DESKTOP GEOTECHNICAL AND MINE SUBSIDENCE ASSESSMENT

Lithgow Mountain Bike Park

Prepared for Central Tablelands Mountain Bike Club

Prepared by RCA Australia

RCA ref 17539-201/2

August 2025

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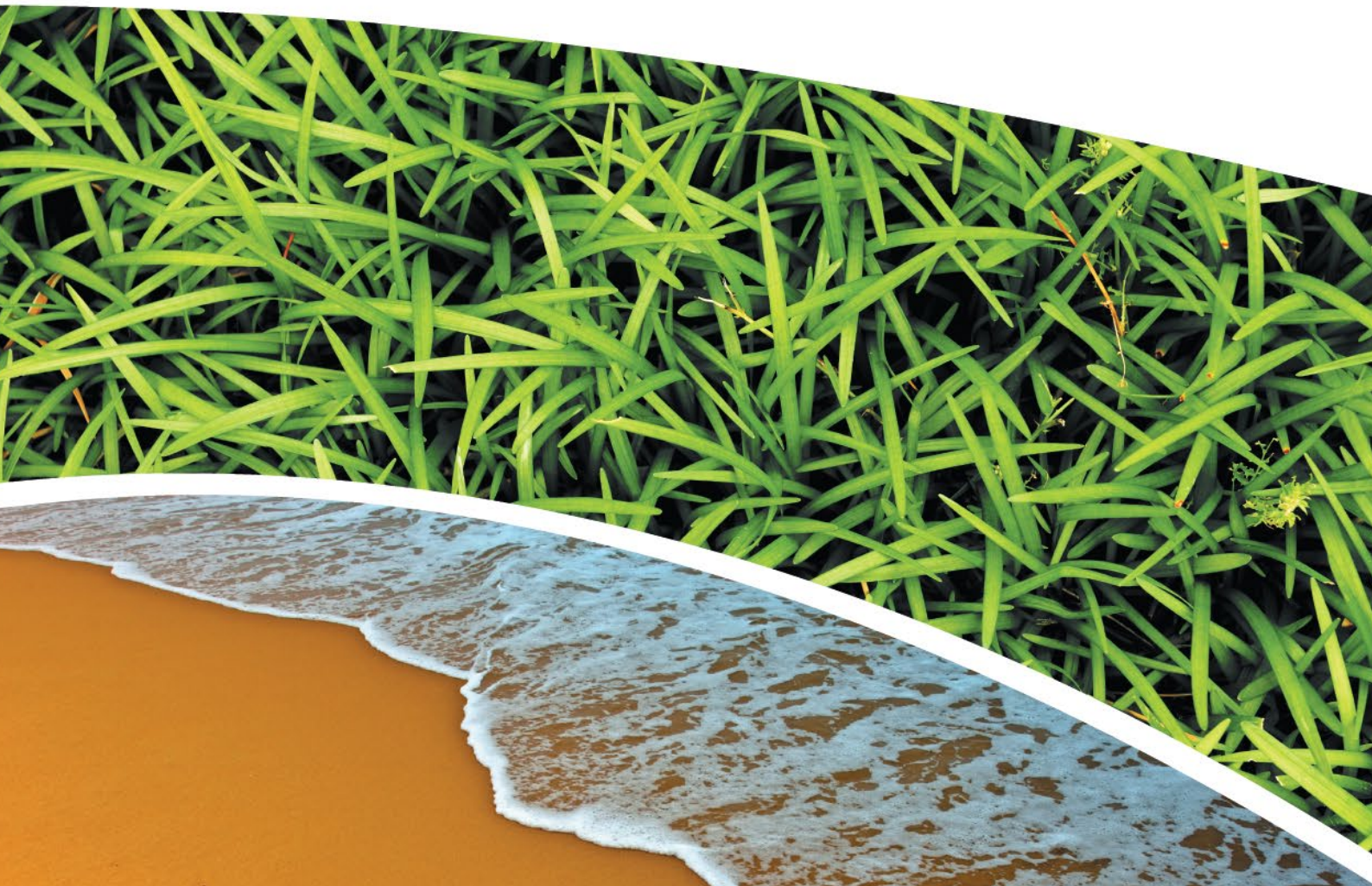

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13 August 2025

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Attention: Paul Smith

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DESKTOP GEOTECHNICAL AND MINE SUBSIDENCE ASSESSMENT LITHGOW MOUNTAIN BIKE PARK

1 INTRODUCTION

This report describes a desktop geotechnical and mine subsidence assessment carried out for Central Tablelands Mountain Bike Club (CTMBC) to support DA submission to Lithgow Council for proposed development of a mountain bike park.

This work was commissioned by Mr Paul Smith of PMO 360 Pty Ltd on behalf of CTMBC.

Based on plans provided by PMO 360 Pty Ltd it is understood that development at the site comprises a 24.54km network of mountain bike trails at State Mine Gully including development of some infrastructure at the trail starting point adjacent to the Lithgow State Mine Heritage Park off Sate Mine Road as well at points along the trails.

The starting point of the trails and much of the trail network length are located within the Lithgow Mine Subsidence District and as such will require SA NSW approval for proposed improvements.

It is understood that the nature of development (other than the trails) includes car parking and covered areas at the trail starting point along with picnic tables, shelters and minor bridges at points (yet to be defined) along the trails.

It is noted that a site inspection was undertaken by a Principal Geotechnical Engineer form RCA Australia in company with Ray Christison the President of the City of Greater Lithgow Mining Museum Inc.

Data provided to RCA Australia in relation to the project comprised:

- The bike alignments in .kmz format

2 SITE DESCRIPTION

2.1 REGIONAL GEOLOGY

Based on published geological maps, the entire site is judged to be situated in the Narrabeen Group, which are listed to comprise sandstone, shale and tuff rock types.

The mining at the Colliery is in the Lithgow Seam.

The following soil landscapes cover the site at various levels:

- Lithgow Soil Group
- Medlow Bath Group
- Warragamba Group
- Mt Sinai Group

2.2 SURFACE CONDITIONS

The proposed trail site lies northeast of Lithgow (see the Locality Plan on **Drawing 1**). The starting point for the trails is adjacent to the Lithgow State Mine Heritage Park. The Heritage Park area is relatively level and lying within the State Mine Gully and the topography over the remainder of the trail site comprises steep cliffs and slopes with the trails rising up out of, and along the gullies, and across exposed sandstone ridges. The RL at the starting point area is about 950m AHD with the highest point towards the northern extent of the trails reaching 1150m AHD and along the western extent of the trails to about 1050m AHD.

An aerial photograph of the site area is provided on **Drawing 1** which includes the proposed trail network shown as red lines along with the Lot boundaries of the network site.

The area of the starting point within the State Mine Gully lies immediately south of the Heritage Park Museum building and car park and is cleared of vegetation while the remainder of the trail network site is mostly bushland with some existing roads and walking trails.

Adjacent to the north and east of the starting point of the trails there is existing development associated with the disused Sate Gully Coal Mine and rail facilities. The starting point area lies over a level filled area that is understood to comprise coal waste and material placed in the past as part of mining activities.

It is noted that the trail infrastructure and all of the trail network will be isolated from the Heritage Park area by fencing and will not include any access to the abandoned mining area and facilities.

Photographs of the site to illustrate site features are provided in **Photograph 1** to **Photograph 6**.

Photograph 1 *View to the north across the area proposed for the starting point of the trail network. Visible in the background are the Park Museum Building with the poppet head over the colliery downcast shaft behind (shaft is 80m deep, fully lined and capped with concrete)*

Photograph 2 *View to the south across the area proposed for the starting point of the network. The Heritage Park carpark is in the foreground.*

Photograph 3 *View to the southeast across the area proposed for the starting point of the network. The Heritage Park carpark is in the foreground. The shed in the background lies on rail land adjacent to the site.*

Photograph 4 *The entry portal to the mine drift within the Heritage Park area.*

Photograph 5 *The concrete cap of the downcast shaft beneath the poppet head.*

Photograph 6 *Representative view of the trail topography in the upper (northern) trail network area*

2.3 SUBSURFACE CONDITIONS

The majority of the network site is expected to compromise sandstone rock outcrop or shallow soil over sandstone bedrock. Areas of colluvium and/or alluvium are present within the site gullies.

At the site starting area (see **Photograph 1, Photograph 2** and **Photograph 3**) there is understood to be an unknown depth of fill comprising mine spoil present.

A series of bores were undertaken in 2010 within the Heritage Park grounds to assess biogas and the drill section from the resulting report is attached in **Figure 1**. The section indicates that in the general area of the Heritage Park and the proposed trail starting area the subsurface comprises 3m of colliery spoil over alluvium to 17m over rock to the mined seam at a depth of about 78m. The mined seam (the Lithgow Seam) lies at a depth of about 78m beneath the trail starting area and becomes deeper to the north as the topography rises.

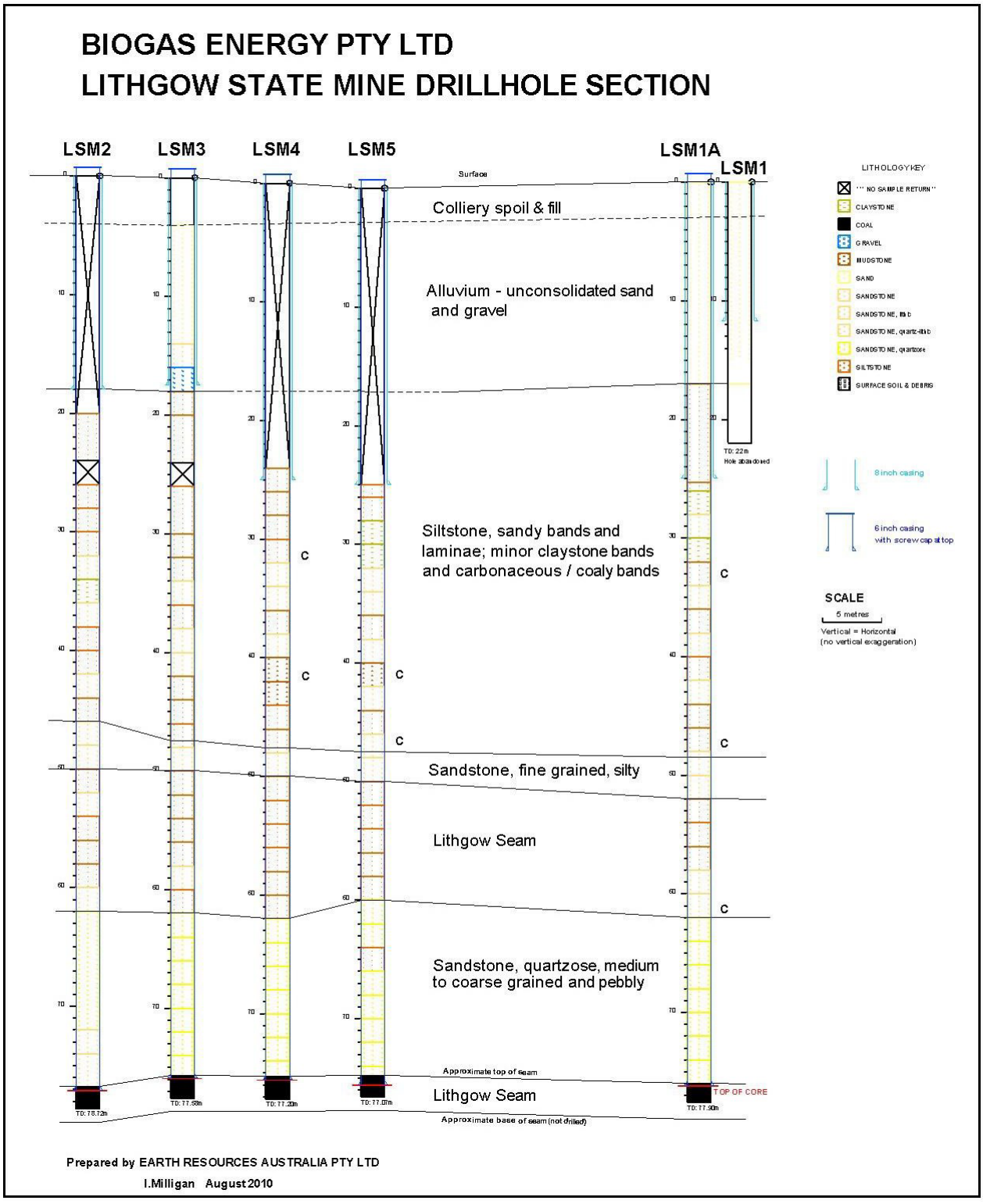

Figure 1 *Lithgow Sate Mine Drillhole Section*

3 DISCUSSION AND COMMENTS

3.1 KARSTS

The site lies over rocks of Narrabeen Group, which are listed to comprise sandstone, shale and tuff rock types. Karsts and karst landscapes form through dissolution of limestone leading to features such as sinkholes and caves. The geology in this area is not consistent with karst formation or presence.

3.2 SOIL SALINITY AND EROSION

No soil sampling or testing was undertaken for this report and the soil salinity and erosion potential has been assessed by desktop assessment.

The soil landscapes across the site listed in Section 2.1 are not listed as having a significant salinity risk.

Soil profile data in this area listed on the eSPADE mapping site list all areas in the Lithgow area as having no salting evident.

On the basis of the desktop data the proposed mountain bike park site does not present a significant risk of soil salinity.

The soils encountered on the site are potentially susceptible to erosion, and soil disturbance should be minimised and protected by vegetation where exposed.

3.3 DETAILS OF WORKINGS

For general reference, a useful history of the Lithgow State Mine Colliery may be found here https://www.statemine.org.au/learn/scmine.htm.

Widespread bord and pillar coal mine workings in the Lithgow Seam by the State Mine Colliery lie under much of the proposed area of the trail network. A mine overlay plan of the trail network area has been prepared using mine record traces (RTs) obtained from the Mine Regulator and is provided on **Drawing 2**. **Drawing 3** provides a bigger scale view of the mine overlay at the trail starting area.

Key features of the mine overlay plans include:

- In the general area of the trail network start point and the Heritage Park the workings comprise first worked rectangular pillars of a regular form.
- Widespread bord and pillar mine workings in the Lithgow Seam lie under much of the proposed area of the trail network.
- Uncrosshatched pillars on the mine overlay represent pillars left in place while crosshatched pillars, and pillar areas, represent areas where pillars have been removed.
- RT20 which includes workings under the trail network site shows the Lithgow Seam dip to be 1V:16H approximately 60º east from north.

- With the rise in topography from the topographic low of about 950m AHD (at the trail starting area) and the seam dip of about 3.5º to the NE the workings beneath the trail network site are minimum 80m near the trail starting area increasing to a maximum in excess of 300m towards to northern site boundary.

3.4 BOREHOLE AND SEAM DATA

3.4.1 SEAM THICKNESS

RT20 includes a seam section at the upcast shaft location within the State Heritage Park area adjacent to the museum building (beneath the poppet head visible in **Photograph 1**). The seam section is reproduced in **Figure 2.** The seam section shows a full seam thickness of 9′ 3′′ (2.8m) at a depth of 263′ (80.16m). It is understood that the colliery generally left the roof coal above the 3′′ shale band in place resulting in a mined seam of closer to 6′ 4′′ (1.93m) in this area. Elsewhere in the Colliery the seam thickness is up to 14′-15′ with the roof coal left in place.

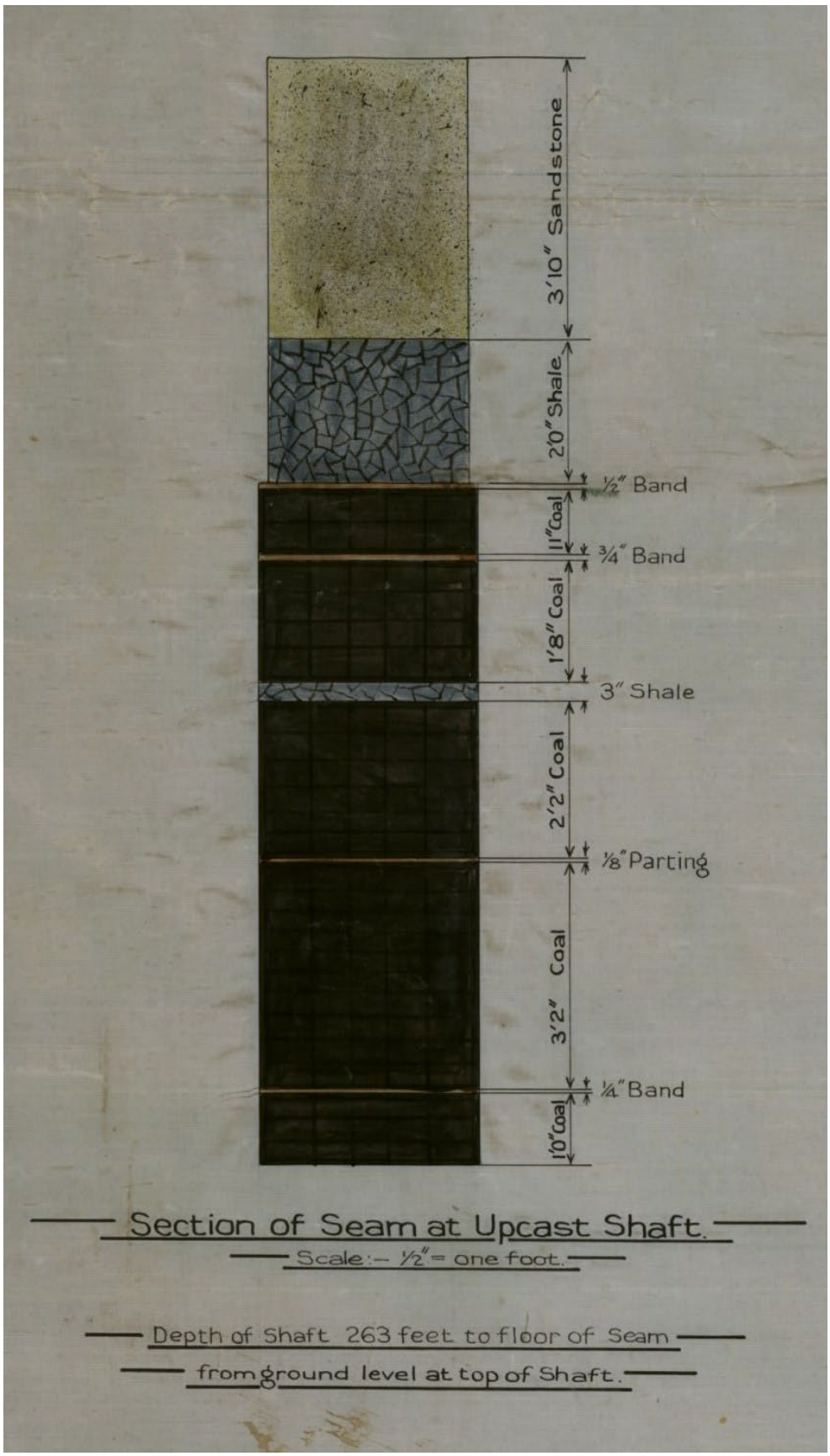

Figure 2 *Colliery Seam Section (RT587)*

3.5 MINE STABILITY ASSESSMENT

3.5.1 OVERBURDEN AND FLOOR CONDITION

The borehole data presented indicates:

- The floor of the seam was typically sandstone.
- The roof of the seam was sandstone with a hard shale band at the roof.

In general, the roof and floor conditions of the Lithgow Seam are not considered to comprise soft materials normally considered to result in pillars punching into the floor.

3.5.2 POTHOLE RISK

There is no risk of pothole subsidence present within the site of the trail network.

3.5.3 TROUGH SUBSIDENCE

3.5.3.1 PILLAR STABILITY

Pillar stability analysis has been undertaken for the typical rectangular pillars that lie beneath the proposed trail start area based on:

- Full seam mined (2.8m)
- Pillar dimensions w1= 34m, w2=45m, x1=5.5m, x2=4.0m (pillar geometry is defined in **Figure 3**).
- Depth to seam 80m

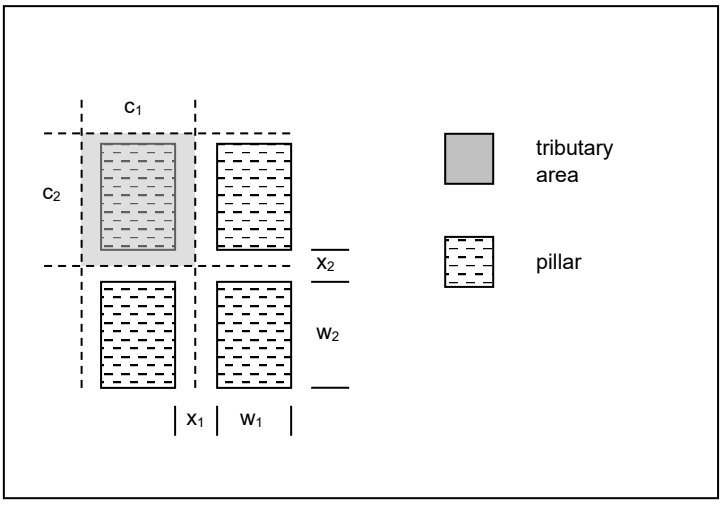

Figure 3 *Pillar Geometry*

An assessment of the pillar stability of the identified pillar has been made using the procedure presented by Ref [1]. A factor of safety for the pillar of the order of 16 is calculated. There is no credible risk of pillar failure and subsidence in the general area of the proposed trail starting point infrastructure.

Elsewhere across the area of the trail network where pillars are crosshatched and shown to have been removed there is the possibility of trough subsidence occurring through pillar collapse and seam closure with resulting subsidence. With reference to the mine overlay plan in **Drawing 2** and **Drawing 3** the only location where the trails cross extensive areas of second workings and potential goaf is in the area starting about 360m NNW of the trail starting area where three trails cross over goaf (subsided ground) and there may be ground surface cracking present.

3.5.4 SHAFTS

The location of four shafts is identified on **Drawing 3** in the general area of the trail starting area. The trail alignments and associated facilities are no closer than 100m to the shafts and the shafts are not considered to cause a risk to the trail infrastructure. RCA has been informed by Ray Christison, President of the City of Greater Lithgow Mining Museum Inc (Member of MPHA and BA Hon. Archeology and Paleoanthropology, specialising in coal mining history) that the shafts proximate to the mountain bike park track alignments are all capped.

3.6 SUBSIDENCE ADVISORY NSW APPROVAL FRAMEWORK

SA NSW has set development guidelines to help landowners building within a mine subsidence district. The guidelines set out the requirements for building on a property based on potential subsidence risks.

SA NSW's guidelines include requirements related to the nature and class of any development on a property, the size, height and location of new structures, and the use of certain building materials and construction methods.

Areas of the Lithgow State Coal Mine site are listed on the NSW Government Planning Portal as either:

- Guideline 2. Guideline 2 applies to properties with a risk of trough subsidence. Trough subsidence forms as a result of the presence of underlying, unstable historical coal mine workings. Development that complies with this Guideline will generally accommodate the following subsidence-induced ground movements:
    - Maximum Horizontal Ground Strain: 2mm/m tensile or compressive
    - Maximum Tilt: 4mm/m
    - Minimum Radius of Curvature: 10km (hogging and sagging).

- Guideline 7. Guideline 7 applies to properties at risk of subsidence with unknown or severe parameters, or properties affected by shallow mine entries or shafts. It is noted that the areas of the site listed as Guideline 7 are the areas that include shafts, which is considered to be the reason for the application of Guideline 7, rather than the areas being subject to unknown or severe subsidence parameters.

As part of the assessment process for development applications that do not comply with Subsidence Advisory's standard guidelines, the following factors will be considered:

- Likelihood that mine subsidence events will occur.
- Consequence of mine subsidence events on surface infrastructure and public safety.
- Reliability of information used to determine the above, including mine plans, assumed pillar and extraction dimensions, and assumptions regarding geotechnical modelling.
- Risks arising from the proposed engineering controls.

3.7 RECOMMENDATION

The proposed development comprises:

- At the trailhead/starting point - car parking, covered areas and possible minor structures.
- Over the trail network - unsealed bike trails, picnic tables, shelters and minor bridges at points (yet to be defined) along the trails.

With reference to the factors for approval listed in Section 3.4 the following points are made:

Likelihood of mine subsidence events – the likelihood of mine subsidence events occurring across the site is low. Workings are in excess of 80m depth, and all shafts are remote from trail infrastructure. A length of trail traverses potential goafed ground over second workings and should be inspected for cracking and the surface remediated if necessary. The risk to user safety associated with any surface cracking is not considered to be greater than the risks associated with the proposed site use normally.

Consequence of mine subsidence events on surface infrastructure and public safety – Infrastructure comprises trails, car parking and lightweight and settlement tolerant structures (picnic tables and shelters). Minor pedestrian type bridges may be required at some watercourse crossings and this is yet to be defined. Shafts are capped and remote from the trails.

Reliability of information used – Mine history available and used for this assessment is expected to be highly reliable. Mine records of the State Mine Colliery are high quality.

It is recommended that the site is suitable for the proposed use, subject to the comments provided in this report.

It is likely that a condition of approval for the facility will include a requirement for site structures to comply with Guideline 2 subsidence limits (for Safety):

- Maximum Horizontal Ground Strain: 2mm/m tensile or compressive
- Maximum Tilt: 4mm/m
- Minimum Radius of Curvature: 10km (hogging and sagging).

It is recommended that this be allowed for in project planning.

4 CONCLUSION

A desktop investigation of abandoned Lithgow Coal Seam workings underlying the site of the proposed development at Lithgow State Coal Mine has been undertaken. The proposed development comprises a mountain bike park.

The starting point of the trails and much of the trail network length are located within the Lithgow Mine Subsidence District and as such will require SA NSW approval for proposed improvements.

The scale of development is relatively minor, the subsidence likelihood and consequence are low and it is recommended that the site is suitable for the proposed use subject to the comments provided in this report.

Allowance should be made in planning for design for safety of structures to comply with the SA NSW Guideline 2 ground movements noted in Section 3.5.

5 LIMITATIONS

This report has been prepared for Central Tablelands Mountain Bike Club in accordance with the agreement with RCA Australia. The services performed by RCA have been conducted in a manner consistent with that generally exercised by members of its profession and consulting practice.

This report has been prepared for the sole use of Central Tablelands Mountain Bike Club for the specific purpose and the specific development described in the report. The report may not contain sufficient information for purposes or developments other than that described in the report or for parties other than Central Tablelands Mountain Bike Club. This report shall only be presented in full and may not be used to support objectives other than those stated in the report without permission.

The information in this report is considered accurate at the date of issue with regard to the current conditions of the site. The conclusions drawn in the report are based on

interpretation of mine records. Conditions can vary between test locations that cannot be explicitly defined or inferred by investigation.

Yours faithfully
RCA AUSTRALIA

Dr Mark Allman
Principal Geotechnical Engineer

REFERENCES

[1] Galvin, JM, Hebblewhite, BK, Salamon, MDG and Lin, BB (1998) "Establishing the Strength of Rectangular and Irregular Pillars" ACARP Research Project No. C5024.

[2] Development Application – Merit Assessment Policy, SA NSW Version 2, 5 April 2023.

Appendix A

Drawings

Lithgow State Mine Heritage Park

Proposed Area for MBT starting point

State Mine Gully Road

Macaulay Street

Legend

Bike path alignment

Lot boundaries

Notes:
1. Aerial image taken from Nearmap, 23 November 2024 (used in accordance with commercial licence)

0 50 100 200 300 400
metres

N

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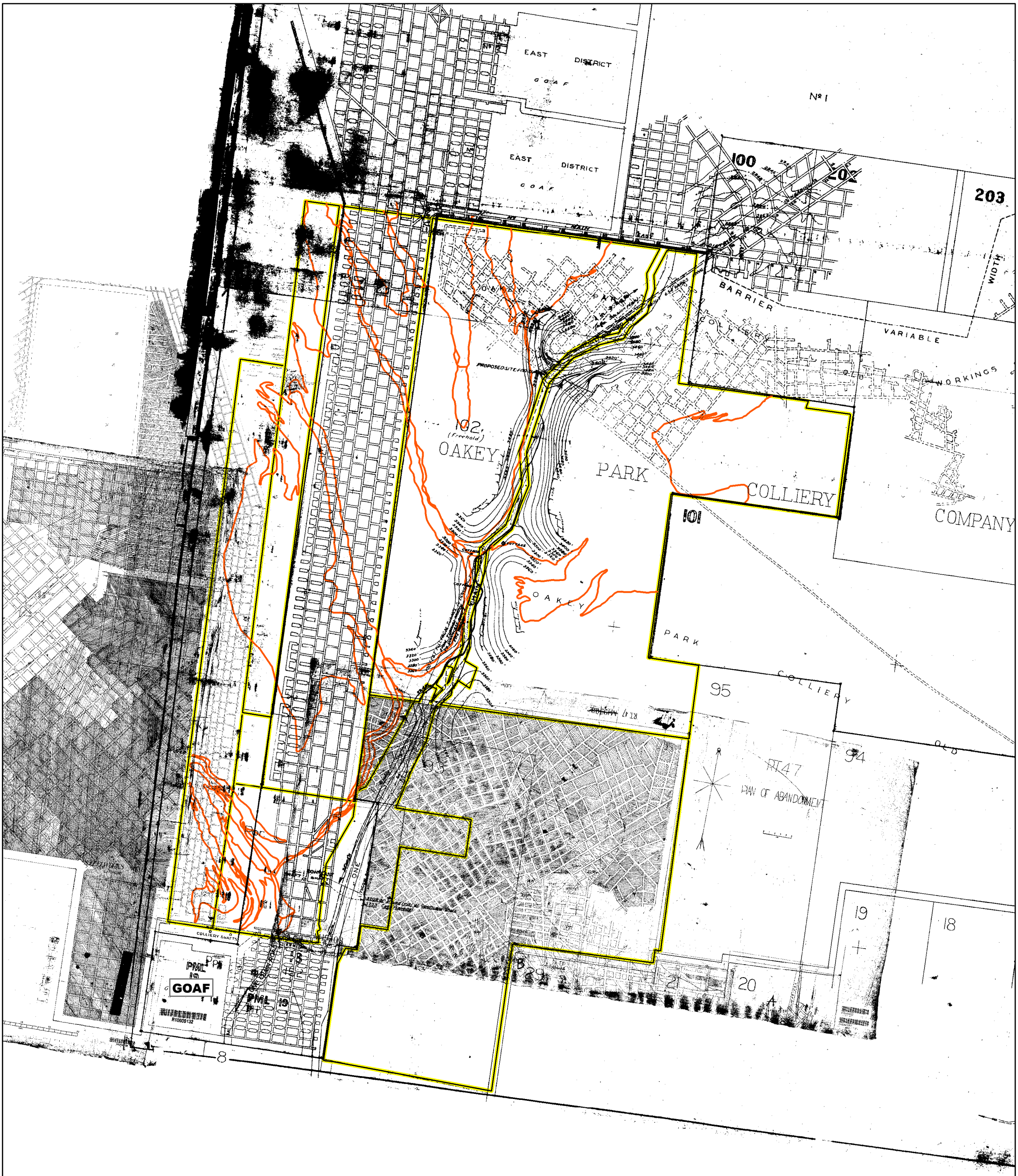
SITE LOCATION PLAN
LITHGOW MBT

CLIENT	Central Tablelands Mountain Bike Club			RCA Ref	17539-201/2
DRAWN BY	MA	SCALE	1:10,000 (A3)	DRAWING No 1	REV 0
APPROVED BY	MA	DATE	9/05/2025	OFFICE	NEWCASTLE



Legend

- Lot boundaries
- Bike path alignment
- Mine workings

0 50 100 200 300 400
metres

N

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MINE OVERLAY PLAN
LITHGOW MBT

CLIENT	Central Tablelands Mountain Bike Club			RCA Ref	17539-201/2	
DRAWN BY	MA	SCALE	1:10,000 (A3)	DRAWING No	2	REV 0
APPROVED BY	MA	DATE	9/05/2025	OFFICE	NEWCASTLE	

Lithgow State Mine Heritage Park

MTB Starting Point

State Mine Gully Road

Macaulay Street

GOAF

PML 19

Legend

- Bike path alignment
- Lot boundaries
- Mine workings
- Shafts

Notes:
1. Aerial image taken from Nearmap, 22 September 2024 (used in accordance with commercial licence)

0 15 30 60 90 120
metres

N

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DETAILED MINE OVERLAY PLAN LITHGOW MBT

CLIENT	Central Tablelands Mountain Bike Club			RCA Ref	17539-201/2
DRAWN BY	MA	SCALE	1:3,000 (A3)	DRAWING No 3	REV 0
APPROVED BY	MA	DATE	9/05/2025	OFFICE	NEWCASTLE