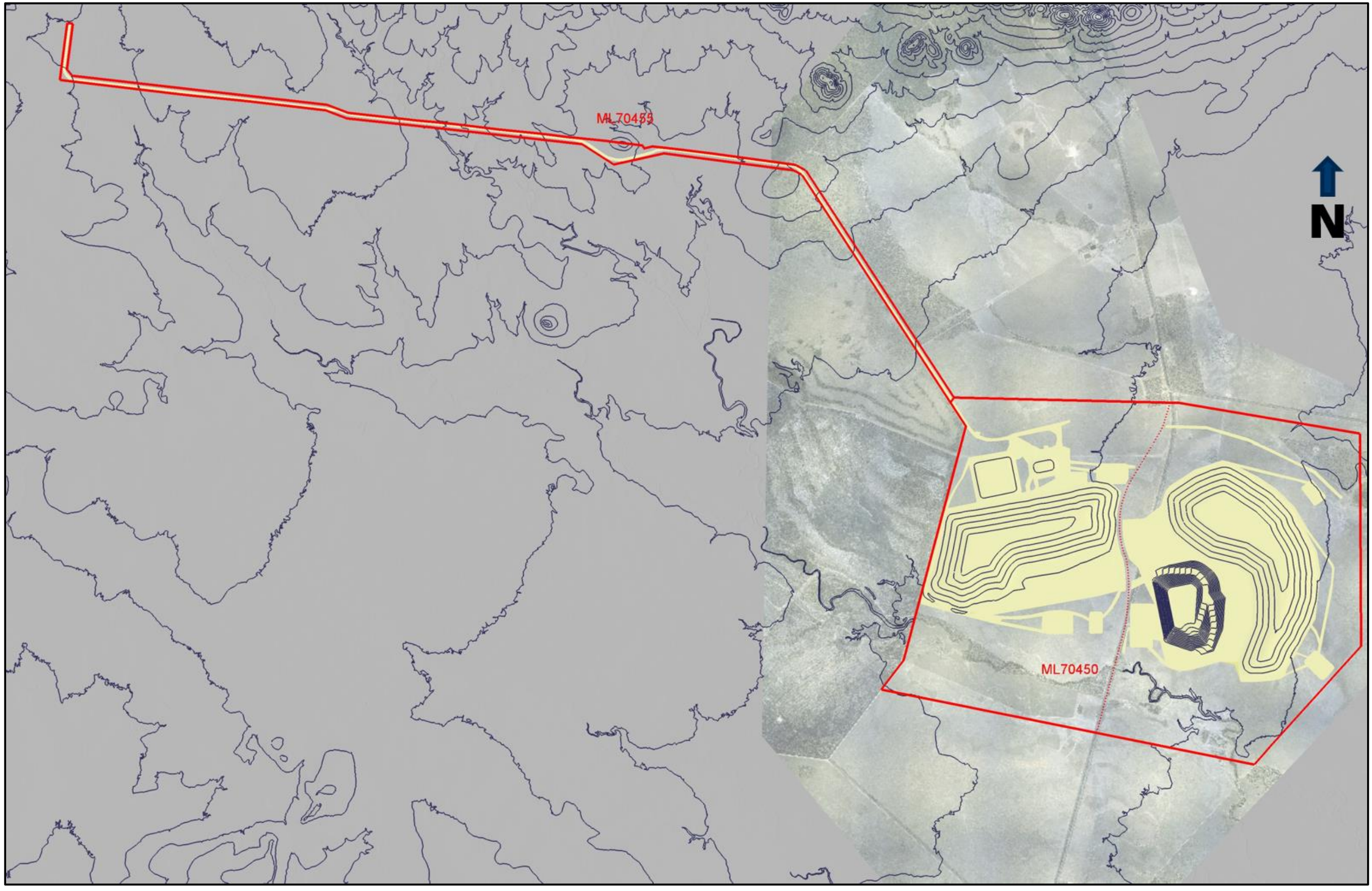

Figure 46 Final Landform Regional Contour Plan

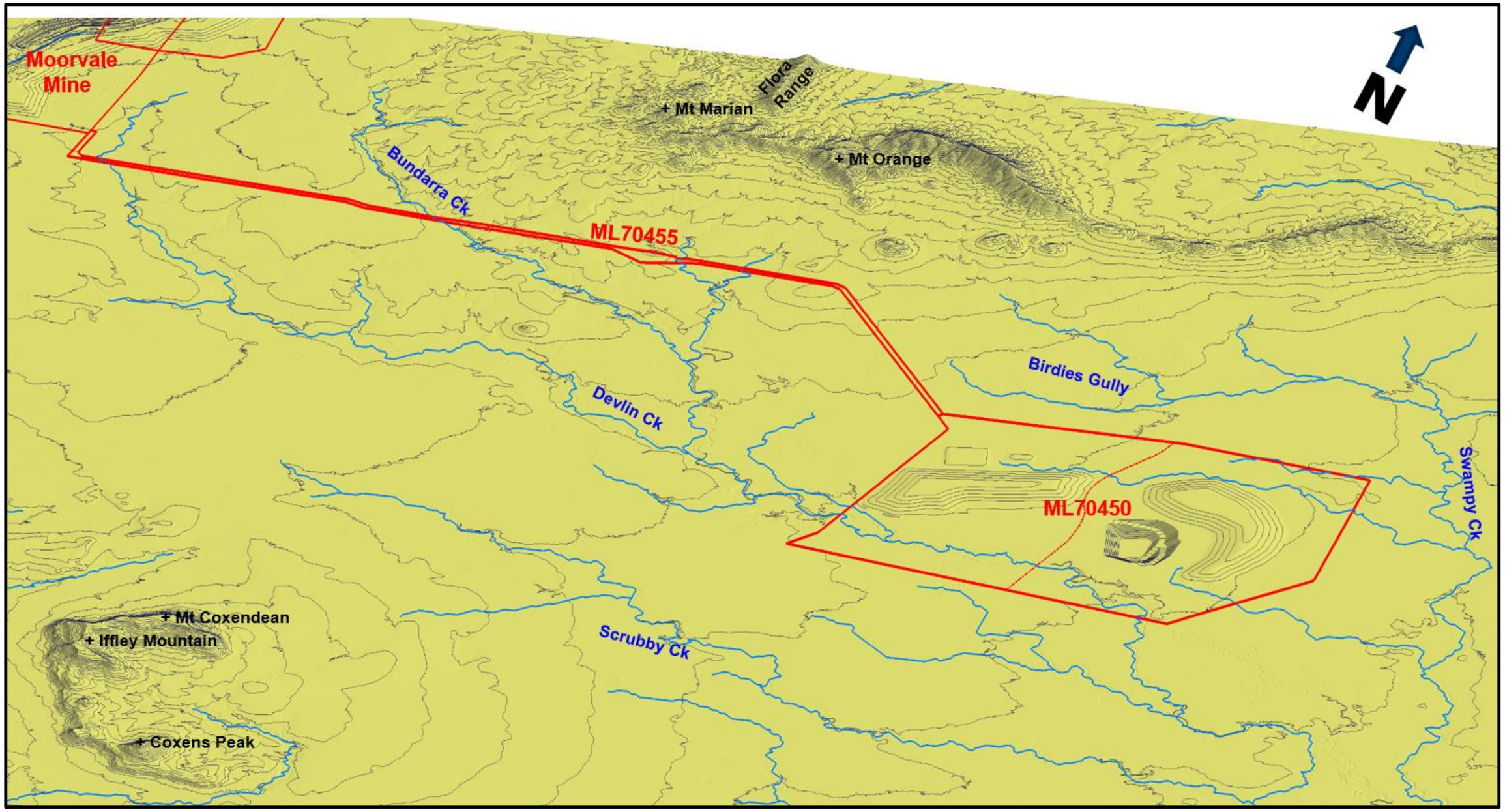

Figure 47 Final Landform - oblique view looking northwest

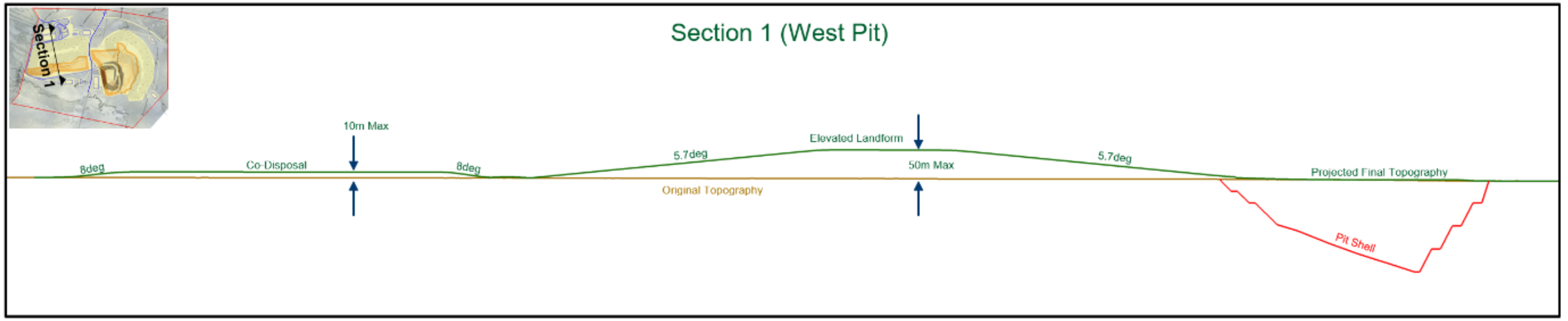

Figure 48 Cross Sections through West Pit

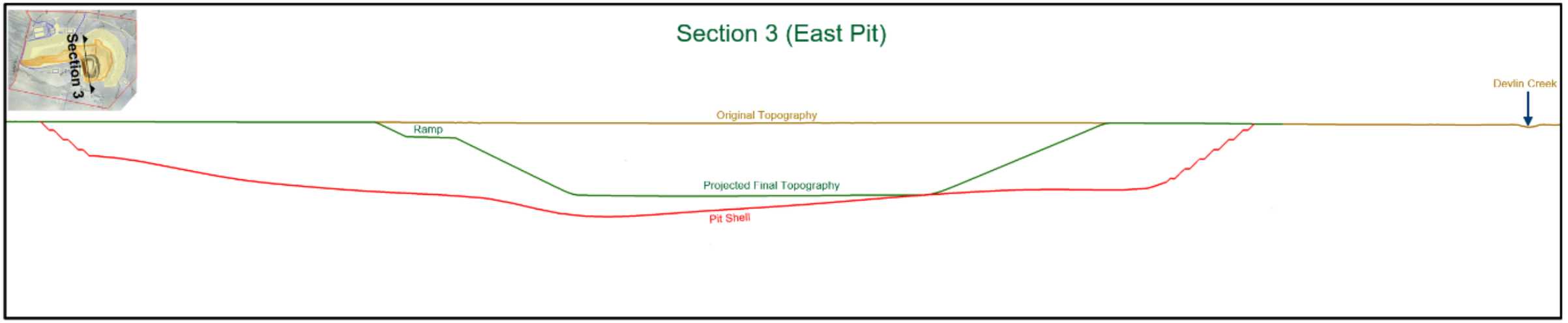

Figure 49 Cross Sections through East Pit

4.1.2 Rehabilitation Areas/Improvement Areas, PMLU/NUMA & Relevant Rehabilitation/Management Milestones

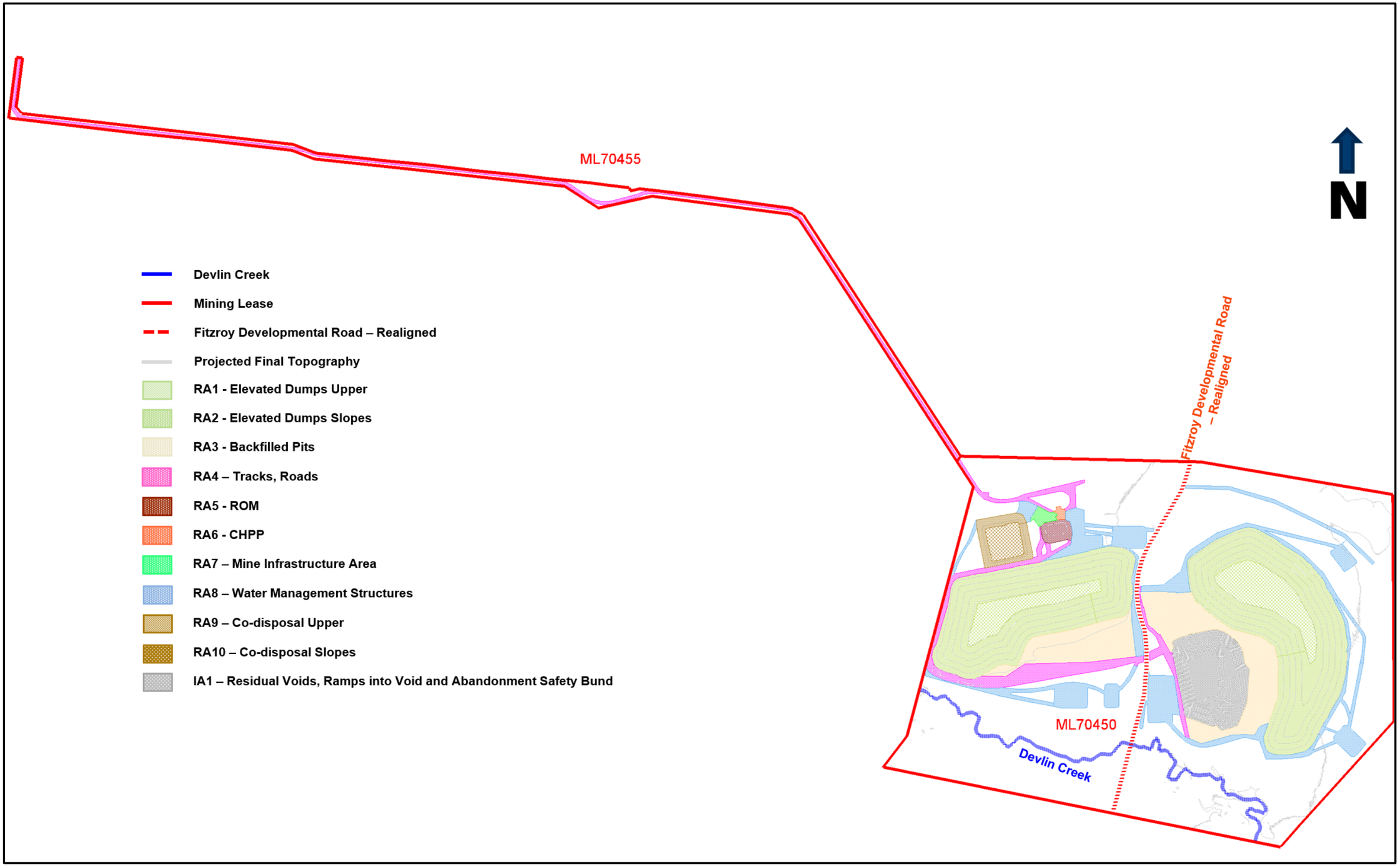

Figure 50 Rehabilitation Areas & Improvement Areas

Table 50 Rehabilitation Areas & Milestones

Rehabilitation Area	PMLU/NUMA	Rehabilitation/Management Milestone
RA1 -Elevated Overburden Dumps - Upper	Native Bushland	RM2, RM4, RM6, RM8, RM10 & RM11
RA2- Elevated Overburden Dumps - Slopes	Native Bushland	RM2, RM4, RM6, RM8, RM10 & RM11
RA3 - Backfilled Pits - Overburden Dumps	Native Bushland	RM2, RM4, RM6, RM8, RM10 & RM11
RA4 - Infrastructure Areas - Access Tracks and Haul Roads	Grazing	RM1, RM2, RM4, RM5, RM7 & RM9
RA5 - Infrastructure Areas - ROM	Grazing	RM1, RM2, RM4, RM5, RM7 & RM9
RA6 - Infrastructure Areas - CHPP General Area	Grazing	RM1, RM2, RM4, RM5, RM7 & RM9
RA7 - Infrastructure Areas - Mine Infrastructure Area	Grazing	RM1, RM2, RM4, RM5, RM7 & RM9
RA8 - Water Management Structures	Grazing	RM1, RM2, RM4, RM5, RM7 & RM9
RA9 - Elevated Landform Co-disposal - Upper	Native Bushland	RM1, RM2, RM3, RM4, RM6, RM8, RM10 & RM11
RA10 - Elevated Landform Co-disposal - Slopes	Native Bushland	RM1, RM2, RM3, RM4, RM6, RM8, RM10 & RM11
IA1 – Residual Voids, Ramps into Voids and Abandonment safety bund	NUMA	MM1 MM2 MM3

4.1.3 PMLU Rehabilitation Milestones and Criteria

Table 51 Rehabilitation Milestones and Criteria

Milestone reference	Rehabilitation milestone	Milestone criteria
RM1	Infrastructure decommissioning & removal	a). All services disconnected. Underground services will remain buried and surface points will be sealed b). All buildings either demolished and removed or relocated off site c). Concrete slabs and footings removed or buried within overburden dump final rehabilitation areas d). Sumps or damps that do not form part of final landform as sediment control structures will be dewatered and where applicable contaminated silt will be removed for licensed disposal e). Sealed asphalt roads, car parks and hardstand areas will have the asphalt removed for reuse or burial within overburden dump final rehabilitation areas and unsealed road, car parks and hardstands will have any contamination removed for licenced disposal f). Hydrocarbon and chemical storage areas will be removed and/or remediated by on-site treatment if required g). All carbonaceous material will be collected from haul roads and disposed in the co-disposal area or buried within the overburden dump final rehabilitation areas h). The contaminated land assessment report prepared by an AQP confirms that the land is not contaminated and is suitable for any use
RM2	Landform design, reshaping and final contouring, inclusive of drainage features	a). Stable landform and slope angles for out of pit overburden dumps areas as follows: outer batter slopes equal to or less than 5.7°and crest slope a maximum of 2.3° b). Stable landform and slope angles for Co-disposal elevated landform and ROM pads as follows: outer batter slopes equal to or less than 8° and crest slope a maximum of 2.3° c). Stable landform and slope angles for coal stockpiles and in pit overburden backfill flat to undulating with slopes equal to or less than 4.6° crest slope a maximum of 2.3° d). Stable landform and slope angles for infrastructure areas flat to undulating with slopes equal or less than 2.3° e). Maximum vertical height of out of pit overburden dumps elevated landforms up to 50m f). Maximum vertical height of Co-disposal elevated landform and ROM pad areas up to 18m g). All major earthworks completed h). Contour drains and rock lined drop structures installed as per appropriate design criteria i). Landforms such as the Co-disposal facility have been signed-off as constructed to design
RM3	Install cover system/cap	a). Cover installed over reject/coal stockpile surfaces (nominally 1m inert overburden)
RM4	Surface preparation (e.g. topsoil, fertiliser, amelioration agents, mulch or woody debris)	a). Topsoil spread to a minimum depth of 150mm b). Gypsum applied at rates determined by an AQP c). Cultivation and keying of topsoil to subsoil with suitable multi-type ripper and performed parallel to slope contours d). Addition of rock and/or log cover to assist erosion resistance of eventual vegetative ground cover
RM5	Revegetation (grazing)	a). Pasture seed applied in accordance with rehabilitation specification, i.e. seeding rate, seed composition and cultivation to incorporate seed into the uppermost layer of the growth media b). Seed mix contains a range of native and introduced grass and legume species consistent with surrounding pastural areas (as per seed mix table in PRC plan)
RM6	Revegetation & habitat development (native bushland)	a). Native seed applied in accordance with rehabilitation specification b). Seed mix contains a suitable range of native tree, shrub and grass species to achieve brigalow and eucalyptus woodland habitat type (as per seed mix table in PRC plan)
RM7	Achievement of surface requirements (grazing)	a). Species density and diversity achieved is consistent with the sown seed mix and surrounding pastural areas b). 80% of the area has a vegetative groundcover >70% for areas of low rock and logs, >50% for areas of high rock and log content c). Growth medium (surface 30cm) pH >5.5 and <9.5; Conductivity <1.0dS/m and ESP<15% d). Invasion of noxious weeds is no worse than surrounding areas

		e). Water control structures are either removed or free of active erosion and integrated into permanent landforms f). No severe erosion gullies and erosion rates are less than 40tonnes/ha/year g). pH and EC indicators for surface water runoff demonstrate the water quality is suitable for the receiving environment and are consistent with water quality indicators of the upstream reference site h). The NEPM assessment confirms areas are free of hazardous materials or have been rendered safe
RM8	Achievement of surface requirements (native bushland)	a). 80% of the area achieves species density and diversity that is greater than 60% of the reference sites and surrounding areas b). 80% of the area has a vegetative groundcover >70% for areas of low rock and logs, >50% for areas of high rock and log content c). Growth medium (surface 20cm) pH >5.5 and <9.5; Conductivity <1.0dS/m and ESP<15% d). Invasion of noxious weeds is no worse than the reference sites and surrounding areas e). Key invertebrate groups such as ants and soil faunal communities are re-establishing f). Bird, mammal, reptile and frog communities are becoming established in the rehabilitated sites g). Evidence of food and shelter opportunities for invertebrate and vertebrate species h). Water control structures are either removed or free of active erosion and integrated into permanent landforms i). No severe erosion gullies (<4m² in cross section) and erosion rates are less than 40tonnes/ha/year j). pH and EC indicators for surface water runoff demonstrate the water quality is suitable for the receiving environment and are consistent with water quality indicators of the upstream reference site k). The NEPM assessment confirms areas are free of hazardous materials or have been rendered safe
RM9	Achievement of a stable condition for the land described as a post-mining land use of grazing	a). Rehabilitation has been certified by an AQP to be: • structurally stable (FoS ≥ 1.5) and slopes are designed in accordance with EA criteria • erosionally stable: no severe erosion gullies (<4m² in cross section) and erosion rates are less than 40tonnes/ha/year and groundcover established and meets criteria in RM7 b). pH and EC indicators for surface water runoff demonstrate the water quality is suitable for the receiving environment and are consistent with water quality indicators of the upstream reference site c). The rehabilitated land meets Class 4 land suitability for grazing using the Guidelines for agricultural land evaluation in Queensland (2nd edn) (DSITI & DNRM, 2015).
RM10	Achievement of a stable condition for the land described as a post-mining land use of native bushland	a). Rehabilitation has been certified by an AQP to be: • structurally stable (FoS ≥ 1.5) and slopes and dump heights are designed in accordance with EA criteria • erosionally stable: no severe erosion gullies (<4m² in cross section) and erosion rates are less than 40tonnes/ha/year and groundcover established and meets criteria in RM9 b). pH and EC indicators for surface water runoff demonstrate the water quality is suitable for the receiving environment and are consistent with water quality indicators of the upstream reference site c). The established native ecosystem has a similar composition to the previous existing woodland ecological communities comprising RE 11.4.8, RE 11.4.9 and RE 11.5.3 and provides habitat opportunities for invertebrate and vertebrate species
RM11	Install fencing or other infrastructure to support the PMLU	a). Fencing / bunding installed to exclude stock

4.1.4 NUMA Improvement Availability and Milestones

Table 52 Management Milestones and Criteria

Milestone reference	Management milestone	Milestone criteria
MM1	Highwall treatment	a). Highwall crest battered back where required to achieve a stable slope angle as specified by an AQP (geotechnical engineer)
MM2	Achievement of landform design and surface requirements	a). Highwall as mined weathered average slope angle of 1V and 0.7H (55°) and low wall as backfilled at angle of repose at 1V to 1.35H (36°) b). Abandonment safety bund setback distance is in accordance with calculated geotechnical factor of safety c). Abandonment safety bund constructed of competent rock and to geometry specified to prevent traversing by vehicles d). Residual void maximum depth of 150m

		e). Residual void outside of PMF f). Abandonment safety bund and ramp into voids revegetated with pasture seed
MM3	Achievement of sufficient improvement not to cause environmental harm and that will be safe and structurally stable	a). Access to highwall, low wall and ramp batter is restricted by physical barriers and fencing is erected on the outside of the abandonment safety bund to specification (nominally five strand barbed stock fencing) b). Safety signage (design in accordance with Australian Standard) is erected at specified intervals along the fence line (nominally one sign every 100m) c). Certification from an AQP that the level of final void water is significantly below the crest of the pit to avoid the risk of overtopping and causing environmental harm d). Certification from an AQP that the water quality (pH & EC) in the final void does not show a statistically significant change when compared to background data and will not cause environmental harm to the surrounding environment

4.2 Attachment - Codrilla EA EPML00916813

4.3 Attachment - EIS Assessment Report for the Codrilla Coal Mine Project

4.4 Attachment – Supplementary EIS Groundwater Report (AGE Consultants – April 2011)

4.5 Attachment - EIS Soil, Overburden and Land Use Report (GSSE – Sept 2010)

4.6 Attachment - Supplementary EIS Surface Water Report (WRM - 10 June 2011)

4.7 Attachment - Updated Feasibility Level Geotechnical Study for Codrilla (IMC – 23 March 2012)

4.8 Attachment - Millennium Mine Residual Void Slope Stability Study (GCS - August 2017)