PROJECT CHINA STONE

Project Description 4

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4 PROJECT DESCRIPTION

4.1 INTRODUCTION

This section describes Project China Stone (the project), including the proposed mining activities and mine site infrastructure. Key project alternatives and the project justification are also discussed in this section.

4.2 PROJECT OVERVIEW

The project involves the construction and operation of a large-scale coal mine on a greenfield site in Central Queensland at the northern end of the Galilee Basin (Figure 4-1). The mine will produce up to approximately 55 million tonnes per annum (Mtpa) of Run of Mine (ROM) coal. This equates to approximately 38 Mtpa of thermal coal for the export market. The mine life will be in the order of 50 years.

Coal will be mined using both open cut and underground mining methods (Figure 4-2). Open cut mining operations will involve multiple draglines and truck and shovel pre-stripping. Underground mining will involve up to three operating longwalls. Coal will be washed and processed on site and product coal will be transported from site by rail.

The majority of the mine infrastructure will be located to the east of the open cut mining area (Figure 4-2). It will include Coal Handling and Preparation Plants (CHPPs), stockpiles, conveyors, rail loop and train loading facilities, workshops, dams and a Tailings Storage Facility (TSF) (Figure 4-2). A workforce accommodation village and private airstrip will also be located in the eastern part of the project site.

The project includes the construction and operation of an on-site power station and associated Power Station Waste Storage Facility (PSWSF). The power station will be used for mine power supply and will utilise coal rejects from the mine as feed coal.

The scope of the Environmental Impact Statement (EIS) is limited to the mine site activities and does not include off-lease infrastructure that will be required for the project. Off-lease infrastructure will include port capacity, rail connection to port, mine site access road connection and raw water supply. These will subject to separate environmental impact assessments and approvals. The current preferred option and status of each off-lease infrastructure component are discussed in Section 4.13.

The EIS refers to Project Years, rather than calendar years, with Project Year 1 being the first year of mine construction. Based on current planning, and subject to gaining the necessary project approvals, Project Year 1 is anticipated to be 2016. It is anticipated that open cut coal production will commence in Project Year 3 (2018) after the removal of the initial box cut overburden. Longwall mining will also commence in Project Year 3 following the construction of underground mine access drifts and initial underground mine development works.

4.3 PROJECT SITE

4.3.1 Location

The project site is the combined area of the proposed mining leases and covers an area of approximately 20,000 ha. It is remote, being located approximately 270 km south of Townsville, and 300 km west of Mackay, in Central Queensland (Figure 4-1). Current access to the site is via the Gregory Developmental Road and approximately 130 km of unsealed local government roads (Figure 4-3). The closest townships to the site are Charters Towers, approximately 285 km by road to the north, and Clermont which is approximately 260 km by road to the south-east (Figure 4-1).

The project site is at the north-western limit of the Isaac Local Government Area and adjacent to the southern boundary of the Charters Towers Local Government Area (Figure 4-3).

The proposed Carmichael Coal Mine site adjoins the south-eastern corner of the project site (Figure 4-3).

4.3.2 Natural Features

The south-eastern portion of the project site consists of low-lying, generally flat to undulating woodlands. A well vegetated ridgeline, known as 'Darkies Range', runs in a roughly north to south alignment through the western portion of the site (Figure 4-4).

The project site is located in the Belyando Sub-Basin of the Burdekin Basin. The site is at the head of the local creek catchments and site drainage is therefore highly ephemeral. There are no major waterways traversing the site. Darkies Range forms a catchment divide at the western boundary of the site. The site drains generally to the east through a network of gullies in the steeper areas in the west which transition to broad shallow drainage lines in the flatter areas in the east (Figure 4-5). Site drainage is discussed in detail in Section 13 – Surface Water.

4.3.3 Land Ownership and Land Use

The project site is located within three parcels of crown land that are leased by three separate landholders (Figure 5-4). A stock route traverses the southern part of the project site from south-west to north-east. There are no easements across the project site.

The project site is currently used for cattle grazing and coal exploration. Government mapping shows that there are no strategic cropping areas on the project site. Built infrastructure on the site is limited to stock fencing, unsealed access tracks and stock watering dams.

Section 5 – Land Use provides a more detailed description of the land ownership and use within the project site. The proponent has commenced discussions with the relevant landholders in relation to gaining access to the land for the project.

4.4 COAL, MINERAL AND PETROLEUM TENEMENTS

The project Mining Lease Application areas (MLAs) (MLA 70514, MLA 70515, MLA 70516, MLA 70517 and MLA 70518) were lodged with the Department of Natural Resources and Mines on 3 February 2014.

The MLAs are within EPC 987 which is held by the proponent. The proponent also holds a Mineral Development Licence Application (MDLA 516) over part of the project site. The MDLA was lodged with the Department of Natural Resources and Mines on 10 October 2013.

Table 4-1 lists the coal and petroleum tenements within the project site and Table 4-2 lists the adjoining tenements. There are no mineral tenements within or adjoining the project site.

The exploration program has determined that the coal seams within the project site are essentially devoid of gas. The holders of the overlapping Exploration Permits for Petroleum (ATP 744 and ATP 1044) confirmed in writing, prior to the lodgement of the project MLAs, that they have no objection to the MLAs.

Table 4-1 Coal and Petroleum Tenements within the Project Site

TENEMENT	TENEMENT HOLDER	EIS FIGURE REFERENCE
COAL TENEMENTS		
Mining Lease Applications (MLA)		
MLA 70518	MacMines Austasia Pty Ltd	Figure 4-6
MLA 70517	MacMines Austasia Pty Ltd	
MLA 70516	MacMines Austasia Pty Ltd	
MLA 70515	MacMines Austasia Pty Ltd	
MLA 70514	MacMines Austasia Pty Ltd	
Mineral Development Licence Applications (MDLA)		
MDLA 516	MacMines Austasia Pty Ltd	Figure 4-6
Exploration Permits for Coal (EPC)		
EPC 987	MacMines Austasia Pty Ltd	Figure 4-7
PETROLEUM TENEMENTS		
Exploration Permits for Petroleum (ATP)		
ATP 744	Comet Ridge Ltd	Figure 4-8
ATP 1044	Queensland Energy Resources Ltd	

Table 4-2 Adjoining Coal Tenements

TENEMENT	TENEMENT HOLDER	EIS FIGURE REFERENCE
MLA 70506	Adani Mining Pty Ltd	Figure 4-6
MLA 70489	Waratah Coal Pty Ltd	
MDLA 485	Waratah Coal Pty Ltd	
EPC 926	Vale Coal Exploration Pty Ltd	Figure 4-7
EPC 1483	Matilda Coal Pty Ltd	
EPC 1663	MacMines North Pty Ltd	
EPC 2166	Spinifex Rural Management Pty Ltd	
EPC 1080	Waratah Coal Pty Ltd	
EPC 1105	Waratah Coal Pty Ltd	
EPC 1288	Waratah Coal Pty Ltd	

4.5 GEOLOGY AND RESOURCE UTILISATION

The proponent has undertaken detailed geological investigations related to the project, including detailed assessment of recent and historic exploration geological data. The key geological information relevant to the EIS Terms of Reference is described in this section.

4.5.1 Regional Geology

The regional geology comprises a sequence of three sedimentary geological basins overlying a stable tectonic basement. These basins comprise, from oldest to youngest, the Drummond Basin, the Galilee Basin and the Eromanga Basin. The eastern margins of these basins outcrop in a north-south orientated arc across central Queensland and regionally dip to the west.

The Drummond Basin sediments are seen in outcrops east of the Galilee Basin. The Drummond Basin was laid down during Late Devonian to Early Carboniferous period. It was subjected to deformation at the end of the Early Carboniferous period when the adjacent metamorphic Anakie Inlier Formation was uplifted causing the basin to be folded. The eastern part of the Drummond Basin was also uplifted along with the Anakie Inlier. Together they formed an upland region which, in the Late Carboniferous, started to shed material into the Galilee Basin to the west.

The Galilee Basin evolved during the Late Carboniferous to Early Permian period and comprised three main depocentres, namely the:

- Lovelle Depression in the north-west;
- Koburra Trough in the north-east; and
- Powell Depression in the south.

Sedimentation was not continuous across the Galilee Basin, with intervals of compression, uplift and erosion marked by hiatus. Deposition was initially through quartz-rich braided streams in the Koburra Trough (the deepest depocentre) and extended to other shallower depocentres in the Early Permian. Early Permian sequences in the western parts of the Koburra Trough and Lovelle Depression were predominantly the result of fluvial and lacustrine deposition. Volcanism at this time generated volcano-lithic strata and tuffs in Early Permian formations.

At the end of the Early Permian period, crustal shortening due to east west compressional tectonics resulted in reverse faulting and uplift.

Accelerated erosion following tectonic uplift produced the basin-wide Middle Permian unconformity. A period of thermal relaxation subsidence combined with crustal loading of the adjacent Bowen Basin during late Permian to Middle Triassic deposited extensive sedimentary sequences throughout the basin. During Late Permian the coal bearing Betts Creek Beds were deposited in the north of the Galilee Basin, while the fluvio-deltaic, coastal plain and shallow marine sequences including the Colinlea Sandstone and Bandanna Formations were deposited in the south of the Galilee Basin. The Early Triassic Rewan Formation sequences were deposited by westerly to south westerly drainage systems.

Further uplift was followed by deposition of the quartz-rich Clematis Sandstone in westerly flowing braided streams. This formation was overlain by basin-wide deposition of the lacustrine and fluvial sequences that formed the Moolayember Formation.

Compressional tectonics from the mid-Triassic Hunter-Bowen Orogeny ceased subsidence, curtailed deposition and tilted the basin down to the south-west prior to deposition of the more recent Eromanga Basin. The Galilee Basin is almost entirely unconformably overlain by the Jurassic-Cretaceous Eromanga Basin. Only along the eastern margin of the Galilee Basin are Permo-Triassic age rocks exposed in a long, narrow and gently curved belt. Maximum known stratigraphic thickness of the Galilee Basin is 2,820 m and the basin is divided into northern and southern parts by the east-west trending Barcaldine Ridge located at approximately 24 degrees south.

Deposition in the Galilee Basin ceased at the end of Triassic, at which time slight erosion and uplift occurred. The Early to Late Jurassic Ronlow Beds of the Eromanga Basin represent a continuation of fluvial deposition. The Ronlow Beds are a marginal facies of the continental sequence of the Eromanga Basin. The Early Cretaceous marked the first period of sea inundation in the region since Early Carboniferous, and formed the Wallumbilla Formation which conformably overlies the Ronlow Beds. Deposition in the Eromanga Basin ceased in the late Cretaceous period.

The stratigraphic succession of the Galilee Basin is partly related to stratigraphic successions in the Cooper and Bowen Basins, with each basin having experienced a hiatus during some part of the Middle Permian period.

In the north of the Galilee Basin, major coal deposition occurred during the Early Permian period in the Joe Joe Group. In the Late Permian period major coal deposition occurred in the Betts Creek Beds, and the regional correlatives in the south of the Galilee Basin, the Colinlea Sandstone and Bandanna Formation. The boundary between the late Permian strata correlatives in the Northern and Southern Galilee Basin is taken at the Barcaldine ridge around 24 degrees south.

Regionally, a thin veneer of more recent Tertiary sediments typically overlies these basins.

Figure 4-9 shows a cross-section of the regional geology in the vicinity of the project site.

4.5.2 Exploration History

Exploration drilling has targeted the Late Permian, coal bearing Betts Creek Beds.

Historical Exploration

The first coal exploration to take place in the Galilee Basin occurred in 1920 near Pentland. In the early 1970s, the then Queensland Mines Department commenced a reconnaissance drilling program along the eastern margin of the Galilee Basin as part of a state-wide coal exploration program. As part of this program, five holes were drilled just to the east of the project site. There was little exploration in the Galilee Basin from the early 1980s until recently.

Recent Exploration

Following the grant of EPC 987 to the proponent in 2006, an exploration drilling program was undertaken from July to October 2008 with twelve core holes drilled. Further exploration was undertaken in 2010 with eighteen core holes drilled.

Between 2011 and 2014 a further 130 open and cored holes and 32 groundwater monitoring bore holes were drilled. This involved a total of approximately 52,000 m of drilling in the southern block of EPC 987, the majority of which was within the project site.

4.5.3 Local Geology

This section describes the stratigraphy, geomorphology and geological structures of the project site and surrounding area.

Stratigraphy

The local stratigraphy is summarised in Table 4-3. The project site is underlain by Galilee Basin and Drummond Basin units. The underlying Drummond Basin comprises Permian and Carboniferous sediments and outcrops approximately 40 km east of the project site. The Eromanga Basin subcrops west of the project site and does not underlie the project site.

Table 4-3 Summary of Local Stratigraphy

SEDIMENTARY BASIN	AGE	FORMATION	PROXIMITY TO PROJECT	REGIONAL CORRELATIONS
-	Quaternary	Quaternary Sediments	Present in surrounding area	-
-	Tertiary	Tertiary Sediments	Present within project site	-
Eromanga	Jurassic	Ronlow Beds	Subcrops west of project site	-
Galilee	Triassic	Moolyamber Formation	Subcrops west of project site	-
		Clematis Sandstone	Present within project site	-
		Rewan Formation	Present within project site	-
	Permian (Late)	Betts Creek Beds	Present within project site	Bandana Formation Colinlea Sandstone
	Permian (Early)	Joe Joe Group	Present within project site	-
Drummond	Permian (Early) / Carboniferous	Basement formations of the Drummond Basin		

In addition to the units presented in Table 4-3, published regional geological information indicates the presence of Warang Sandstone and Dunda Beds in the vicinity of the project site. Clarification with the former Department of Mines and Energy and the Geological Survey of Queensland (pers. comm. Dr J McKellar and Ms S Edwards) confirms that neither is present in the vicinity of the project site; the former being local to the Pentland area of the Galilee Basin, and the latter being present 20 km to the south-east of the project site.

The stratigraphy of the project site is shown on Figure 4-10. Figure 4-11 shows the surface geology of the main stratigraphic units underlying the recent Tertiary Sediments. Quaternary sediments are localised to present day drainage lines.

As shown on Figure 4-10, the stratigraphy of the project site comprises:

- A veneer of highly weathered Tertiary sediments and localised fluvial Quaternary sediments;
- Triassic sediments of the Clematis Sandstone and Rewan Formation; and
- Permian Betts Creek Beds including coal seams and the underlying sediments of the Joe Joe Group.

The stratigraphic units present at the project site and in the surrounding area are described in detail in the following sections.

Quaternary Sediments

Published regional geological mapping indicates the presence of fluvial sediments associated with present day drainage lines (Figure 4-11). The distribution of these sediments in the vicinity of the project site was further investigated through targeted groundwater drilling and stream geomorphology assessments. These assessments are discussed in the *Groundwater Report* (Appendix I) and Section 13 – Surface Water, respectively.

These studies confirmed that the minor drainage lines and overland flowpaths present within the project site and downstream catchment are characterised by rock channels or exposed Tertiary materials. Extensive, deep alluvial deposits and associated shallow groundwater are therefore absent from the project site and surrounding area. Fluvial sediments present in the vicinity of the project site are limited to thin (less than 1 m) patches of mud and gravel.

Tertiary Sediments

The Tertiary sediments comprise claystone and weakly indurated sandstone and siltstone. This unit is a highly weathered, low to moderate permeability detrital deposit that covers much of the low-lying areas either side of the Darkies Range ridgeline. These sediments typically increase in thickness with distance from Darkies Range and within the project site range from zero to 60 m. The Tertiary sediments are thin or absent on the elevated ridge of Darkies Range.

Ronlow Beds

The Ronlow Beds subcrop approximately 26 km west of the project site and do not underlie the project site. These deposits are present to the west of the project site and represent the eastern limit of the Eromanga Basin.

The Ronlow Beds are fluvial deposits of predominantly quartzose sandstone with minor claystone and siltstone. Rowlow Beds are up to 200 m thick. Sandstones are poorly consolidated, off-white to clear and occasionally stained red and orange, with a medium to coarse-grain. They also contain an abundant clay and limonitic matrix. Claystone beds are off white, brown and green with a waxy to fissile texture and locally grade to siltstone.

Triassic Strata

Within the project site and surrounding region, Triassic strata progressively thin eastward as underlying Permian coal seams emerge and subcrop against the Tertiary Sediments. Relevant Triassic strata are described as follows:

Moolayember Formation

The Moolayember Formation is the youngest Triassic formation in the vicinity of the project and comprises mudstone, siltstone and lithic sandstone. This unit subcrops to the west of Darkies Range within 7 km of the project site and dips to the west, reaching thicknesses of over 600 m. The subcropping unit is covered by Tertiary sediments. The Moolayember Formation sits conformably above the Clematis Sandstone.

Clematis Sandstone

The Clematis Sandstone is a massive sandstone unit, with minor interbeds of siltstone and claystone. The sandstone is mostly light grey to off-white with quartzose composition and kaolinitic matrix. Siltstone and claystone are grey and red brown.

This unit outcrops to form the western slopes of Darkies Range where is it is up to 200 m thick along the ridgeline. In this area, the formation is deeply weathered and there are prominent laterite horizons with a red and white appearance and high iron content.

The Clematis Sandstone sits unconformably on Rewan Formation sediments within the project site.

Rewan Formation

The Rewan Formation is a thinly interbedded sequence of siltstone, claystone and minor fine grained sandstone. This unit is predominantly a greenish-grey colour with minor red and brown coloured horizons. It has a low visual porosity.

This unit outcrops along the eastern margin of Darkies Range where the Clematis Sandstone has been removed by erosion. This unit has also been subject to erosion and disconformably overlies the Betts Creek Beds. South of the project site, the upper Rewan Group transitions to the equivalent Dunda Beds. This transition is defined by a progressive increase in sandstone content.

Permian Strata

Betts Creek Beds

The Betts Creek Beds sub-crop under the Tertiary sediments immediately east of Darkies Range and dip gently towards the west. The sub-cropping Betts Creek Beds are deeply weathered and the coal seams are typically absent within this weathered profile. As this unit dips under Darkies Range, the depth increases to between approximately 200 m and 450 m at the western extent of the project site.

The Betts Creek Beds typically consists of light grey, fine to very coarse grained, sublabile to quartzose, sandstone, with interbedded siltstone, mudstone, coal and shale in places. The Betts Creek Beds contains seven major coal seams at the project site. In stratigraphic order from top to base these are the A to G Seams. The overall stratigraphic thickness of the A to G Seam profile ranges from 90 m in the north of the project site to 130 m in the south of the project site, and contains approximately 35 m of coal.

A detailed description of the coal seam and interburden stratigraphy in the Betts Creek Beds is provided in Table 4-4.

Table 4-4 Detailed Summary of Coal Seam Geology Units

UNIT / HORIZON	THICKNESS	DESCRIPTION
A Upper Seam	2.5 - 6.5 m	Plies consist of A Upper 1 (AU1) to AU4. AU1 and AU2 plies join together in the central and northern areas of the project site.
Interburden Unit	Generally < 10 m thick above the A Lower Seam, increasing in the south	Interbedded sandstone and siltstone which thickens considerably in the south trending to coarse grain sandstone.
A Lower Seam	14 m	Mostly dull and stony coal with tuff and claystone partings. Typical density of plies is 1.5 to 1.6 g/cm^3.
Interburden Unit	0 – 50 m	Increases as upper ply splits from the main A/B Seam package. Comprises massive fine to coarse grained sandstone with minor siltstone bands.
B Seam	6 - 7 m	Plies consist of B1 to B3. Package is heavily banded with tuff and claystone. Density ranges from 1.6 to 1.8 g/cm^3. B1 occasionally pinches out and B2 and B3 vary in thickness.
Interburden Unit	15 – 30 m	Interbedded sandstone and siltstone with minor claystone. The immediate floor of B seam is claystone while roof of C Seam (C3 ply) is weak carbonaceous claystone and tuff.
C Seam	0 – 5 m	Six plies. Uppermost C6 in northern section of site and 0.8 m thick emerging from a carbonaceous zone between B1 and C5. C5 ply is tuff banded.
Interburden Unit	10 – 20 m	Contains thin basal plies (C1 and C2) of C Seam, each 1 m or less thick. Unit comprises interbedded sandstone and siltstone becoming predominantly siltstone with sporadic claystone in roof of D Seam. C Seam floor comprises claystone and siltstone.

UNIT / HORIZON	THICKNESS	DESCRIPTION
D Seam	Variable	Three plies. In the north is typically 0-10 m below C1/C2 and remains approximately 10 m below C1 in the south. D2/D1 is 1.8 m thick in the south with a 0.15 m tuff band separating plies. D1 is consistently 1.5 m thick with an average density of 1.4 g/cm^3. D2 remains approximately 0.2 m thick above the tuff parting.
Interburden Unit	5 – 8 m	Comprises interbedded sandstone and siltstone with minor claystone bands. Claystone or siltstone is typical in the immediate roof and floor of D and E Seams.
E Seam	Variable	Two plies. E1 is consistently 1 to 1.2 m thick throughout the site and is separated from E2 by a claystone parting between 0.1 and 0.4 m thick in the central and southern areas. The parting improves to a stony coal band in the northern area uniting the E1/E2 plies into a 1.2 m to 1.5 m seam.
Interburden Unit	5 – 8 m	Comprises fine to coarse grained quartzose sandstone coarsening downwards. E Seam floor usually consists of siltstone, while F Seam roof is medium to coarse sandstone.
F Seam	Variable	Two plies in central area of southern section with approximately 0.6 m parting. Otherwise appears as a 1.4 to 1.8 m seam with an average density of 1.5 g/cm^3. Thickness ranges from 1.2 to 2 m in the northern section.
Interburden Unit	10 – 15 m	Comprises medium to coarse grained sandstone. The F Seam floor and G Seam roof are typically sandstone and on occasion G Seam roof can be conglomeratic. G Seam floor consists of siltstone and claystone.
G Seam	Variable	The G Seam is not laterally consistent across the site and where absent is replaced by coarse sandstone. In the south is approximately 2 m thick with a density range of 1.4 to 1.7 g/cm^3. In the lower north is present in two plies with a thickness of 3 m with 0.8 m parting.

Joe Joe Group

The Joe Joe Group comprises conglomerate, lithic sandstone, siltstone, minor mudstone and coal. The Joe Joe Group is the base unit of the Galilee Basin and underlies the Betts Creek Beds. The Joe Joe Group subcrops in the east of the project site under the Tertiary sediments. There is a localised outcropping of this unit in the south of the project site.

Geomorphology

Darkies Range, a topographic high runs approximately north-south and is present in the western portion of the project site. The range is primarily composed of Triassic Clematis Sandstone which extends beyond the western boundary of the project site (Figure 4-11). Where the Clematis Sandstone has eroded on the eastern slopes of Darkies Range, the underling Rewan Formation is exposed.

The depth to the top of the uppermost A Seam at the project site increases towards the west and Darkies Range, as Triassic strata increases the thickness of overburden.

Palaeontology

Significant fossils are unlikely to be found in the mining area. Permian-age rocks of the Galilee Basin and other contemporaneous basins in eastern Australia routinely contain vegetation fossils and microfauna fossils, however these are not considered to be unique or rare. Although macrofauna fossil assemblages have been identified (rarely) in Permian-age basins in Australia, the nature of the project mining operations are not conducive to unearthing macrofauna fossil assemblages, or any other fossil assemblages. However, should fossils of palaeontological significance be discovered during mining, the immediate site of the fossil find will be isolated and the Queensland Museum notified.

Geological Structures and Features

Within the project site, the coal seams dip gently south-west at about 3º and increase to 6º close to the southern boundary. The current structural interpretation makes use of data from a number of sources, including historic exploration data, targeted exploration drilling within the project site, and data from surrounding exploration programs.

A normal fault has been identified within the Triassic and Permian units in the northern section of the project site, running in a roughly north-south alignment. The down-thrown side of the fault is to the east.

The fault opens and closes at the southern and northern extremities with 100 m maximum displacement in the centre. The fault breaks the continuity of the Clematis Sandstone and on the downthrown eastern side of the fault, places this unit in direct contact with the Rewan Formation that lies on the western side of the fault.

4.5.4 Resource Utilisation

Exploration drilling has identified the A, B, C and D seams as the principal exploration and mining target for the project. While a number of additional seams are present within the project site, drilling to date has indicated that these are not economic to mine.

The assessment of the project's coal resources and reserves was conducted in accordance with the JORC 2012 Code and was generally in accordance with the principles outlined in the *Australian Guidelines for the Estimation and Classification of Coal Resources* (Coalfields Geology Council of NSW and QLD Resources Council 2014). A summary of the current resource estimate is provided in Table 4-5.

Table 4-5 Coal Resource Summary (Millions of Tonnes)

MINING AREA	MEASURED	INDICATED	INFERRED	TOTAL
MLA 70514	-	-	-	-
MLA 70515	210	440	440	1,090
MLA 70516	620	530	490	1,640
MLA 70517	-	260	1,300	1,560
MLA 70518	-	-	1,300	1,300
Total	**830**	**1,230**	**3,530**	**5,590**

4.5.5 Resource Recovery and Potential for Sterilisation of Resources

The project mining methods and mine designs have been selected and developed to ensure optimum recovery of the target coal resources. The proposed mining operations will not result in the sterilisation of any economic resources. The E, F and G Seams are not proposed to be mined as part of the project. However, these seams have potential for future underground mining subject to further geological exploration, feasibility assessment and approvals.

4.6 MINING

The project will target the A, B, C and D seams in the Permian coal measures. The coal will be extracted using both open cut and underground mining methods. An overview of the two methods is provided in the following sections.

4.6.1 Open Cut Mining

Overview

The A, B and C seams will be targeted in the open cut mine. The C seam will only be mined in the northern end of the open cut. At the southern end of the open cut the C seam will be extracted by the Southern Underground (as discussed in Section 4.6.2). The open cut mine will have a peak ROM production in the order of 32 Mtpa and a mine life in the order of 30 years.

The proposed open cut mine plan and mining schedule are shown on Figures 4-12 to 4-15. Overburden removal in the open cut mine will be via multiple draglines with truck and shovel pre-strip. Coal will be mined using surface miners supported by truck and shovel fleets.

The open cut mining operations will involve the following activities:

- Clearing of any vegetation;
- Stripping and stockpiling of topsoil;
- Drilling and blasting of pre-strip overburden, where necessary;
- Removing the pre-strip overburden using truck and shovel fleets;
- Drilling and blasting of dragline overburden;
- Overburden removal by draglines;
- Coal mining using surface miners and excavators; and
- Progressive rehabilitation of overburden emplacement areas.

A schematic of the open cut mining operations is shown in Figure 4-17.

Coal mined from the open cut pits will be transported to the CHPP ROM coal loading station by haul truck. ROM coal will be crushed and sized after loading and then transported to the raw coal stockpiles or CHPP by overland conveyor. In-pit coal crushing and conveying systems are also being considered as an alternative to minimise haulage of coal by truck.

Open Cut Mine Layout

The open cut mine layout and mining schedule is illustrated in Figures 4-12 to 4-16. Initial boxcuts will be constructed at the eastern extent of the open cut pits, with mining progressing down-dip from east to west. Initial overburden will be stored in out-of-pit overburden emplacement areas to the east of the open cut pits. Once the open cut pits are developed, overburden will be placed in-pit. The overburden emplacements will be rehabilitated progressively over the life of the mine. Rehabilitation is discussed in detail in Section 8 – Rehabilitation.

Four main ramps will provide access from the surface to the pit floor. When fully developed, the open cut pits will be approximately 275 m to 410 m wide and 330 m to 400 m deep, with a total length of approximately 8.7 km.

4.6.2 Longwall Mining

Overview of Longwall Mining

A longwall is a complex system of mining equipment that incorporates hydraulic roof supports (called 'shields'), coal cutting and coal transport equipment. Longwall mining involves extracting rectangular panels of coal, typically around 150 to 400 m wide, up to 7 km long and 2 to 5 m thick (Figure 4-18). Longwall panels are defined by access roadways that are constructed around the perimeter of each longwall panel. These roadways provide access for the installation of the longwall mining equipment, mine workers and equipment and services.

The longwall mining equipment (coal shearer) travels back and forth across the width of the longwall panel, starting at the furthest point progressively removing the coal from the panel back to the main headings (Figure 4-18). The shearer cuts the coal from the coalface on each pass and delivers the coal to a face conveyor that runs along the full length of the longwall (Figure 4-19). The face conveyor transports the coal from the coalface to another conveyor in an access roadway. Coal is then transported to the surface via a series of connecting underground conveyors.

The roof at the coalface is held up by a series of hydraulic roof supports (Figure 4-19). The supported section of roof provides space for the shearer, face conveyor and man access. After each shear of coal is removed, the face conveyor, hydraulic roof supports and the shearer are moved forward.

The roof immediately above the mined seam collapses into the void (called a 'goaf') that is left as the roof supports progressively retreat through the panel. As the roof material collapses into the goaf behind the roof supports, the fracturing and settlement of the rocks progresses through the overlying strata and results in the sagging and bending of the near surface rocks (Figure 4-19). This can result in the progressive formation of gentle trough-like depressions on the surface relative to the natural topography (called subsidence). The subsidence effect moves across the ground at approximately the same speed as the advance of the mining face, which is typically up to 100 m per week. The majority of subsidence at a point on the surface occurs within three months of undermining and all subsidence is generally complete within 12 months. Subsidence is discussed further in the subsidence assessment undertaken for the project (*Subsidence Report*, Appendix A) and Section 6 – Subsidence.

Project Longwall Mining Operations

The project includes up to three longwalls operating in two underground mining areas, the Southern Underground and Northern Underground (Figure 4-2). The Southern Underground will extract the C seam below the southern end of the open cut mine (Figure 4-20). Mining in areas of the Southern Underground will be completed prior to any open cut mining in the area above (Figures 4-12 to 4-15). The Southern Underground will have a peak ROM production of up to 8 Mtpa and a mine life in the order of 13 years.

The Northern Underground will involve two longwalls extracting the D seam and A seam in the northern section of the project site (Figures 4-21 and 4-22). The Northern Underground will have a peak production of up to 15 Mtpa and a mine life in the order of 47 years.

Longwall Layouts

The conceptual longwall layouts are described in the following sections. Modifications to the underground mine layouts may be necessary based on the results of future geological exploration and more detailed mine planning. However, any revised longwall layouts would not have any significant additional impacts beyond those presented in this EIS.

Southern Underground

The C seam longwall panels will be approximately 300 m wide and vary in length from approximately 0.5 km to 4.2 km. The longwall panels will have an extraction height of approximately 4.5 m. The width of the proposed chain pillars (the coal left between the longwall panels) will be approximately 35 m. In the longwall mining area, the depth of the C seam ranges from approximately <100 m to 450 m.

Northern Underground

The D seam longwall panels will be approximately 300 m wide and vary in length from approximately 0.8 km to 3 km. The longwall panels will have an extraction height of between 3.0 and 4.5 m. The width of the proposed chain pillars (the coal left between the longwall panels) will be approximately 35 m. In the longwall mining area, the depth of the D seam ranges from approximately 200 m to 490 m.

The A seam longwall mine is located above the D seam longwall mine. The A seam longwall panels will be approximately 300 m wide and vary in length from approximately 1 km to 4.8 km. The longwall panels will have an extraction height of approximately 4.5 m. The width of the proposed chain pillars (the coal left between the longwall panels) will be approximately 35 m. In the longwall mining area, the depth of the A seam ranges from approximately 140 m to 420 m.

Mine Access Roadways

Mine access roadways will be developed to provide access to the longwalls for mine workers, ventilation and equipment. These roadways will be developed within the coal seam and are typically 5.5 m wide and 4 m high. The roadways will be constructed using continuous miners (electric mining machines that excavate the roadways) and shuttle cars (electric mining machines that transport excavated material to the underground conveyor system).

Underground Mine Entries

Access to the Southern and Northern underground mining areas will be provided via inclined drifts (i.e. tunnels) from the surface to the underground workings.

Each mining area will have separate drifts for men and materials access, and the ROM coal conveyor to the surface. The drift portals will be located near the respective underground mine industrial areas. The locations of the drifts and portals for the Southern and Northern Undergrounds are shown in Figures 4-20 and 4-21, respectively.

Underground Mining Schedules

The mining schedules for the three longwalls have been developed in order to manage potential interactions between the various mining operations. The C seam longwall in the Southern Underground has a mine life in the order of 13 years and is expected to be completed by Project Year 15. The Southern Underground is located within the footprint of the southern section of the open cut mine. The mining schedules have been developed such that C seam longwall extraction in areas of the Southern Underground will be completed prior to any open cut mining in the area above.

The A and D seam longwalls are both located in the Northern Underground within the northern section of the project site. Longwall extraction in the D Seam and A seam commences in Project Year 3. The mining schedules for the D seam and A seam longwalls have been developed to ensure there is a minimum 5 year lag between extraction of the D seam, and extraction of the A seam. This will ensure that all subsidence from extraction in the D seam has completed prior to extraction of the overlying A seam.

4.7 ONGOING EXPLORATION ACTIVITIES

An ongoing exploration program will be undertaken over the life of the mine. This may include installation of exploration boreholes, as well as 2D seismic surveys in some areas. These activities are similar to the exploration activities that have been undertaken on the project site to date. There is considerable flexibility with respect to the location of exploration bores and, as per current practice, exploration bores will be sited to avoid significant surface features, as far as possible. Similarly, there is flexibility in the layout of any 2D seismic exploration programs. These will be designed to minimise any disturbance of vegetation.

4.8 MINE INFRASTRUCTURE

The majority of mine infrastructure will be located to the east of the open cut mining area (Figure 4-23). Key infrastructure in this area will include:

- Haul roads and access roads;
- Raw and product coal stockpiles and coal conveyors;
- CHPP and associated coal handling facilities;
- Rail loop and train loading facility;
- Power Station;
- Workshops and vehicle servicing facilities;
- Warehouses, laydown and storage areas;
- Administration buildings and employee facilities;
- Workforce accommodation village;
- Private airstrip;
- Mine waste storage facilities; and
- Numerous sediment control and water storage dams.

Key mine infrastructure components are discussed in the following sections.

4.8.1 Open Cut Mine Infrastructure

An Open Cut Mine Industrial Area (MIA) will be located to the east of the out-of-pit overburden emplacement areas (Figure 4-24). The Open Cut MIA will include buildings specifically associated with the open cut mining operations, including a radio control centre, offices and employee facilities.

Other open cut mining infrastructure will be located within the open cut mine footprint, and to the east of the out-of-pit overburden emplacement areas including:

- Haul roads and ramps providing access to the open cut pits;
- ROM coal dump hoppers at the CHPP loading station;
- Coal stockpiles;
- Laydown areas; and
- Ammonium nitrate storage.

The location of open cut mining infrastructure is shown on Figure 4-24.

4.8.2 Underground Mine Infrastructure

Infrastructure associated with the underground mines will be located close to the drift portals for each underground mining area. The Northern Underground MIA, which will service the A and D seam longwall mines, will be located near the north-eastern corner of the open cut mining area (Figures 4-23 and 4-25).

The Southern Underground MIA, which will service the C seam longwall, will be located near the product coal stockpiles towards the southern end of the open cut mining area (Figures 4-23 and 4-26).

Infrastructure in the underground MIA's will include:

- Administration buildings, bathhouse and employee facilities;
- Workshop, servicing and refuelling facilities;
- Warehouse, storage and laydown areas;
- Security, first aid, mine rescue and fire services facilities;
- Water storage dams;
- Water and sewage treatment plants; and
- Car parks.

A number of minor surface facilities will be required above the longwall mining areas. These will include ventilation shafts, underground communication cables, mine dewatering boreholes and associated pipelines, and other access boreholes. These facilities will have a relatively small footprint. Ventilation shafts have the largest footprint at approximately 15 m x 15 m per shaft. There is flexibility in the siting of these facilities and they will be sited, where practicable, to avoid disturbance of any significant surface features, such as drainage lines or vegetation within threatened species habitat. Given the flexibility in the location of this minor infrastructure it is expected that this infrastructure will generally be able to be located to avoid any significant environmental impacts. A formal process will be established for the selection of locations for this minor infrastructure.

4.8.3 Coal Handling and Transport Infrastructure

The coal handling and coal transport system within the project site will include the following components:

- Open cut coal handling and transport:
  - Truck haulage of ROM coal from the open cut pits and/or field ROM stockpiles to dump hoppers at the CHPP loading station.
- Underground coal handling and transport:
  - Underground conveyor systems for transporting coal from the underground workings to surface ROM coal stockpiles adjacent to each underground MIA;
  - Overland conveyor transporting coal reclaimed from the Northern Underground ROM coal stockpile to the CHPP loading station; and
  - Truck haulage of ROM coal from the Southern Underground ROM coal stockpile to the CHPP loading station.
- ROM coal crushing, screening and sizing at the CHPP loading station;
- Conveyor system transporting raw coal from the CHPP loading station to the raw coal stockpiles;
- Raw coal stockpile reclaim and conveying to the CHPP for washing;
- Conveyor system transporting washed product coal from the CHPP to the product coal stockpiles;
- Product coal stockpile reclaim and conveying to the train loadout; and
- Loading of trains for transport of product coal by rail to port.

The location of the various components of the coal handling and transport system is shown in Figure 4-24 and a conceptual process flow sheet is shown in Figure 4-27.

4.8.4 Drainage and Flood Protection Infrastructure

A network of drainage and flood protection infrastructure is proposed to be constructed on the project site, progressively over the life of the mine. This infrastructure will ensure effective drainage of the site, minimise the generation of mine-affected water and provide an appropriate level of flood protection for the mining operations and mine infrastructure. This infrastructure will include a network of diversion drains and catch drains. Surface drainage is addressed in detail in Section 13 – Surface Water.

4.8.5 Utilities

Table 4-6 summarises the utilities required for the project.

Table 4-6 Utilities

UTILITY	AVERAGE DEMAND	SOURCE
Energy		
Electricity	1,320 GWH/year	Electricity requirements for initial construction will be supplied by 14 MW diesel generators. Power for the remainder of the project life will be provided by the on-site power station.
Diesel	90,000 kL/year	Diesel will be supplied by a contracted service provider. Diesel storage is discussed in Section 22 – Hazard and Risk and the on-site fuel storage area is shown on Figure 4-24.
Water		
External Raw Water	12,500 ML/year (maximum)	The external water supply is discussed in Section 4.13.4. The proposed reuse of mine-affected water for mine water supply is discussed in Section 13 – Surface Water. On-site package water treatment plants will be installed at the mine industrial areas and at the accommodation village in accordance with relevant standards and regulatory requirements.
Other		
Sewerage	Up to 1,000 kL/day	Package sewage treatment plants with a total capacity of approximately 440 kL/day will be constructed within the mine industrial areas. The accommodation village sewage treatment plant will have a peak capacity of approximately 560 kL/day. Sewage treatment plants will be constructed and operated in accordance with relevant standards and regulatory requirements.
Telecommunications	Telephone, internet, facsimile and security alarms	Necessary telecommunications infrastructure will be installed by a suitably qualified service provider.

4.9 REJECTS AND TAILINGS STORAGE

4.9.1 Coarse Rejects

Coarse rejects generated from the CHPP will be stockpiled at the rejects stockpile adjacent to the CHPP (Figure 4-24). Rejects will be loaded to trucks and hauled to the overburden emplacement area for disposal within the active overburden emplacement areas. Coarse rejects may also be used during the construction of the TSF, subject to the results of geotechnical testing to confirm the suitability of the material. The geochemical characterisation of the rejects material and rehabilitation of the overburden emplacements is discussed in Section 8 – Rehabilitation.

4.9.2 Fine Rejects

Fine rejects, referred to as tailings, will be generated by the coal washing process at the CHPP. Tailings will be transported via a slurry pipeline to a designated TSF (Figure 4-23). The TSF will be a conventional tailings dam with sufficient capacity for life-of-mine tailings storage.

The TSF will have nil external catchment and will be operated to ensure that it does not overflow. A decant pond with a pontoon mounted pump will be maintained within the active tailings storage area. Tailings water and rainfall runoff will collect in the decant pond and will be returned to the CHPP for water supply. Water management associated with the TSF is discussed in more detail in Section 13 – Surface Water.

The TSF will have a capacity of approximately 100 Mm^3 with an ultimate footprint of approximately 600 ha and a maximum embankment height of 34 m. The geochemical characterisation of tailings and the design, operation and rehabilitation of the TSF are discussed in detail in Section 7 – Tailings and Power Station Waste Storage Facilities.

4.10 POWER STATION

A coal fired power station is proposed to be constructed in stages on the project site. The power station will be used to power the mine. The power station will be air-cooled and utilise circulating fluidized bed technology. Fine rejects from the CHPP, supplemented with raw coal, will be used to fuel the power station.

The power station will comprise 350 MW supercritical generating units. 350 MW generating units are proposed in order to maximise thermal efficiency, consistent with best practice.

Two generating units will need to be operational to supply the potential maximum peak mine power demand. Peak demand will include the operation of:

- Open cut mine at peak production with two separate pits and including two large scale draglines;
- Three longwalls;
- 55 Mtpa capacity CHPP; and
- Other associated facilities such as workshops, workforce accommodation village and supporting infrastructure.

A third generating unit will be provided as redundancy. Due to the remote location of the project site, the power station is required to have redundancy to ensure a reliable power supply for mining operations.

At full generating capacity, the power station would have sufficient spare capacity for maintenance and potential future supply to off-lease users. Any future off-lease supply of power would be subject to separate approvals.

The layout of the power station is shown in Figure 4-28 and consists of the following key components:

- Feed coal stockpiles and conveyors;
- Generating (boiler) units and transformers;
- Warehouse and storage areas; and
- Administration and control buildings.

4.10.1 Power Station Waste Storage Facility

The power station will generate dry waste material in the form of fly ash, bottom ash and clinker. These dry waste materials will be transported by haul truck for storage in a designated Power Station Waste Storage Facility (PSWSF), located to the north-east of the power station (Figure 4-24). The PWSF will have sufficient capacity to store the power station waste for the first 10 years of operation. After this time, the power station waste will be stored within the overburden emplacement areas.

The dry power station waste will be placed in the PSWSF using dump trucks in a similar manner to the development of an out-of-pit overburden emplacement. The material will be paddock dumped and spread with a dozer in successive lifts.

The PSWSF will have a capacity of approximately 16.4 Mm^3 with an ultimate footprint of approximately 80 ha and a maximum height of 30 m. The geochemical characterisation of power station waste material and the design, operation and rehabilitation of the PSWSF are discussed in detail in Section 7 – Tailings and Power Station Waste Storage Facilities.

4.11 ACCOMMODATION VILLAGE

An accommodation village will be constructed in the south-eastern part of the project site to accommodate the project workforce (Figure 4-29). The accommodation village will be located adjacent to the airstrip to facilitate the efficient movement of workers to and from the site.

An initial stage of the accommodation village will be completed as a priority during Project Year 1 to house the construction workforce. This section will comprise approximately 560 rooms and will operate on a motelling basis. The operations stages of the accommodation village will be constructed progressively as the workforce increases. The ultimate village will comprise approximately 3,050 rooms.

The accommodation village is intended to be self-sufficient with regard to communications infrastructure, recreational facilities and medical services. The accommodation village will include:

- Tennis court, gym, swimming pool, shops and recreation facilities;
- Administration buildings, bathhouse and employee facilities;
- Kitchens and mess halls;
- Health and first aid facilities; and
- Water and sewage treatment facilities.

Further details on accommodation village and its facilities are provided in the *Socio-Economic Impact Assessment Report* (Appendix N).

4.12 PRIVATE AIRSTRIP

A private airstrip will be constructed in the south-eastern part of the project site, for the transport of mine workforce and materials (Figure 4-29). Construction of the airstrip is scheduled to be completed prior to the end of Project Year 1, for the transport of the project workforce from Project Year 2 onwards. The airstrip facilities will include baggage handling and passenger security.

The airstrip will be designed to cater for a range of aircraft, including Boeing 737s, Airbus 320s and Bombardiers. Current planning estimates approximately 40 flights per week will be required during operations, from a range of coastal centres.

The airstrip will be designed, constructed and operated in accordance with the Civil Aviation Safety Authority regulations and guidelines.

4.13 OFF-LEASE INFRASTRUCTURE

The scope of the EIS is limited to the mine site activities and does not include off-lease infrastructure that will be required for the project. Off-lease infrastructure will include port capacity, rail connection to port, mine site access road connection and raw water supply. These will subject to separate environmental impact assessments and approvals. The current preferred option and status of each off-lease infrastructure component are discussed in the following sections.

4.13.1 Port Capacity

The proponent is proposing to obtain access to export capacity at the Abbot Point Coal Terminal via a port access agreement with a third party. The proponent will not be directly involved in any port development for the purposes of the project. Any development of export capacity at the Abbot Point Coal Terminal necessary for the project will be developed by others and would be subject to separate approvals to be obtained by others.

4.13.2 Rail Connection to Port

The project includes an on-site rail loop and train loading facility (Figure 4-24). The on-site rail will connect to a future off-site rail spur connecting the mine site to a future rail line from the Galilee Basin to the Abbot Point Coal Terminal. The rail line connecting the Galilee Basin to the Abbot Point Coal Terminal will be developed by another party. The proponent will be responsible for developing the off-site rail spur connection. However, the alignment of the preferred rail line from the Galilee Basin to the Abbot Point Coal Terminal is not certain at this stage and consequently it is not possible to confirm the location of the off-site rail spur connection. The off-site rail spur would be subject to a separate environmental impact assessment and approvals. These will be progressed once the alignment of the rail spur can be determined.

4.13.3 Mine Site Access Road Connection

Access to the project site will be via a new mine access road to be constructed from Moray-Carmichael Road. However, Adani Mining Pty Ltd (Adani) is proposing to realign a section of Moray-Carmichael Road as part of the development of the adjacent Carmichael Coal Mine and Rail Project (CCM&RP). Adani’s proposed realignment of the road has not yet been confirmed or approved and consequently the precise location of the mine access road for Project China Stone cannot be confirmed at this stage. In addition, responsibility for constructing the mine access road has not yet been confirmed. The mine site access road would be subject to a separate environmental impact assessment and approvals. These will be progressed once the alignment of the access road connection can be determined.

A new intersection with Moray-Carmichael Road will be required for the mine site access road. The location and design of this intersection will be determined in consultation with the Isaac Regional Council who own the road.

The intersection will be designed and constructed in accordance with appropriate engineering standards and the Isaac Regional Council's requirements.

Project traffic impacts are discussed in detail in Section 19 – Traffic and Transport.

4.13.4 Raw Water Supply

The project will require an external raw water supply of up to approximately 12,500 MLpa. There are a number of parties currently developing water supply options for the Galilee Basin coal mines. The current preferred water supply option would be to gain an allocation from a piped water supply from one of two schemes being proposed to harvest water from the Cape River or the Belyando/Suttor River system. The latter scheme has the potential to be supplemented by a connection to the Burdekin Falls Dam. Any future water supply development would be developed by others and would be subject to separate environmental impact assessment and approvals.

These off-lease project components are not discussed further in this EIS.

4.13.5 Potential Interactions with Other Northern Galilee Basin Developments

Other proposed developments in the Northern Galilee Basin include the CCM&RP and the associated Moray Power Project (MPP). These projects are further advanced in the approval phase and are likely to be developed in advance of Project China Stone.

As discussed in Section 4.13.2, the current preferred option for a rail connection from the project site to the port is dependent on the development of a rail connection from the Galilee Basin to Abbot Point by others. The CCM&RP is the current preferred option for this rail connection.

As discussed in Section 4.13.3, the CCM&RP involves the realignment of a section of Moray-Carmichael Road. Access to the Project China Stone site will also be from Moray-Carmichael Road. Based on current scheduling, any realignment of the road as part of the CCM&RP will be completed prior to the commencement of Project China Stone construction.

The CCM&RP involves the development of an accommodation village and airstrip for the accommodation and transport of mine workers. The option of a shared accommodation village and airstrip with the CCM&RP was considered. At present, the CCM&RP's proposed accommodation village is approximately 30 km from the project site. The option of an on-site accommodation village and airstrip is considered the most feasible for the project workforce, however the proponent will continue discussions with Adani regarding the possibility of shared accommodation and airstrip facilities.

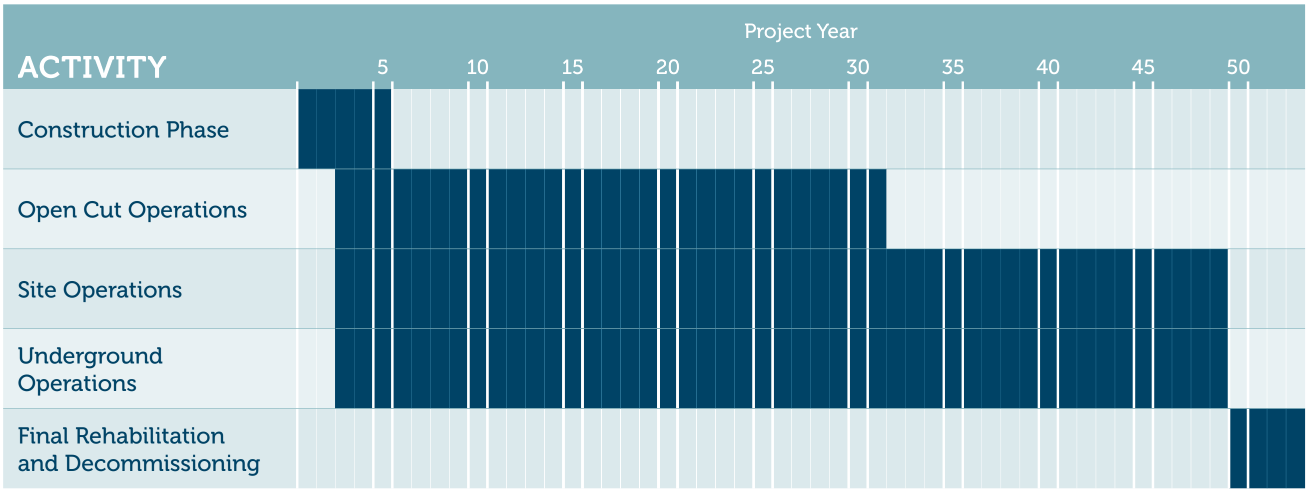
The MPP involves the construction and operation of a new 150 MW thermal and diesel power station to supply power to the CCM&RP. The MPP site is adjacent to the proposed Carmichael Coal Mine site. It is noted that the MPP approval application indicates that the MPP could be expanded in the future, subject to additional approvals, to supply other users including other Galilee Basin coal mines. As discussed in Section 4.16.1, the low cost power supply provided by Project China Stone's on-site power station is fundamental to the economic feasibility of the project and other options for project power supply are not being considered at this stage.

4.14 CONSTRUCTION AND DEVELOPMENT

4.14.1 Project Development Schedule

The following chart provides the key milestones in the proposed project development schedule. It is important to note that this is an indicative schedule, subject to change based on detailed planning and mining conditions. The timing of the commencement of construction is also subject to the receipt of environmental approvals, a mining lease and other necessary approvals. Project Year 1 is currently anticipated to be 2016, subject to gaining the necessary approvals.

Chart 4-1 Project Development Schedule



Construction of mine site infrastructure, including the accommodation village and air strip is scheduled to commence in Project Year 1. Construction of mine infrastructure is scheduled to be completed in Project Year 5. First coal production from the open cut and underground mines is scheduled for Project Year 3, once initial mine development works have been completed. Open cut mining is expected to be completed by Project Year 32 and underground mining would continue until Project Year 49. Mining will be followed by a final rehabilitation and decommissioning period.

4.14.2 Project Development Activities

The main construction and development activities associated with the development of the project are as follows:

- Construction of the accommodation village and airstrip;
- Construction of mine infrastructure and the coal handling and transport system;
- Construction of the power station;
- Open cut mine development;
- Underground mine development; and
- Final Rehabilitation and decommissioning.

These activities are discussed in the following sections.

Accommodation Village and Airstrip

The staged construction of the accommodation village is scheduled to commence in Project Year 1 and be completed by Project Year 2. The initial stage of the accommodation village for the construction workforce will be constructed from the commencement of the construction phase. This initial stage will accommodate up to 1,120 construction workers. It will be constructed over 5 months in Project Year 1. This stage will include 560 prefabricated Single Person Quarters (SPQs). The initial construction village will include a full kitchen and associated facilities, offices, first aid and emergency services facilities and will remain in use as supplementary accommodation after the operations village stages are completed.

The first stage of the operations village will involve construction of 1,280 SPQs over 9 months in Project Year 1. The final stage of the operations village will involve construction of the remaining 1,768 SPQs over 11 months in Project Year 2. The final stage will also involve completion of the kitchen(s), mess hall, offices, shops, village square, recreational facilities, swimming pool, gyms, multifunction hall, recreation pavilion(s), laundries and communal facilities.

Due to the remote location of the project site the large majority of the construction and operations workforces will work on a fly-in/fly-out basis. The private airstrip will therefore be constructed at the commencement of the construction phase and is expected completed and commissioned by the end of Project Year 1.

Mine Infrastructure

Construction of mine infrastructure and the coal handling and transport system will involve:

- Clearing vegetation, topsoil stripping, site preparation and drainage earthworks. Earthmoving equipment such as dozers, scrapers, excavators, trucks, graders, water carts and compactors would be used.
- Construction of roads and on-site rail including culverts and drains using conventional road and rail construction plant.
- Building construction for the administration buildings, workshops, warehouses and small buildings.
- Installation of site services including power, water distribution, water treatment, sewage treatment and telecommunications.
- Erection of steel structures associated with the CHPP and coal handling system. Steel structures would be constructed using standard construction techniques involving equipment such as cranes, scissor lifts and concrete pumps.
- Construction of water supply dams, mine water dams, initial TSF embankment and PSWSF area. Construction of the TSF and PSWSF is discussed in detail Section 7 – Tailings and Power Station Waste Storage Facilities. Mine water dams are discussed in Section 13 – Surface Water.

Construction of mine infrastructure, including the CHPP and coal transport system, will commence in Project Year 1 and will be completed progressively over a period of five years. The CHPP will be built in modules with the commissioning of the initial modules completed in Project Year 3 to coincide with scheduled first coal production. Commissioning of the final CHPP unit is scheduled in Project Year 5.

Construction of the on-site rail loop and train loadout is scheduled to commence in Project Year 2, with the target date for first coal railed in Project Year 3.

Over dimensional loads associated with the delivery of equipment to the project site during the construction phase are discussed in Section 19 – Traffic and Transport.

Power Station

The staged construction of the power station is scheduled to commence in Project Year 1 and will be completed in Project Year 5.

The power station will consist of 3 x 350 MW boiler units, which will be constructed in stages. Power station earthworks and site preparation will commence in Project Year 1, together with construction of the power station infrastructure. Each 350 MW boiler unit will be commissioned sequentially, with the first boiler unit commissioned in Project Year 3. The remaining two units will be commissioned by Project Year 5.

Initial power requirements for the project will be provided by 14 MW diesel generators. Once the power station is constructed the diesel generators will be decommissioned.

Open Cut Mine Preparation Works and Development

The open cut mine preparation and development works will involve:

- Clearing vegetation, topsoil stripping and drainage earthworks. Heavy earthmoving equipment such as dozers, scrapers, excavators, trucks, graders, water carts and compactors will be used.

- Initial box cut overburden removal using heavy mining earthmoving equipment such as dozers, excavators, trucks, graders and water carts. Boxcut overburden will be stored in the out-of-pit overburden emplacement. Some overburden material may also be used as construction material, where suitable.
- Establishment of haul roads and box cut pit ramps using mine haul road construction plant.
- Construction of the initial open cut mine drainage system, pit water dams and associated pump and pipeline systems.

Construction of the initial box cut pits is scheduled to commence in Project Year 1 with open cut coal production in Project Year 3.

Underground Mine Development and Commissioning

The underground mine development works will involve:

- Construction of the mine access drifts using a road-header, which is a track-mounted machine designed to cut stone. Drift spoil will be stored in the open cut mine overburden emplacement or used as construction material, if suitable.
- Underground development involving construction of the initial underground in-seam access roadways with continuous miners. Underground development will also involve construction of associated facilities including ventilation, conveyors and other underground mine services.
- Installation and commissioning of the longwalls in the initial panels.

Underground mine development is scheduled to commence in Project Year 1 with the commencement of construction of the drifts. First longwall coal production is scheduled for Project Year 3.

Final Rehabilitation and Decommissioning

Mining would be followed by a decommissioning and rehabilitation period lasting up to four years in which infrastructure such as buildings, conveyors and dams will be decommissioned and dismantled and final rehabilitation will be undertaken and monitored. Decommissioning of the site is discussed in Section 8 – Rehabilitation.

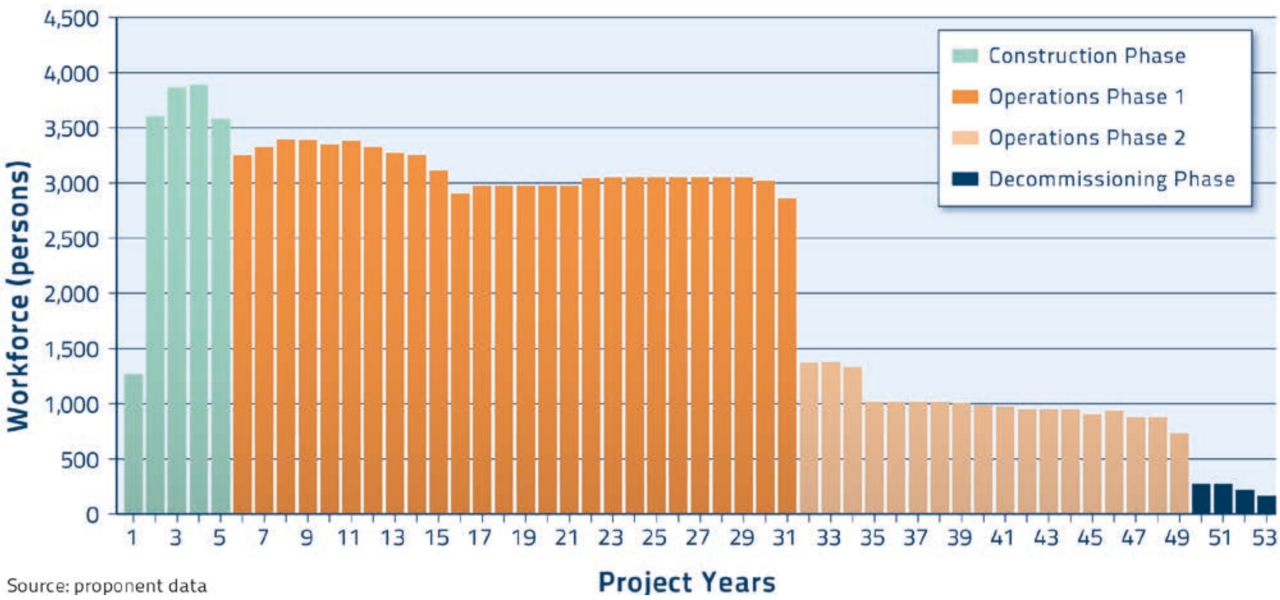
4.14.3 Operating Hours

Construction and operations will be undertaken 24 hours/day, 7 days/week.

4.15 WORKFORCE

The workforce is described in detail in Section 18 – Socio-Economic Impact Assessment and the *Socio-Economic Impact Assessment Report* (Appendix N). The workforce figures presented in these sections and summarised below are based on current planning and are subject to change as more detailed planning is undertaken.

The following graph illustrates the anticipated project workforce by project phase.



4.15.1 Construction Phase Workforce

The construction phase for the project extends from Project Year 1 to Project Year 5 and involves:

- The construction of mine site infrastructure and buildings;
- The early development operations for the open cut pit;
- The early development operations for the underground longwalls; and
- The operation of site facilities.

During the construction phase, the size of the workforce will rise and fall to adjust to the requirements of the project. The anticipated peak workforce during the construction phase of 3,892 persons is associated with the fourth year of construction (Project Year 4). It is anticipated that the majority of the workforce during the construction phase will be employed as contractors.

4.15.2 Operations Phase Workforce

There are two distinct operations phases for the project. Operations phase 1 includes the operation of the open cut mine, as well as operation of the three underground longwall mines. Operations phase 1 represents the peak operations phase for the project and runs from Project Year 6 to Project Year 31. Operations phase 1 will have an average annual workforce of 3,119 persons across the phase and a peak workforce of 3,391 persons in Project Year 8.

Operations phase 2 runs from Project Year 32 to Project Year 49 and commences following the completion of open cut mining. Mining in operations phase 2 are limited to the A and D seam longwall mines in the Northern Underground. This phase has an average annual workforce of 1,016 persons. The peak workforce in this phase is 1,377 persons in Project Years 32-33.

At the completion of mining in Project Year 49, a four-year decommissioning phase will run from Project Year 50 to Project Year 53. A small decommissioning workforce is expected to be required for this phase, with a peak of 275 workers in Project Year 50.

4.16 PROJECT ALTERNATIVES AND JUSTIFICATION

4.16.1 Project Alternatives

The key aspects of the project where alternatives were considered during project planning include:

- Alternative resources;
- Alternative mining methods;
- Alternative project layout;
- Alternative tailings storage strategies;
- Alternative power supply options;
- Alternative workforce strategy; and
- Alternative open cut ROM coal transport options.

Alternative Resources

The project involves mining the A, B, C and D seams. Investigations to date indicate that these are the only economically viable coal seams within the project site. Mining of the remaining seams within the project site is not economically feasible (Section 4.5).

Alternative Mining Methods

The project involves mining the shallower coal seams by open cut mining, and the deeper coal seams by underground mining. The coal seams in the open cut mining area are thick and could not be extracted by underground mining methods with an acceptable level of resource recovery or economic viability. Open cut mining is not economically viable for the deeper underground seams.

The proponent intends using conventional longwall mining methods for extraction of the deeper target seams. Alternative underground mining methods including Longwall Top Coal Caving and bord and pillar mining were considered. Longwall Top Coal Caving was considered in the A seam underground mine, however it is not proposed due to the uncertainty and associated risk in relation to its technical feasibility.

Bord and pillar mining would result in reduced surface subsidence effects in the underground mining areas. However, the method would also result in lower resource recovery and is not feasible for a high production capacity mining operation.

Alternative Project Layout

Alternative project layouts were considered during the project planning phase. However, the opportunities for alternative layouts are constrained by the location of the coal resources and the area available for the construction of infrastructure on the project site. The location of the open cut mine is determined by the shallower target coal seams. The location of the underground mining areas are determined by the location of the target coal seams, and are designed to maximise resource utilisation. The proponent does not own any land beyond the boundary of the proposed ML and therefore does not have an option to locate any of the mine site infrastructure beyond the ML. The eastern portion of the project site is the only suitable and sufficient area available for the construction of the mine infrastructure.

In order to enable management of drainage through the project site and to minimise the impact of the project on downstream drainage, the design of the mine infrastructure area includes drainage corridors at the northern and southern ends with capacity to convey drainage through the site (Figure 4-30). The northern corridor has been designed to avoid disturbance of a drainage line traversing the north-eastern corner of the site. The establishment of these drainage corridors also avoids disturbance of the remnant vegetation and fauna habitat in these areas, as shown in Figure 4-30.

The entire project site is well vegetated with remnant vegetation and hence there is no potential alternative project layout that would avoid clearing of remnant vegetation. High value habitat areas for threatened species listed under the Queensland *Nature Conservation Act 1992* and the Commonwealth EPBC Act are located in the proposed open cut mining and mine infrastructure areas (Figure 4-30). Avoidance of any additional areas of habitat in this area is not possible without sterilising open cut mine reserves and/or eliminating mine infrastructure from the project site and hence making the project unviable. Biodiversity offsets are proposed to offset these unavoidable impacts.

Vegetation and fauna habitat within the northern section of the project site will be largely unaffected by the project. Disturbance in this area will be limited to relatively minor impacts due to the rehabilitation of subsidence effects. Appropriate management and monitoring is proposed for these minor impacts.

The proposed project layout has been developed taking into account these constraints.

Alternative Tailings Storage Strategies

Alternative tailings disposal strategies were considered as part of project planning. Alternative options considered included storage within the open cut pits and disposal of dewatered tailings within the overburden emplacement.

The option for in-pit storage was not progressed for the purposes of the EIS as it is not feasible in the initial years of operations due to a lack of available in-pit storage area. The potential feasibility of this option in later years would be subject to very detailed production scheduling, open cut mine planning and open cut mine scheduling, as well as detailed geotechnical investigations. This option may be considered again in the future, subject to the completion of favourable feasibility studies and gaining the necessary approvals.

Disposal of dewatered tailings in the overburden emplacement was considered, however due to the volume of tailings being generated by the project, mechanical dewatering of the tailings is not considered economically viable.

A conventional tailings dam is proposed as it is a proven and economically viable option considering the volume of tailings generated by the project.

Alternative Power Supply Options

Alternative power supply options, including the construction of a high voltage transmission line to connect to the existing power grid, were considered as part of project planning. This option was not preferred due to the higher operating and power purchase costs, long lead time for a connection, and potential transmission loss due to the long distances involved. In particular, the costs associated with importing power over the proposed 50 year mine life are considerable and variable and outweigh the capital expenditure to construct an on-site power station. This is due to the low on-site power production costs, predominantly due to the power station being fuelled by washery rejects and coal extracted as part of mining activities.

It is noted that there is a current Development Application, lodged in November 2014, for a 150 MW power station to be developed by Moray Power to supply the Carmichael Coal Mine. MacMines is not considering a future expansion of this power station as a potential alternative power supply source as the low cost power supply provided by MacMines' on-site power station is fundamental to the economic feasibility of Project China Stone.

The construction of an on-site power station fuelled by coal reject material is the preferred option for mine power supply as it provides the most cost effective power supply for the project. The use of washery rejects in the feed to the on-site power station will ensure the lowest cost fuel supply of any thermal power station in Queensland. The on-site power station also results in higher resource utilisation, greater security for power supply, and the potential option of future supply to off-lease parties.

Alternative Workforce Strategy

Alternatives workforce strategies were considered as part of project planning. Alternatives included:

- The option for workers to live locally;
- Construction of an off-lease township; and
- A shared accommodation village or township with Adani.

Due to the remote location of the project site, there are limited options for workers to live locally. The nearest townships to the project site are Charters Towers, located approximately 285 km by road to the north, and Clermont, located approximately 260 km by road to the south-east (Figure 4-1). While a small portion of the workforce is expected to be sourced from the existing populations of these towns, it is considered unlikely that workers would move to these locations to take up employment on the project. Driving time from these locations would be greater than the flight time from coastal home-base locations.

Construction of an off-lease township was considered as part of project planning, however due to the remote location of the project site and the lack of surrounding amenities or infrastructure, it is considered unlikely that the project workforce would move their families to be near the project site.

The option of a shared accommodation village or township with Adani was considered. At present, Adani's proposed accommodation village is approximately 30 km from the project site. The option of an on-site accommodation village is considered the most convenient for the project workforce, however the proponent will continue discussions with Adani regarding the possibility of a shared facility.

Alternative Open Cut ROM Coal Transport Options

In-pit coal crushing and transport of raw coal from the open cut pits to the CHPP raw coal stockpiles by conveyor is an alternative to transporting coal from the pits in haul trucks. The EIS studies have been based on haulage of open cut coal by truck as this would be the worst case with regard to potential environmental impacts. For example, the noise and dust emissions from coal haul trucks would be higher than a coal conveyor. A final decision on the preferred transport option for open cut coal will be made during detailed open cut mine planning.

4.16.2 Project Justification

The proponent's justification for the project is:

- It involves a responsible mine plan that incorporates appropriate constraints and control measures to limit any adverse environmental and social impacts to an acceptable level;
- It maximises the responsible utilisation of the coal resource; and
- It will result in significant economic benefits for the local area and Queensland.

The key economic benefits of the project include:

- Direct employment of up to 3,892 persons during the construction phase, and up to 3,391 persons during the operations phase;
- Creation of substantial indirect employment in Queensland during the construction and operations phases;
- The addition of up to $1.5 billion annually to the gross state product of Queensland; and
- The payment of an annual average of $188 million to the Queensland Government in the form of royalty payments.

4.16.3 Consequences of Not Proceeding with the Project

The consequences of the project not proceeding are:

- The opportunity to mine a substantial coal resource would be lost;
- The opportunities provided by the project to maintain and develop Australia's market share in the global thermal coal market would be lost;
- The royalty charges and other government levies, coal freight and port opportunities associated with the project would be lost;
- The contribution of the project to the state economy would not eventuate;
- The employment opportunities provided by the project would not eventuate;
- The project's environmental impacts specified in this EIS would not eventuate;
- The significant socio-economic benefits associated with the development of the project would be forgone; and
- The project's significant contribution to the economic feasibility of the development of the Galilee Basin would be lost.

FIGURES

PROJECT CHINA STONE

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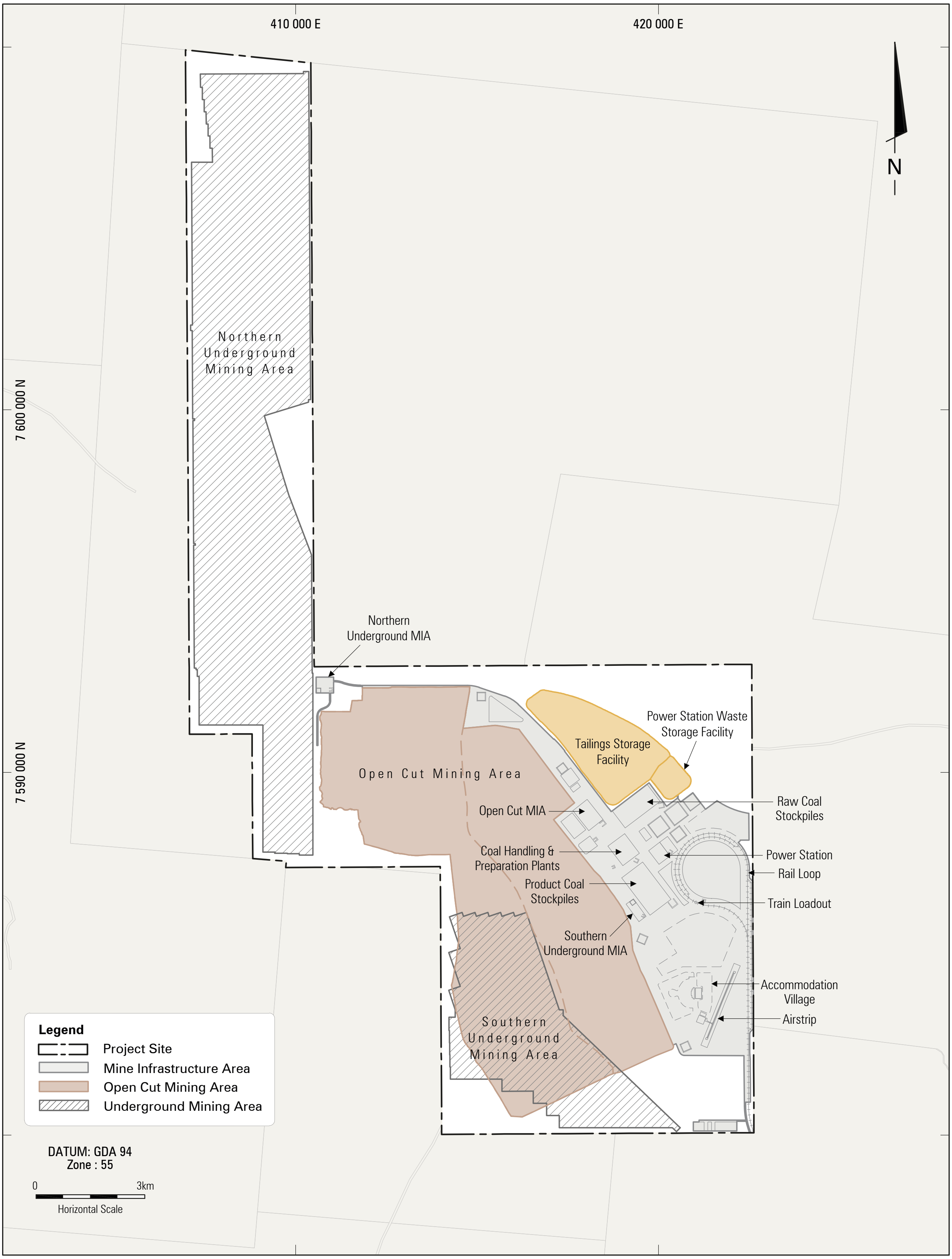
Project Location

FIGURE 4-1



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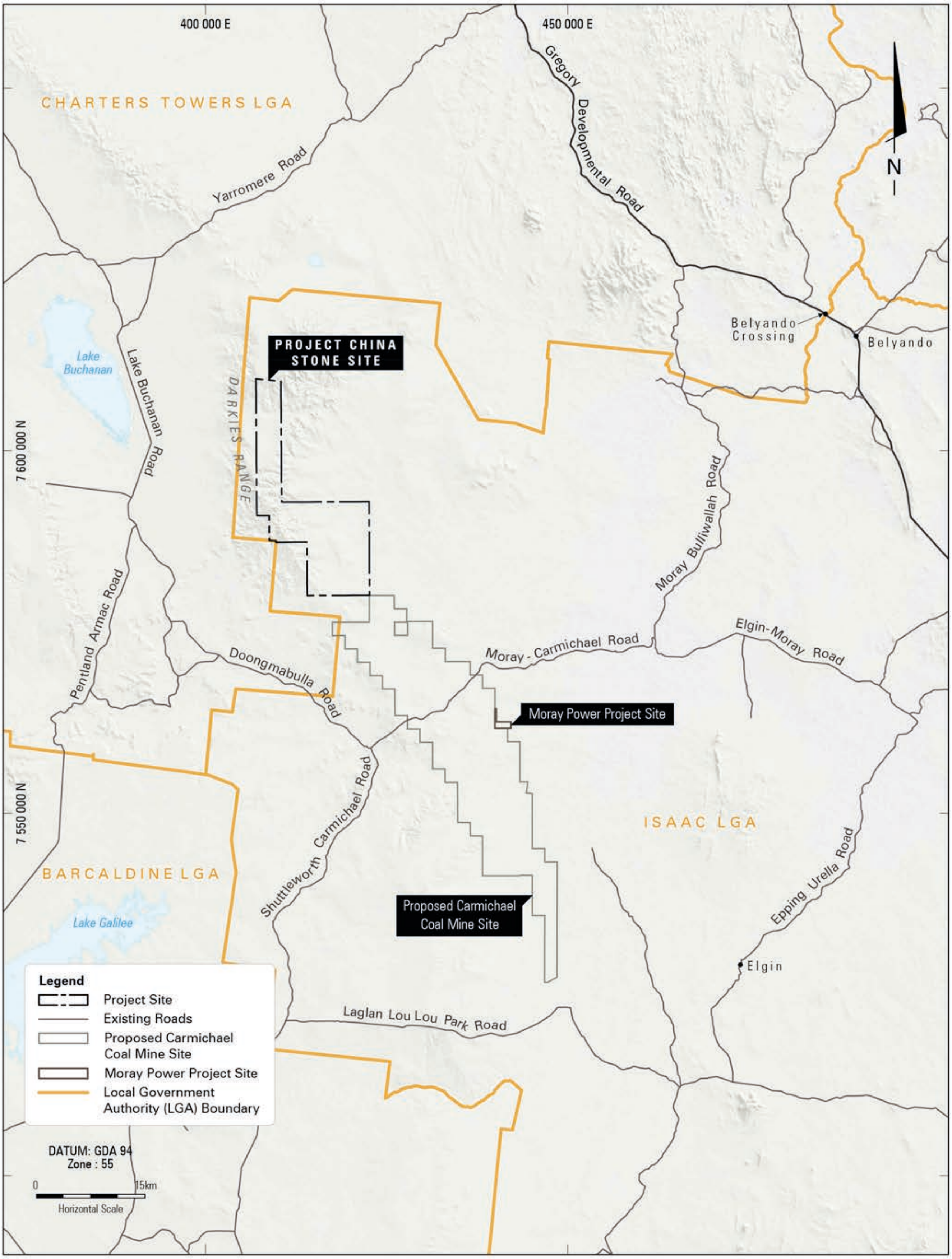
Project Layout

FIGURE 4-2



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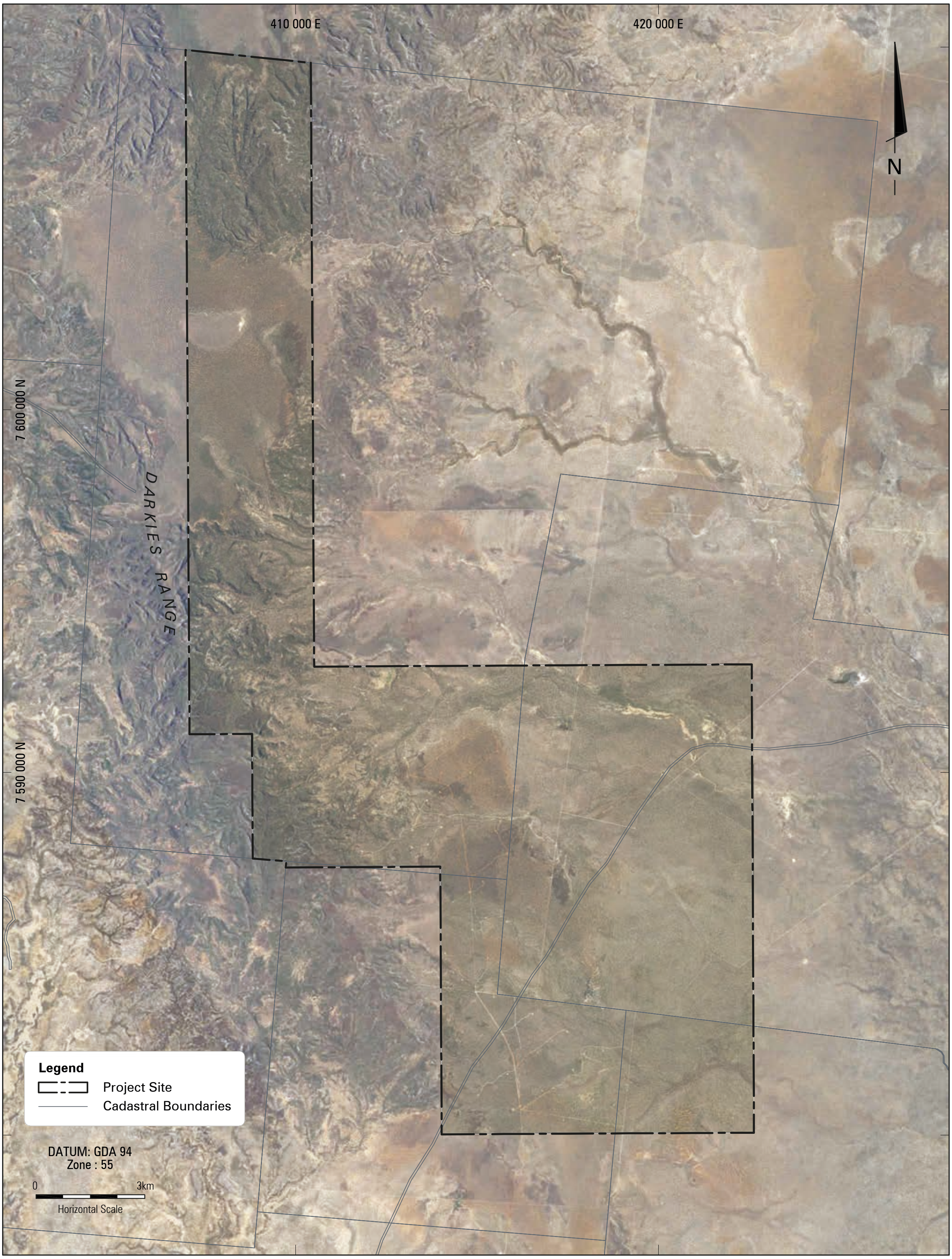
Local Setting

FIGURE 4-3



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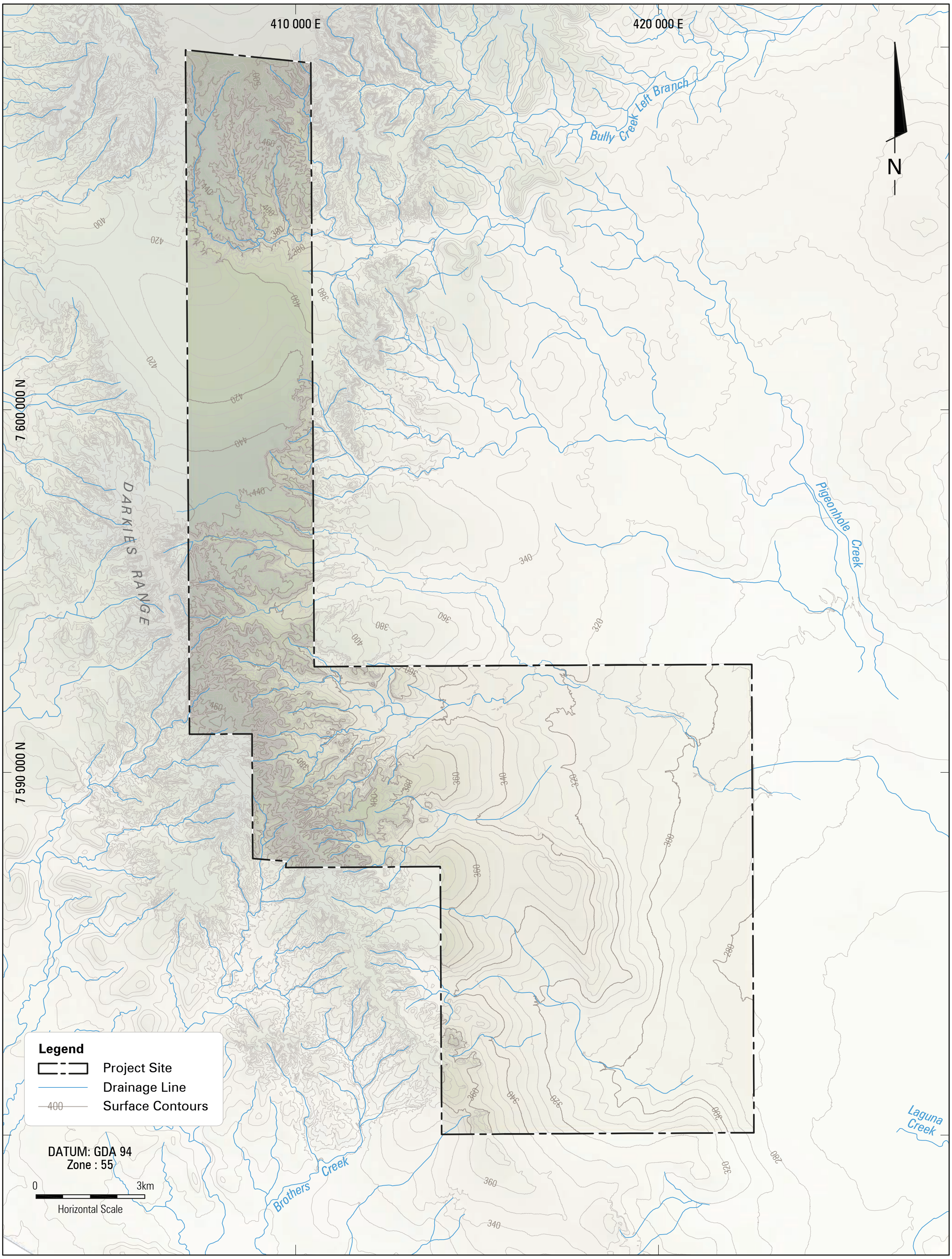
Site Air Photo

FIGURE 4-4



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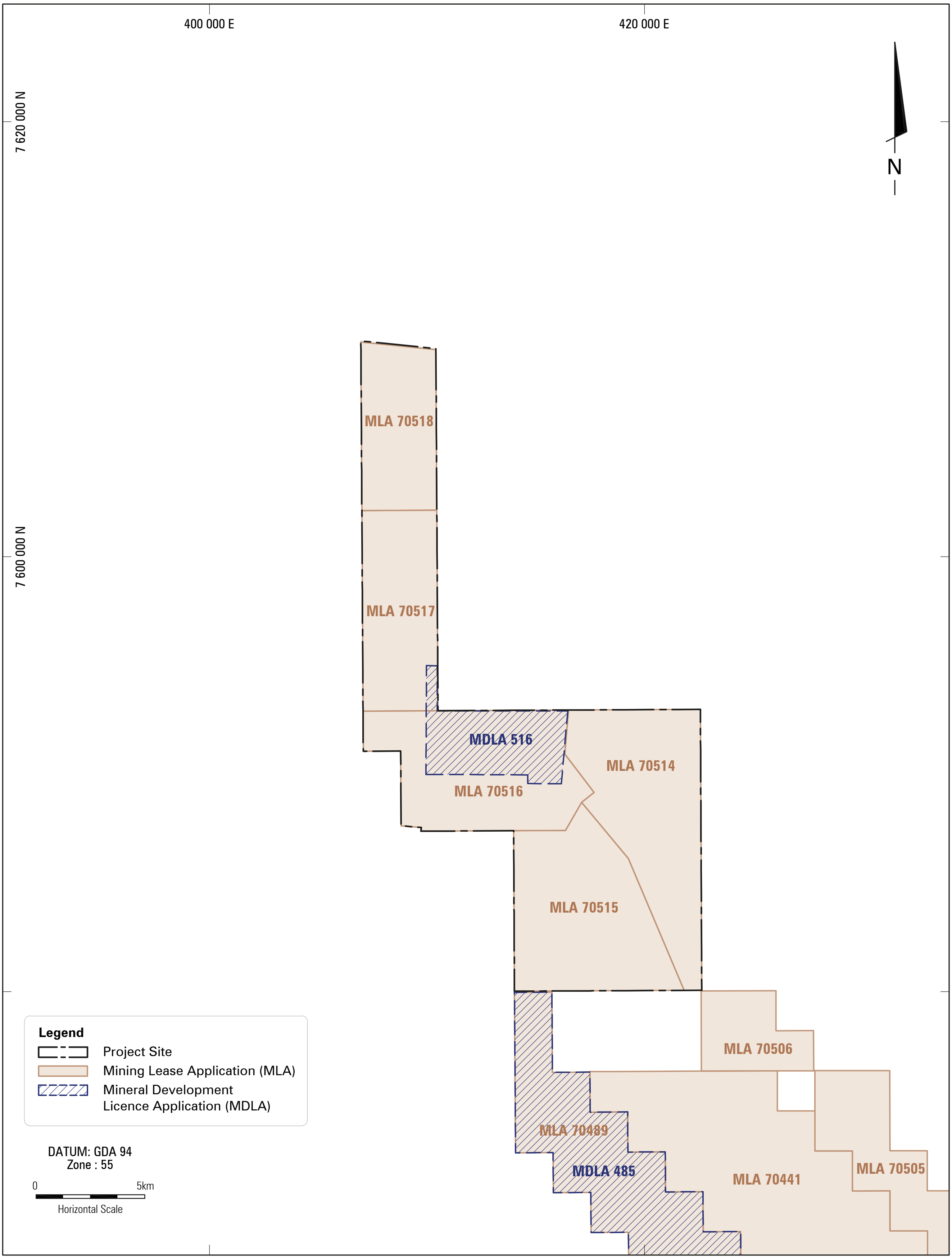
Site Contour Plan

FIGURE 4-5



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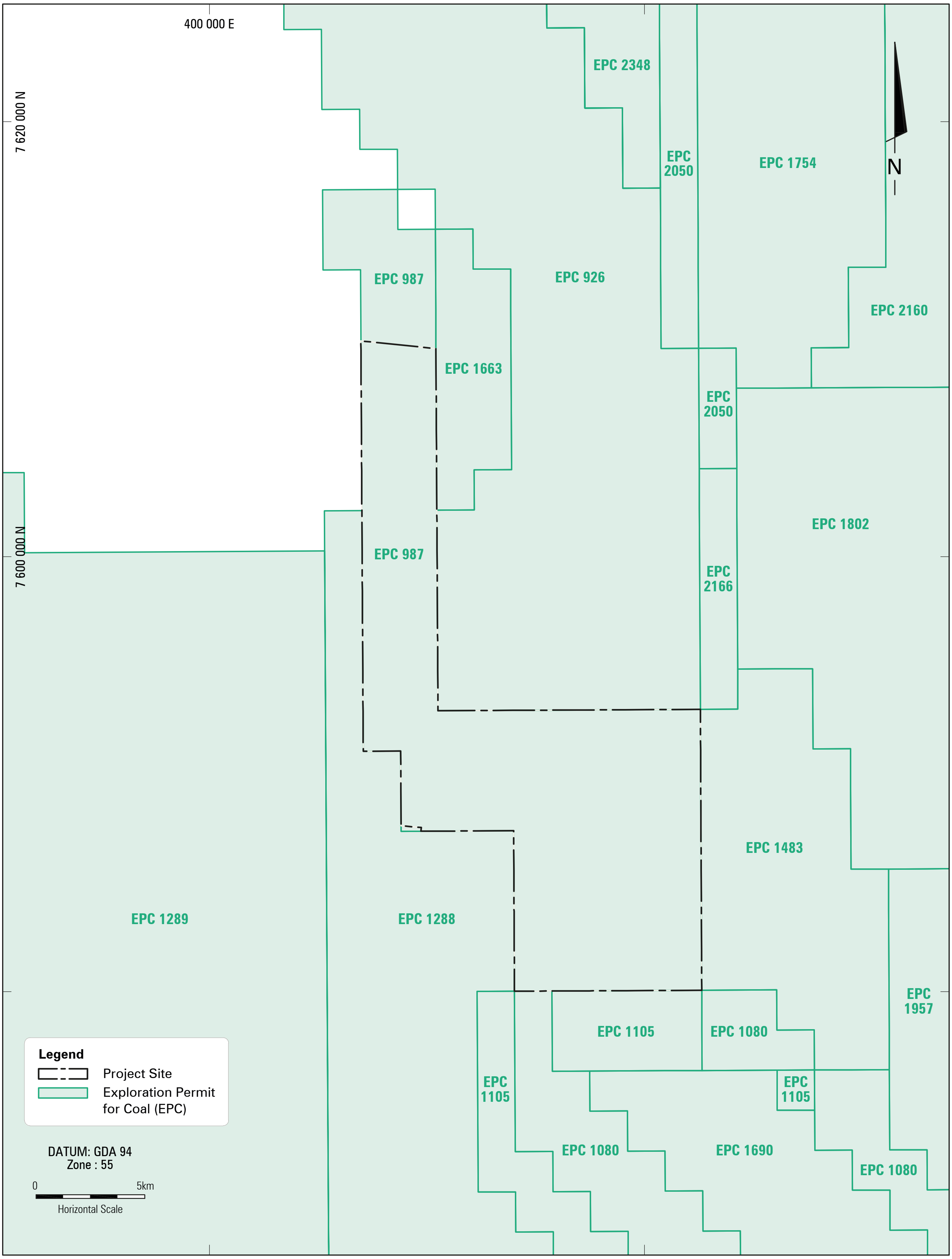
Coal Tenements

FIGURE 4-6



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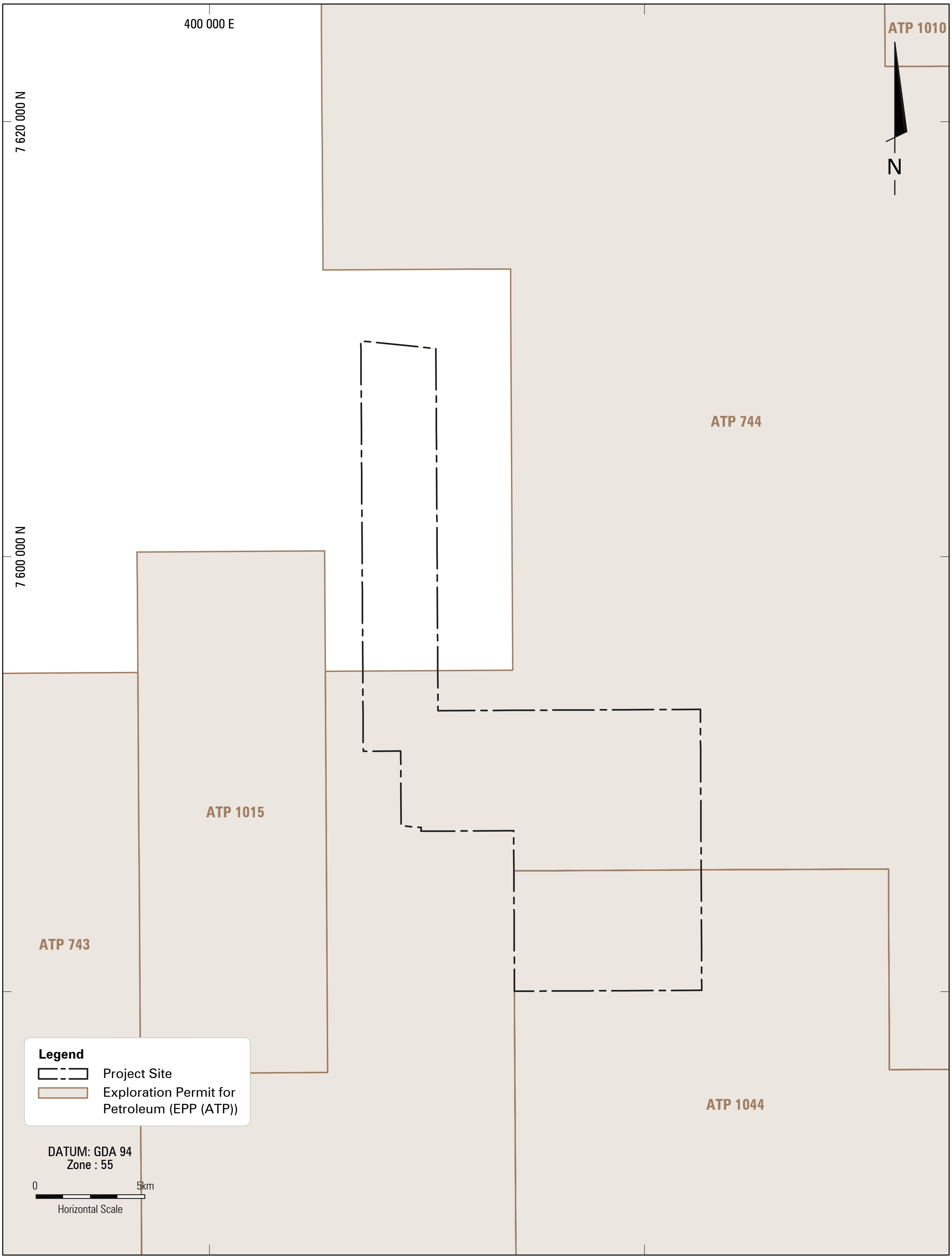
Exploration Permits for Coal

FIGURE 4-7



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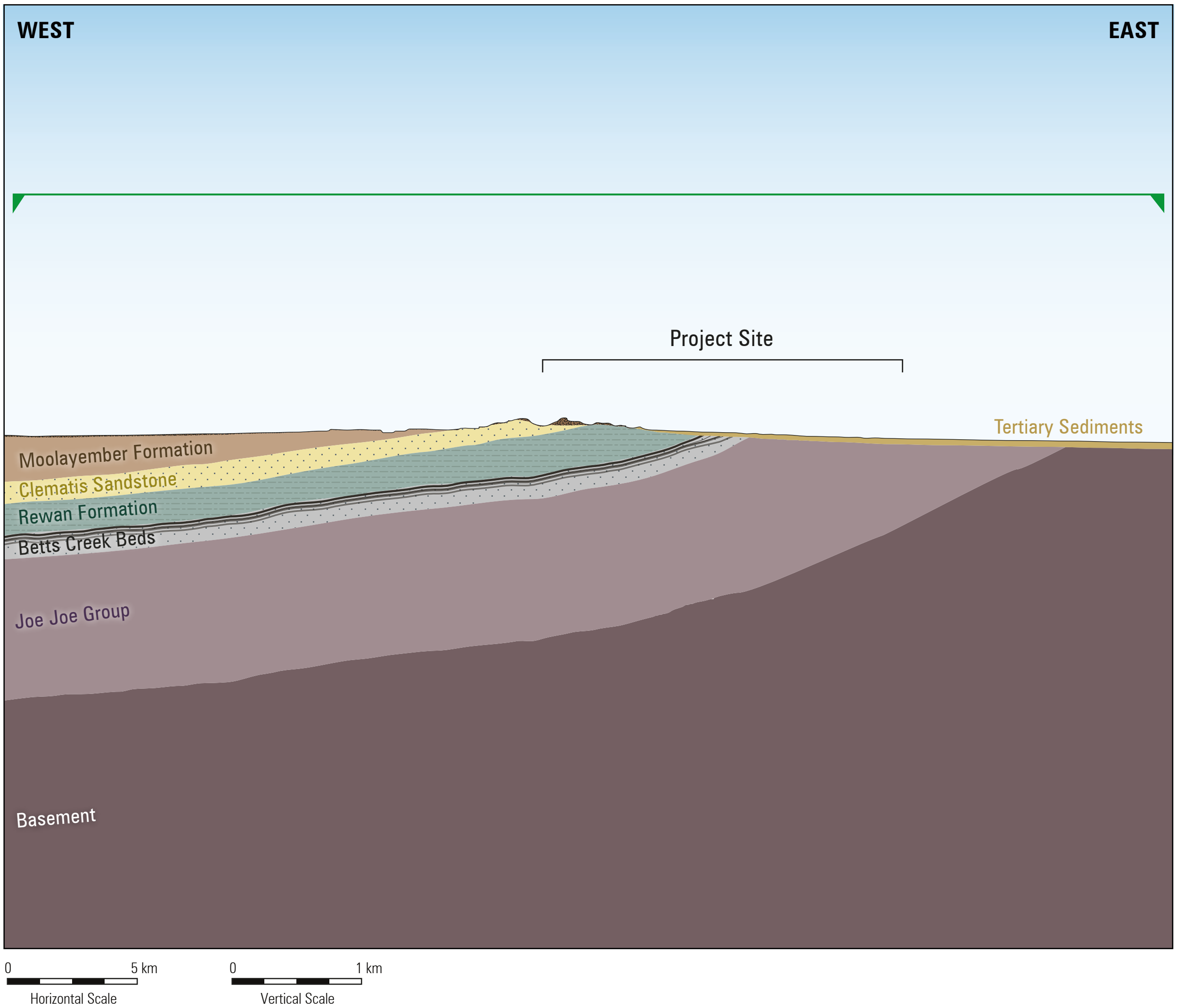
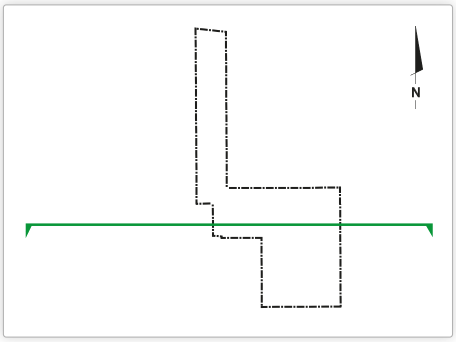
Exploration Permits for Petroleum

FIGURE 4-8



Legend

	Basin	Age	Stratigraphic Unit
		Tertiary	Tertiary Sediments
	Galilee	Mid-Triassic	Moolayember Formation
		Mid-Triassic	Clematis Sandstone
		Early-Triassic	Rewan Formation
		Late Permian	Betts Creek Beds
		Early Permian	Joe Joe Group
	Drummond	Late Carboniferous - Early Permian	Basement



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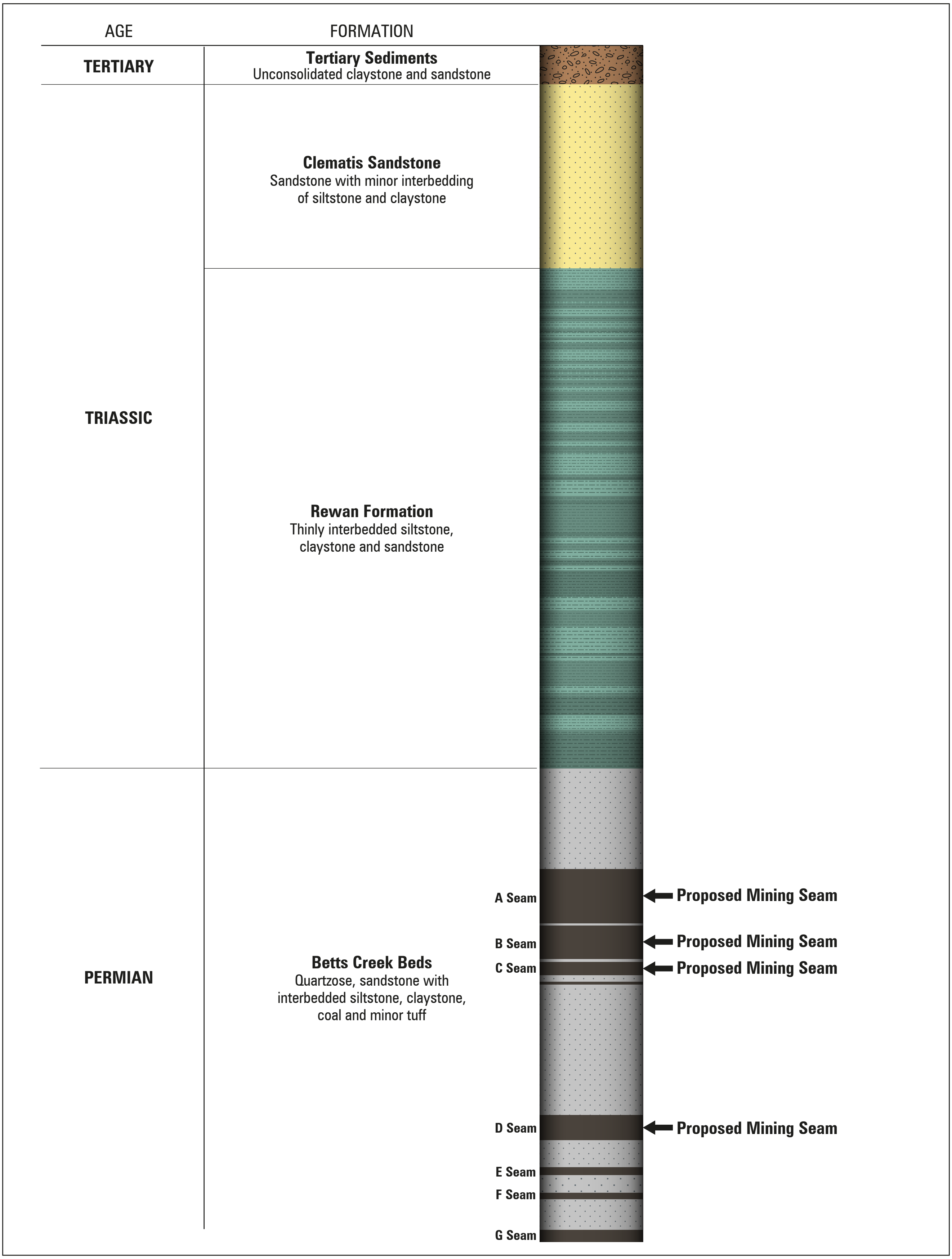
Regional Geology Section

FIGURE 4-9



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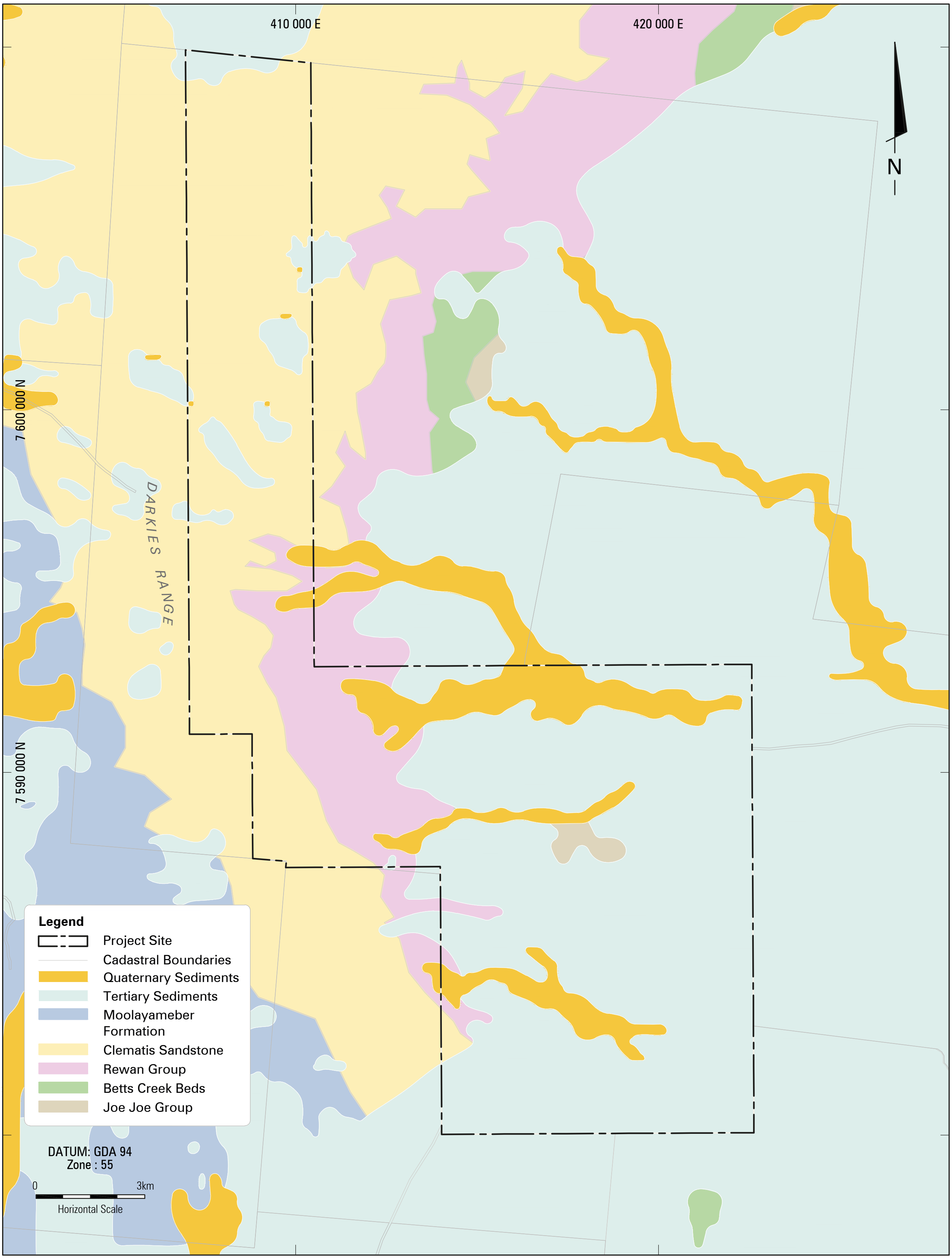
Indicative Site Stratigraphy

FIGURE 4-10



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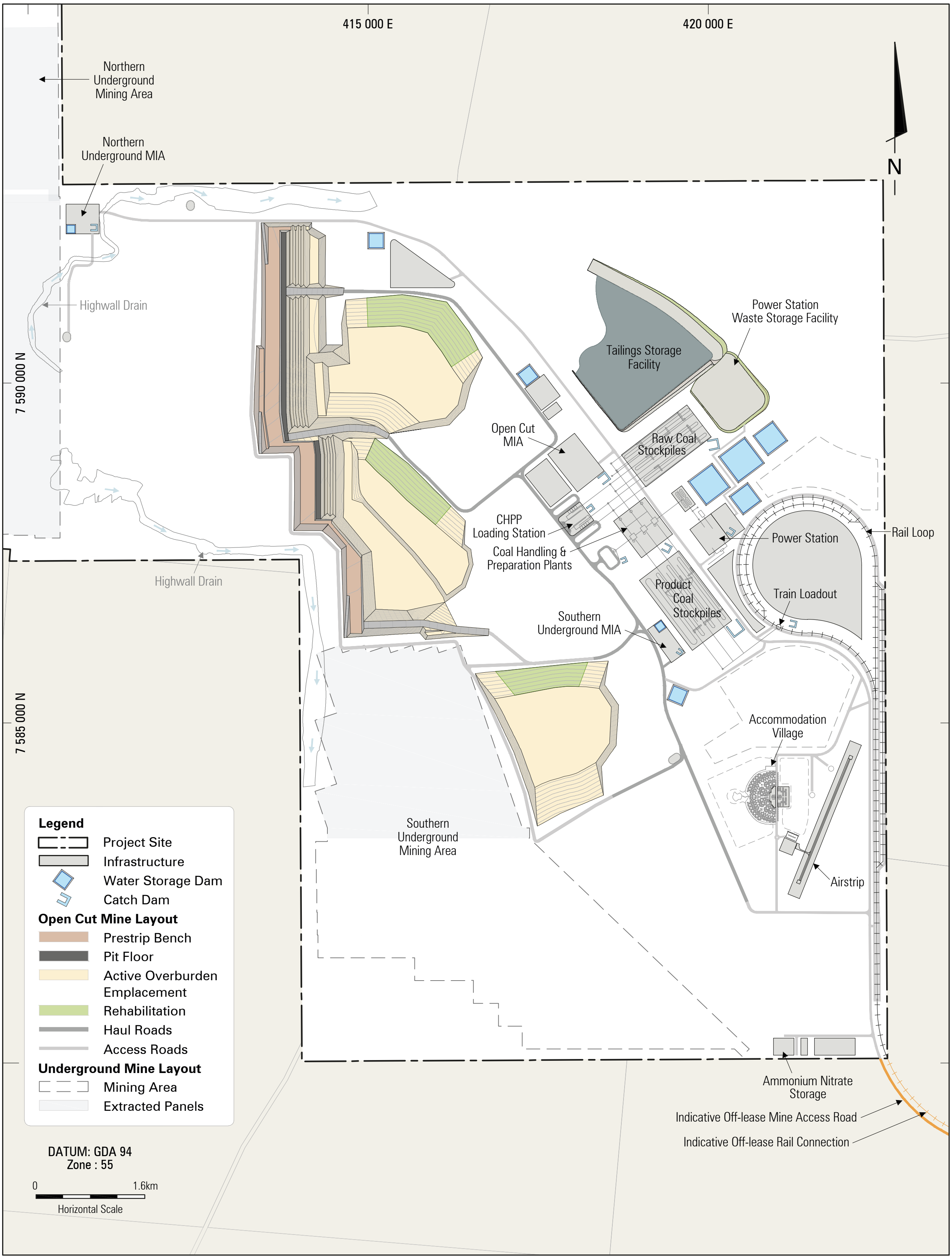
Surface Geology

FIGURE 4-11



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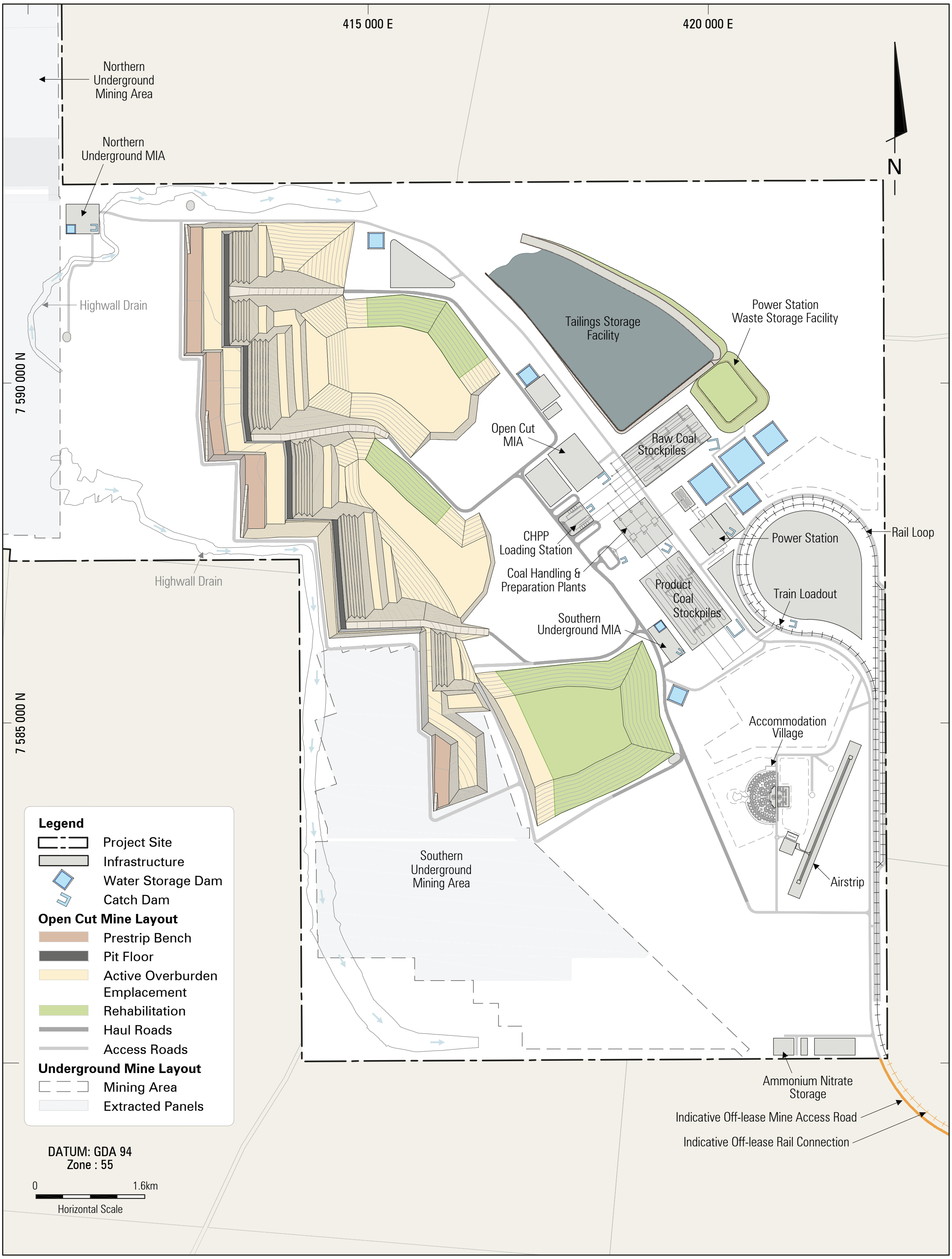
Open Cut Mine Layout - Year 5

FIGURE 4-12



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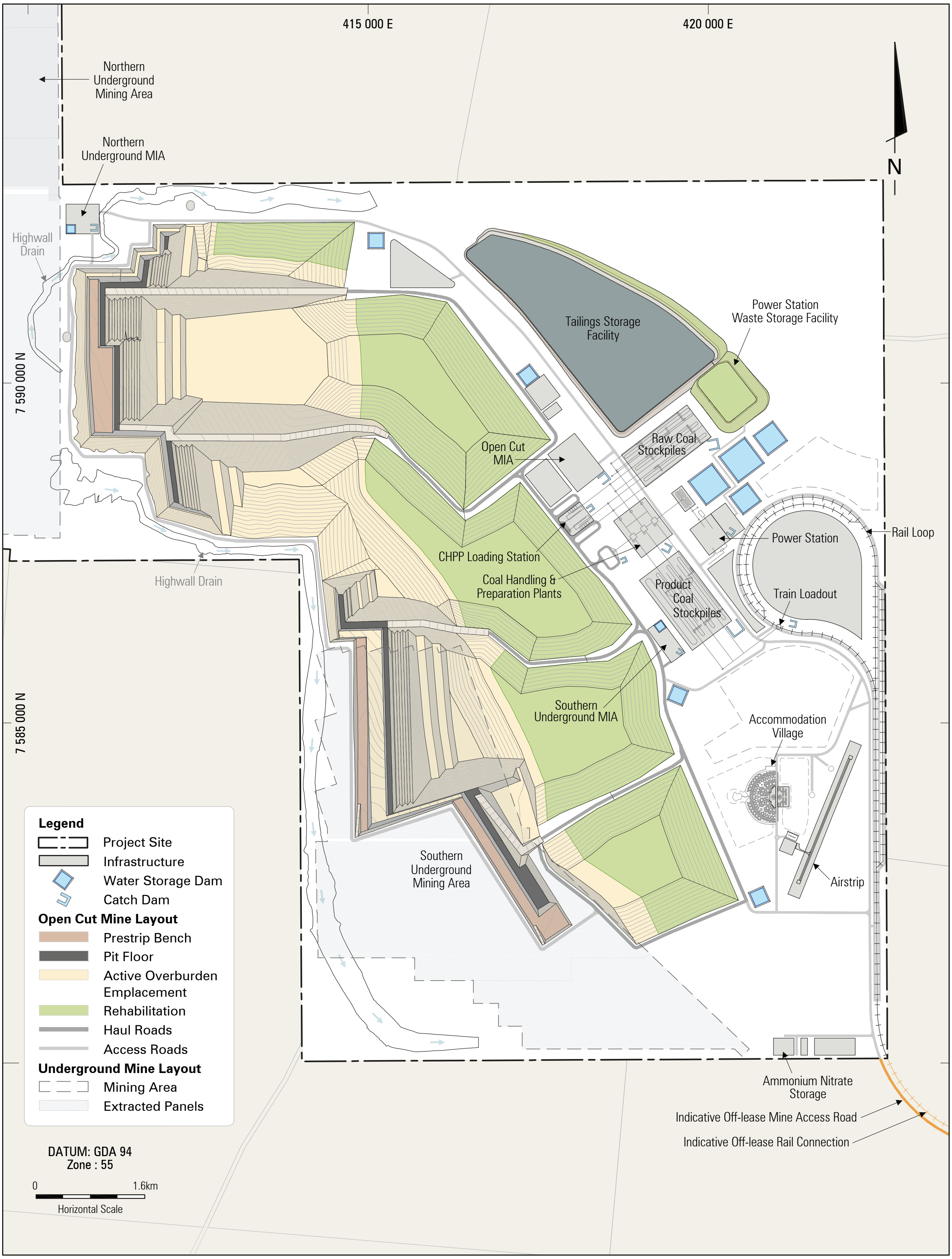
Open Cut Mine Layout - Year 10

FIGURE 4-13



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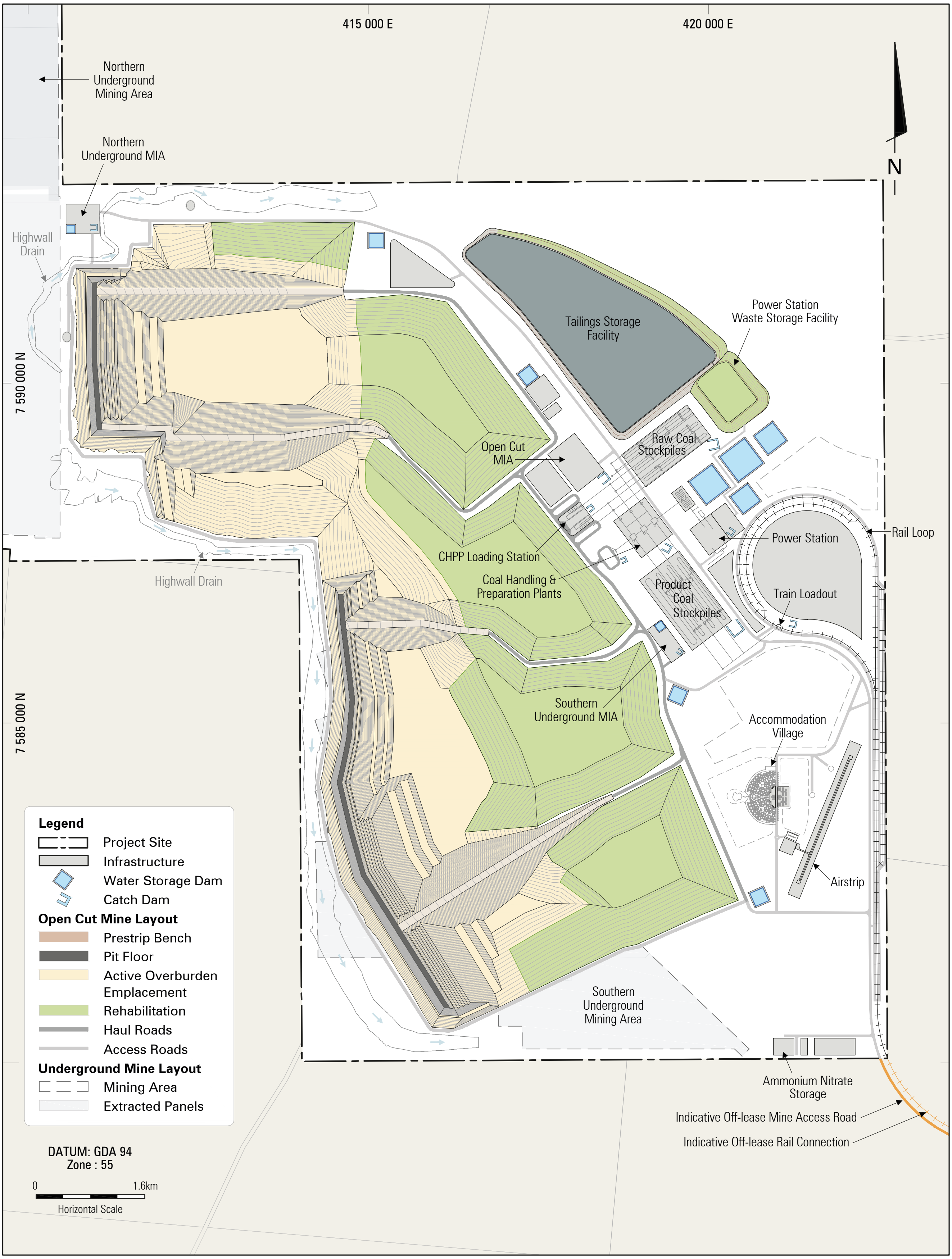
Open Cut Mine Layout - Year 20

FIGURE 4-14



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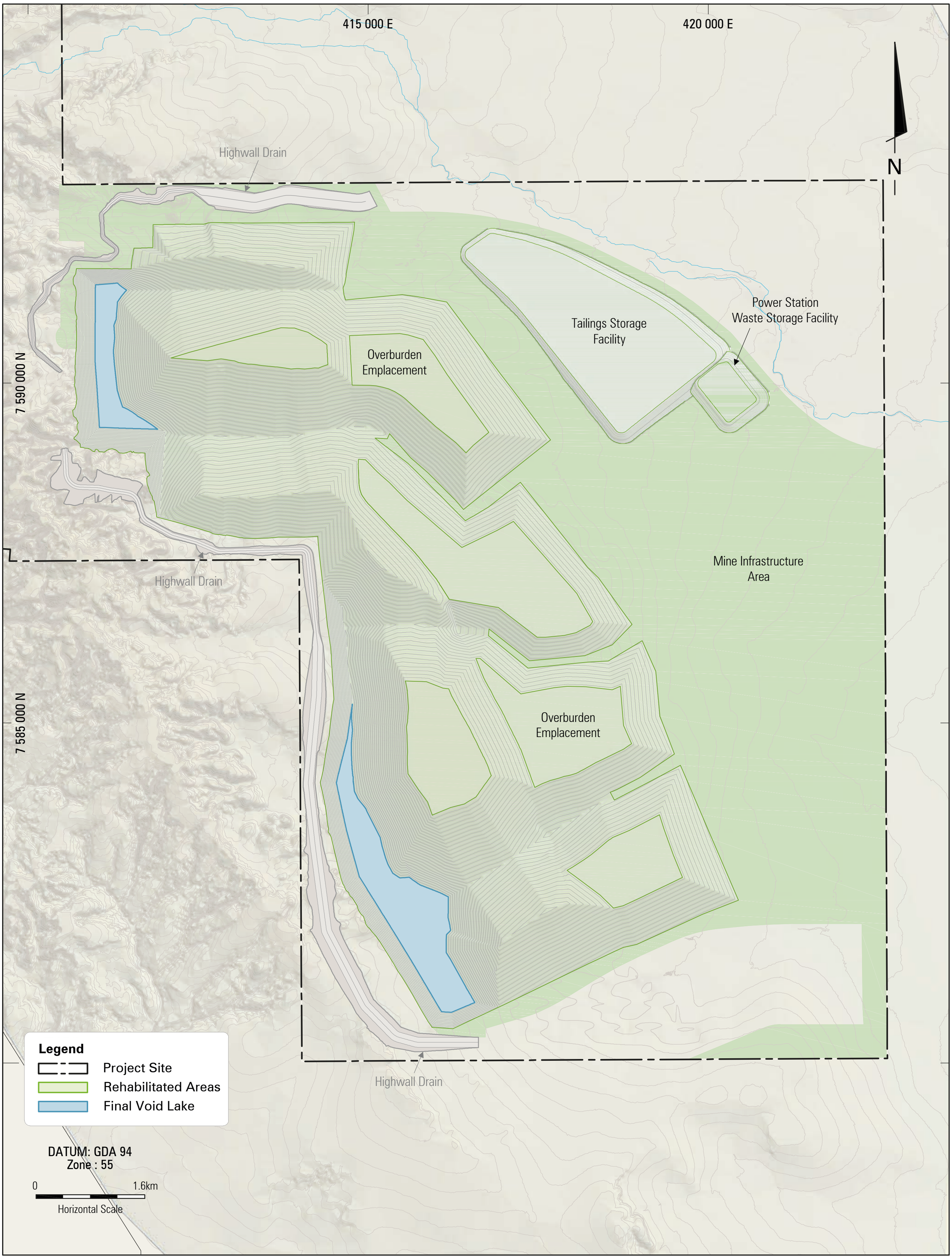
Open Cut Mine Layout - Year 30

FIGURE 4-15



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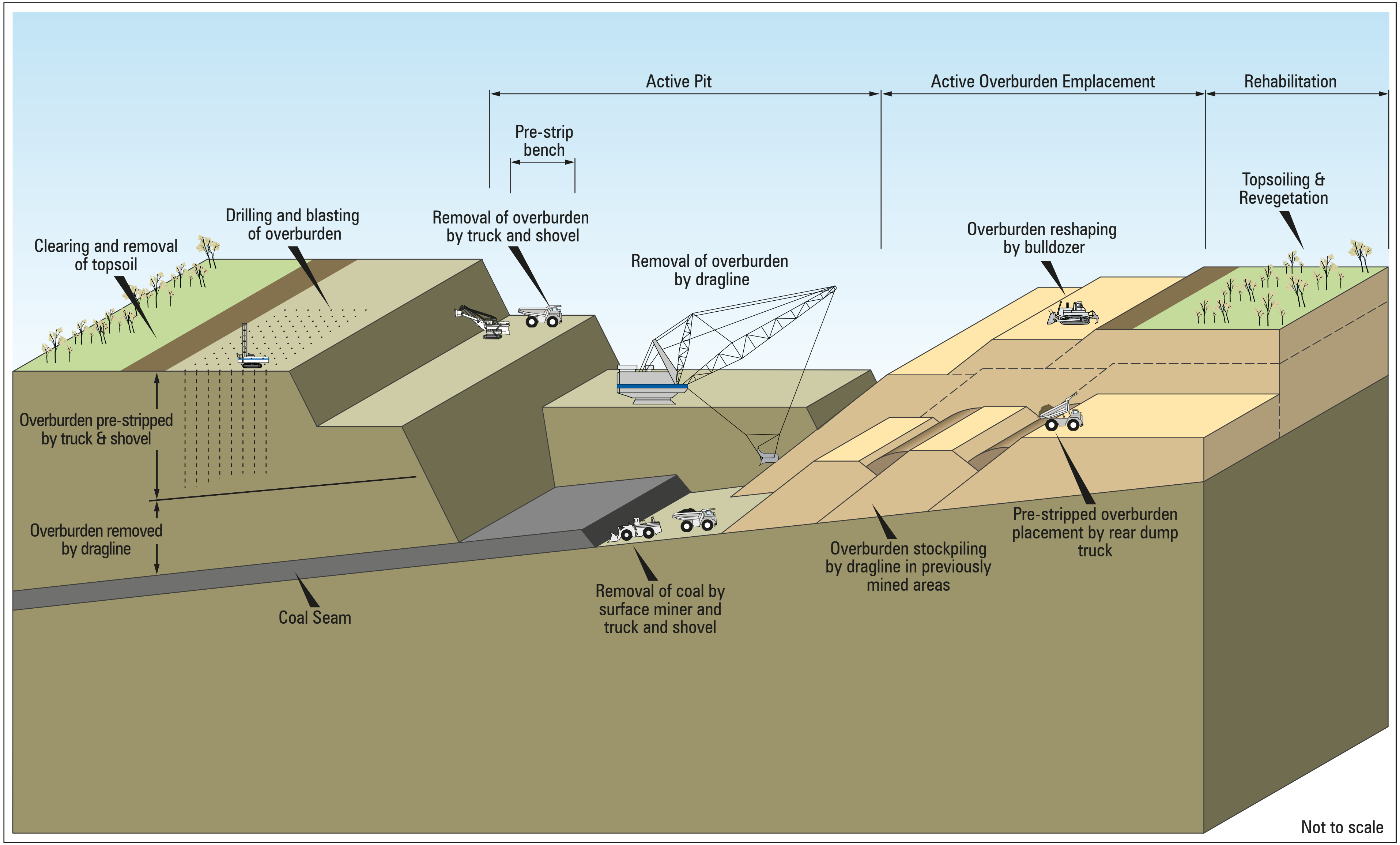
Open Cut Mine Layout - Final Landform

FIGURE 4-16



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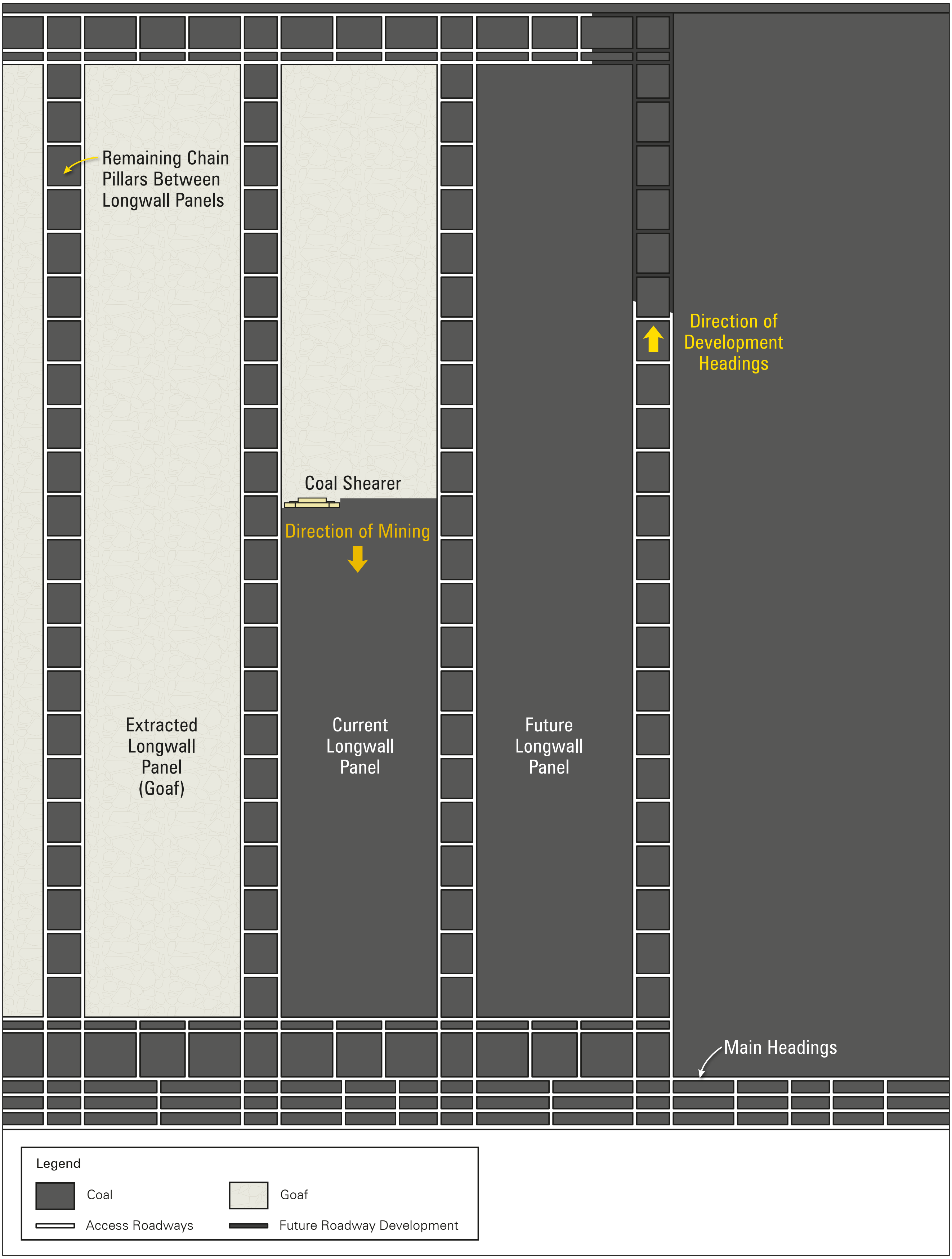
Open Cut Mining Operations Schematic

FIGURE 4-17



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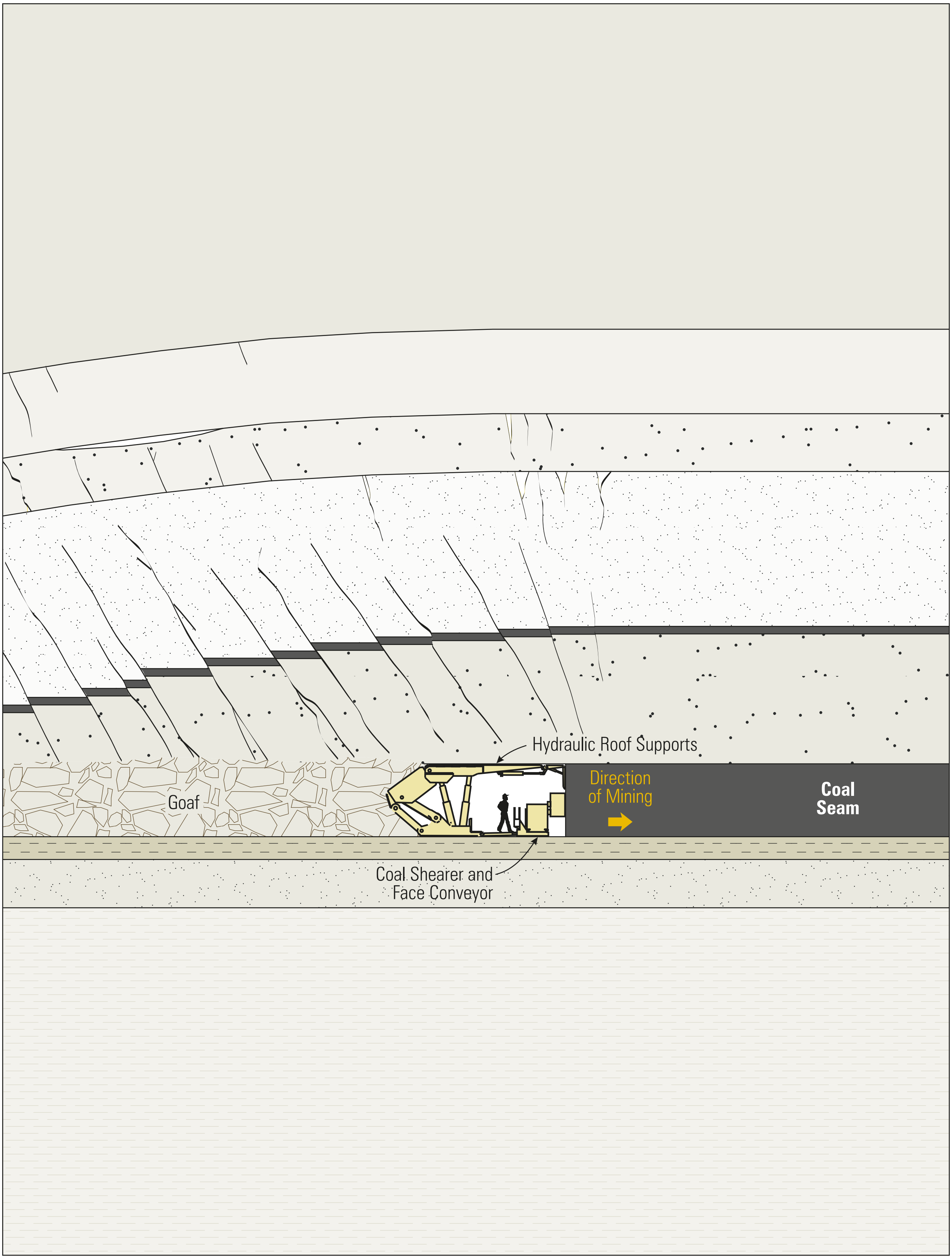
Typical Longwall Layout

FIGURE 4-18



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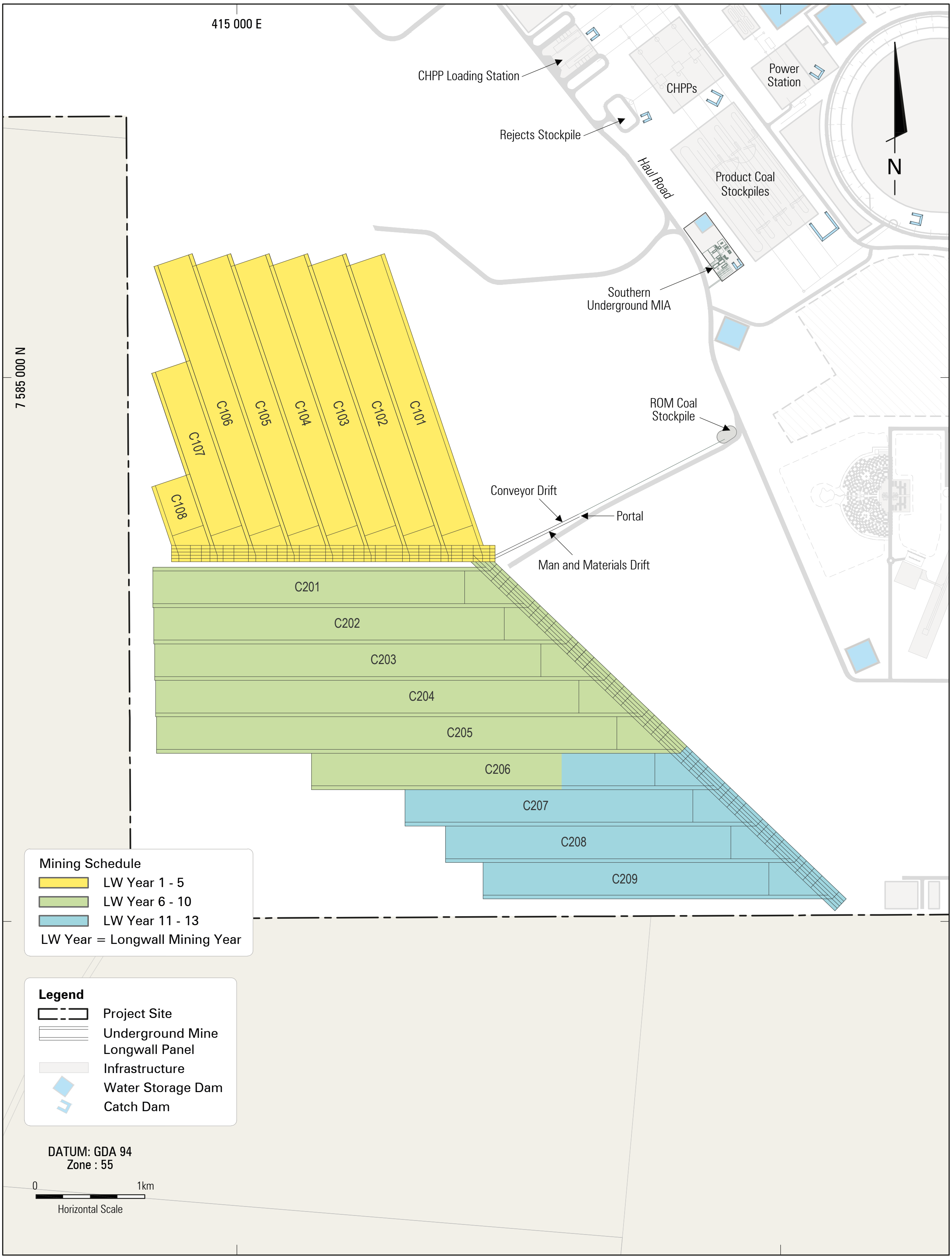
Cross Section Through
Typical Longwall Face

FIGURE 4-19



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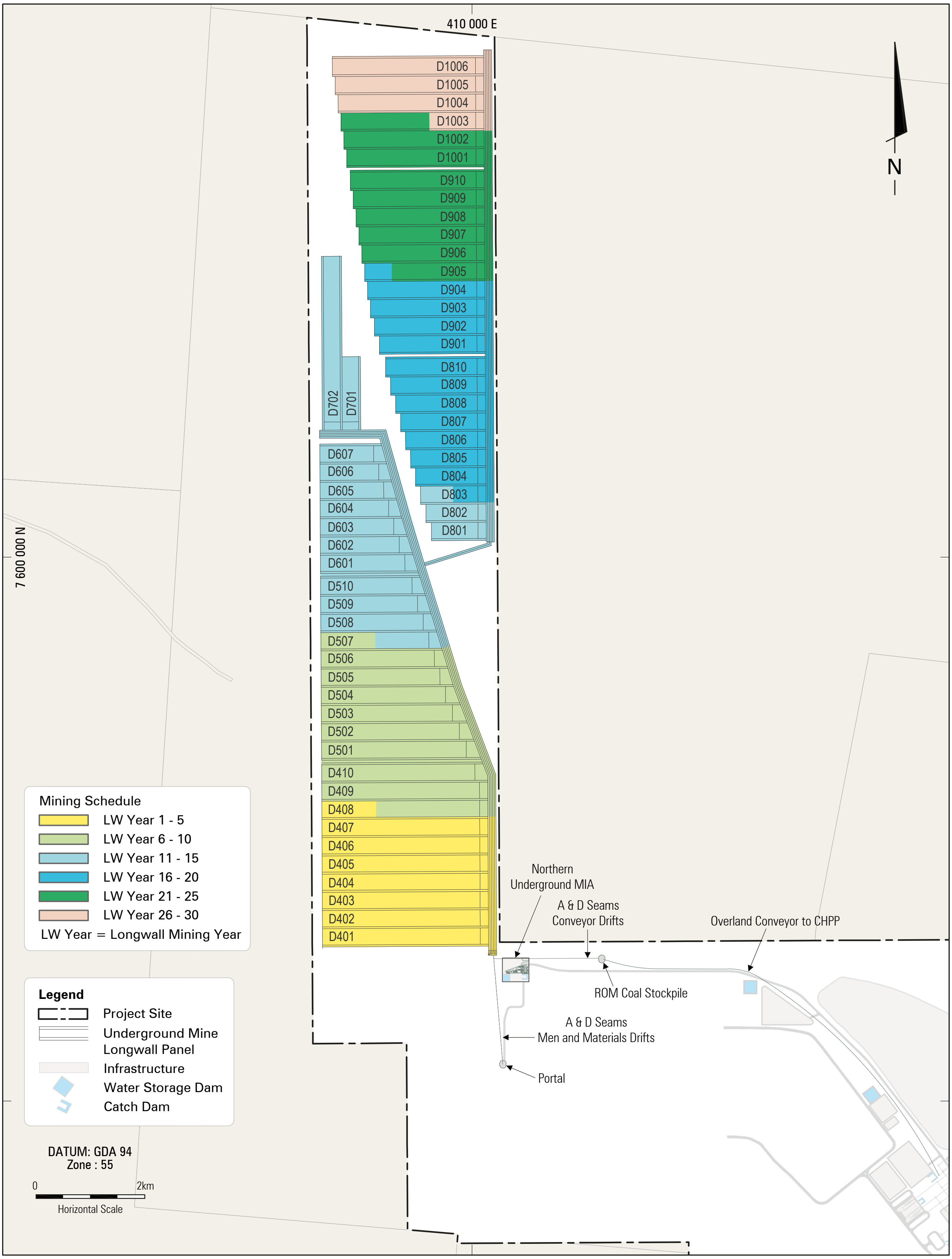
Southern Underground (C Seam)
Mine Layout and Schedule

FIGURE 4-20



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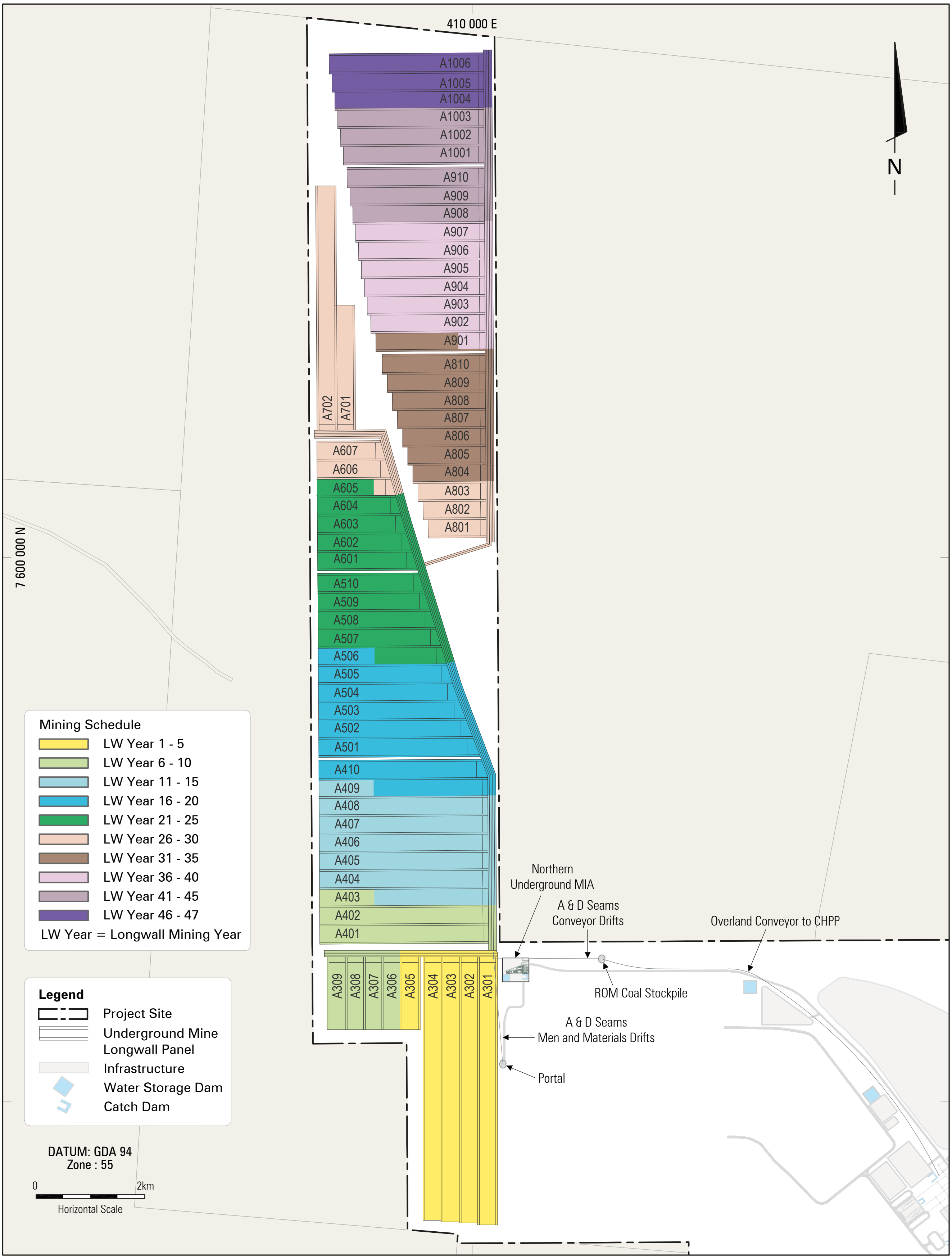
Northern Underground (D Seam)
Mine Layout and Schedule

FIGURE 4-21



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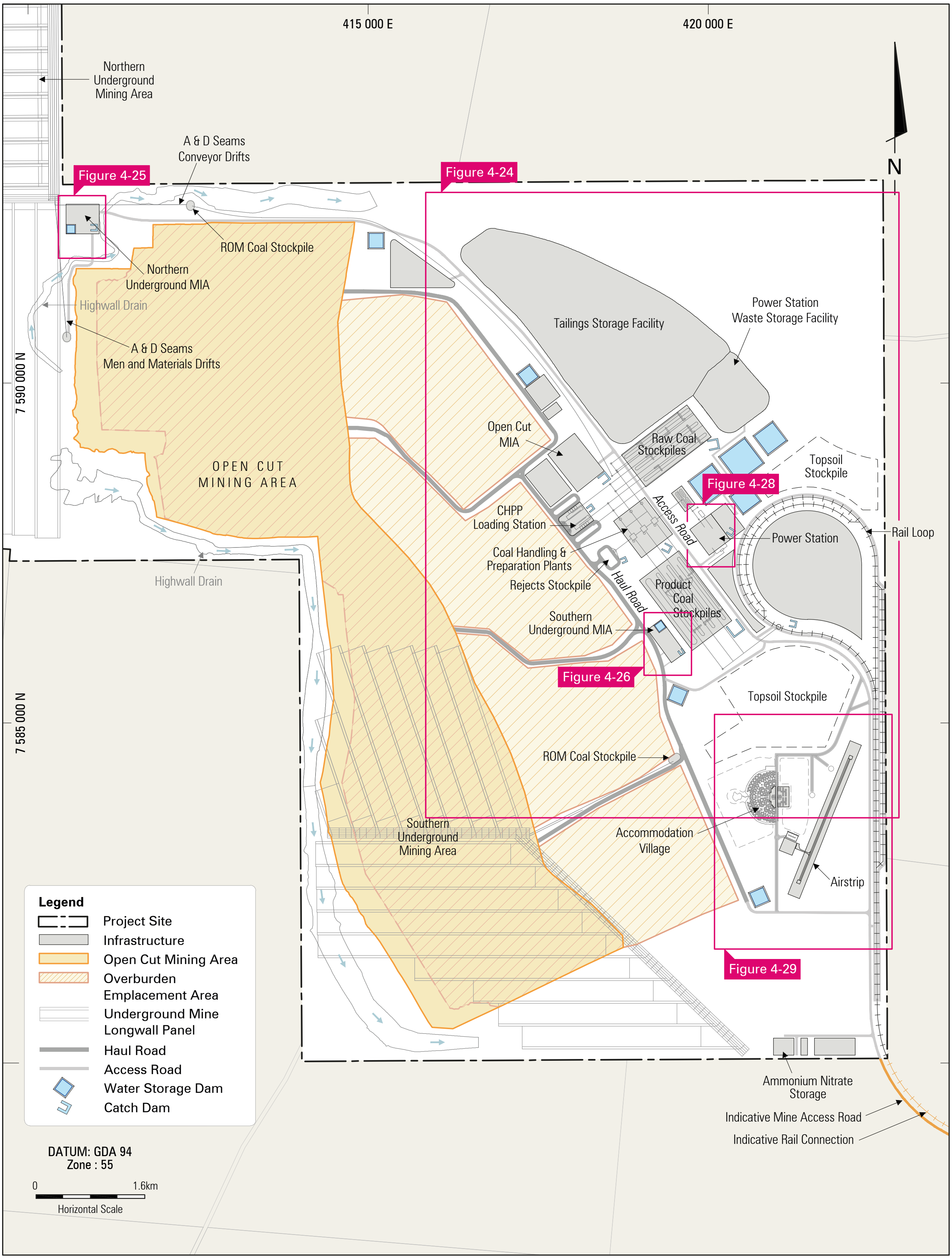
Northern Underground (A Seam)
Mine Layout and Schedule

FIGURE 4-22



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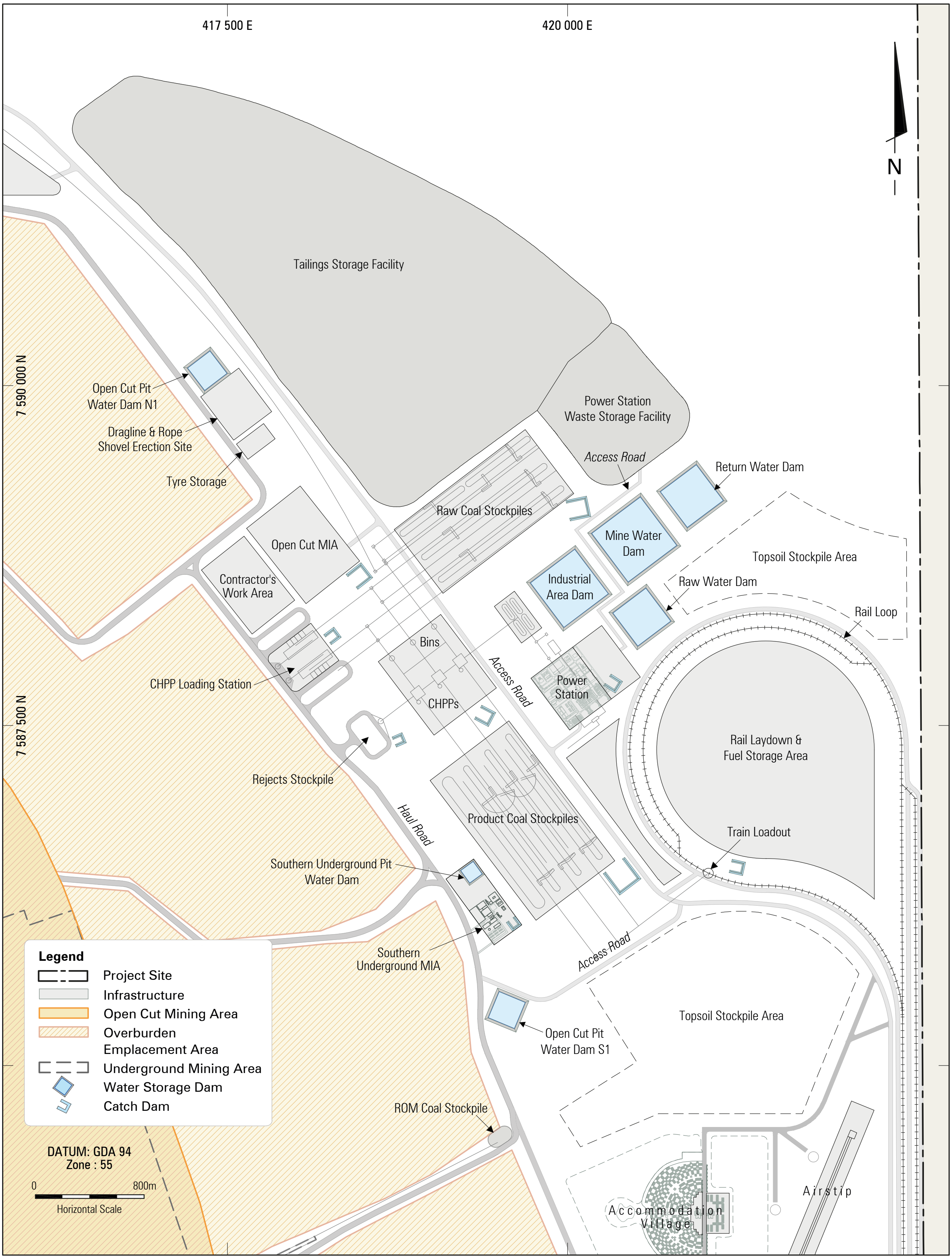
Project Layout - Detail

FIGURE 4-23



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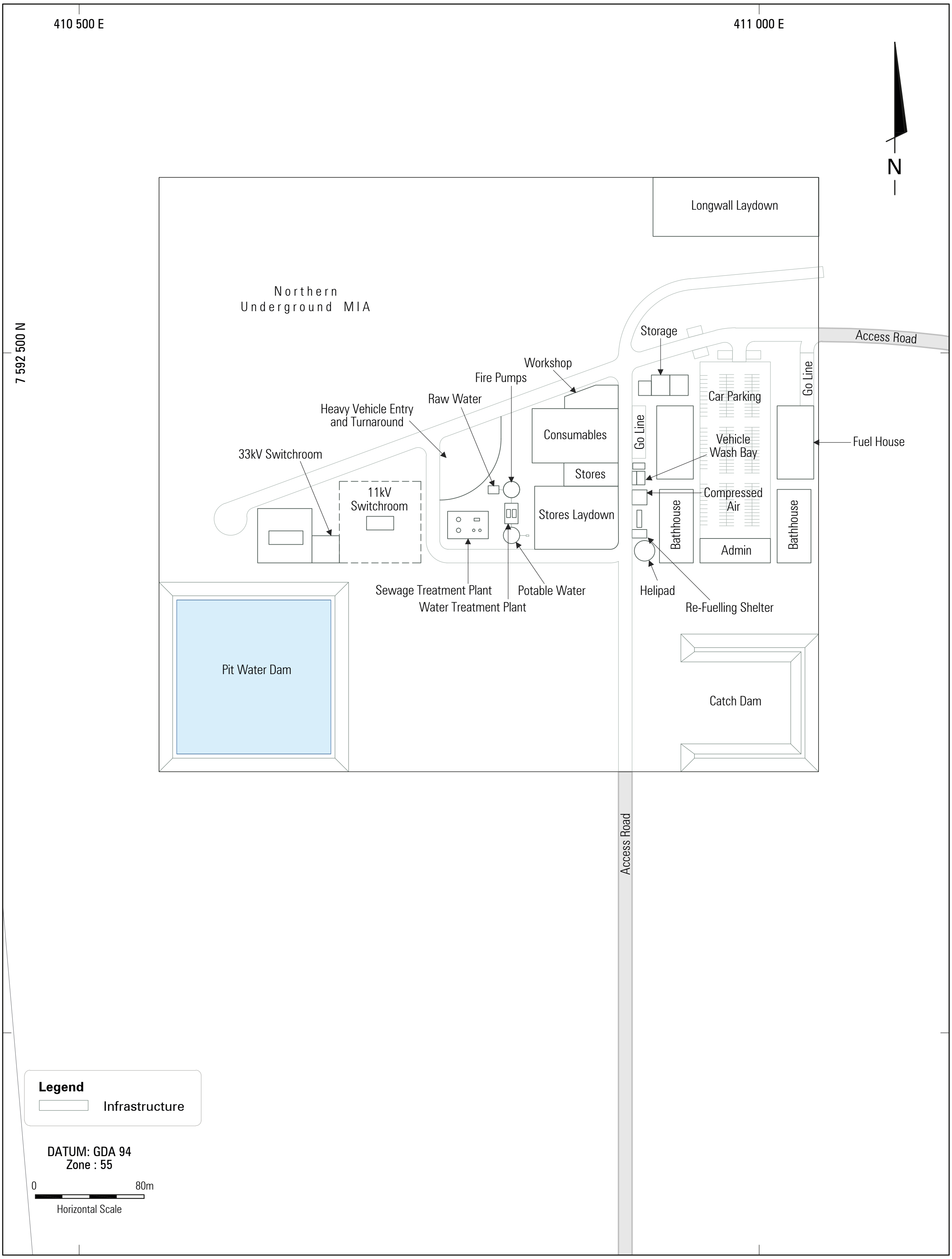
Project Layout -
Central Infrastructure Area Detail

FIGURE 4-24



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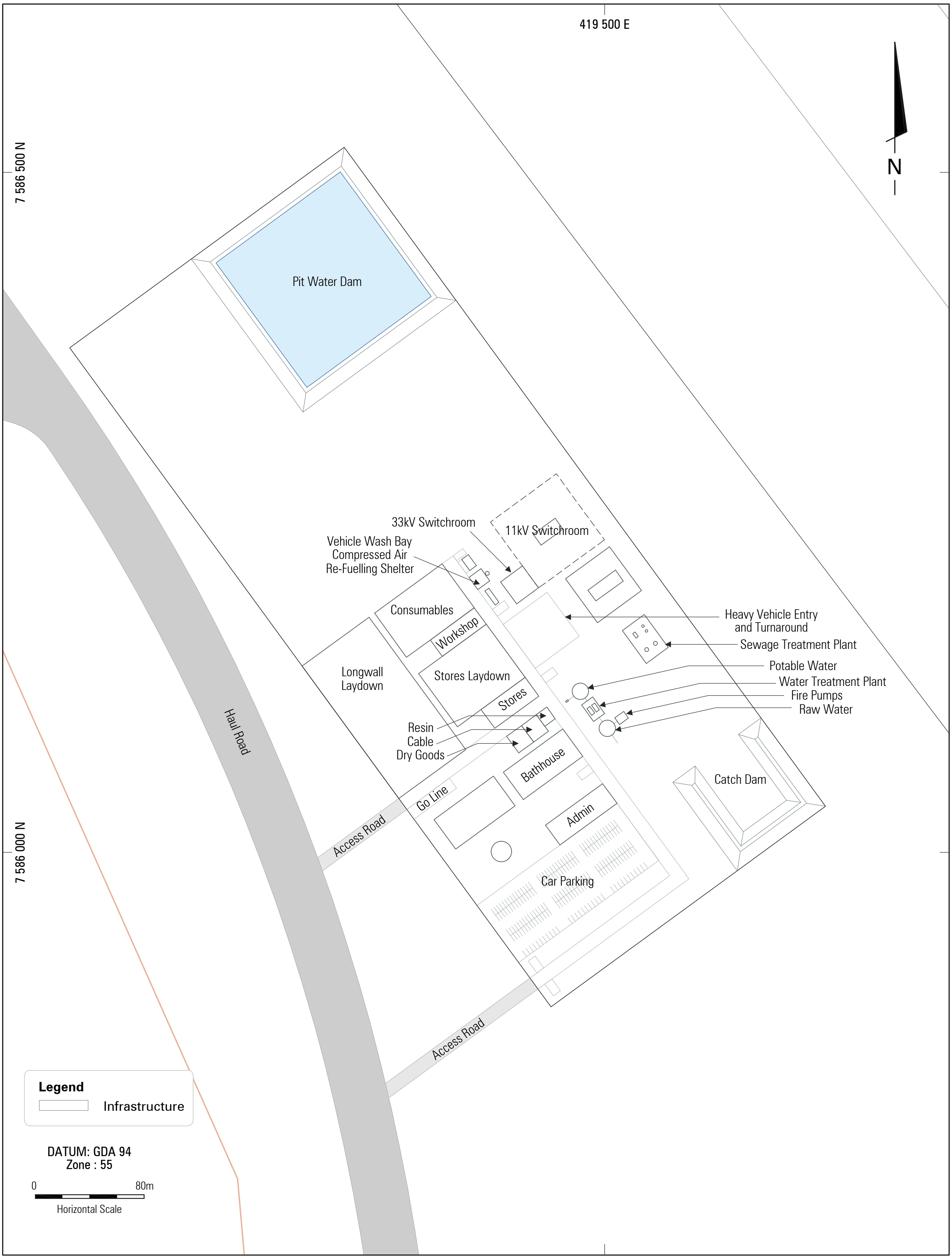
Project Layout - Northern Underground Mine Industrial Area

FIGURE 4-25



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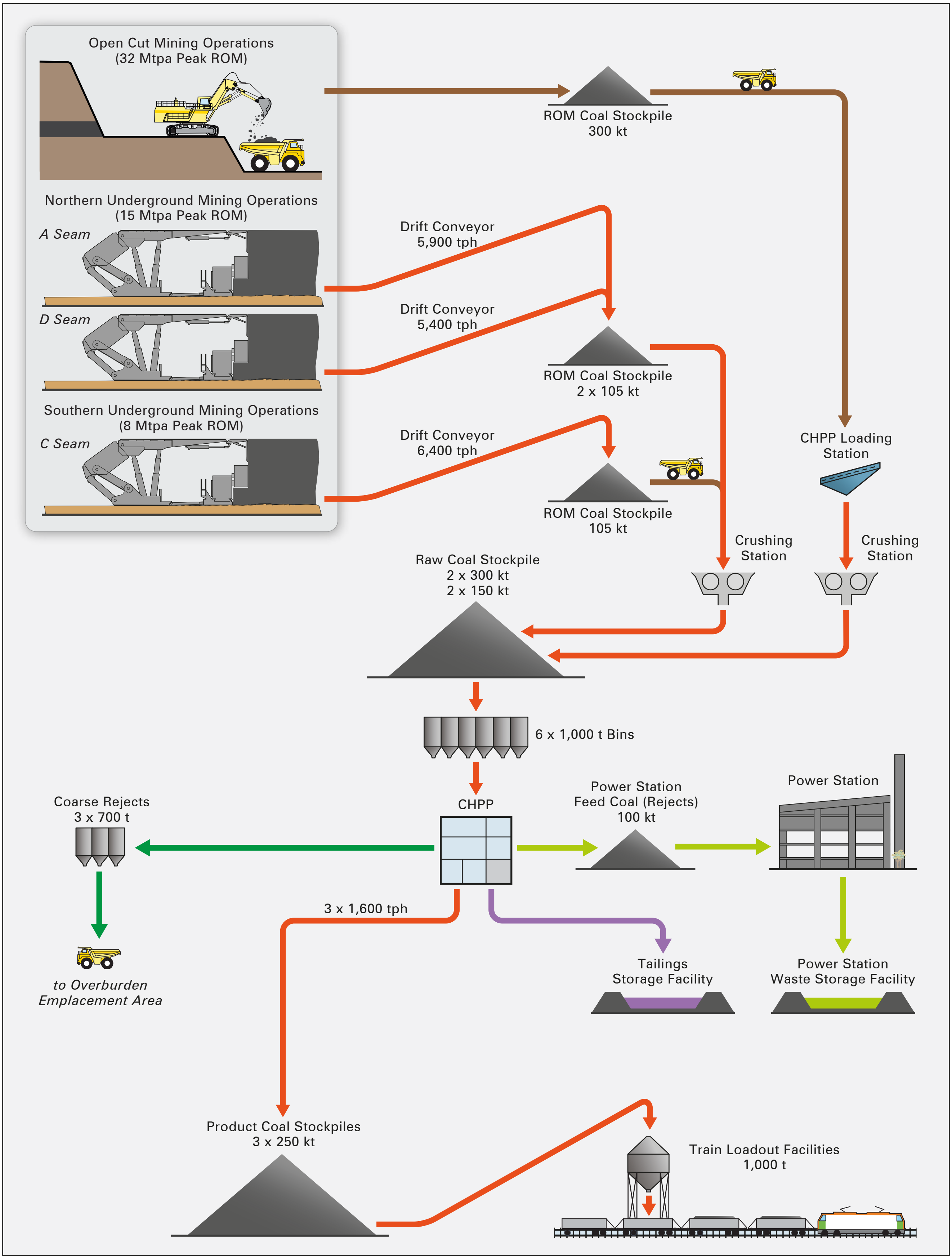
Project Layout - Southern Underground
Mine Industrial Area

FIGURE 4-26



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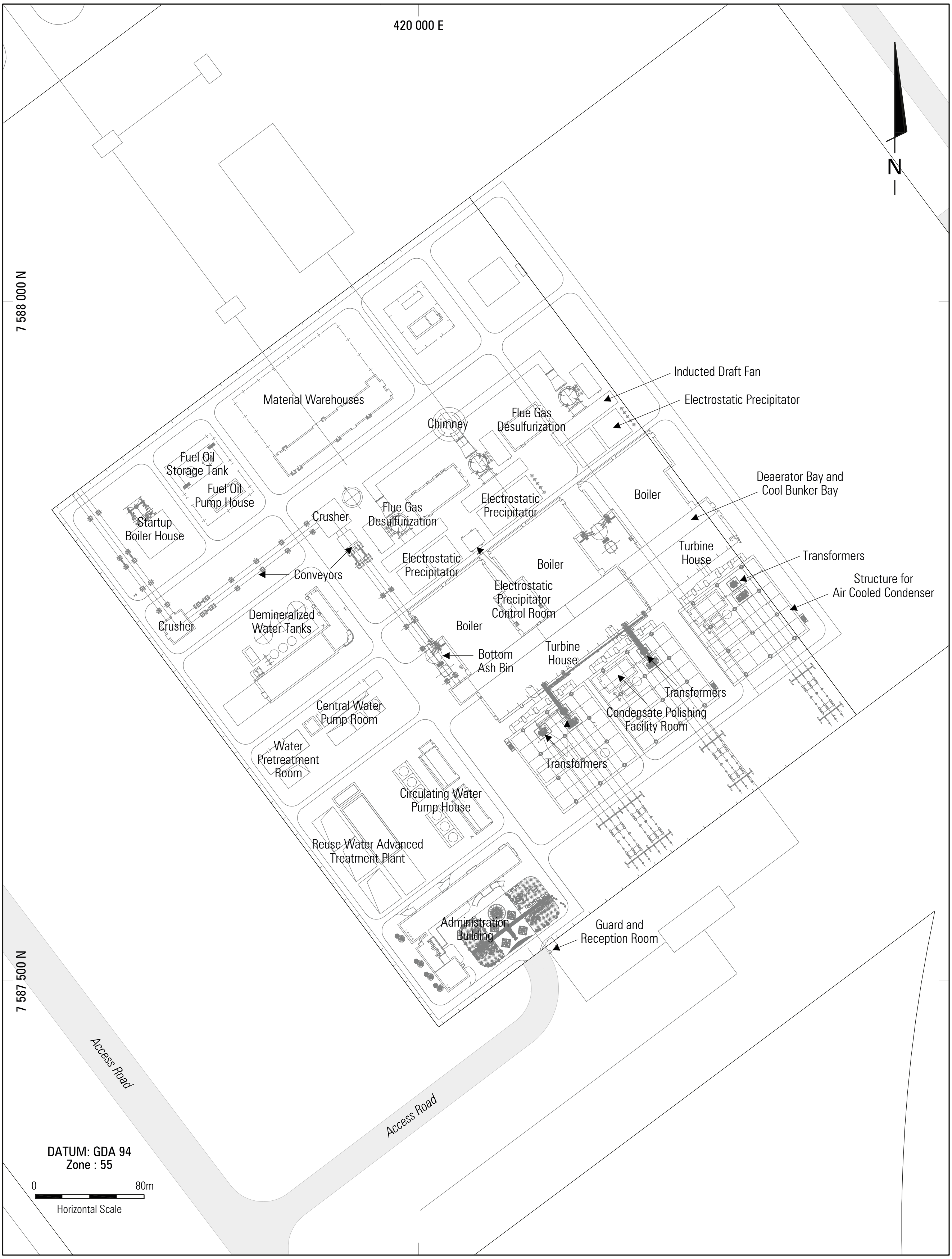
Coal Handling System
Conceptual Process Flowsheet

FIGURE 4-27



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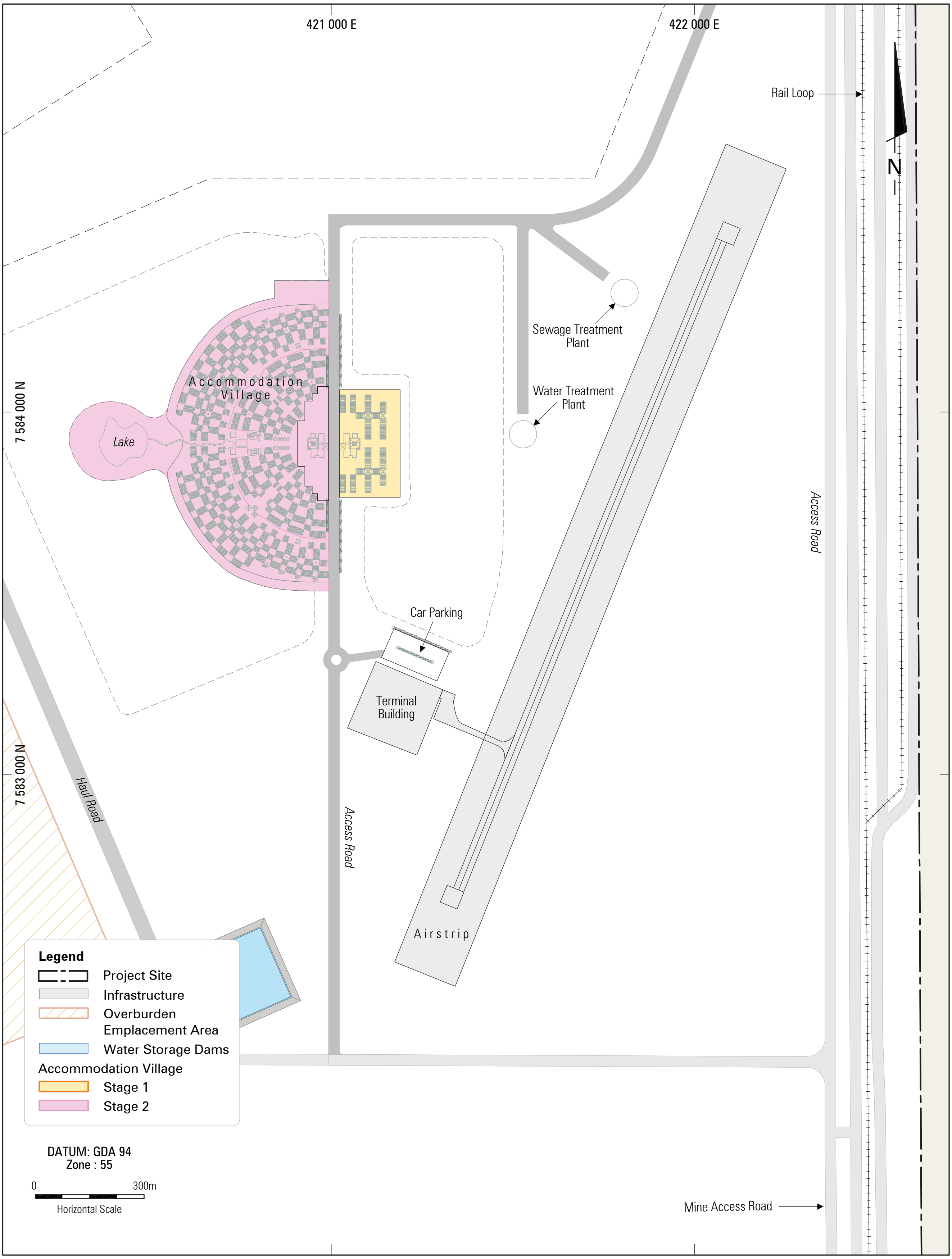
Project Layout - Power Station Detail

FIGURE 4-28



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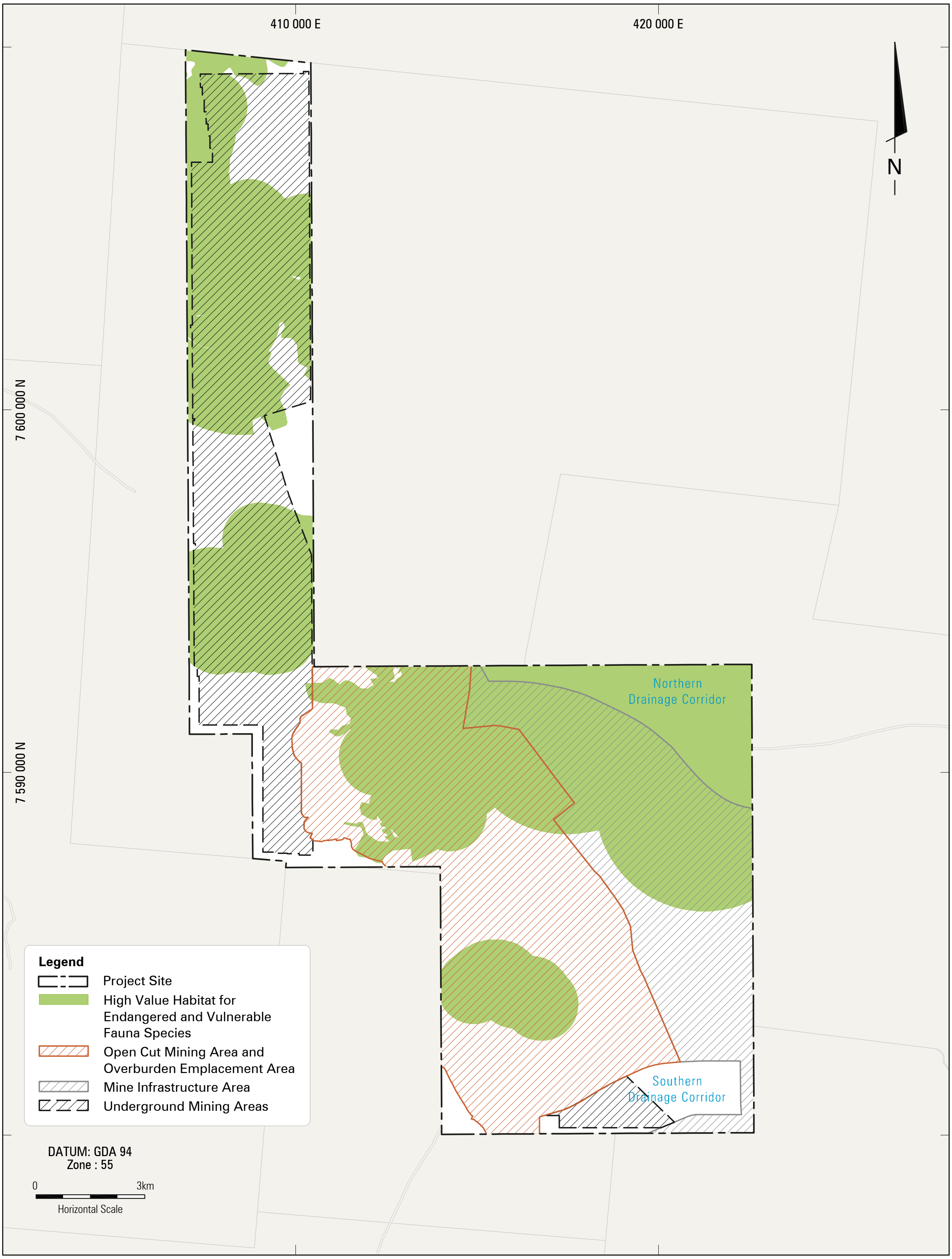
Project Layout - Accommodation Village and Airstrip Detail

FIGURE 4-29



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Habitat Disturbance

FIGURE 4-30