Mine Plan Justification

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DRAYTON SOUTH COAL PROJECT

MINE PLAN JUSTIFICATION

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MINE PLAN JUSTIFICATION REPORT

for
Anglo American

1 INTRODUCTION

Hansen Bailey Pty Ltd (Hansen Bailey) has prepared this Mine Plan Justification Report at the request of Anglo American Metallurgical Coal (Anglo American). This report forms part of the Environmental Assessment (EA) for the Drayton South Coal Project (the Project).

The Project is located approximately 10 km north-west of the village of Jerrys Plains and approximately 13 km south of the township of Muswellbrook in the Upper Hunter Valley of New South Wales (NSW). The Project is predominately situated within the Muswellbrook Shire Local Government Area (LGA), with the south-west portion falling within the Singleton LGA. The Project is located within close proximity to two thoroughbred horse studs, two power stations and several existing coal mines. The location of the Project is illustrated in **Figure 1**.

Anglo American is seeking Project Approval under Part 3A of the *Environmental Planning & Assessment Act 1979* (EP&A Act) to facilitate the continuation of the existing Drayton Mine by the development of an open cut and highwall coal mining operation within the Drayton South area. The Project Application Boundary (Project Boundary) is shown in **Figure 1**.

The Project generally involves:

- The continuation of the operations of the Drayton Mine as presently approved until the completion of the extraction of coal in the presently approved mining area;
- The development of an open cut and highwall mining operation extracting up to 7 Million tonnes per annum (Mtpa) of Run of Mine (ROM) coal over a period of 27 years within the Drayton South area;
- The utilisation of the existing Drayton Mine equipment fleet with the addition of a highwall miner and coal haulage fleet;
- The continuation of the existing workforce with an additional 55 employees and contractors bringing the total operational workforce to 465 personnel;
- The use of Drayton Mine's existing voids for rejects and tailings disposal and water storage to allow for the optimisation of the final landform of the existing Drayton Mine mining area;
- The utilisation of the existing Drayton Mine infrastructure including the Coal Handling Preparation Plant (CHPP), rail loop and associated loading infrastructure, workshops, bath houses and administration offices;

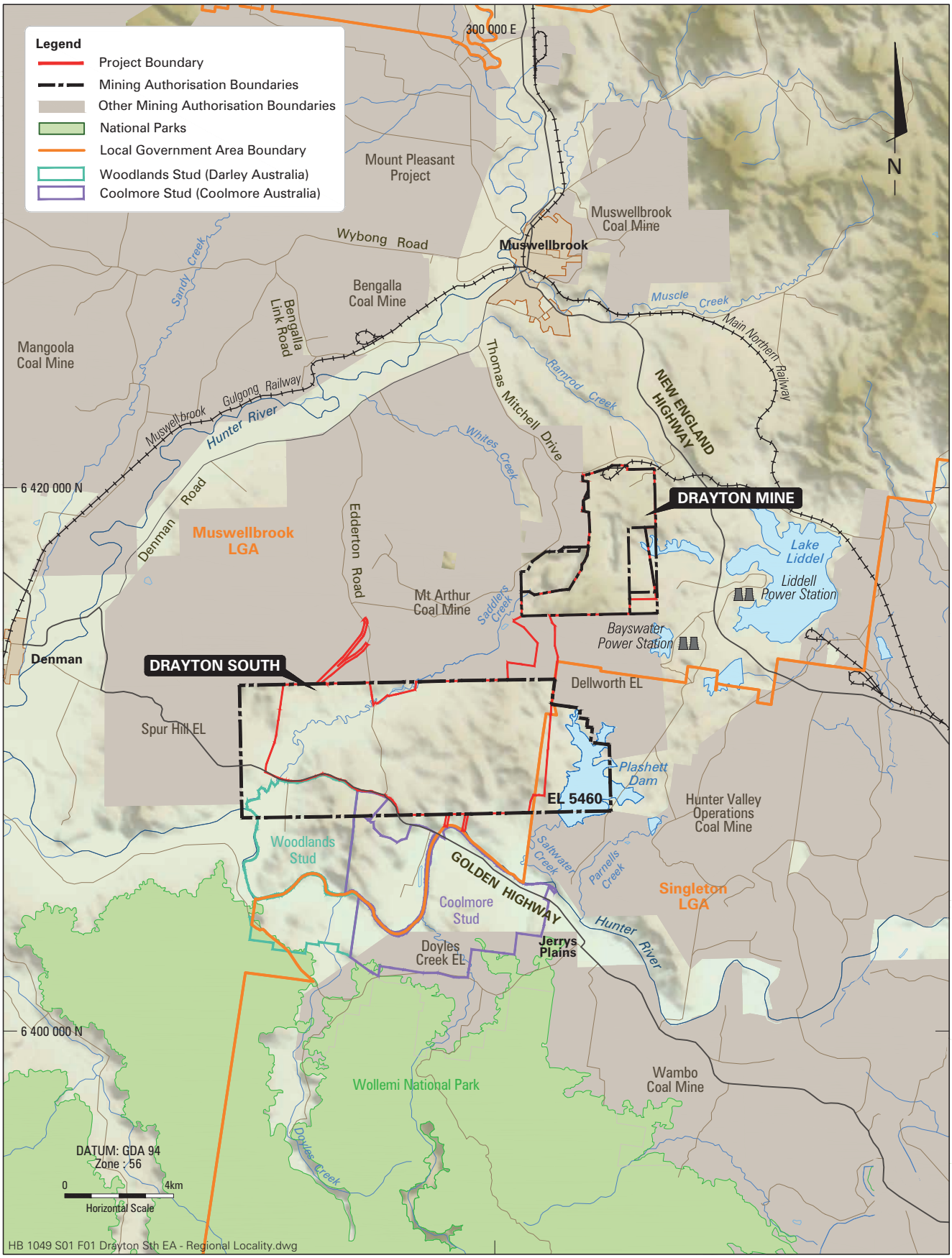
- The construction of a transport corridor between the Drayton South mining area and the existing Drayton Mine;
- The continued utilisation of the Antiene Rail Spur off the Main Northern Railway to transport product coal to the Port of Newcastle for export;
- The realignment of a section of Edderton Road; and
- The installation of further water management and power reticulation infrastructure to support mining in the Drayton South area.

A contractor based workforce of approximately 369 personnel will be required during the peak construction phase.

Following construction at Drayton South, there will be a period when mining will occur at the existing approved Drayton Mine and the Drayton South area concurrently as mining activities are transitioned. During this period, personnel and equipment will be progressively transferred from the existing Drayton Mine area to the Drayton South area. This will continue up until the stage when mining is completed at the existing Drayton Mine.

Once the new Project Approval is granted, the existing approval for Drayton Mine (PA 06_0202) and Development Consent for the use of the Antiene Rail Spur (DC 106-04-00) will be surrendered.

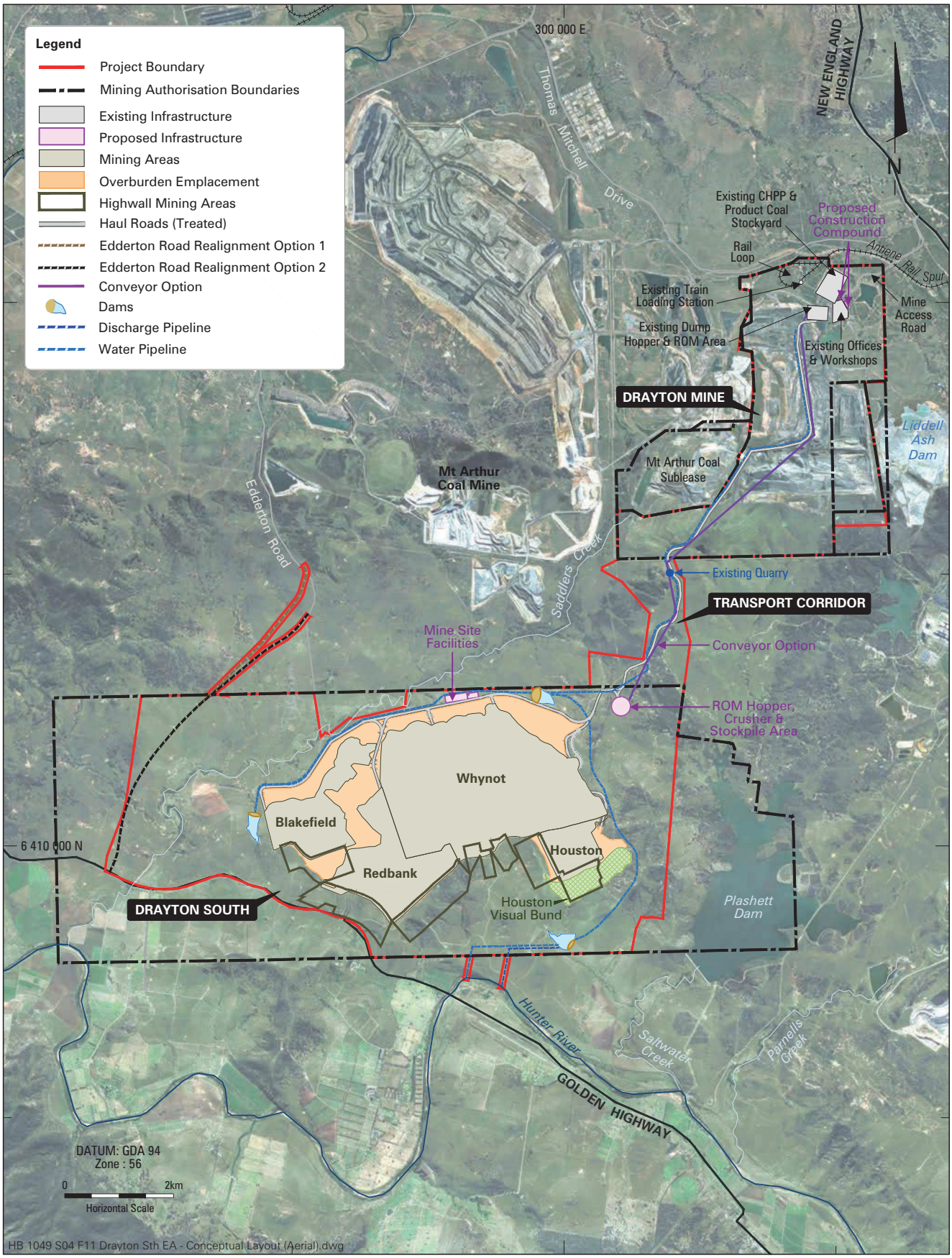
The conceptual layout of the Project is illustrated in **Figure 2**.



DRAYTON SOUTH COAL PROJECT

Regional Locality Plan

FIGURE 1



DRAYTON SOUTH COAL PROJECT

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Conceptual Project Layout

FIGURE 2

1.1 OVERVIEW AND CONTEXT

The Drayton South area is located within Exploration Licence (EL) 5460. EL 5460 was originally granted to the Saddlers Creek Joint Venture (SCJV) on 2 April 1998. Anglo American manages EL 5460 on behalf of the SCJV. Extensive exploration activities have been undertaken within EL 5460 to determine the extent and economic value of the coal resources present. The Drayton South area has previously been known as the Saddlers Creek area and Mount Arthur South.

During the late 1970's and early 1980's, a targeted drilling program was undertaken by the Mount Arthur South Coal Company Pty Ltd (Mount Arthur South Coal Company) as part of the Mount Arthur South Coal Project. In 1982, the Mount Arthur South Coal Company submitted an application for planning approval for coal mining within the same area as the Drayton South Coal Project, with development consent granted by the Minister for Planning on 22 September 1986. Subsequently an ML was issued in 1989. The development consent and ML lapsed in 1991 and 1994 respectively due to failure to physically commence the project.

In 2010, Anglo American conducted a Pre-feasibility Study (PFS) into potential open cut coal mining operations within the Drayton South area. The purpose of the Drayton South PFS was to develop a preferred mine plan for assessment and inclusion in an EA. The PFS considered three options:

- Option 1 assumes no mining at Drayton South, resulting in the closure of Drayton Mine at the end of 2017;
- Option 2 assumes maximum resource recovery from the Drayton South area; and
- Option 3 seeks to maximise resource recovery whilst maintaining environmental impacts at acceptable levels.

The PFS concluded that there was a compelling case for the recovery of the Drayton South Coal resource, which has been identified for mining and held by Anglo American and its predecessors for that purpose for over 30 years. The PFS also determined that this could be achieved without material detrimental effect on the surrounding land uses based on the location, scale and method of mining operations and subject to the application of best practice management and control measures.

From this position Anglo American conducted pre-feasibility assessments of each alternative to determine the most appropriate means of recovering the Drayton South coal resource. The Project was then developed with reference to all of the constraints identified.

The mine plan options investigated as part of the 2010 PFS were generally consistent with the mine plan that was approved for the Mount Arthur South Coal Project over the same area.

Following detailed consideration of the three mine plan options in the PFS, it was decided that Option 3 is the mine plan that should be assessed in an EA for the Project. Option 3 was the preferred mine plan because it optimises coal production as much as possible whilst limiting environmental impacts to approvable levels. A detailed discussion of the mine plans considered in the PFS is provided in **Section 3**.

The assessment of the Option 3 during the preparation of this EA indicated that further constraints were necessary. These additional constraints were applied to the Option 3 mine plan to produce the '*Project Mine Plan*', for which planning approval is being sought. The development of the Project Mine Plan is described in **Section 4**.

1.1.1 REPORT PURPOSE

This Mine Plan Justification Report describes the key factors considered during the development of the mine plan for the Project. It evaluates the two mine plan options considered in the PFS and explains why the Option 3 mine plan was selected for assessment in an EA. This report also describes how the Option 3 mine plan was further refined during the preparation of this EA, and explains why the Project Mine Plan is the most suitable mine plan for the Project.

This Mine Plan Justification addresses the Director-General's Environmental Assessment Requirement which states that the EA must contain:

> *"A detailed description of the Project, including the:*
>
> - *alternatives considered, including justification for the proposed mine plan."*

1.1.2 REPORT STRUCTURE

This report is structured as follows:

- **Section 2** provides a detailed overview of the geology in the vicinity of the Project and the exploration work undertaken by Anglo American to define the coal resource;
- **Section 3** provides a detailed description of the various factors considered in the development of the mine plan, including geology, coal reserve, coal quality, mining method, and environmental considerations;
- **Section 4** describes the preferred mine plan for the Project and justifies why it is the most efficient and ecologically sustainable option; and
- **Section 5** provides a conclusion to this report.

2 GEOLOGY

2.1 REGIONAL SETTING

The geology underlying the Drayton South area consists of Quaternary alluvial deposits and Permian coal measures within the Singleton Supergroup (formerly known as the Singleton Coal Measures). The Singleton Supergroup is comprised of several geological sub-groups including the Newcastle Coal Measures, Tomago Coal Measures and Wittingham Coal Measures. Open cut mining operations at Drayton South will target five seams within the Wittingham Coal Measures: the Whybrow, Redbank Creek, Wambo, Whynot and Blakefield seams.

The coal plies within EL 5460 generally exhibit good lateral continuity, with limited splitting. The overburden and interburden within the Wittingham Coal Measures consist mainly of sandstone, siltstone, mudstone, tuff and claystone. Triassic / Jurassic intrusives are present within EL 5460, with the different coal seams intruded in different areas, resulting in an overlapping sill sequence. Dykes and sills have been confirmed by field mapping and drilling.

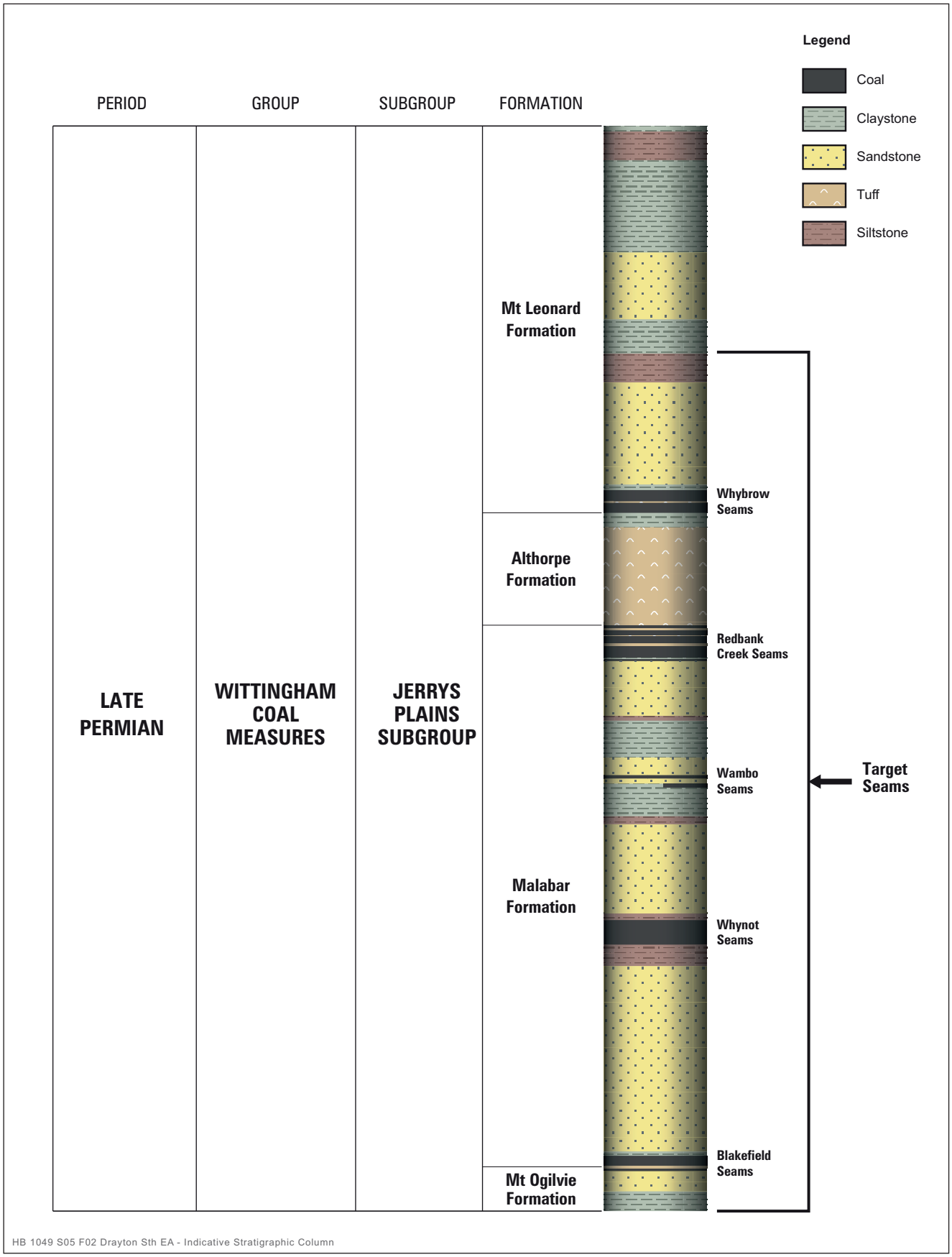
The Project is located on the west of the Muswellbrook Anticline. The Wittingham Coal Measures subcrop in the eastern portion of EL 5460, along the strike of the Muswellbrook Anticline. The coal seams generally dip gently to the south-west; however, the dip can reach 45° on the western limb of the Muswellbrook Anticline.

The Calool Syncline is a gentle south south-east plunging syncline system that transects the eastern half of the Project. West of the syncline, the strata dip at 2-3° to the south-east. The most significant regional fault structures are:

- A complex north north-west trending graben structure (the graben structure), which is part of a regional graben system, which transects the western half of EL 5460; and
- A north south trending thrust system along the western edge of EL 5460, which is part of a regional thrust fault.

Within the Project Boundary, the Wittingham Coal Measures are overlain by thin Quaternary alluvial deposits along Saddlers Creek and the Hunter River. The alluvial and colluvial deposits consist of unconsolidated silt, sand and minor fine gravels.

The stratigraphic sequence within the Project Boundary is illustrated in **Figure 3**.



HB 1049 S05 F02 Drayton Sth EA - Indicative Stratigraphic Column

DRAYTON SOUTH COAL PROJECT

Indicative Stratigraphic Column

FIGURE 3

2.2 EXPLORATION HISTORY AND STATUS

2.2.1 Historical exploration

The area that is now covered by EL 5460 has been the focus of exploration activities since the 1940's. There were four main phases in the exploration history of the area prior to the granting of EL 5460:

- Drilling by the Bureau of Mineral Resources in the 1940's and 1950's;
- Regional drilling by the Joint Coal Board and the Electricity Commission from 1968 to 1976;
- Drilling for the Mount Arthur South Coal Project between 1978 and 1982; and
- Between 1975 and 1993, over 130 boreholes were drilled by Carpentaria ex / Mount Isa Mines Limited in the course of mining and feasibility studies.

2.2.2 Anglo American Exploration

In 1997, the SCJV was awarded the Saddlers Creek Coal Development Area. The Saddlers Creek area was earmarked for open cut mining of the Whybrow and Redbank Creek seams, followed by underground mining of the Whynot shallow underground and then the Woodlands Hill, Arrowfield, Bowfield and Warkworth seams using longwall methods.

The area set aside for underground mining was explored using 3D dynamite surface seismic surveys. These surveys assisted in interpreting structure of the seams targeted by underground mining. The seismic surveys also supported the existence of interpreted faults, which were later confirmed by drilling.

From 1998 to 2009, extensive drilling was conducted in both the open cut and underground resource areas to obtain structural, coal quality, geotechnical, geochemical, hydrogeological, spontaneous combustion and seam gas data. Exploration drilling utilised slim and large diameter cored holes as well as non-cored holes, all with down-hole geophysics. Cored holes were subject to quality and geotechnical testing. Drilling was supplemented by aerial and ground magnetic and radiometric surveys. These exploration activities enabled the modelling of the coal deposit, and facilitated the development of mining options for consideration in a PFS.

From 2005 to 2007, a PFS was undertaken for the then Saddlers Creek Project, a combined open cut and underground operation utilising two draglines and longwall extraction. This mine would produce thermal coal product from the open cut operations and thermal, semi-soft and pulverised coal injection products from the underground operations.

By 2009, Anglo American had developed a nominal 500 m x 500 m coal quality grid covering the majority of the Project's disturbance footprint.

In 2010, Anglo American conducted a PFS for the Drayton South Coal Project. The PFS evaluated the suitability of two mine plans similar to the mine plans considered in the Saddlers Creek PFS. The PFS recommended that Project Approval be sought for mine plan Option 3.

Anglo American will undertake further exploration within the Drayton South area in 2012 and 2013. The objectives of the 2012/13 Exploration Program are to obtain further coal quality data, locate the seam subcrops and limits of oxidation (LOX) line, and refine the extents of sills present in the area.

The extensive exploration program undertaken by Anglo American has resulted in a comprehensive understanding of the geology of the area.

3 MINE PLAN DEVELOPMENT

3.1 INTRODUCTION

The primary objective of mine planning was to design an effective replacement for the coal production at Drayton Mine. The key objectives of mine planning were to achieve:

- A relatively uniform blend of coal from different seams to overcome detrimental impacts caused by any one seam;
- A uniform feed rate to the CHPP to achieve high utilisation of the Coal Treatment Unit (CTU);
- Minimal fines generation by reducing rehandling and dozing;
- Minimal dust, noise and visual impacts on sensitive receivers to the south of the Project; and
- A smooth transitioning of operations from the existing Drayton Mine to Drayton South, obviating the need to retrench employees.

The development of the preferred mine plan for the Project consisted of careful consideration of the following factors:

- Geology of the Drayton South area, particularly coal seam thickness and distribution, geological structure and faulting, igneous intrusions and coal quality;
- Coal Reserves estimated in accordance with the JORC;
- Various mining methods;
- Mining locations;
- Location and design of overburden emplacement areas (OEAs);
- Equipment Selection;
- Mine Safety; and
- Environmental considerations.

The PFS assumed that the Project will commence in 2014. All timeframes in the mine plans are relative to this start date.

3.2 GEOLOGY

3.2.1 Coal Quality

Coal quality analysis has been undertaken on NQ, HQ and large diameter (150 mm and 200 mm) core samples. Both structural and Coal quality models have been developed using Gemcom's MINEX software. The coal quality model was used to compare Option 2 and Option 3 for the mine plan. A comparison of Drayton South coal quality for mine plan options 2 and 3 is presented in **Table 1**.

Table 1
Coal Quality Validation

	Simulated LD Cores	Mine Plan Option 2	Mine Plan Option 3	Option 3 Variance
ROM Ash (%)	24.3	21.9	23.5	-0.8
Yield (%)	74.6	73.2	75.3	+0.7
Product Ash (%)	13.4	14.0	14.2	+0.8

All seams are best suited to production of export and high quality domestic thermal coal. Yield will be optimised when seams are processed concurrently, thereby allowing ROM and product coal blending to be undertaken.

3.2.2 Coal Seam Thickness and Distribution

The Project will target the Whybrow, Redbank Creek, Wambo, Whynot and Blakefield seams. These seams occur throughout the Drayton South area, but are limited in distribution by igneous intrusions. The thicknesses of the target coal seams are listed in **Table 2**.

Table 2
Stratigraphic Sequence at Drayton South

SUMMARY OF STRATIGRAPHIC SEQUENCE					
Age	**Group**	**Subgroup**	**Coal Seams**	**Thickness (m)**	**Lithology**
Quaternary	--	--	--	0 – 10	Residual soils and colluvium units including all blanketing sandy, loamy and clay soils
Permian	Wittingham Coal Measures	Jerrys Plains Subgroup	Whybrow	2.5 - 4	Coal seams, claystone, tuff, siltstone, sandstone and conglomerate
			Redbank Creek	4 - 6	
			Wambo	0.5	
			Whynot	2	
			Blakefield	2.2	

3.2.3 Seam Subcrops and Limits of Oxidation

Drilling has been undertaken to define the subcrop and LOX lines for the target coal seams. The seam subcrops and LOX lines have been used to define the updip of the mining areas. The implications of the LOX lines are discussed further in **Section 3.5.1**.

Further LOX line definition drilling will be undertaken at Drayton South in 2012 and 2013.

3.2.4 Geological Structure and Faulting

The two major structural features present at Drayton South are the regional Muswellbrook Anticline and the Calool Syncline. The coal seams dip gently at an angle of 2 – 5°. In the eastern extents of EL 5460, the seams onlap onto the western limb of the Muswellbrook anticline, where seam dips can be as high as 45°.

Faulting within the Drayton South area is limited. The faults that are present are expected to be normal faults, with dips of greater than 70° and throws of less than 10 m. To the west of the Project Boundary is a graben structure within a throw of 25 – 70 m trending approximately north south, while to the east is a significant structure thought to underlie the Muswellbrook Anticline. The majority of structure at Drayton South is oriented NE-SW.

Igneous sills and intrusions are a major limiting factor for mining at Drayton South. Four dykes have been identified and an additional four igneous plugs have been inferred. The impact of dykes on open cut mining is expected to be minimal, with in-seam silling being the major limiting factor in pit design.

Each target seam at Drayton South has been silled to a certain extent, resulting in limitations for mining. Sills at Drayton South are thought to derive from a number of feeders, and typically replace coal seams where present. Sills are typically doleritic, and around sill limits, some coal is generally heat affected. Sills within the Project Boundary define the pit limits of the Blakefield and Whynot mining areas, and reduce the available resources of every seam to some extent during mining. Where sills are present above target seams, additional design work will be used for mining.

A sill in the Blakefield seam prevents this seam from being mined to the east of Edderton Road. There is a dolerite sill in the centre of the Drayton South area that constrains mining of the Whynot seam in the north-east of the area. It also limits mining in the west to above the Blakefield Seam. Silling in the Wambo seam is not as extensive but largely overlies the Whynot sill. As a result, the central area of the deposit can only be mined to the Redbank Creek seam. The Redbank Creek seam is intruded near the intersection of Edderton Road and the Golden Highway.

The Whybrow seam is intruded in the south-east of the Drayton South area. This increases the stripping ratio for mining the deeper Redbank Creek and Whynot seams. In the south-east of the area, most of the upper seams are intruded. In addition to limiting coal extraction, the silling may impact blast design.

3.3 RESERVE ESTIMATES

3.3.1 Reserve Estimates

A coal reserve estimate was developed for the Option 2 and Option 3 mine plans. These reserves are presented in **Table 3** and **Table 4**.

Table 3
Reserves for Option 2

Mining Area	ROM Coal (Mt)	Product Coal (Mt)	ROM Coal Ash (%)	Product Coal Ash (%)
Whynot	111.4	82.8	22.9	13.8
Redbank	45.4	32.4	28.8	17.4
Blakefield	14.9	11.7	13.8	8.7
All mining areas	171.7	126.9	23.7	14.3

Table 4
Reserves for Option 3

Mining Area	ROM Coal (Mt)	Product Coal (Mt)	ROM Coal Ash (%)	Product Coal Ash (%)
Whynot	71.7	54.3	22.8	12.9
Redbank	21.7	15.8	27.4	16.7
Blakefield	5.5	4.5	14.9	7.2
Houston	5.5	4.0	31.1	19.1
Highwall mining	6.2	4.8	-	14.8
All mining areas	110.6	83.4	22.4	13.7

3.4 MINING METHOD

Mining operations at Drayton South will utilise the infrastructure and equipment presently at Drayton Mine. Therefore, the mining methods to be employed at Drayton South have been largely dictated by the equipment fleet in use at Drayton Mine. Mining at Drayton Mine is presently undertaken using a dragline, excavators and fleet of haul trucks.

3.4.1 Dragline assisted by truck and excavator

The dragline and excavators in operation at Drayton Mine will be transported to and used at Drayton South. The advantages of dragline operations are high productivity and low operating cost.

Drayton South is a shallow open cut deposit with low seam dips, a long strike length and a relatively high strip ratio. Due to the higher strip ratio, the dragline is not capable of removing sufficient overburden to expose the required coal in all areas. As a result, some areas will need to be stripped by excavator to achieve the target ROM production.

In order to maximise efficiency, the dragline will be utilised in higher strip ratio areas, where it would be uneconomic to remove overburden using excavators in these areas. The higher strip ratio areas target the higher quality coal at Drayton South. Due to the long strike length at Drayton South, throw blasting and dozer push can be used to assist the dragline in overburden removal.

Excavators will be used to remove overburden down to the Redbank Creek seam for all mining areas, with the dragline exposing coal below this horizon.

The Redbank mining area will be mined predominantly using the truck and excavator method. Throw blasting and dozer push will be employed to improve efficiency of overburden removal. The design of this mining area incorporates a minimum strike length of 1.8 km to allow continuous sequencing of blasting and excavator operations.

3.4.2 Highwall Mining

Due to the larger reserve available under mine plan Option 2, open cut operations can produce the required 4 Mtpa of product coal for in excess of 21 years. However, under Option 3, this production rate can only be sustained until 2021 using only open cut mining. In order to achieve this production rate beyond 2021, highwall mining will be used to supplement open cut mining. Highwall mining is also required to maximise resource recovery and limit the quantity of coal that is sterilised.

In order to maximise the productivity of highwall mining, the Project will utilise a continuous miner system, which can mine to a depth of 500 m. The alternative is open-flight circular auger scrolls, which are limited to a depth of 200 m. The Project will employ the Addington continuous highwall miner system, which has been successfully operated at the Ulan Coal Mine.

Since no artificial supports are installed during highwall mining, the stability of the highwall is reliant upon the self-supporting nature of the rock mass. The Highwall Mining Index (HMI) is a measure of the suitability of a mining area for highwall mining operations. The HMI is a score derived from 15 different parameters, including roof condition, highwall condition and seam condition. A site with a HMI greater than 60 is considered to be a good site for highwall mining. In contrast, a HMI below 40 is considered unsuitable for highwall mining. The HMI scores for the seams targeted by highwall mining are presented in **Table 5**.

Table 5
Highwall Mining Indices

Seam	Highwall Mining Index
Whybrow	75
Redbank Creek Upper	71
Redbank Creek Lower	56
Whynot	65
Blakefield	62

All seams except for the Redbank Creek Lower seam are considered good sites for highwall mining. The Redbank Creek Lower seam will require further geotechnical evaluation and design. The process used to determine the HMI is described in the Australian Coal Association Research Program (ACARP) Report C8033 (2001).

3.4.3 Underground mining

The Drayton South PFS considered the feasibility of underground mining as an alternative to open cut and highwall mining. Under mine plan Option 3, there is an open cut reserve of 111 Mt, including a highwall reserve of 6 Mt. If these seams were mined using underground methods, the coal reserve would be approximately 40 Mt. Underground operations can generate an output of 3.5 Mtpa, which is significantly less than the 5.6 Mtpa recoverable using open cut and highwall mining methods. Since underground mining is not conducted at the existing Drayton Mine, the underground mining alternative would entail substantially higher initial capital expenditure due to the need to purchase new equipment. A comparison of open cut and underground mining is provided in **Table 6**. Clearly, open cut mining is the preferred method.

Table 6
Comparison of Open Cut and Underground Mining

	Open Cut / Highwall Mining	Underground Mining
Reserve (Mt ROM)	111	40
Annual ROM output (Mtpa)	5.6	3.5
Mine Life (Years)	23	12 – 14
Geological Risk	Very Low	Medium

3.5 MINING LOCATION

There is considerable variation in the coal qualities of the different target coal seams at Drayton South. In order to achieve a continuous output of saleable quality coal, multiple mining areas are needed to facilitate the blending of coals from different seams.

3.5.1 Mining area limits

The limits of the Drayton South mining areas have been determined by economic ratios, geological limitations and environmental considerations. The mining areas for the Option 2 and Option 3 mine plans are illustrated in **Figure 4**.

Whynot Mining Area

Whynot mining area is the largest mining area at Drayton South and contains the majority of the reserves for the Project. The Whynot seam forms the base of the pit. The Whynot Seam is replaced by a significant sill in the south-east of this mining area. This sill also forms the southern and western boundaries of the Whynot mining area. The northern and eastern boundaries of the mining area are defined by the Whynot seam subcrop and limit of oxidation.

The Whynot mining area has also been restricted to the area north of the south-west / north-east trending ridgeline. This limit has been adopted in order to minimise visual impacts on sensitive receptors to the south of the Whynot mining area.

Blakefield Mining Area

The Blakefield seam forms the base of the Blakefield mining area. The northern limit of the mining area is defined by the seam subcrop and limit of oxidation. The eastern limit is imposed by silling in the Blakefield seam. The western boundary is formed by the graben structure with a throw of up to 25 m. Under Option 2, the Blakefield mining area extended beyond this fault, and to the Golden Highway in the south.

It was determined that extending mining to the Golden Highway would result in excessive environmental impacts on the Woodlands Stud. Under Option 3, the Blakefield mining area is restricted to the west of the graben structure. This results in a significant setback from the Golden Highway, thereby reducing impacts on the Woodlands Stud. **Figure 4** reveals that the Blakefield mining area is significantly smaller under Option 3.

Redbank Mining Area

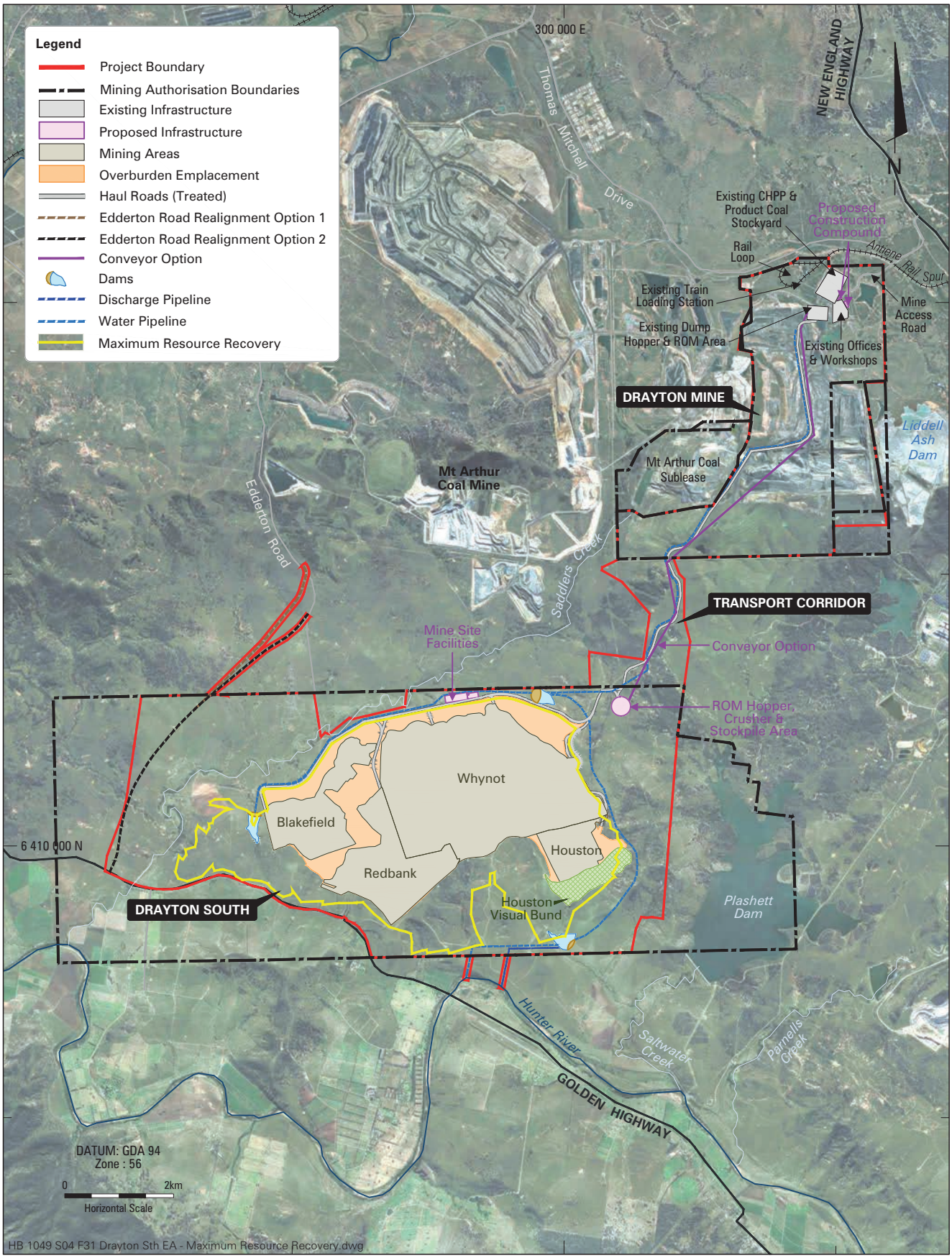
The Redbank Creek seam forms the base of the Redbank mining area. Mining the deeper Whynot and Blakefield seams is not feasible due to silling of these seams in the Redbank area. The Wambo seam can be mined, but is too thin for mining to be economically viable.

The northern boundary is dictated by the Redbank Creek seam LOX. Under Option 2, the western boundary is defined by the Whynot mining area and a sill in the Whybrow seam. The southern limit is formed by the EL boundary, the Golden Highway and silling in the Redbank Creek seam. Under Option 3, the Redbank mining area does not extend as far south and west. In order to reduce visual impacts on receivers to the south of the Project, the mining area has been constrained to the area north of the ridgeline. The south-western limit has also been curtailed to maintain a 500 m setback from the Golden Highway. This buffer is designed to minimise blasting impacts. The reduction in the size of the Redbank mining area is evident in **Figure 4**.

Houston Mining Area

The Houston mining area only exists under Option 3. This area is incorporated into the Whynot mining area under Option 2. The Redbank Creek seam is uncovered with excavator prestrip, and the lower seams down to the Whynot seam are uncovered using the dragline.

The Houston mining area is limited to the east by the Redbank Creek and Whynot seam subcrops and oxidation limits. The southern and western limits are dictated by geological and economic considerations. The topography in these southern areas is steep and makes mining difficult. In any event, mining has been limited to north of this ridgeline to avoid excessive visual impacts on sensitive receptors.



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Comparison of Mine Plans

FIGURE 4

Highwall Mining

Highwall mining will occur in all four mining areas at Drayton South. In the mine plan for the Project, the extent of highwall mining has been limited to a face penetration of 500 m from the highwall. This is the maximum face penetration that can be achieved using the Addington highwall mining system. However, highwall mining will be limited by faults, dykes, sills and LOX lines.

3.6 MINING SCHEDULE

The mining schedule seeks to achieve a uniform blend of coal types being fed to the CHPP. Blending of low ash and high ash coal is necessary to ensure a consistent production of saleable coal. The relative proportions of the different coal types in the CHPP feed is outlined in **Table 7**.

Table 7
Blend of Coal Types

Coal Type	Coal Seams*	Proportion
Low Ash Coal	WA1, WA2, WN, WN2, WNL, BK, BKL	30%
Moderate Ash Coal	WB, WBL	20%
Moderate Ash Coal	RBL, RB4	20%
High Ash Coal	WB3, RB12, RBU, RB2	30%

** WA – Wambo seam; WN – Whynot seam; BK – Blakefield seam; WB – Whybrow seam; and RB – Redbank Creek seam.*

Since the Project is a continuation of an existing mining operation, there will be a progressive transitioning of equipment from the existing mining areas to the new mining areas. Once excavators have finished work at the existing Drayton area, they will be used to establish the box-cuts in the Drayton South mining areas. All box cuts are anticipated to be completed before the end of 2015.

Dragline operations are scheduled to commence at Drayton South in 2015. From 2015 to 2027, the dragline will mine alternating strips in the Whynot and Blakefield mining areas. By 2027, there will be sufficient working room in the Whynot mining area for the dragline to remain predominantly in this area. In order to maintain coal supply, the dragline will occasionally alternate between the Whynot and Houston mining areas.

The pre-strip requirements ahead of the dragline for Drayton South are relatively low. The material required to be removed in pre-stripping matches the capacity of one excavator. As a result, the other excavator can predominantly be utilised in the Redbank mining area, which is a truck and excavator mining area.

Once open cut mining in the Redbank mining area has been completed, the excavators will be re-deployed to the Houston and Whynot mining areas.

Highwall mining operations will generally commence after the completion of open cut mining in each of the four main mining areas. Highwall mining is required under Option 3 to sustain production rates.

The existing Drayton Mine will operate until 2017. Therefore, both Drayton Mine and Drayton South will be operating during the first four years of the Project. During this period of simultaneous operation, the output of the mine will peak at 7 Mtpa of ROM coal. After the completion of mining at Drayton Mine, the maximum ROM output of the Project will be approximately 5.6 Mtpa.

3.7 OVERBURDEN EMPLACEMENT AREAS

As part of the Drayton South PFS, detailed designs for the overburden emplacement areas (OEAs) were developed for both Option 2 and Option 3. A swell factor of 25% was assumed for design purposes. This is similar to swell factors for other Hunter Valley coal operations mining the same seams: Wambo, Hunter Valley Operations, Bulga and Mount Thorley-Warkworth.

Mining in all of the Drayton South mining areas (Whynot, Blakefield, Redbank and Houston) will progress from north to south. As a result, the OEAs will be established to the north of the active mining areas. This is desirable because it increases the distance from the OEAs to sensitive receivers south of the Project, thereby reducing noise and dust impacts caused by overburden emplacement.

The visibility of the OEAs from sensitive viewing locations was a key consideration when designing the OEAs. Each of the OEAs has been limited to a certain height so that they do not protrude above the ridgeline that shields views from the south. The Houston Visual Bund supplements the screening provided by the ridgeline, and ensures that the OEAs are not visible from sensitive receivers to the south of Project.

3.8 EQUIPMENT SELECTION

Since the Project is a continuation of the existing Drayton Mine, mining operations at Drayton South will utilise the equipment fleet currently in use at Drayton Mine. This reduces the capital expenditure and equipment risk for the development of a new mining area.

Since operations at Drayton South will require highwall mining to achieve the optimal production rate, the Project will require the addition of a highwall miner to the existing equipment fleet. The Addington continuous highwall mining system has been chosen because of its higher productivity compared to other highwall mining systems, as well as its proven track record at other Australian coal mines.

Compared to the existing Drayton Mine, Drayton South will have lower haul truck requirements due to the shorter haulage distances from the active mining areas to the OEAs.

Preliminary air quality modelling results revealed that the Project would result in some periods of elevated PM_{10} levels above EPA criteria at sensitive receivers on the Coolmore Stud. In order to reduce the Project's dust emissions, the Cat 789 haul trucks currently in use at Drayton Mine will be replaced by the larger Komatsu 830E trucks in Year 10 of the Project. The upgrade to larger trucks will result in a 10% reduction in dust emissions. As explained in **Section 3.6**, mining intensity in the Redbank mining area has been limited by utilising only one of the two available Hitachi EX5500 excavators during years 10 – 15 of the mine life. These improvements are sufficient to reduce PM_{10} concentrations over the Coolmore Stud to an acceptable level. Real time air quality monitors will be established in sensitive areas to ensure that dust levels are maintained within acceptable limits.

4 PROJECT MINE PLAN

The most critical environmental constraint on the mine plan for the Project is the proximity of sensitive receivers to the south of the Project. These include Woodlands Stud, Coolmore Stud and Arrowfield Estate.

The Drayton South PFS considered the feasibility of two mine plans. Mine plan Option 2 maximised the coal reserve at Drayton South by mining all areas that were technically and economically feasible to mine. Whilst this mine plan optimises production, the environmental impacts are likely to lead to impacts on the sensitive receivers to the south and result in significant acquisition liabilities. Consequently, a number of environmental constraints were applied to Option 2, resulting in mine plan Option 3. Mine Plan Option 3 maintains acceptable production as far as possible without causing unacceptable environmental impacts. This is the mine plan that was progressed for assessment in this EA.

The preliminary assessment of mine plan Option 3, as developed during the PFS, revealed a range of further environmental constraints. The environmental constraints identified during the EA process were incorporated into the Option 3 mine plan to develop the Project Mine Plan. This is the mine plan that has been considered in the final assessments for this EA. The Project Mine Plan for which approval is being sought is shown on **Figure 2**.

The environmental constraints incorporated into the Project Mine Plan include:

- Significantly reducing the footprint of the Blakefield and Redbank mining areas so that they are situated entirely to the north of the ridgeline;
- Utilisation of highwall mining to maximise coal recovery while maintaining the existing ridgeline as a buffer between the operational areas of the Project and the receptors to the south;
- Revised design and location of the Houston Visual Bund;
- Incorporation of extensive tree screening into the Project Mine Plan to limit views to the operational areas of the Project and improve the amenity of the surrounding area;
- Limiting the intensity of excavator operations in the Redbank mining area in years 10 – 15;
- Construction of the box cut in the Houston mining area using the double benching method to reduce noise impacts;
- Replacing the existing truck fleet with larger trucks in Year 10 to reduce dust generation;
- Design of all permanent haul roads to be treated with a dust suppressant to minimise dust emissions associated with vehicle movements;

- Design of the mine plan to ensure sufficient buffer zones are maintained for both the Hunter River Alluvium and the Saddlers Creek stream bank; and
- Avoidance of the stone quarry archaeological site when realigning Edderton Road.

These constraints and the changes to the mine plan as a result of these constraints are described in greater detail in **Section 4.1**.

The Option 3 mine plan developed in the PFS had a reserve of 111 Mt, including a highwall reserve of 6 Mt. Further exploration work has been undertaken since the completion of the Drayton South PFS. This data has been used to update the coal reserve estimate. The Project Mine Plan has an open cut reserve of 119 Mt, including a highwall reserve of 6 Mt.

4.1 ENVIRONMENTAL CONSTRAINTS

4.1.1 Visual Considerations

The aesthetic value of the landscape is of importance to Woodlands Stud, Coolmore Stud and Arrowfield Estate. The mining areas proposed by Option 2 would be substantially visible from both Woodlands Stud and Coolmore Stud. Under the Project Mine Plan, the Blakefield mining area is limited in its extent to the west. As a result, the distance between the operation and the Woodlands Stud is substantially increased. More importantly, the entire Blakefield mining area is situated to the north of the large ridgeline trending through Drayton South. The Project Mine Plan also limits the Redbank mining area to the area north of the ridgeline. As a result, the active mining areas are hidden behind the existing topography. In addition, the maximum heights of the OEAs have been maintained below the elevation of the ridgeline so that they are also concealed by the topography.

There are locations on the Coolmore Stud where the ridgeline does not completely screen views of the Project. Anglo American designed the Houston Visual Bund to remedy the '*gaps*' in the ridgeline. Once completed, the Houston Visual Bund will eliminate views of the Whynot mining area that otherwise would have been possible from receivers on the Coolmore Stud.

The design of the visual bund was developed in consultation with Coolmore Australia. Three different locations and designs for the Houston Visual Bund were considered. The first option is located 2.4 km from the nearest receptor to the south and will require approximately 18 million loose cubic metres (Mlcm) of overburden material to construct. This bund is the preferred option for Anglo American because it provides an optimal strike length for the dragline in the Houston mining area, resulting in greater operational efficiency. Coolmore Australia objected to the size and location of this visual bund, and proposed a second option. The second visual bund option is located 4.5 km from the nearest receiver on the Coolmore property, and will require 8.1 Mlcm of overburden material to construct. This option was deemed by Anglo American to be unsuitable because it did not provide a sufficient strike length in the Houston mining area, effectively precluding the operation of a

dragline. Replacing dragline operations with the higher cost truck and excavator method would render the lower seams uneconomic.

A third option for the visual bund was developed as a compromise between the Option 1 bund (as preferred by Anglo American) and the Option 2 bund (as preferred by Coolmore Australia). This bund is a greater distance from receivers on the Coolmore property than the first option, and still provides a sufficient strike length for the operation of a dragline. Visual bund Option 3 is the bund that has been incorporated into the preferred mine plan for the Project. The locations and sizes of the three visual bund options are illustrated in **Figure 5**.

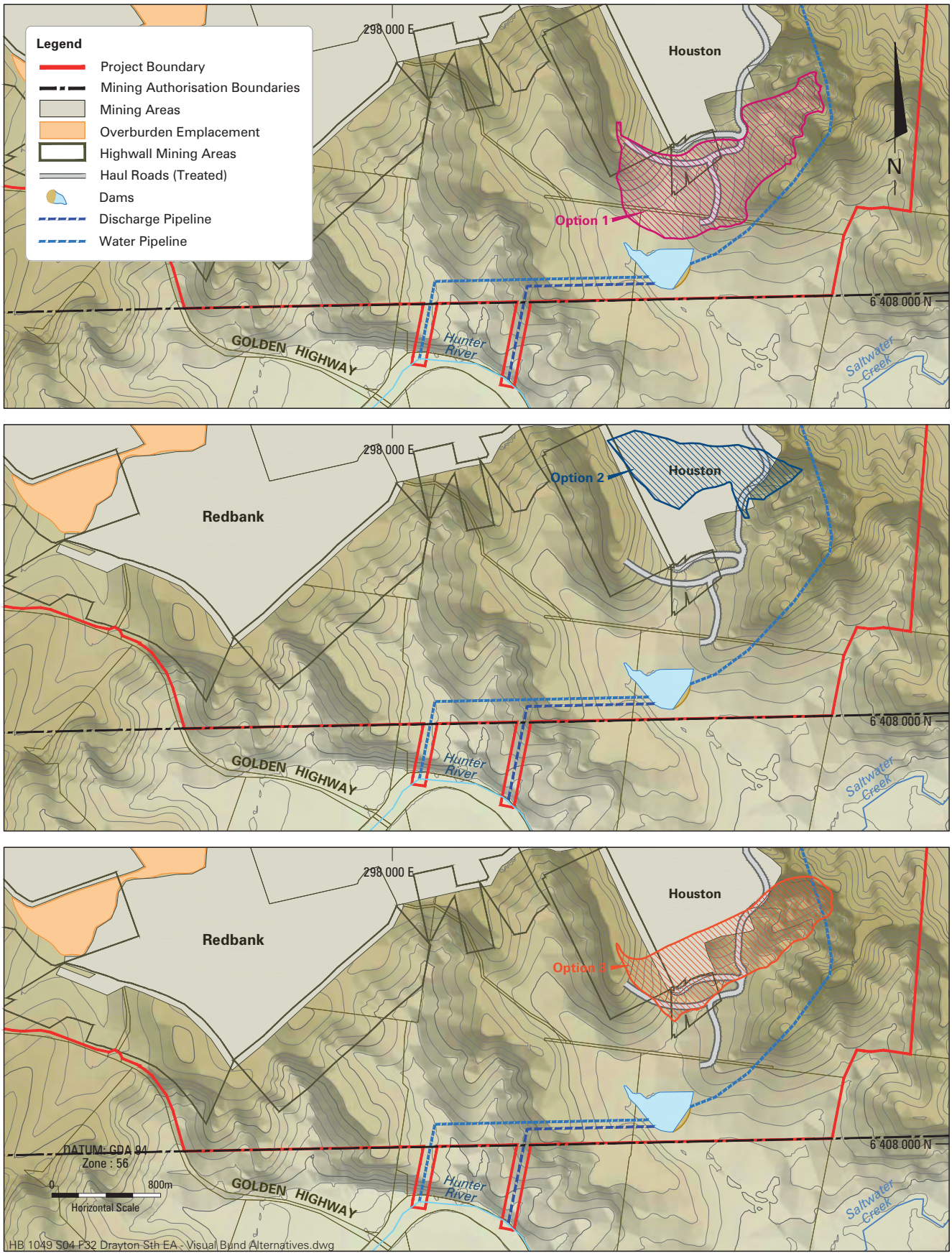
The Houston visual bund will involve an eight stage construction program (see **Table 8**) from Year 3 for a period of about 16 months. It will be situated approximately 2.8 km from the nearest receptor in the south. Approximately 16.6 Mlcm of overburden material from mining activities will be required for its construction. The design provides for a maximum batter height of 77 m and a crest length of 1,750 m, and aligns with the existing topography once fully constructed. Throughout stages 1, 3, 6 and 8, a dozer (D11) and trucks (789) will be supporting construction activities on the southern face of the visual bund. All other stages of the construction of the visual bund have been designed to remain shielded behind the previous lifts (see **Table 8**).

Table 8
Visual Bund Construction Program

Stage	Construction Activity	Volume (Mlcm)	Time (Months)	Anticipated Visibility (Months)
1	Lift to RL 175	2.2	2.1	2.1
2	Backfill to RL 170	1.5	1.5	-
3	Lift to RL 200 and 4% grade to RL 225 (East End)	4.5	4.3	4.3
4	Backfill to RL 195	1.6	1.5	-
5	Backfill to 4% grade (East End)	1.1	1.0	-
6	Lift to RL 225 and crest line (West End)	2.2	2.1	2.1
7	Backfill to RL 220	0.7	0.6	-
8	Lift to crest line and final shaping	2.8	2.7	2.7
Total		**16.6**	**16**	**11.3**

The Houston visual bund will be progressively covered with available topsoil and rehabilitated with a crop of pasture grass and/or sterile cover crops to minimise exposed areas. Tree screens, composed of native species, will be established on the visual bund to restore visual amenity.

Tree screens have been established on the Golden Highway and will be planted along the ridgeline adjoining the Houston visual bund and the Edderton Road realignment to minimise views of the Project from various vantage points. These tree screens will be planted prior and during to the construction phase to allow for substantial growth and to maximise the opportunity for establishment.



DRAYTON SOUTH COAL PROJECT

Houston Visual Bund Alternatives

FIGURE 5

4.1.2 Noise and Blasting Considerations

The Project Mine Plan seeks to alleviate noise and blasting impacts by increasing the distance from the mining areas to the sensitive receivers in the south. This is achieved by limiting the extent of the Redbank and Blakefield mining areas when compared to that of the Option 2 mine plan from the PFS. As part of the Project Mine Plan, both the Blakefield and Redbank mining areas are situated entirely to the north of the ridgeline. This ridgeline provides acoustic shielding for receivers to the south of the ridgeline. As a result of the constraints imposed on the Blakefield and Redbank mining areas, noise generated by mining operations will remain within acceptable limits.

Preliminary noise modelling predicted noise exceedances during the construction of the Houston Visual Bund. In order to avoid this, the initial box cut in the Houston mining area will be constructed using the double benching method. This method allows the equipment to work on a bench below surface topography. The double benching method reduces noise by reducing the amount of time that equipment will work on the exposed ground surface. When the double benching method is implemented, there are no exceedances of the regulatory noise criteria during the construction of the Houston Visual Bund.

Some activities, including blasting and the operation of particular equipment on exposed surfaces may be constrained to daylight hours to avoid adverse noise and vibration impacts as required. Blasting in particular will only be undertaken during the hours of 9:00 am to 5:00 pm from Monday to Saturday. Blasting will not be undertaken on Sundays and public holidays unless granted prior approval on a one off basis from the EPA in an emergency situation. The Project Mine Plan creates a 500 m buffer between the Blakefield and Redbank mining areas and the Golden Highway. This buffer reduces the risk of damage from fly-rock.

4.1.3 Air Quality Considerations

As part of the PFS, it was determined that mine plan Option 2 is likely to result in unacceptable air quality impacts on receivers to the south of the Project. The Option 3 mine plan developed as part of the PFS alleviates these impacts by increasing the distance from the Blakefield and Redbank mining areas to these receivers. During the EA process, preliminary air quality modelling indicated that there would still be some air quality impacts during years 10 – 15 of the Project life. The major contributor to these impacts was mining in the Redbank mining area. As explained in **Section 3.6**, dust emissions for the Project Mine Plan were reduced by mining the Redbank area using only one excavator instead of two (as originally planned) during years 10 – 15. Further reductions in dust emissions were achieved by upgrading the Cat 789 haul trucks to the larger Komatsu 830E trucks in year 10 of the Project (refer to **Section 3.8**). The adoption of these operating constraints will allow the PM_{10} levels at Coolmore Stud receivers to be maintained within acceptable limits.

The Project Mine Plan has been designed to ensure that all permanent haul roads outside of the main mining areas will be treated with a heavy duty bonding agent that suppresses dust generation on the road surface. This will significantly minimise dust emissions associated with vehicle movements.

Mining has also been scheduled so that pre-strip does not occur more than two – three strips ahead of the dragline, and rehabilitation takes place progressively behind the mining operation. This reduces dust emissions by limiting the exposed area at any one time. The mine plan also minimises the haul distances from the active mining areas to the OEAs.

4.1.4 Watercourses

The Department of Planning, Infrastructure and Natural Resources prepared the "*Management of Stream / Aquifer Systems in Coal Mining Developments, Hunter Region*" guidelines (2005), which prescribe buffer zones between mining operations and streams. The two streams in close proximity to the Project are Saddlers Creek and the Hunter River. The required buffer is determined by the magnitude of the stream:

- 40 m for significant stream systems (Schedule 2 streams); and
- 150 m for primary rivers (Schedule 3 streams).

There is no prescribed buffer zone for minor stream systems (Schedule 1 streams). For Schedule 1 streams, the only requirement is that the geomorphic integrity of the stream be preserved during mining.

The Hunter River is a Schedule 3 stream, and requires a 150 m buffer between the mining areas and the alluvium of the stream. Saddlers Creek has been conservatively classified as a Schedule 2 stream, and as such, requires a buffer of 40 m from the mining area to the bank of the stream. The Project Mine Plan provides the necessary buffer zones for both the Hunter River Alluvium and the Saddlers Creek stream bank.

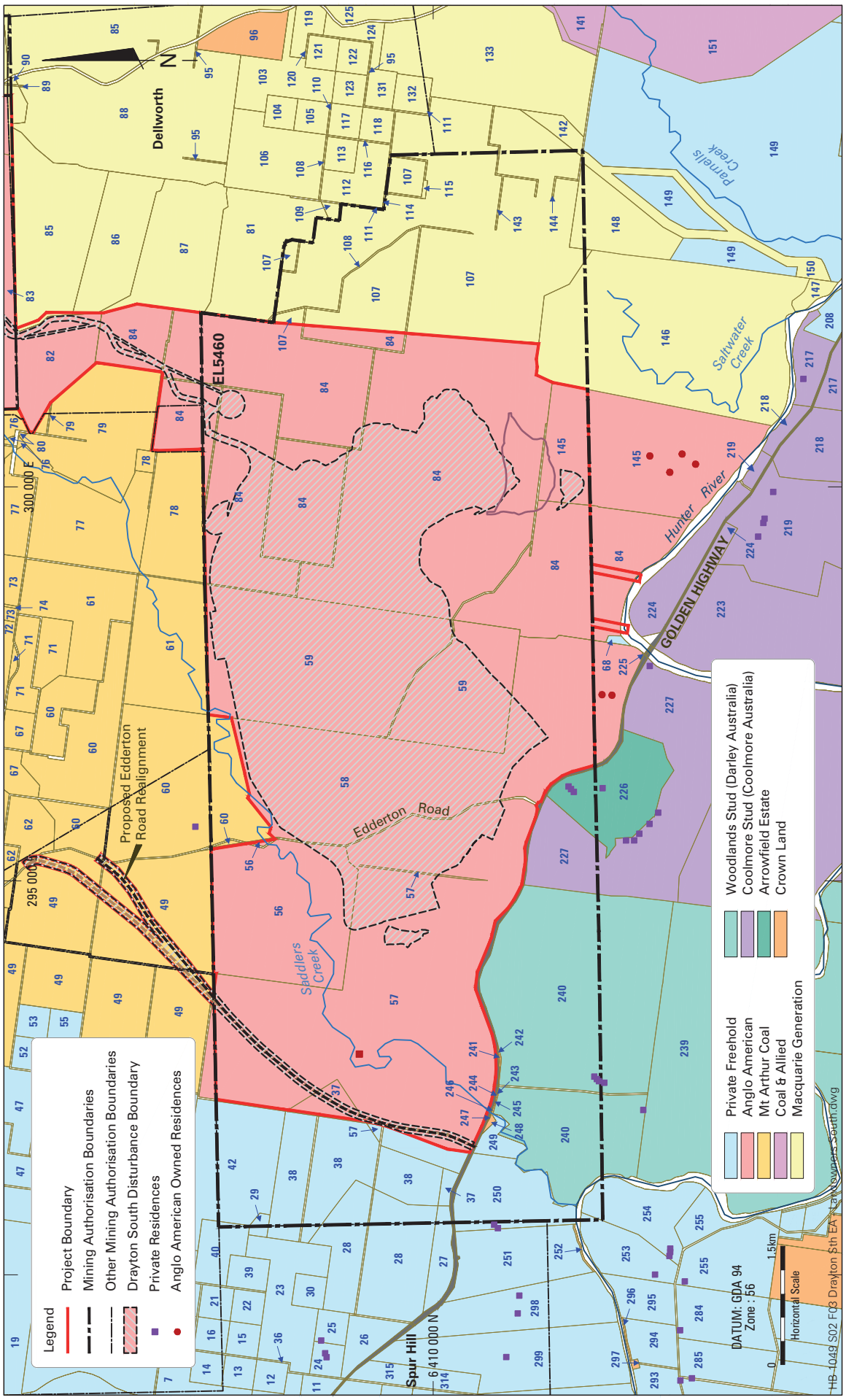
4.1.5 Aboriginal Archaeology

In order for mining to occur in the Blakefield and Redbank areas, the existing Edderton Road will need to be realigned to the west. The new alignment will pass to the west of Saddlers Creek to avoid intersecting the creek. There is a significant stone quarry site immediately to the west of Saddlers Creek. This site has been assessed as being of high archaeological significance and is one of the largest stone quarry sites of its kind in the Hunter Valley.

As such the alignment of Edderton Road has been designed so that it avoids this site. This involved arranging a land swap with an adjoining property owner to ensure that the road could be designed to sufficiently avoid this site to the west as the location Saddlers Creek posed as constraint to the east.

4.1.6 Land Ownership

The mining areas, OEAs and infrastructure areas at Drayton South have been restricted to land owned by Anglo American. The ownership of land in the vicinity of the Project is illustrated in **Figure 6**.



DRAYTON SOUTH COAL PROJECT

Land Ownership

FIGURE 6

AngloAmerican | Hansen Bailey ENVIRONMENTAL CONSULTANTS

5 CONCLUSION

The mine plans in the Drayton South PFS further developed the mine plan advanced by the Saddlers Creek PFS. The Saddlers Creek mine plan was itself based on the mine plan for the previously approved Mt Arthur South Coal Project.

The Project for the continuation of the Drayton Mine via the development of mining operations within the Drayton South area was developed with reference to all of the constraints identified during the PFS and the analysis of alternatives. It involves the extraction of the state significant coal resource present within the Drayton South area via open cut and highwall mining methods producing up to 7 Mtpa of ROM coal for 27 years. It maximises the opportunity to secure the social and economic benefits that would result from the continued utilisation of the existing Drayton coal processing, handling, loading and other surface mine infrastructure and ensures the continued employment for the existing workforce of 410 employees as well as providing for an additional 55 jobs. The mine plan developed ensures that the southern ridgeline is maintained to minimise environmental and social impacts, and addresses the requests of neighbouring stakeholders. The Project also incorporates the construction of the Houston visual bund to ensure long term screening is afforded to the residents and receivers located to the south.

The Project is considered the most environmentally sensitive, economic and efficient alternative for all stakeholders. It will maximise the social and economic benefits associated with the Project and ensure that a significant coal resource is not sterilised in an area that has been set aside for mining since the late 1970's.

6 REFERENCES

Australian Coal Association Research Program (2001) *C8033 Optimal Design and Monitoring of Layout Stability for Highwall Mining*.

Department of Planning, Infrastructure and Natural Resources (2005) *Management of Stream/Aquifer Systems in Coal Mining Developments, Hunter Region*.