ASHTON COAL PROJECT

COAL RESOURCE RECOVERY PLAN PIKES GULLY LONGWALL 6B

30/05/2013

EXTRACTION PLAN LW 6B

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Version History

Version	Status	Details	Authors	Authorised/Approved for Issue	
				Name/Position	Date
A	Draft	Draft for Consultation	P Fletcher & AECOM	Phil Fletcher Technical Services Manager	16/04/2012
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1 INTRODUCTION

This Coal Resource Recovery Plan has been prepared to demonstrate effective recovery of available resources obtained through underground mining activities at the Ashton Coal Project (ACP).

The Ashton Coal Environmental Management Strategy (see **Figure 2** of the Extraction Plan) provides the strategic context for the environmental management of the ACP. The Extraction Plan forms part of the Environmental Management Strategy and is required by the ACP development consent. The Extraction Plan provides a framework for the management of subsidence impacts associated with ACOL's underground mining activities and details the proposed workings, including dimensions, overburden depth and mining schedule.

This Coal Resource Recovery Plan is a sub-set to the Extraction Plan and has been prepared in accordance with Condition 3.12 of the development consent (309-11-2001-i), which states inter alia:

> *3.12 The Applicant shall prepare and implement an Extraction Plan for the second workings within each seam to be mined to the satisfaction of the Director General. Each Extraction Plan must:*
>
> *(g) Include to the satisfaction of DRE*
>
> - A coal resource recovery plan that demonstrates the effective recovery of the available resource.

This report provides a description of the:

- Coal resource available within the ACP area;
- Proposed mining method, schedule and mine plan;
- Coal resource recovery and effects on future mining; and
- Justification for the mine plan.

Plans 1-6 and the Approved Plan (included in Appendix A) provide supporting information and provide details of coal resource, existing and proposed workings, and impacted surface features. The Plans have been prepared in accordance with the Division of Resources and Energy's (DRE) Guideline for Applications for Subsidence Management Approvals (Department of Mineral Resources, 2003).

1.1 SCOPE

The scope of this Coal Resource Recovery Plan includes Longwall (LW) 6B in the Pikes Gully (PG) Seam.

Plans 1-2 and the **Approved Plan (Appendix A)** show the proposed mine plan, Extraction Plan boundary and surface features associated with these longwall panels, whilst **Plan 5** shows the current Mining Titles and Land Ownership.

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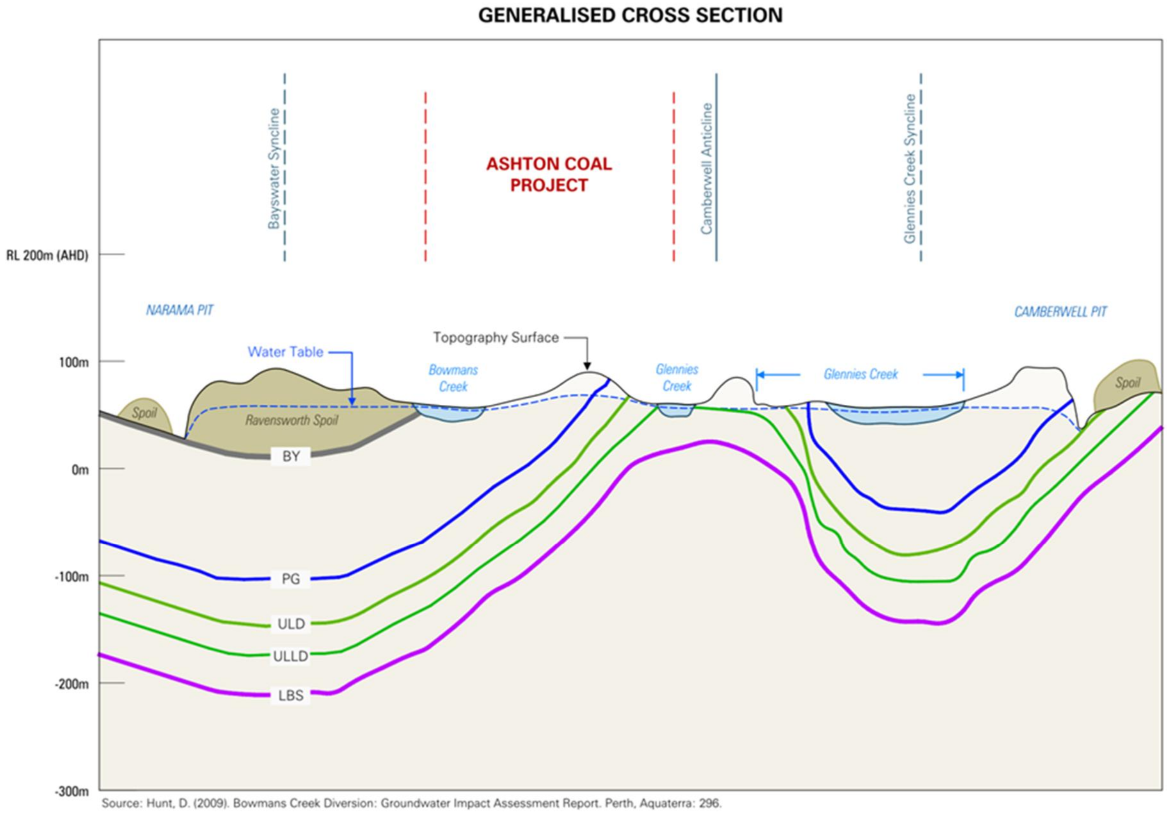
2 RESOURCE DESCRIPTION

2.1 SITE CONDITIONS

The ACP is located within the Hunter Coalfields of the Sydney basin. The coal seams and surrounding strata are assigned to the Foybrook Formation which is a stratigraphical unit of the Late Permian Singleton Supergroup. This formation is part of the Vane Subgroup within the Whittingham Coal Measures and is the basal coal bearing sequence of the Singleton Supergroup.

The current study area is located on the western limb of the Camberwell Anticline (see **Figure 1**) which is the principal structural feature of the project area. The axis of this structure trends along the eastern boundary of Exploration Lease 4918 which coincides with sub crop of the coal seams of principal interest. These sub crops define the westerly dipping limb of the Camberwell Anticline. The stratum consists of a mix of sandstone, shale, and interbedded to finely laminated sandstone/shale with a number of coal seam splits between.

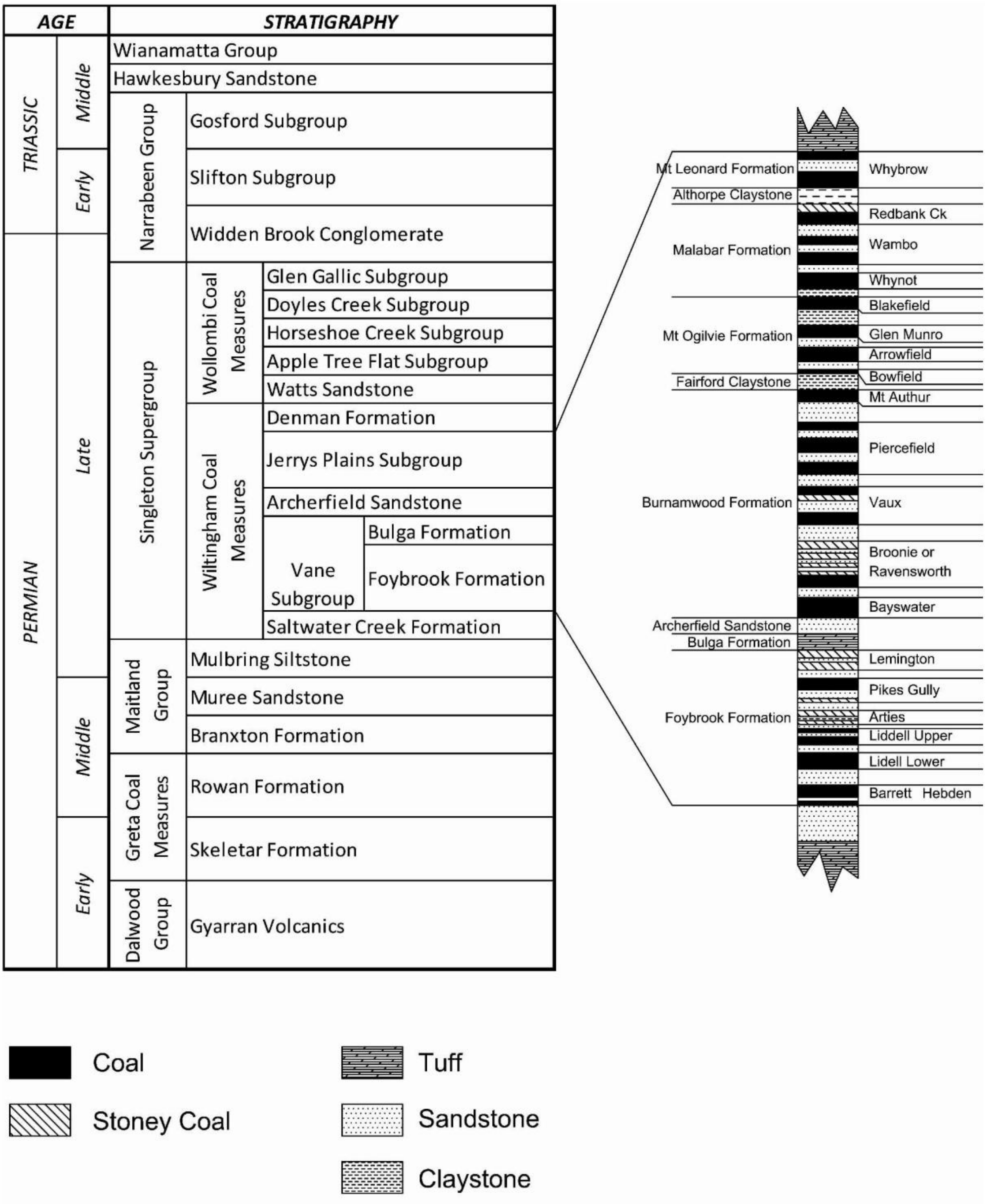
Figure 1 Generalised Cross Section



The Foybrook Formation contains at least six named coal seams (see **Figure 2**) which commonly split and coalesce. Within ACOL's mining lease, the economically viable seams proposed for extraction include (in descending order):

- Pikes Gully Seam (PG);
- Upper Liddell Seam (ULD);
- Upper Lower Liddell Seam (ULLD); and
- Lower Barrett Seam (LB).

Figure 2 Stratigraphy



Ref : Ashton Coal A-9410 (10/02/2010)

The ACP underground mining operation primarily produces a semi soft coking coal for the export market. The Foybrook Formation coals at ACP are bituminous, high-volatile, low sulphur, vitrinite rich and low in other elements such as chlorine and phosphorous. Ash content of the PG Seam is variable and ranges between 20% and 28% (HLA, 2001). Raw coal is processed in the Ashton Coal Handling and Preparation Plant (CHPP) and a low ash product (8.5% average) with strong coking properties is recovered. The coal matter within the Pikes Gully to Hebden Seam interval is markedly uniform and contains large proportions of vitrinite. This places the resource at ACP at the upper end of the rank profile for the Hunter Valley.

2.2 OVERBURDEN STRATIGRAPHY

The stratum within the Foybrook Formation is deltaic in origin and comprises in order of predominance: fine to coarse grained sandstone, siltstone, conglomerate, mudstone, shale and coal. The top of this formation corresponds with the base of the overlying Bulga Formation which is in turn overlain by the Archerfield Sandstone and Jerrys Plains Subgroup respectively. The Bulga Formation and Archerfield Sandstone are marine sandstones or laminates. The Jerrys Plans Subgroup includes the Bayswater Seam which has been mined (open cut methods) in the adjacent Ravensworth development and only a remnant portion of it exists in the far western part of the ACP. In-situ coal attributed to the Bayswater seam does not form part of the ACP. Conglomerates outcrop at several locations along the natural channel of Bowmans Creek (i.e. near the New England Highway Bridge and the NSW Office of Water (NoW) stream gauging station).

2.3 LITHOLOGICAL AND GEOTECHNICAL CHARACTERISTICS (OVERBURDEN)

The PG Seam overburden comprises sandstone and minor siltstone units. These sandstone units are variable in nature, and range from coarse-grained, bedded to massive, with zones of sub-vertical jointing.

Plan 6 (**Appendix A**) provides geological strata sections within the ACP. The principal features of the overburden are:

- Mudstone or sandstone units are consistently within the roof bolting horizon providing a competent roof; and
- Regional trends in the sandstones suggest the presence of channels, this has been confirmed in the existing underground operations.

The PG Seam is on average between 2.4 and 2.6m thick, excluding the rider seam (refer to Extraction Plan). The seam thickness across the ACP is shown in **Plan 3** (**Appendix A**).

2.4 LITHOLOGICAL AND GEOTECHNICAL CHARACTERISTICS (ROOF AND FLOOR STRATA)

The sandstone units forming the main roof are variable in nature, ranging from fine to coarse grained / conglomeritic, bedded to massive, with typically widely spaced zones of sub-vertical jointing. These sandstone units are categorised as being moderate to strong in terms of their structural competency (with associated UCS values of generally >60MPa) and are largely self-supporting during gateroad drivage.

The floor generally consists of moderately competent, thinly bedded sandstone and siltstone units with UCS values of 30 to 60MPa. Often a weak (i.e. UCS <15MPa) mudstone unit is encountered in the immediate floor (typically <0.5m thick), but this does not create significant difficulties for either development or longwall retreat.

2.5 EXISTENCE AND CHARACTERISTICS OF GEOLOGICAL STRUCTURE

Exploration of the underground area has been ongoing since the commencement of operations, primarily with a combination of surface and some long hole drilling. Mining development provides additional geological information which has been incorporated into the modelling. Structural geological mapping is an integral part of the understanding of the framework of the sedimentological and tectonic characteristics of the deposit. An aeromagnetic survey was undertaken of the underground area in early 2008, with no magnetic anomalies detected.

Whilst this data provides confidence that there are no major structures within the footprint of the LW 6B area, minor structures encountered during the previous longwall panels included:

1. A north-south trending dolerite dyke was intersected at 7 cut through in Maingate 2 development and again in the LW 2 installation road. The dyke in both places was less than 1m thick with approximately 0.50m of cindered coal on either side. Some clay alteration had occurred and strength testing determined a maximum compressive strength of 80MPa. Long hole drilling was undertaken from Maingate 2 which confirmed the dyke's presence along the block. As the longwall production progressed, a zone of thicker (up to 4m), fresher and harder dyke was encountered. Underground blasting and excavation was required to enable the longwall to progress through this localised hard zone. Additional long hole drilling has determined the continuation of the dyke in the underlying ULD seam and future drilling will be used to determine the thickness and strength of the dyke in the ULD Seam.
2. A small north-south trending graben fault structure was intersected in the installation road of LW3, the initial displacement was downthrown 0.80 metres to the east followed by an upthrow of 1.80 metres to the east 20 metres away. Both surface and long hole drilling has determined this structure decreases in displacement to the north and will have relatively minimal impact on production.
3. Minor north south normal faulting had been intersected during the drivage of the final 200 metres of main gate 5 development. Two small faults with a cumulative down throw to the west of 0.35 m had been mapped. During the development of both the installation and back road for longwall 5 further normal faulting was intersected.

   The structure was a typical north south tension zone of relatively small normal faults, displacements ranged from 2.50 metres down to the west to 0.15 metres down to the east. Overall displacement of the five major faults was 3.30 down to the west. The zone of faulting was approximately 180 metres across.

   As production from the longwall progressed the faults converged and decreased in displacement and essentially vanished within 250 metres.
4. A small thrust fault was intersected in the north west mains development around 27 cut through, total displacement was measured at approximately 1 metre. The structure dipped gently to the west and preferentially followed a small claystone band within the Pikes Gully Seam forming a de'coullemnt surface within the band. Minor rib instability was associated with the surface in some locations. The structure trends north south and dips across the remaining long wall blocks.

2.6 STABILITY OF UNDERGROUND WORKINGS

The underground workings have typically proven to be highly stable during both development and extraction, with very low levels of roof displacement and very little rib or floor deformation. This reflects both the general competency of the strata and the low levels of in situ stress associated with mining depths of less than 160m. Rib deterioration is anticipated to be consistent with PG workings at increased depths, but is expected to manifest itself largely as increased skin deterioration only (i.e. loosening of the first 0.5m of the rib), which can be readily addressed with appropriately matched levels of rib bolting. Minor levels of roof deformation have been associated with anomalies (primarily seam split zones), which have warranted increased levels of support. Ashton uses external geotechnical experts to advise on Strata Control. The stability of the underground workings is assessed in a range of specific reports including gateroad drivage; pillar, roof and rib stability; secondary support requirements; install road support requirements and LW take-off support requirements.

3 MINING SYSTEM AND RESOURCE RECOVERY

3.1 Mining Geometry

The layout of LW6B is shown in **Plan 1** (**Appendix A**). A summary of proposed longwall panel dimensions is provided in **Table 1**.

Table 1 Proposed Longwall Panel Dimensions

Panel	Gate Roads (Nominal) (m)	Tailgate Pillar Width to Rib (m)	LW Void Width (m)	LW Length (m)
LW6B	5.4	25	215.8	1034

3.2 Depth of Cover

Depth of cover is variable and increases in the direction of seam dip (to the southwest). The depth of cover ranges from a minimum of approximately 100m at the northern end of LW 6B to a maximum of approximately 140m at the south-western extent of LW 6B.

The depth of cover contours to the Pikes Gully Seam and seam thicknesses are shown in **Plan 3** (**Appendix A**).

3.3 Mining Method

The Ashton underground operation uses the retreating longwall method for secondary extraction. Construction of development main headings, maingates and tailgates is undertaken using continuous miners.

Within the study area, the PG Seam ranges in thickness from 2.4 metres to 2.5 metres (refer to **Plan 3**). ACOL's longwall equipment is capable of operating within a height range of 1.8 to 3.1 metres and therefore the proposal involves extracting the full seam thickness.

3.4 Schedule

ACOL's underground mine operates five to seven days a week, 24 hours a day on a rotating shift basis. At the date of this report, extraction of LW8 was complete with mining progressing within LW1 of the ULD Seam.

Mining of PG LW6B is subject to completion of the Bowmans Creek eastern diversion. Construction of the diversion is expected to complete by the end of October 2012. Therefore to ensure continued production, PG LW6B is to be mined out of sequence following ULD LW1. Anticipated start and completion dates are summarised in **Table 2**, dependent on relevant mining constraints and status of subordinate approvals.

Table 2 Proposed Mining Schedule (Secondary Extraction)

Panel	Start Date	Duration	Completed Date
ULD LW1	August 2012	10 months	May 2013
PG LW6B	June 2013	4 months	October 2013
ULD LW2	November 2013	6 months	May 2014

3.5 Future Mining

Mining within LW 6B will complete the extraction of coal in the PG Seam within the current ACP Mining Lease. To the west of LW8, Ravensworth Underground Mine proposes to extract coal using retreating longwall methods within the PG Seam, as well as lower seams in the future (their mains headings are parallel to Ashton's LW8 maingate).

The ACP is approved as a descending, multi-seam longwall operation and therefore following completion of LW8 in the PG Seam, mining will progressively access the reserves within the Upper Liddell, Upper Lower Liddell and Lower Barrett seams in accordance with the development consent. Planned future workings in these seams, along with cover depth and seam thicknesses are shown in **Plans 4a – 4c** respectively.

3.6 Resource Recovery

The PG Seam mining layout has been optimised to maximise resource recovery within the lease boundary. No other mining method is likely to achieve greater recovery with the subsidence constraints applied.

Due to the small footprint of LW6B compared to the total inventory within the PG Seam within the ACOL mining leases, resource recovery has not been estimated to industry standards. However, based on the footprint of the mine plan, and given the physical and environmental constraints, resource recovery across LW6B, 7B & 8 in the PG Seam is estimated at approximately 64% of available resources. Resource estimates in LW 6B are provided in **Table 3**.

Table 3 Resource Recovery in LW 6B

Longwall Panel	Reserves (Tonnes)
LW 6B	763,315

As a result of secondary extraction of coal within the PG Seam, there will be some subsidence impacts on the overlying strata. However, the overlying strata contain no currently identified viable coal seams within the geographical and depositional constraints of the deposit.

Some stress-related impacts on the strata immediately below the floor of the PG Seam may occur as a result of longwall extraction; however this will not impact the ability of lower seams to be extracted in the future.

Consideration of multi-seam extraction has been included in the mine plan design. In particular, modelling the subsidence behaviour of proposed future mining in the ULD Seam was used to identify potential issues relating to the stability of chain pillars and the layout of the longwall panels (i.e. stacked vs offset layouts).

3.7 Justification

Detailed information, monitoring results and project justification are provided in the Bowmans Creek Diversion Environmental Assessment (Evans & Peck, 2009). The current mine plan is consistent with the mine plan approval as included in the approval documents.

Since the beginning of the project an improved understanding of groundwater and surface water systems and their response to mining has enabled ACOL to developed an underground mine plan that will result in acceptable environmental impacts whilst providing resource optimisation together with business and employment security.

The layout, as indicated on the **Approved Plan** (**Appendix A**), has been developed based on extensive drilling, groundwater modelling, environmental investigation and assessment and consultation with relevant authorities.

The longwall panel lengths are constrained by:

- Mining Lease boundary and New England Highway to the north; and
- Bowmans Creek (existing retained creek channel) to the south.

The natural and built features present above LW6B are shown in **Plan 2** (**Appendix A**). The subsidence monitoring program contained within the Extraction Plan summarises the overall monitoring of mining impacts on the natural and built environments, with management actions detailed in the relevant environmental management plan(s) or Built Features Management Plan (refer to **Figure 3** of the Extraction Plan for the content and structure of the ACOL Environmental Management Strategy).

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4 REFERENCES

Department of Mineral Resources (2003) **Guideline for Applications for Subsidence Management Approvals** (EDG17)

Evans and Peck (2009) **Bowmans Creek Diversion Environmental Assessment**. Evans and Peck, Newcastle, NSW, Australia

HLA (2001) **Environmental Impact Statement Ashton Coal Project,** HLA Envirosciences, Newcastle, NSW, Australia

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APPENDIX A – PLANS 1 – 6 AND APPROVED PLAN

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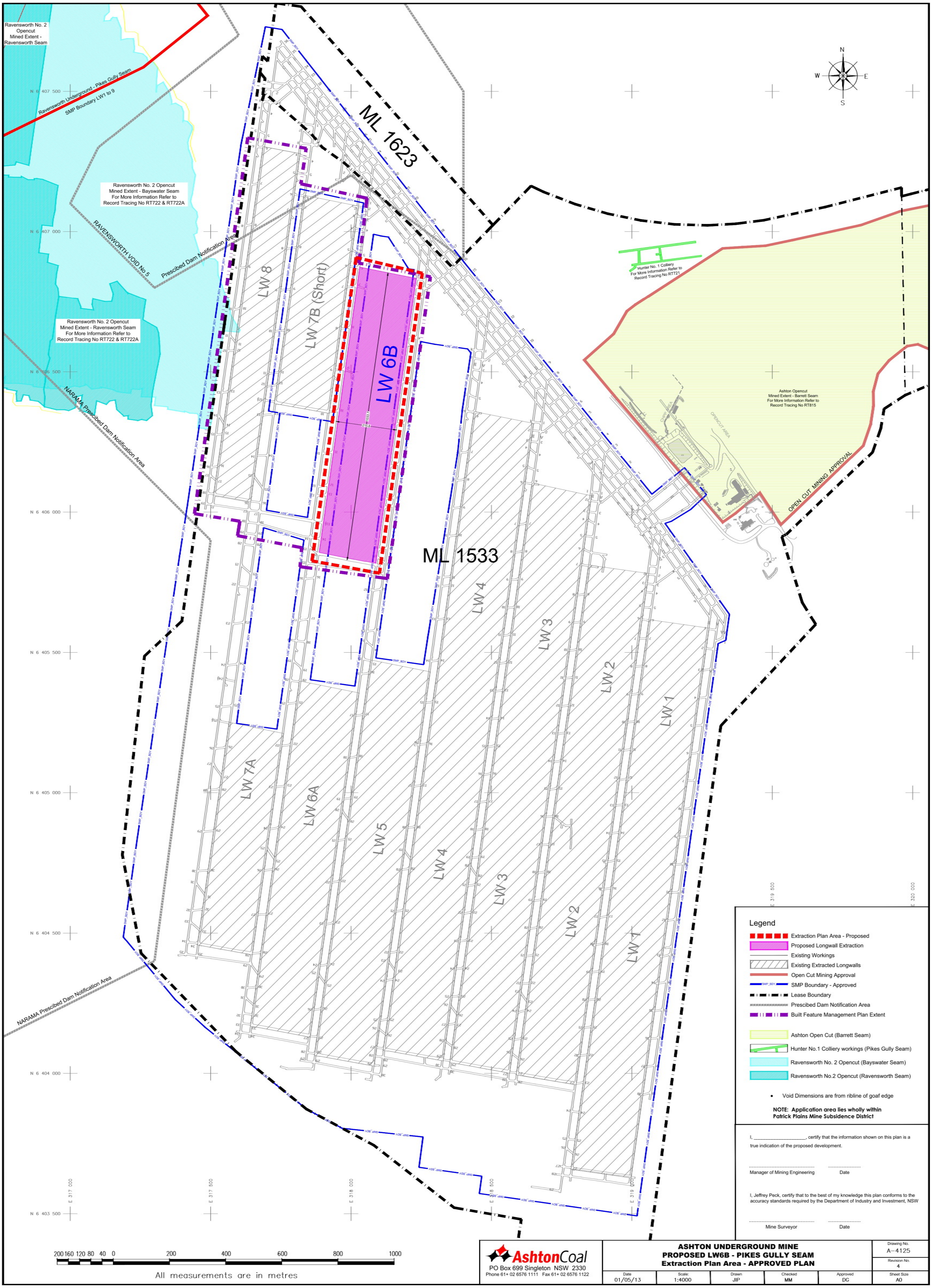

ASHTON UNDERGROUND MINE
PROPOSED LW6B - PIKES GULLY SEAM
Extraction Plan Area - APPROVED PLAN
ML 1623
ML 1533
LW 6B
LW 7B (Short)
LW 8
LW 7A
LW 6A
LW 5
LW 4
LW 3
LW 2
LW 1
Ravensworth No. 2 Opencut Mined Extent - Ravensworth Seam
Ravensworth Underground - Pikes Gully Seam SMP Boundary LW1 to 9
Ravensworth No. 2 Opencut Mined Extent - Bayswater Seam For More Information Refer to Record Tracing No RT722 & RT722A
RAVENSWORTH VOID No 5
Prescibed Dam Notification Area
Ravensworth No. 2 Opencut Mined Extent - Ravensworth Seam For More Information Refer to Record Tracing No RT722 & RT722A
NARAMA Prescibed Dam Notification Area
Hunter No. 1 Colliery For More Information Refer to Record Tracing No RT721
Ashton Opencut Mined Extent - Barrett Seam For More Information Refer to Record Tracing No RT815
OPEN CUT MINING APPROVAL
N 6 407 500
N 6 407 000
N 6 406 500
N 6 406 000
N 6 405 500
N 6 405 000
N 6 404 500
N 6 404 000
N 6 403 500
E 317 000
E 317 500
E 318 000
E 318 500
E 319 000
E 319 500
E 320 000
Legend
Extraction Plan Area - Proposed
Proposed Longwall Extraction
Existing Workings
Existing Extracted Longwalls
Open Cut Mining Approval
SMP Boundary - Approved
Lease Boundary
Prescibed Dam Notification Area
Built Feature Management Plan Extent
Ashton Open Cut (Barrett Seam)
Hunter No.1 Colliery workings (Pikes Gully Seam)
Ravensworth No. 2 Opencut (Bayswater Seam)
Ravensworth No.2 Opencut (Ravensworth Seam)
• Void Dimensions are from ribline of goaf edge
NOTE: Application area lies wholly within Patrick Plains Mine Subsidence District
I, ____________________, certify that the information shown on this plan is a true indication of the proposed development.
Manager of Mining Engineering
Date
I, Jeffrey Peck, certify that to the best of my knowledge this plan conforms to the accuracy standards required by the Department of Industry and Investment, NSW
Mine Surveyor
Date
200 160 120 80 40 0 200 400 600 800 1000
All measurements are in metres
AshtonCoal
PO Box 699 Singleton NSW 2330
Phone 61+ 02 6576 1111 Fax 61+ 02 6576 1122
Date 01/05/13
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Approved DG
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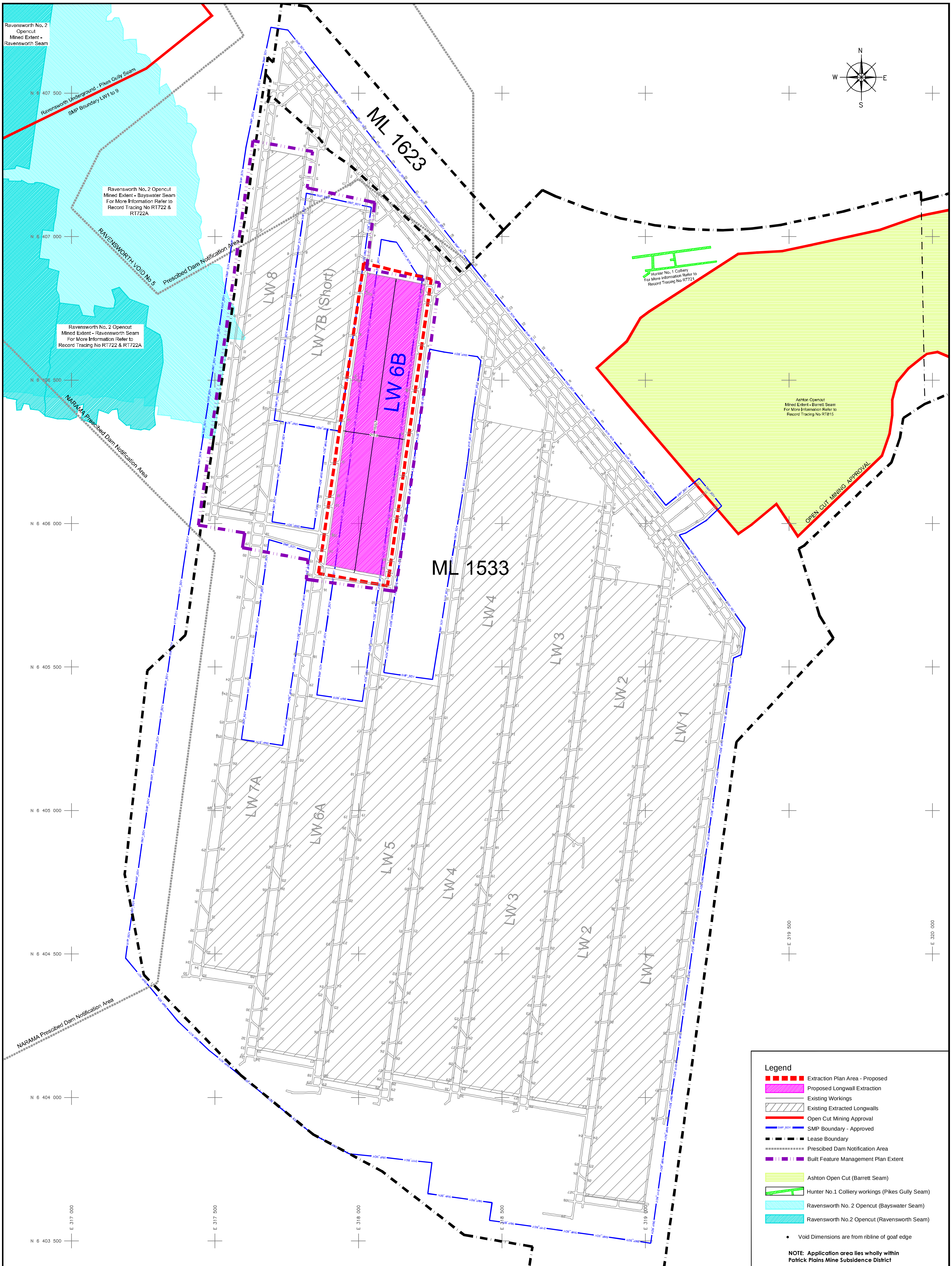

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ASHTON UNDERGROUND MINE
PROPOSED LW6B - PIKES GULLY SEAM
PLAN No.1A - Proposed Extraction Area Boundary

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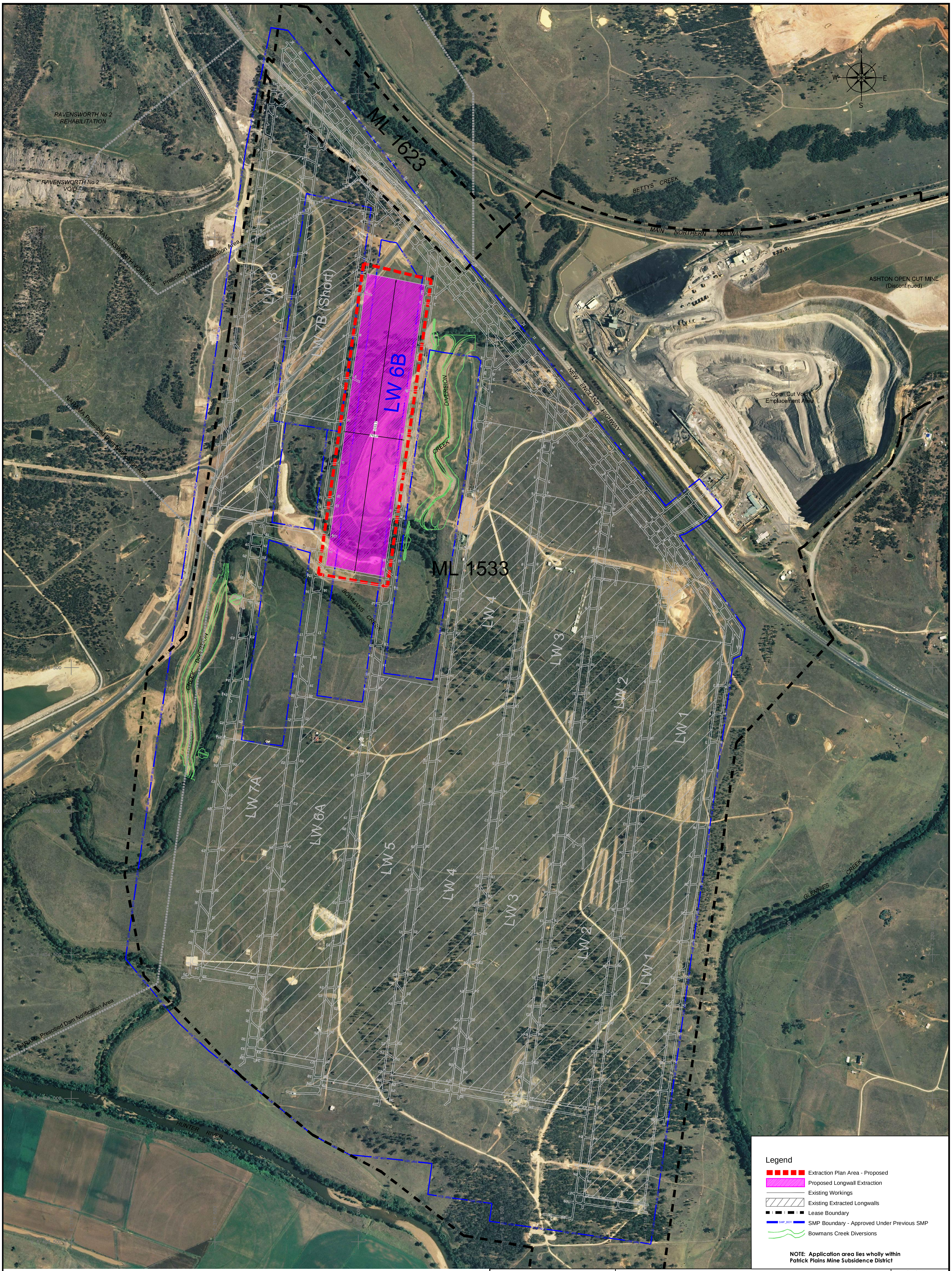

200 160 120 80 40 0 200 400 600 800 1000

All measurements are in metres

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ASHTON UNDERGROUND MINE
PROPOSED LW6B - PIKES GULLY SEAM
PLAN No.1B - Aerial Photograph & Proposed Extraction Boundary

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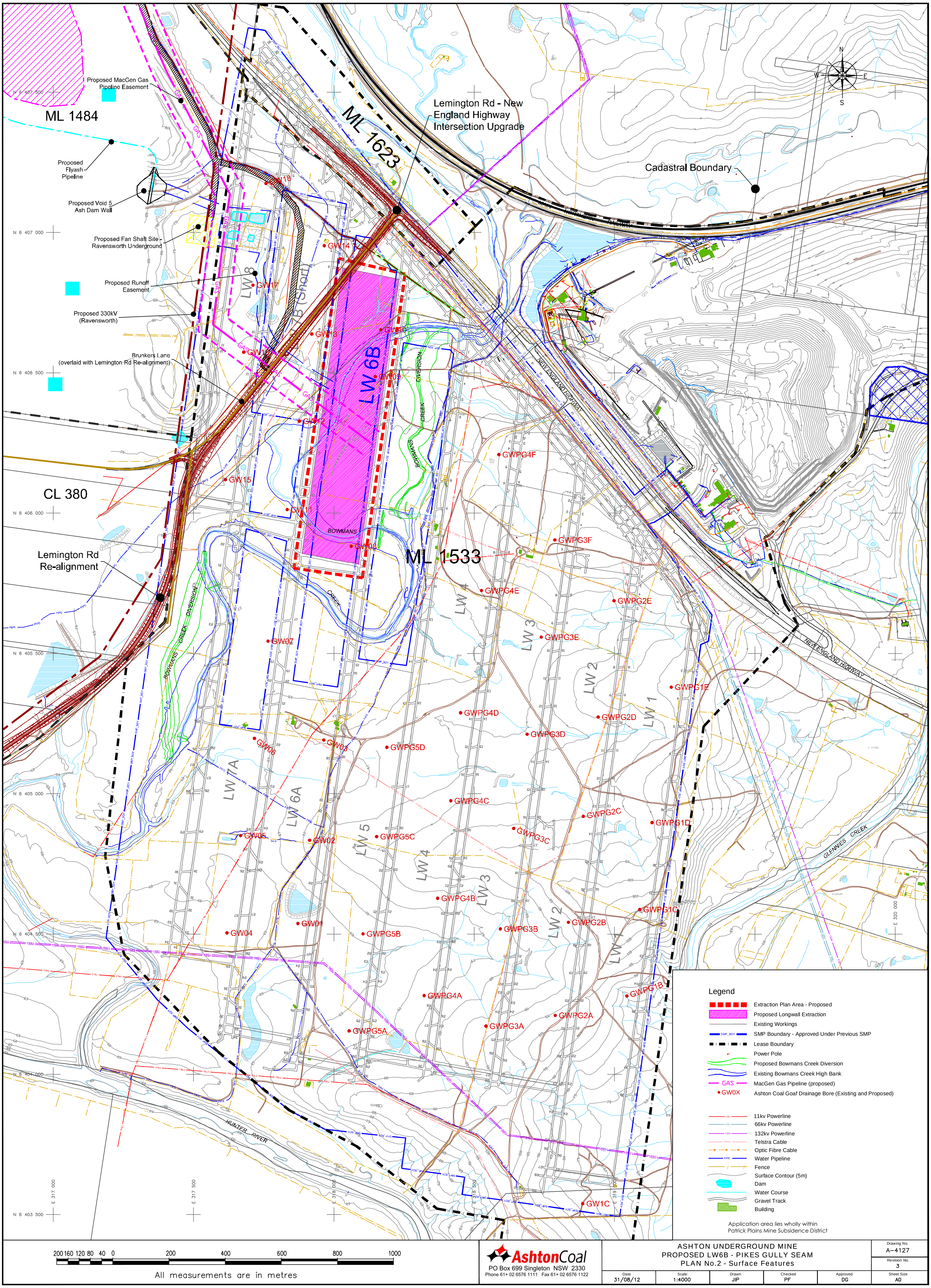

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ASHTON UNDERGROUND MINE
PROPOSED LW6B - PIKES GULLY SEAM
PLAN No.2 - Surface Features

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Revision No. 3

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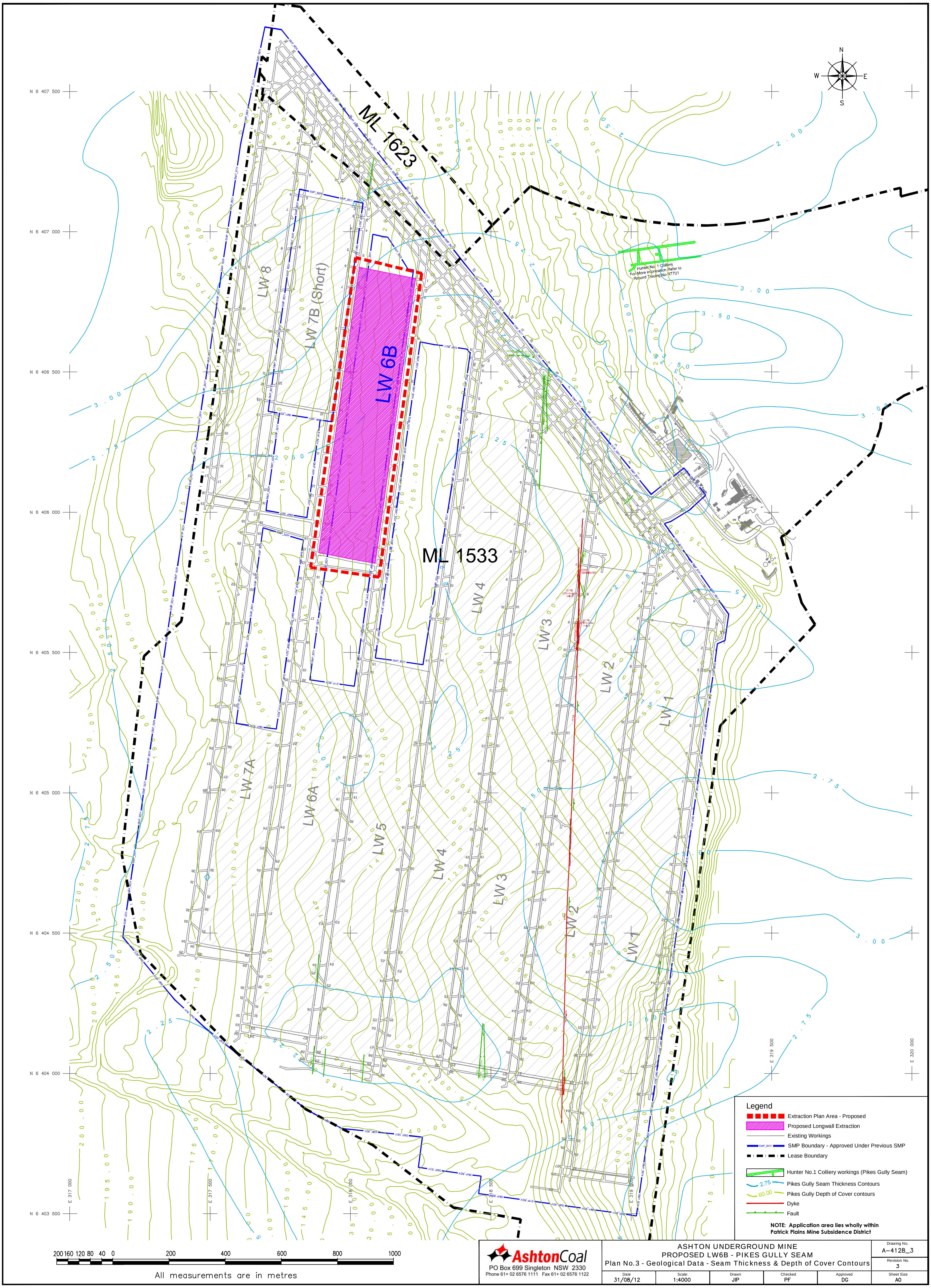
ML 1623
ML 1533
LW 6B
LW 8
LW 7B (Short)
LW 7A
LW 6A
LW 5
LW 4
LW 3
LW 2
LW 1
N 6 407 500
N 6 407 000
N 6 406 500
N 6 406 000
N 6 405 500
N 6 405 000
N 6 404 500
N 6 404 000
N 6 403 500
E 317 000
E 317 500
E 318 000
E 318 500
E 319 000
E 319 500
E 320 000
N
S
E
W
Hunter No.1 Colliery For More Information Refer to Record Tracing No.R7721
200 160 120 80 40 0 200 400 600 800 1000
All measurements are in metres
Legend
Extraction Plan Area - Proposed
Proposed Longwall Extraction
Existing Workings
SMP_BDY
SMP Boundary - Approved Under Previous SMP
Lease Boundary
Hunter No.1 Colliery workings (Pikes Gully Seam)
2.75
Pikes Gully Seam Thickness Contours
60.00
Pikes Gully Depth of Cover contours
Dyke
Fault
NOTE: Application area lies wholly within Patrick Plains Mine Subsidence District
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ASHTON UNDERGROUND MINE
PROPOSED LW6B - PIKES GULLY SEAM
Plan No.3 - Geological Data - Seam Thickness & Depth of Cover Contours
Drawing No. A–4128_3
Revision No. 3
Date 31/08/12
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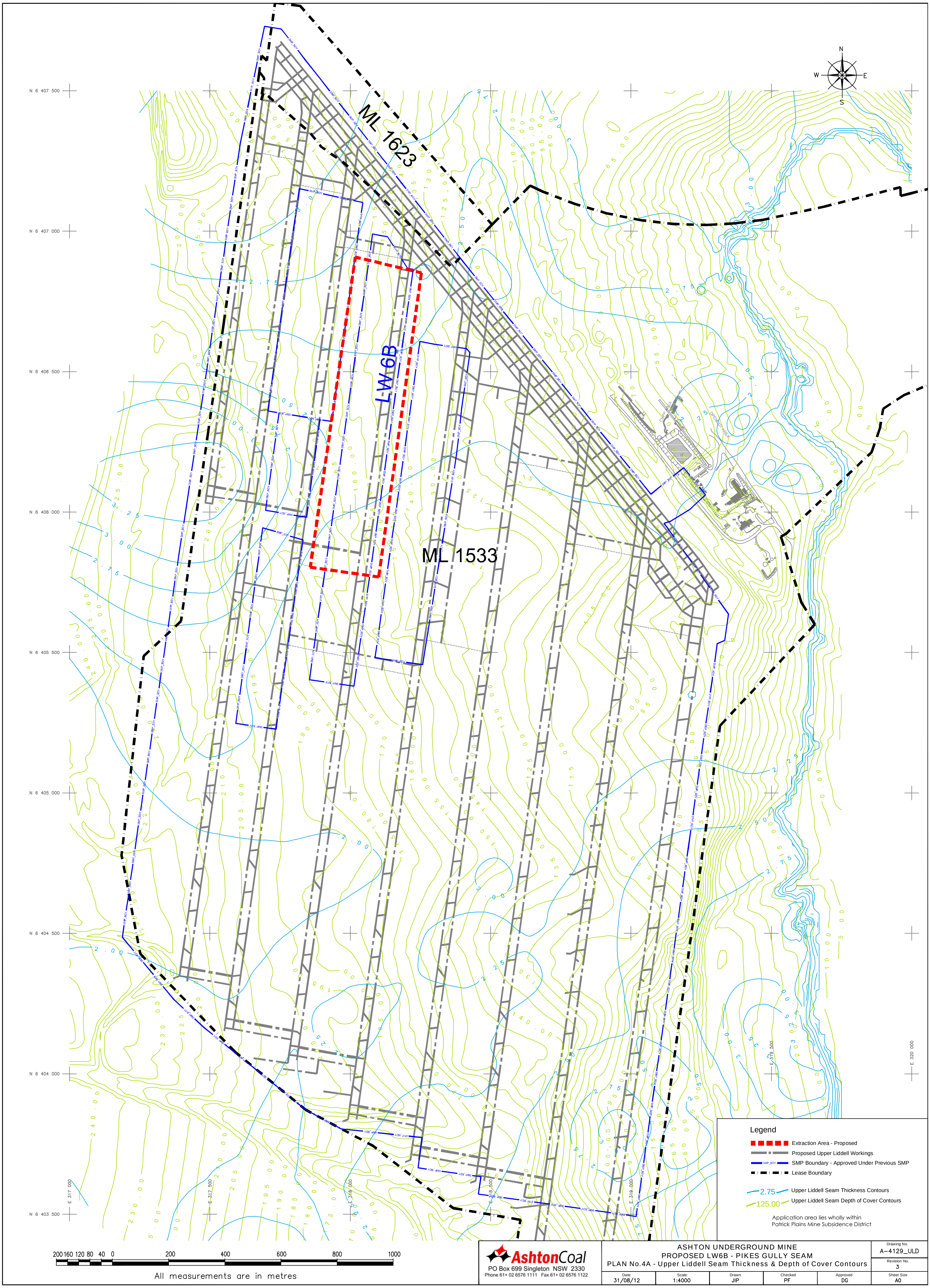

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ASHTON UNDERGROUND MINE
PROPOSED LW6B - PIKES GULLY SEAM
PLAN No.4A - Upper Liddell Seam Thickness & Depth of Cover Contours

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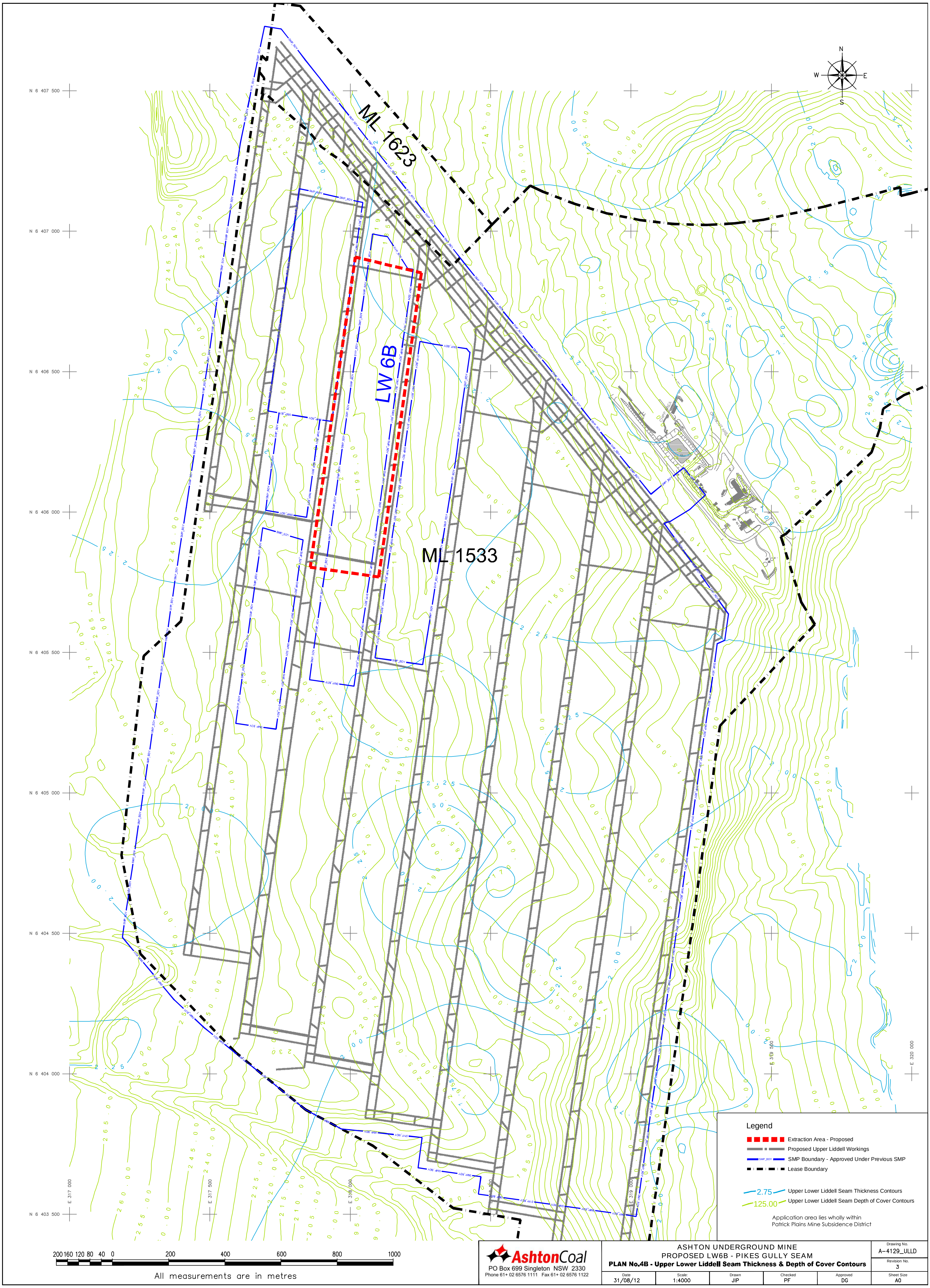
ML 1623
LW 6B
ML 1533
N
S
W
E
N 6 407 500
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N 6 406 000
N 6 405 500
N 6 405 000
N 6 404 500
N 6 404 000
N 6 403 500
E 317 000
E 317 500
E 318 000
E 319 000
E 319 500
E 320 000
Legend
Extraction Area - Proposed
Proposed Upper Liddell Workings
SMP_BDY
SMP Boundary - Approved Under Previous SMP
Lease Boundary
2.75
Upper Lower Liddell Seam Thickness Contours
125.00
Upper Lower Liddell Seam Depth of Cover Contours
Application area lies wholly within
Patrick Plains Mine Subsidence District
200 160 120 80 40 0 200 400 600 800 1000
All measurements are in metres
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ASHTON UNDERGROUND MINE
PROPOSED LW6B - PIKES GULLY SEAM
PLAN No.4B - Upper Lower Liddell Seam Thickness & Depth of Cover Contours
Date
31/08/12
Scale:
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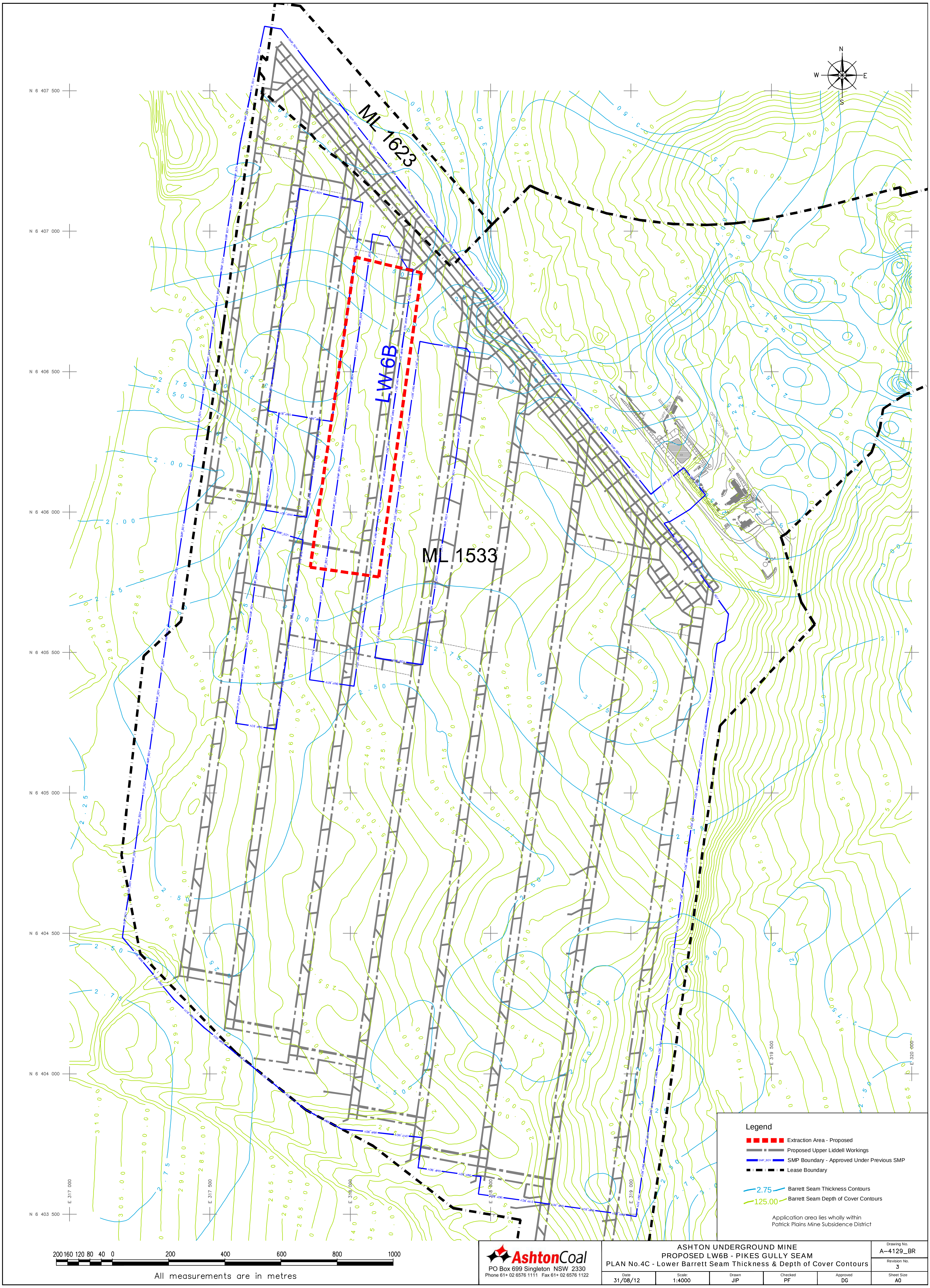

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ASHTON UNDERGROUND MINE
PROPOSED LW6B - PIKES GULLY SEAM
PLAN No.4C - Lower Barrett Seam Thickness & Depth of Cover Contours

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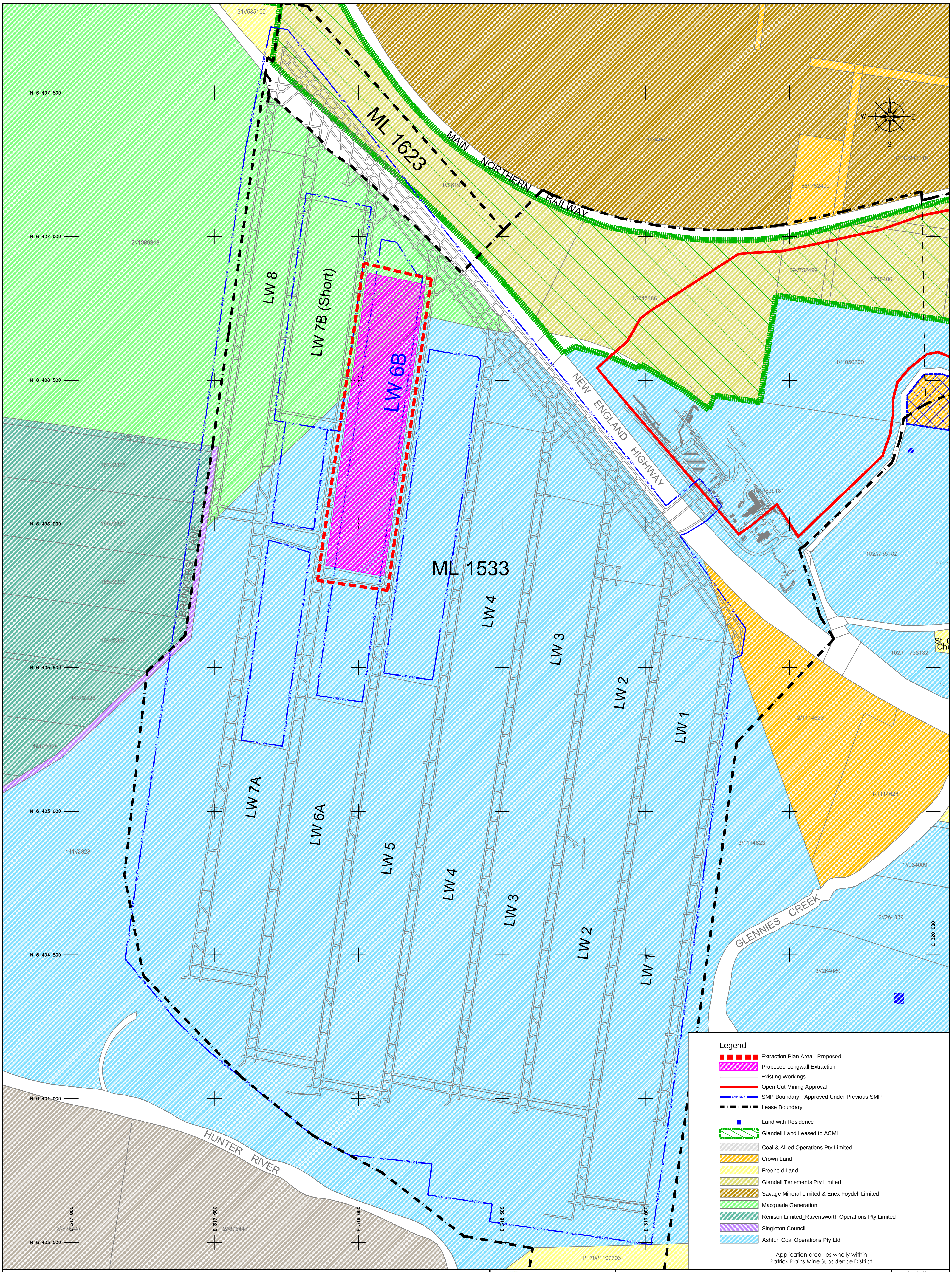

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ASHTON UNDERGROUND MINE
PROPOSED LW6B - PIKES GULLY SEAM
PLAN No.5 - Mining Titles and Land Ownership

Date	Scale	Drawn	Checked	Approved	Drawing No.	Revision No.	Sheet Size
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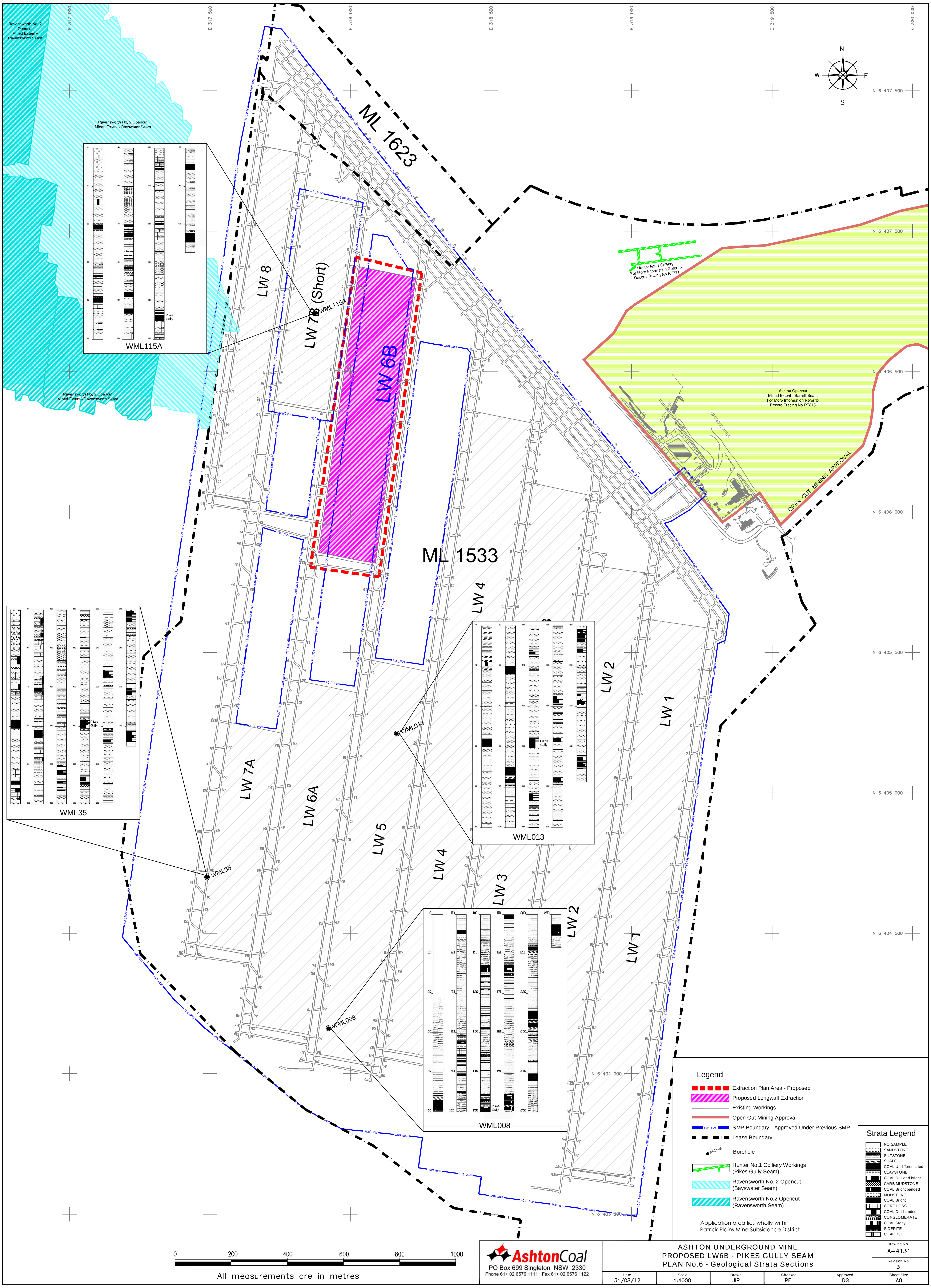

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ASHTON UNDERGROUND MINE
PROPOSED LW6B - PIKES GULLY SEAM
PLAN No.6 - Geological Strata Sections

Date	Scale:	Drawn	Checked	Approved	Drawing No.	Revision No.	Sheet Size
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