



**DENDROBIUM MINE - PLAN FOR THE FUTURE:  
COAL FOR STEELMAKING**

**AMENDMENT REPORT  
AUGUST 2020**

## TABLE OF CONTENTS

1	INTRODUCTION	1
2	DESCRIPTION OF AMENDMENTS	4
	2.1 DELINEATION OF ANCILLARY INFRASTRUCTURE	4
	2.1.1 Revised Native Vegetation Disturbance	4
	2.1.2 Revised Biodiversity Offsetting Requirements	6
	2.2 REDUCTION IN PROJECT RESOURCE	6
	2.3 SURFACE WATER OFFSETS	6
	2.4 SUMMARY OF PROPOSED AMENDMENTS	7
3	STRATEGIC AND STATUTORY CONTEXT	10
	3.1 STRATEGIC AND STATUTORY CONTEXT	10
	3.2 INTERACTION OF THE PROJECT WITH THE APPROVED DENDROBIUM MINE AND BULLI SEAM OPERATIONS	10
4	ASSESSMENT OF IMPACTS	13
	4.1 DELINEATION OF ANCILLARY INFRASTRUCTURE	13
	4.1.1 Biodiversity	13
	4.1.2 Aboriginal Cultural Heritage	13
	4.2 REVISED LONGWALL LAYOUT	16
	4.2.1 Groundwater and Surface Water	16
	4.2.2 Aquatic Ecology	18
	4.2.3 Aboriginal Cultural Heritage	18
	4.2.4 Emissions-related Impacts	18
	4.2.5 Economic Effects	19
5	PROJECT EVALUATION	20
6	REFERENCES	21

Table 6	Updated Project Ecosystem Credit Requirements (Source: Niche, 2020)
Table 7	Updated Project Species Credit Requirements (Source: Niche, 2020)
Table 8	Comparison of Subsidence Predictions for Site AHIMS ID #52-2-1752
Table 9	Revised Project Economics (\$ million)

## LIST OF FIGURES

Figure 1	Regional Location
Figure 2	Project General Arrangement – Underground Mining Areas
Figure 3	Setbacks Adopted in the Amendment Report Mine Plan from Named Watercourses and Key Stream Features

## LIST OF ATTACHMENTS

Attachment 1	Revised Project Description
Attachment 2	Supplementary Biodiversity Assessment Report (Niche, 2020)

## LIST OF TABLES

Table 1	Revised Breakdown of Proposed Project Native Vegetation Disturbance
Table 2	South32 Commitments to Address Surface Water Losses
Table 3	Project Summary Comparison Table
Table 4	Interaction of Existing and Proposed Approvals
Table 5	Breakdown of Revised Native Vegetation Impacts (Source: Niche, 2020)

## 1 INTRODUCTION

The Dendrobium Mine is an underground coal mine situated in the Southern Coalfield of New South Wales (NSW) approximately 8 kilometres (km) west of Wollongong (Figure 1). Illawarra Coal Holdings Pty Ltd (Illawarra Coal), a wholly owned subsidiary of South32 Limited (South32), is the owner and operator of the Dendrobium Mine.

The Dendrobium Mine – Plan for the Future: Coal for Steelmaking (the Project) proposes the extraction of additional coal reserves within Consolidated Coal Lease (CCL) 768. The extraction of additional Project coal reserves would be supported by the development of supporting infrastructure and the use and augmentation of existing surface facilities at the Dendrobium Mine.

In 2019, South32 submitted the *Dendrobium Mine – Plan for the Future: Coal for Steelmaking Environmental Impact Statement* (the EIS) for assessment under the NSW *Environmental Planning and Assessment Act, 1979* (EP&A Act).

In 2020, South32 submitted the *Dendrobium Mine – Plan for the Future: Coal for Steelmaking Submissions Report* (the Submissions Report) to the Department of Planning, Industry and Environment (DPIE) in response to the submissions received by Government agencies, organisations and the community on the EIS.

South32 has identified several amendments to the Project following lodgement of the Project EIS and to reflect Project refinements and commitments resulting from the assessment process. These changes to the Project involve the following:

- **Delineation of ancillary infrastructure** – in response to the Biodiversity Conservation Division’s (BCD) submission on the Submissions Report, South32 has undertaken further design works to delineate (i.e. “fix”) the locations of ancillary infrastructure for the Project. Overall, there is no change to the total native vegetation disturbance of 28.5 hectares (ha) described and assessed in the EIS. Credit offset liabilities for ecosystem and species credits have been confirmed accordingly as part of the additional survey work undertaken for these changes.
- **Refinement of Avon Dam Full Supply Level (FSL) and associated setback** – the Project mine design commitment is to setback the Project longwalls by 300 metres (m) from the FSL of the Avon and Cordeaux dams. South32 has obtained more detailed surface contour data which has resulted in a refinement to the FSL mapping for the Avon Dam. As a result, there is a small reduction of approximately 0.4 million tonnes (Mt) of total run-of-mine (ROM) coal no longer proposed to be mined as a result of a reduction to the extent of the proposed Area 5 longwalls.
- **Confirmation of surface water offset commitments** – following lodgement of the Submissions Report, South32 has provided further detail to DPIE in regard to proposed surface water offsets for the Project in response to DPIE’s letter dated 20 April 2020. The proposed offsets are to achieve South32’s revised commitment to offset predicted surface water losses so that there would be a “net gain” to Metropolitan drinking water supplies.

This Amendment Report has been prepared by South32 to describe the above Project changes. South32 seeks to incorporate these changes by obtaining the agreement of the consent authority, pursuant to clause 55 of the *NSW Environmental Planning and Assessment Regulation, 2000* (EP&A Regulation), to amend the Project that is subject to State Significant Development (SSD) Application No. 8194.

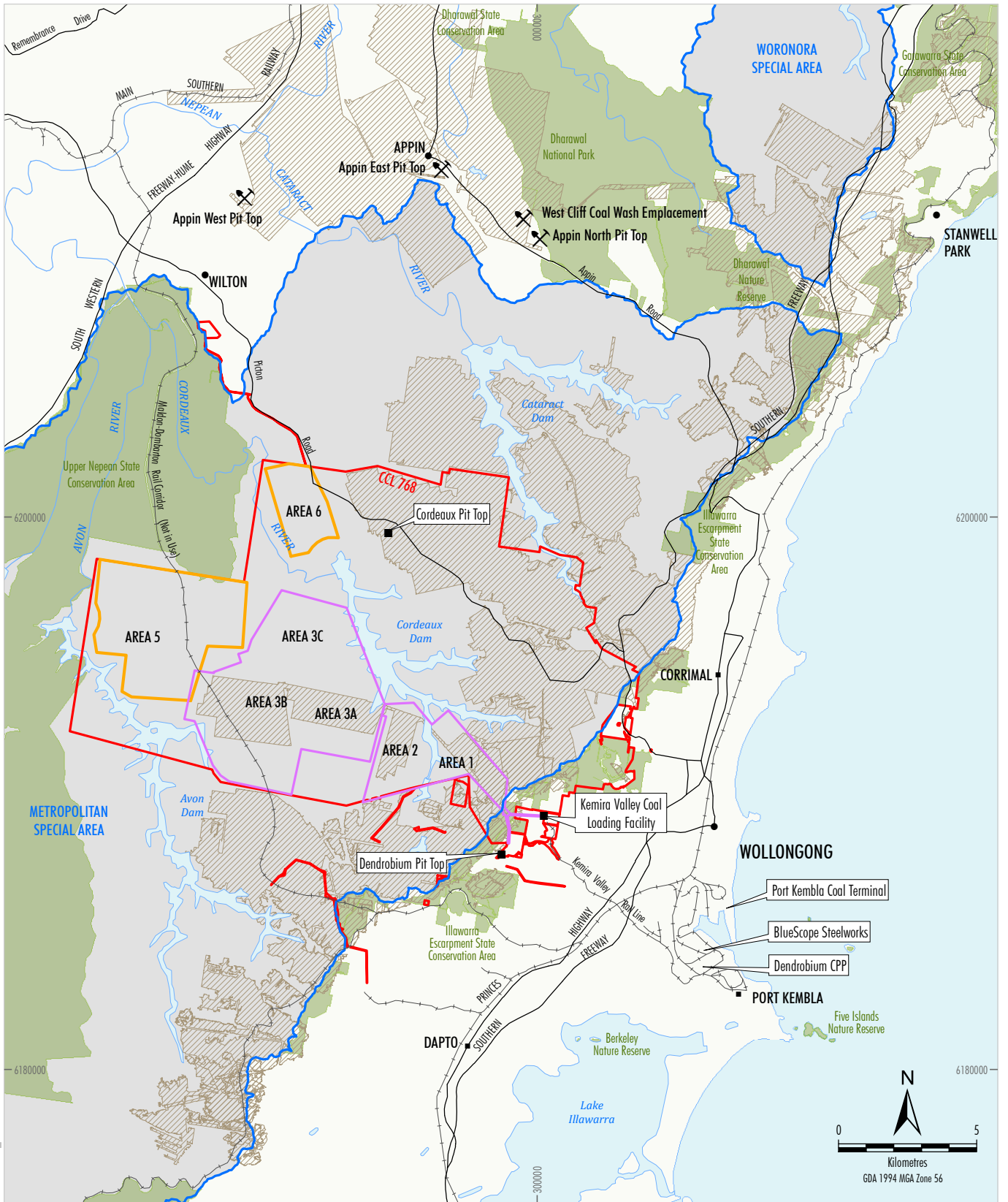
In summary, when compared to the EIS, the proposed amendments would:

- Reduce the total coal resource for the Project from approximately 77.6 Mt to approximately 77.2 Mt.
- Result in an estimated reduction in net benefits to NSW from \$1,073.2 million to \$1,069.6 million in net present value [NPV].
- Reduce indirect greenhouse gas emissions (i.e. Scope 3) over the life of the Project from 237.1 Mt of carbon dioxide equivalent (CO<sub>2-e</sub>) to 235.9 Mt CO<sub>2-e</sub> (annual average reduction from approximately 8.2 Mt CO<sub>2-e</sub> per year to approximately 8.1 Mt CO<sub>2-e</sub> per year).
- Result in no change to the total native vegetation disturbance of 28.5 ha as described and assessed in the EIS, however, delineate the disturbance footprint for some ancillary infrastructure.

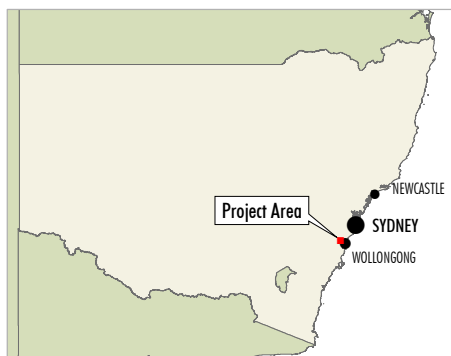
- Refinements to the Biodiversity Offset Strategy and offset requirements commensurate with delineating the native vegetation disturbance footprint (refer to Section 4.1.1 and Attachment 2).
- Result in no change to:
  - peak production rate;
  - mine life;
  - workforce;
  - hours of operation; and
  - Project longwall setback commitments.
- Not result in additional environmental impacts beyond those assessed in the EIS (e.g. surface water, groundwater and biodiversity).
- Not require any changes to relevant monitoring, mitigation and management measures as outlined in the EIS.

This Amendment Report has been prepared in consideration of the *Guideline 5: Guidance for State Significant Projects - Preparing an Amendment Report June 2019* (DPIE, 2019), and is structured as follows:

- Section 2** Provides a description of the proposed amendments.
- Section 3** Details the strategic and statutory context of the amended Project.
- Section 4** Provides an updated assessment of the Project impacts.
- Section 5** Provides an updated evaluation of the Project merits.
- Section 6** Lists the documents referenced in the Amendment Report.



SIH-16-02 DAR\_2024



- LEGEND**
- Dendrobium Mining Lease
  - Road
  - Railway
  - National Park, Nature Reserve and State Conservation Area
  - Historic Mine Workings
  - Declared Catchment Area
  - Dendrobium Underground Mining Area - Proposed Project
  - Dendrobium Underground Mining Area - Existing Mine (DA 60-03-2001)

Source: Geoscience Australia, (2006); Department of Industry (2018); Department Finance, Services & Innovation (2018);



Illawarra Coal

**DENDROBIUM MINE**  
Regional Location

**Figure 1**

## 2 DESCRIPTION OF AMENDMENTS

### 2.1 DELINEATION OF ANCILLARY INFRASTRUCTURE

#### 2.1.1 Revised Native Vegetation Disturbance

The Project EIS described and assessed native vegetation disturbance areas for both ‘fixed’ (e.g. Ventilation Shaft Sites) as well as for ‘unfixed’ infrastructure, as at the time of preparation of the EIS the locations of this infrastructure had not been defined (e.g. additional service boreholes and electricity transmission line [ETL]).

The EIS provided an allowance of 9.5 ha of native vegetation disturbance for this ‘unfixed’ infrastructure outside of delineated areas (described in Section 3.10.4 of the EIS). Impact assessment included the calculation of offset credit liabilities based on the assumed native vegetation disturbance area allowance.

In response to BCD’s submission on the Project Submissions Report, South32 has undertaken further design works to delineate (i.e. ‘fix’) the locations of ancillary infrastructure for the Project.










Overall, there is no change to the total native vegetation disturbance of 28.5 ha of native vegetation described in the EIS, with the revised vegetation disturbance comprising:

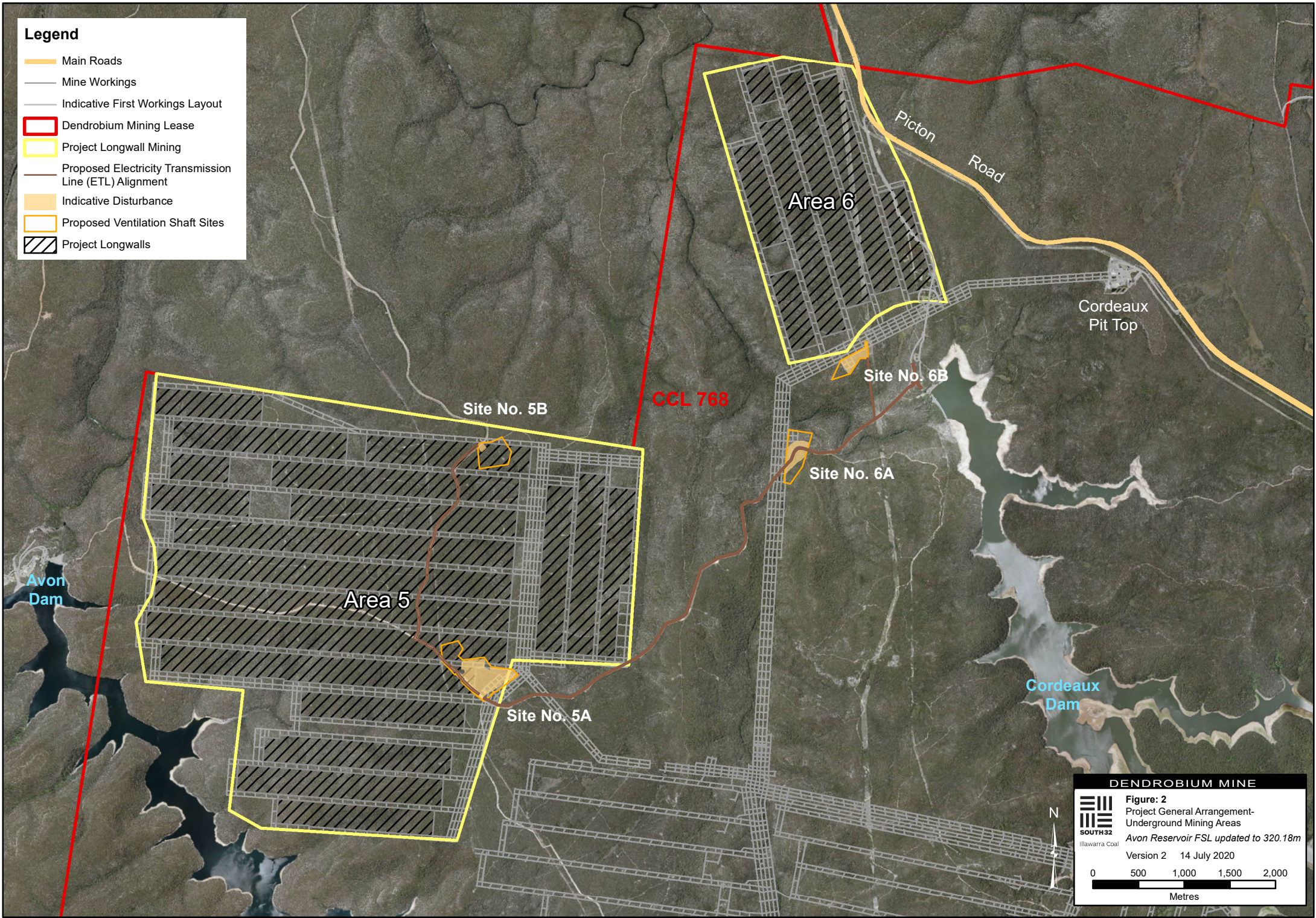
- amendment of the native vegetation disturbance extent of Ventilation Shaft Site No 5A to incorporate:
  - the service boreholes which previously did not have a fixed location (+5 ha); and
  - ventilation and gas management infrastructure previously located at Ventilation Shaft Site No 5B (+2.5 ha); and
- finalisation of the alignment of ETLs that will supply the ventilation shafts (no change to the 4.5 ha allowance in the EIS).

The revised native vegetation disturbance for ancillary infrastructure is summarised in Table 1 and is shown on Figure 2.

**Table 1**  
**Revised Breakdown of Proposed Project Native Vegetation Disturbance**

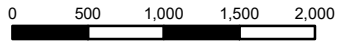
	Site	EIS – Area of Native Vegetation Disturbance (ha)	Revised – Area of Native Vegetation Disturbance (ha)	Change (ha)
‘Fixed’ Infrastructure (EIS)	Ventilation Shaft Site No 5A	7.5	15.0 (includes service boreholes – previously ‘unfixed’)	+7.5
	Ventilation Shaft Site No 5B	3.0	0.5	-2.5
	Ventilation Shaft Site No 6A	4.3	4.3	-
	Ventilation Shaft Site No 6B	4.0	4.0	-
	Pit Top Carpark Extension	0.2	0.2	-
‘Unfixed’ Infrastructure (EIS)	Service Boreholes	5	0 (refer to Site No 5A)	-5
	Electricity Transmission Lines (to Ventilation Shaft Sites)	4.5	4.5 (now ‘fixed’)	-
<b>Total</b>		<b>28.5</b>	<b>28.5</b>	<b>-</b>

- Legend**
-  Main Roads
  -  Mine Workings
  -  Indicative First Workings Layout
  -  Dendrobium Mining Lease
  -  Project Longwall Mining
  -  Proposed Electricity Transmission Line (ETL) Alignment
  -  Indicative Disturbance
  -  Proposed Ventilation Shaft Sites
  -  Project Longwalls



**DENDROBIUM MINE**

**Figure: 2**  
 Project General Arrangement-  
 Underground Mining Areas  
 Avon Reservoir FSL updated to 320.18m  
 Version 2 14 July 2020

  
 Metres

### 2.1.2 Revised Biodiversity Offsetting Requirements

The Project EIS included an allowance of 9.5 ha of native vegetation disturbance for the previously ‘unfixed’ infrastructure (i.e. ETL and service boreholes) outside of delineated areas (note this included an allowance of 1.5 ha of Shale Sandstone Transition Forest Threatened Ecological Community [TEC]) which was assessed accordingly by Niche (2019) (Appendix D of the EIS).

The Project EIS calculated offset ecosystem and species credit liabilities for this allowance of 9.5 ha based on assumed vegetation types to be impacted (including the 1.5 ha of TEC) and fauna habitat associated with these vegetation types.

As a result of the additional design works and fixing of ancillary infrastructure, additional ecology surveys were conducted accordingly. The additional survey effort has revised the biodiversity offsetting requirements for the Project (i.e. credit offset liabilities for ecosystem and species credits), which have been confirmed and revised accordingly. Refer Attachment 2, Supplementary Biodiversity Assessment Report (Niche, 2020).

The revised breakdown of native vegetation disturbance and credit offset liabilities are summarised in Section 4.1.1.

## 2.2 REDUCTION IN PROJECT RESOURCE

The Project EIS described South32’s mine design criteria, which included design of the Project longwalls such that there would be a minimum setback of 300 m from the FSL on the Avon and Cordeaux dams.

South32 has obtained more detailed surface contour data which has resulted in a refinement to the FSL mapping for the Avon Dam. As a result, South32 has revised the proposed longwall layout for the Project Area 5 to ensure the 300 m setback distance from the Avon Dam FSL is achieved.

As such, there would be a minor reduction in the extent of the Area 5 longwalls and other minor changes, which as a consequence would result in a reduction in ROM coal extraction of approximately 0.4 Mt. The main reduction would be the shortening of the western end of Longwall 516 by approximately 303 m.

The revised Project longwall layout, which shows the revised extent of the Area 5 longwalls, is shown on Figure 2.

## 2.3 SURFACE WATER OFFSETS

In response to the Department’s letter dated 20 April 2020, South32 provided further detail in regard to proposed commitments to offset predicted surface water take for the Project.

As described, South32 commits to implement (i.e. “direct” offset) or fund (i.e. “indirect” offset) works such that the Project results in a net gain to Metropolitan water supplies.

South32’s commitments over the life of the Project and post-mining are described below and are summarised in Table 2.

The direct offsets would involve the establishment by South32 of water treatment facilities and pipelines (estimated cost of \$34 million, which would be borne by South32) to facilitate the treatment and beneficial use of mine water by third parties, thereby offsetting incidental surface water take by the Project and associated reduction in Metropolitan water supply.

These facilities would be subject to separate approvals, however, would be preferentially located within existing industrial areas, with pipelines preferentially co-located within existing pipeline easements to minimise the potential for impacts. Any brine generated from water treatment facilities could be released via the existing Dendrobium Mine Licenced Discharge Point 5 (subject to authorisation via Environmental Protection Licence [EPL] 3241).

**Table 2**  
**South32 Commitments to Address Surface Water Losses**

Timing	South32 Commitments to Address Surface Water Losses						
	1. Achieve “net gain” to metropolitan water supplies			AND	2. Compensate WaterNSW for lost revenue	AND	3. Hold appropriate licences
	1a. “Direct” offsets	OR	1b. “Indirect” offsets				
Already occurred							✓ Groundwater licences (>\$6 million)
Commencement of Project	✓ Capital (\$34 million)	OR		AND		AND	✓ Surface water (\$TBC by Govt)
During Project life	✓ Annual operating costs	OR	✓ Annual funding contribution to NSW Govt based on \$2.30/kilolitre (kL) (“base”) or \$3.12/kL (“drought”) <sup>1</sup>	AND	✓ Annual funding contribution to WaterNSW based on \$49.90/megalitre (ML) (“base”) or \$59.70/ML (“drought”)	AND	✓ Hold licences
Post-mining	✓ Gift treatment facility (capital of \$34 million already spent)	OR	✓ Relinquish funds of \$34 million to NSW Govt at the end of the mine life	AND		AND	✓ Retire licences

<sup>1</sup> “Base” and “drought” scenarios as defined by the Independent Pricing and Regulatory Tribunal of NSW (IPART).

However, while direct offsets are South32’s preference, it is noted that agreement by third parties to receive this treated water is outside South32’s control. Accordingly, if for reasons outside South32’s control, direct offsets are not able to be provided, South32 would provide funding to the NSW Government during the Project life (based on the calculated volumes of annual surface water loss resulting from the Project), with this funding to be used for projects that result in net gain to Metropolitan water supplies.

Post-mining, the \$34 million infrastructure would be gifted to the NSW Government, enabling ongoing access to the reservoir of water that would be stored in the historic mine workings for treatment and beneficial use. If the infrastructure is not commissioned (i.e. indirect offset scenario), South32 will relinquish funds of \$34 million to the NSW Government at the end of the mine life (this funding could then be used by the NSW Government for ongoing projects that result in net gain to Metropolitan water supplies).

As WaterNSW would not necessarily be the beneficiary of direct or indirect offsets, South32 would make annual payments to WaterNSW during the Project life based on the calculated volumes of annual surface water loss resulting from the Project (Table 2).

## 2.4 SUMMARY OF PROPOSED AMENDMENTS

Table 3 provides a summary of the proposed amendments compared to the Project as presented in the EIS. Note that the proposed amendments would not change or increase the following components of the Project:

- Project longwall setback commitments;
- peak production rate (i.e. approximately 5.2 Mtpa of ROM coal);
- total native vegetation disturbance footprint for ancillary infrastructure;
- mine life;
- hours of operation; or
- workforce.

The Project Description (Section 3 of the EIS), updated to incorporate the amendments as described above, is provided as Attachment 1.

**Table 3**  
**Project Summary Comparison Table**

<b>Project Component</b>	<b>Project</b>	<b>Summary of the Amended Project</b>
Mining Method	Underground extraction using longwall mining methods.	Unchanged from the Project EIS.
Resource	Mining of the Bulli Seam in Area 5 and the Wongawilli Seam in Area 6 within CCL 768.	Unchanged from the Project EIS.
Annual Production	Production of up to 5.2 Mtpa of ROM coal.	Unchanged from the Project EIS.
Mine Life	Until 31 December 2048.	Unchanged from the Project EIS.
Total Resource Recovered	Approximately 78 Mt (77.6 Mt) of ROM coal from Areas 5 and 6.	Approximately 77.2 Mt of ROM coal from Areas 5 and 6.
Longwall Setback Commitments	<p>Longwall setbacks from both built and natural features, including:</p> <ul style="list-style-type: none"> <li>• longwall setbacks from both the Avon and Cordeaux dam walls (adopted minimum setback distance of 1,000 m);</li> <li>• no direct undermining of the existing Avon and Cordeaux dam waterbodies, with a minimum 300 m longwall setback adopted from the existing dam FSLs;</li> <li>• setbacks from named watercourses to achieve 200 millimetres (mm) or less predicted additional Project-related closure; and</li> <li>• setbacks from mapped key stream features by 50 m or 100 m (when mining will occur on more than one side of the feature).</li> </ul>	Unchanged from the Project EIS.
Coal Handling and Processing	<p>Transport of coal from underground workings to the Kemira Valley Coal Loading Facility via an underground conveyor network.</p> <p>Continued sizing and stockpiling of coal at the Kemira Valley Coal Loading Facility prior to transport to the Dendrobium Coal Preparation Plant (CPP) via the Kemira Valley Rail Line, in accordance with the approved hours of operation.</p> <p>Continued processing of up to 5.2 Mtpa of sized ROM coal at the Dendrobium CPP.</p>	Unchanged from the Project EIS.
Management of Mining Waste	<p>Transportation of up to approximately 1.6 Mtpa of coal wash by road from the Dendrobium CPP to the West Cliff Stage 3 and Stage 4 Coal Wash Emplacement. A portion of this total would be made up of coal wash produced from the processing of coal from remaining areas of the approved Dendrobium Mine (Area 3).</p> <p>Continued development and rehabilitation of the West Cliff Stage 3 Coal Wash Emplacement.<sup>1</sup></p> <p>Continued supply of coal wash to customers for engineering purposes (e.g. civil construction fill) or for other beneficial uses.</p>	Unchanged from the Project EIS.
General Infrastructure	<p>Continued use of the Dendrobium Pit Top, Kemira Valley Coal Loading Facility, Kemira Valley Rail Line, Dendrobium CPP and Dendrobium Shafts Nos 1, 2 and 3 with upgrades and extensions.</p> <p>Use of the Cordeaux Pit Top for mining support activities.</p> <p>Augmentation of mine access arrangements, including upgrades to, and the use of, the Cordeaux Pit Top.</p> <p>Development of surface infrastructure associated with mine ventilation and gas management and abatement, and other ancillary infrastructure.</p>	Unchanged from the Project EIS.

**Table 3 (continued)**  
**Project Summary Comparison Table**

<b>Project Component</b>	<b>Project</b>	<b>Summary of the Amended Project</b>
Product Transport	Continued delivery of product coal from the Dendrobium CPP to the BlueScope Steelworks or to the Port Kembla Coal Terminal for transport to Liberty Primary Steel Whyalla Steelworks or export.	Unchanged from the Project EIS.
Water Management	<p>Augmentations and extensions to existing water management infrastructure.</p> <p>Continued use of a combination of recycled treated mine water and potable water purchased from Sydney Water in underground and surface operations.</p> <p>Continued release of water in accordance with the conditions of EPL 3241.</p> <p>Release volumes and release infrastructure to be modified as required based on Project mine inflow rates.</p> <p>Beneficial re-use of excess Project water by industrial users, where practicable.</p>	<p>Unchanged from the Project EIS.</p> <p>Unchanged from the Project EIS.</p> <p>Unchanged from the Project EIS.</p> <p>Unchanged from the Project EIS.</p> <p>Provision of offsets (either implementation of “direct” or funding of “indirect” offsets) for predicted surface water take as a result of the Project that would result in a net gain to Metropolitan water supplies (refer Table 2).</p>
Workforce	<p>At full development, the Project would employ in the order of 500 operational personnel (including South32 staff and on-site contractor personnel).</p> <p>Up to approximately 200 contractor personnel may be required for surface facility construction and longwall development activities at any one time.</p>	Unchanged from the Project EIS.
Hours of Operation	<p>Operated on a continuous basis, 24 hours per day, seven days per week.</p> <p>Trains would not travel on the Kemira Valley Rail Line between 11.00 pm and 6.00 am, unless written approval is obtained from the Environment Protection Authority (EPA) for emergency use of the rail line.</p>	Unchanged from the Project EIS.
Net benefit to NSW	\$1,073.2 million in NPV terms.	\$1,069.6 million in NPV terms.

<sup>1</sup> Development and rehabilitation of the West Cliff Stage 4 Coal Wash Emplacement would continue to be conducted in accordance with Project Approval 08\_0150 for the Bulli Seam Operations.

### **3 STRATEGIC AND STATUTORY CONTEXT**

#### **3.1 STRATEGIC AND STATUTORY CONTEXT**

The strategic context of the Project, which described the importance of the Project to NSW and the local region, is provided in Sections 4 and 9 and Attachment 6 of the Project EIS. The conclusions of Sections 4 and 9 and Attachment 6 remain unchanged in consideration of the proposed amendments to the Project.

The statutory approvals required for the Project, as outlined in Section 4 of the EIS, are unchanged by the proposed amendments to the Project.

#### **3.2 INTERACTION OF THE PROJECT WITH THE APPROVED DENDROBIUM MINE AND BULLI SEAM OPERATIONS**

South32 seeks to confirm the extent of the interaction of the Project (and any Development Consent for the Project) with both the approved Dendrobium Mine (Development Consent DA 60-03-2001) and Bulli Seam Operations (Project Approval 08\_0150). The interaction of the Project with these approved operations is described below, and is summarised in Table 4. The Project is described in the Project Description (Attachment 1), and includes:

- New underground mining areas (Areas 5 and 6) and associated underground mining development.
- Use of underground development constructed under DA 60-03-2001 that is required to facilitate development in Areas 5 and 6 (e.g. drifts and roadways), including any alterations to this development required to facilitate this mining.
- Continued use of existing surface infrastructure currently approved under DA 60-03-2001, including the Dendrobium Pit Top, Kemira Valley Coal Loading Facility, Dendrobium CPP and Dendrobium Shafts Nos 1, 2 and 3, including ongoing maintenance and development as specified in the EIS.
- Emplacement of coal wash generated by the Project at the West Cliff Stage 3 Coal Wash Emplacement, including ongoing maintenance and development as specified in the EIS.
- Transport of coal wash generated by the Project for emplacement at the West Cliff Stage 4 Coal Wash Emplacement, which would continue to operate under Project Approval 08\_0150 for the Bulli Seam Operations (as modified).
- Continued use of the Cordeaux Pit Top, approved under D74/134 issued by the Wollongong City Council, including ongoing maintenance and development as specified in the EIS.

The Project does not include longwall mining (i.e. secondary extraction) of ROM coal in the Wongawilli Seam which is already approved to be mined under DA 60-03-2001, including longwall mining in Areas 3A, 3B and 3C:

- These activities would continue to be undertaken in accordance with DA 60-03-2001.
- If the Project is approved, longwall mining in Area 3C would occur after longwall mining in Area 5, and a modification to DA 60-03-2001 would be required to authorise mining in Area 3C beyond the currently approved operational life (31 December 2030) of DA 60-03-2001. Such a modification would be subject to separate assessment and approval.
- Subsidence monitoring and remediation works related to longwall mining operations covered by DA 60-03-2001 would continue to be undertaken in accordance with DA 60-03-2001, as management requirements under DA 60-03-2001 would remain in force until such time as DA 60-03-2001 is able to be surrendered.

If the Project is approved, there would be a period of time when the use of surface facilities would be approved under both DA 60-03-2001 and the Development Consent for the Project (i.e. until DA 60-03-2001 is either modified to exclude these surface activities or DA 60-03-2001 is able to be surrendered). South32 accepts that it may need to comply with the conditions of both DA 60-03-2001 and the Development Consent for the Project for development that is covered by both approvals. This would continue until DA 60-03-2001 is either modified or surrendered.

**Table 4**  
**Interaction of Existing and Proposed Approvals**

<b>Operations</b>	<b>Existing Approval / Consent</b>	<b>Proposed Approval</b>	<b>Current Status / Comments</b>
<b>Underground Mining</b>			
Areas 1, 2 and 3A	DA 60-03-2001	Continuation of DA 60-03-2001	Currently approved development – mining has occurred in these domains.
Area 3B	DA 60-03-2001	Continuation of DA 60-03-2001	Currently approved development – currently mining in this area.
Area 3C	DA 60-03-2001	Continuation of DA 60-03-2001 with modification	Currently approved development – mining delayed due to high gas content identified, therefore, modification to DA 60-03-2001 would be required to allow mining post-2030 (expiry date for DA 60-03-2001), this would be subject to a separate application and approval.
Area 5	-	SSD 8194	New development for the Project – new mining domain.
Area 6	-	SSD 8194	New development for the Project – new mining domain.
<b>Surface Facilities</b>			
Dendrobium Shafts Nos 1, 2 and 3	DA 60-03-2001	SSD 8194	Currently approved development – to be used by the Project.
Dendrobium Pit Top	DA 60-03-2001	SSD 8194	Currently approved development – to be used by the Project.
Kemira Valley Coal Loading Facility	DA 60-03-2001	SSD 8194	Currently approved development – to be used by the Project.
Kemira Valley Rail Line	DA 60-03-2001	SSD 8194	Currently approved development – to be used by the Project.
Dendrobium CPP	DA 60-03-2001	SSD 8194	Currently approved development – to be used by the Project.
West Cliff Stage 1 and Stage 2 Coal Wash Emplacement	Project Approval 08_0150 for Bulli Seam Operations	Project Approval 08_0150 for Bulli Seam Operations	Currently approved development under Project Approval 08_0150.
West Cliff Stage 3 Coal Wash Emplacement	DA 60-03-2001	SSD 8194	Currently approved development – to be used by the Project.
West Cliff Stage 4 Coal Wash Emplacement	Project Approval 08_0150 for Bulli Seam Operations	Continuation and modification of Project Approval 08_0150 for Bulli Seam Operations	Currently approved development. Extension to life of Project Approval 08_0150 from 31 December 2041 to 31 December 2048 required to facilitate ongoing receipt of coal wash from the Project for emplacement at Stage 4. This would be subject to a separate modification application and is not part of this Project.
Shafts Nos 5A, 5B, 6A and 6B	-	SSD 8194	New development for the Project – new ventilation shafts.
Cordeaux Pit Top	D74/134 issued by Wollongong Council in 1974	SSD 8194	Currently approved development – to be used by the Project. South32 would be prepared to surrender the D74/134 consent and rely on any Development Consent for the Project.

Source: After Project EIS (South32, 2019)

Project Approval 08\_0150 for the Bulli Seam Operations currently authorizes operations until 2041, and accordingly, a modification to Project Approval 08\_0150 would be required to facilitate emplacement of coal wash at the West Cliff Stage 4 Coal Wash Emplacement from the Project (which has an operational life to 2048) beyond 2041. Such a modification would be subject to separate assessment and approval. Environmental management at the West Cliff Stage 4 Coal Wash Emplacement would continue to be undertaken in accordance with the conditions of Project Approval 08\_0150 (as modified).

## 4 ASSESSMENT OF IMPACTS

No additional environmental impacts beyond those assessed in the Project EIS (e.g. surface water, groundwater, Aboriginal heritage, biodiversity and air quality) would occur as a result of the proposed amendments to the Project longwall layout.

The reduction in total ROM coal mined over the life of the Project has an associated minor reduction in estimated greenhouse gas emissions and minor changes to economic effects to the local region and NSW.

As a result of the revised native vegetation disturbance for ancillary infrastructure (i.e. ventilation shaft sites and ETL) and additional biodiversity survey effort undertaken, there has been updates to the Project Biodiversity Offset Strategy (however, note there is no change to the overall native vegetation disturbance footprint).

### 4.1 DELINEATION OF ANCILLARY INFRASTRUCTURE

#### 4.1.1 Biodiversity

As a result of the delineation of ancillary surface infrastructure and subsequent additional biodiversity survey effort, the biodiversity offsetting requirements for the Project (i.e. credit offset liabilities for ecosystem and species credits) have been revised accordingly (refer to Tables 5, 6 and 7).

In summary, revised offset credit liabilities were confirmed and include the following:

- increased species credit liabilities for the Eastern Pygmy-possum and Rosenberg's Goanna;
- a reduction of approximately 1 ha in proposed disturbance of Shale Sandstone Transition Forest TEC (Plant Community Type [PCT] 1395) and associated credit requirement; and
- an increase in offset credit requirements for vegetation community HN566 (Red Bloodwood - scribbly gum heathy woodland) and a decrease for HN651 (Sydney Peppermint - Smooth-barked Apple - Red Bloodwood shrubby open forest).

There is no change proposed for the offset liability associated with Upland Swamps, vegetation within the Dendrobium Pit Top Carpark Extension area or species credit species that were assessed in the EIS (i.e. Giant Burrowing Frog, Littlejohn's Tree Frog, Giant Dragonfly, Red-crowned Toadlet, Broad-headed Snake or Koala).

Accordingly, potential impacts would be offset in accordance with the Project Biodiversity Offset Strategy, which would include these revised credit requirements.

#### 4.1.2 Aboriginal Cultural Heritage

The ETL is located primarily within existing fire trail corridors (i.e. used for access to the catchment and subject to ongoing maintenance activities, for example, slashing by WaterNSW to facilitate vehicle access and bushfire management). A desktop based due diligence assessment of the proposed ETL to identify potential Aboriginal cultural heritage site has been undertaken which confirms there are no previously identified Aboriginal cultural heritage sites in the ETL corridor.

Consistent with the recommendations of the Aboriginal Cultural Heritage Assessment (ACHA) (Appendix F of the EIS), the location and design of the ETL corridor would avoid Aboriginal cultural heritage sites and areas of cultural sensitivity as far as practicable.

**Table 5**  
**Breakdown of Revised Native Vegetation Impacts (Source: Niche, 2020)**

PCT Code	BVT Code	BVT Name	Updated Area of Impacted Native Vegetation (ha)								Change
			Ventilation Shaft Site No. 5A	Ventilation Shaft Site No. 5B	Ventilation Shaft Site No. 6A	Ventilation Shaft Site No. 6B	Pit Top Carpark Extension	Service Boreholes	ETL Alignment	Total	
1083	HN566	Red Bloodwood - scribbly gum heathy woodland on sandstone plateaux, Sydney Basin Bioregion	15.0	0.5	4.3	4.0	-	-	3.1	26.9	+1.1 ha
1395	HN556	Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion*	-	-	-	-	-	-	0.55	0.55	-0.95 ha
1250	HN651	Sydney Peppermint - Smooth-barked Apple - Red Bloodwood shrubby open forest on slopes of moist sandstone gullies, eastern Sydney Basin Bioregion	-	-	-	-	-	-	0.85	0.85	-0.15 ha
1245	HN597	Sydney Blue Gum x Bangalay - Lilly Pilly moist forest in gullies and on sheltered slopes, southern Sydney Basin Bioregion	-	-	-	-	0.2	-	-	0.2	-
<b>Total</b>			<b>15.0 ha</b>	<b>0.5 ha</b>	<b>4.3 ha</b>	<b>4.0 ha</b>	<b>0.2 ha</b>	<b>0.0 ha</b>	<b>4.5 ha</b>	<b>28.5 ha</b>	<b>-</b>
<b>Change (from EIS BARBOS)</b>			<b>+7.5 ha</b>	<b>-2.5 ha</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-5.0 ha</b>	<b>-</b>	<b>-</b>	<b>-</b>

Note: Red text indicates the area of impact has increased, green text indicates the area of impact has reduced.

\* Shale Sandstone Transition Forest TEC

**Table 6**  
**Updated Project Ecosystem Credit Requirements (Source: Niche, 2020)**

Impact Mechanism		Vegetation Community		Project EIS		Amendment Report		Change in Credit Requirement
				Area Impacted (ha)	Ecosystem Credits Required	Area Impacted (ha)	Ecosystem Credits Required	
Native Vegetation Disturbance	Ventilation shaft sites and ETL alignment	HN566	1083 Red Bloodwood - scribbly gum heathy woodland on sandstone plateaux, Sydney Basin Bioregion (PCT 1083)	25.8	1,022	26.9	1,051	+29
		HN556	Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion (PCT 1395)	1.5	120	0.55	40	-80
		HN651	Sydney Peppermint - Smooth-barked Apple - Red Bloodwood shrubby open forest on slopes of moist sandstone gullies, eastern Sydney Basin Bioregion (PCT 1250)	1.0	80	0.85	68	-12
	Pit Top Carpark Extension	HN597	Sydney Blue Gum x Bangalay - Lilly Pilly moist forest in gullies and on sheltered slopes, southern Sydney Basin Bioregion (PCT 1245)	0.2	6	0.2	6	0
Subsidence	Upland Swamps	HN560	Needlebrush - Banksia wet heath on sandstone plateau of the Sydney Basin Bioregion (PCT 978)	16.3	227	16.3	227	0
		HN662	Needlebrush - Banksia wet heath swamps on coastal sandstone plateaux of the Sydney Basin (PCT 1804)	4.6	78	4.6	78	0

**Table 7**  
**Updated Project Species Credit Requirements (Source: Niche, 2020)**

Impact Mechanism		Threatened Fauna Species	Project EIS		Amendment Report		Change in Credit Requirement
			Area Impacted (ha)	Species Credits Required	Area Impacted (ha)	Species Credits Required	
Subsidence	Streams and Upland Swamps	Giant Burrowing Frog ( <i>Heleioporus australiacus</i> )	32.74	426	32.74	426	0
		Littlejohn's Tree Frog ( <i>Litoria littlejohni</i> )	32.74	426	32.74	851	0
	Cliff lines	Broad-headed Snake ( <i>Hoplocephalus bungaroides</i> )	0.28	9	0.28	9	0
	Upland Swamps (breeding/foraging habitat)	Giant Dragonfly ( <i>Petalura gigantea</i> )	13.93	1073	13.93	1073	0
	Streams	Red-crowned Toadlet ( <i>Pseudophryne australis</i> )	7.21	94	7.21	94	0
Native Vegetation Disturbance	Pit Top Carpark Extension and ETL alignment	Koala ( <i>Phascolarctos cinereus</i> )	1.5	39	1.51	39	0
	Pit Top Carpark Extension, ventilation shaft sites and ETL alignment	Eastern Pygmy-possum ( <i>Cercartetus nanus</i> )	n/a	n/a	27.25	545	+545
	Ventilation shaft sites and ETL alignment	Rosenberg's Goanna ( <i>Varanus rosenbergi</i> )	n/a	n/a	27.05	893	+893

Note: Red text indicates the area of impact has increased, green text indicates the area of impact has reduced.

As described in the ACHA, South32 would undertake additional systematic survey in consultation with the Registered Aboriginal Parties (RAPs) to identify potential Aboriginal cultural heritage sites within the ETL corridor as part of the development of an Aboriginal Heritage Management Plan (AHMP) for the Project.

Management measures for any previously unidentified sites along the ETL corridor would be detailed in the AHMP, including, but not limited to, preclearance and clearance activities, notification requirements and procedures for determining requirements for salvage or excavation in consultation with RAPs and an archaeologist.

## **4.2 REVISED LONGWALL LAYOUT**

As a result of the revised longwall layout to achieve South32's mine design criteria of a setback from the Project longwalls by a minimum of 300 m from the FSL of the Avon Dam, there would be a minor reduction in the extent of the Area 5 longwalls. The main reduction would be the shortening of the western end of Longwall 516 by approximately 303 m (Figure 3).

As a result of the reduced longwall extents, the revised Project would avoid the direct undermining of additional drainage lines and stream features that would have otherwise been located above the Project longwalls, including (Figure 3):

- approximately 220 m of drainage line LA13A;
- approximately 20 m of drainage line LA13; and
- approximately 30 m of drainage line LA15.

In addition, the revised Project would also avoid undermining or setback further from a number of additional Aboriginal cultural heritage sites (Section 4.2.3).

There are no other specific natural or built features that would be affected by the reduced extent of Area 5 (i.e. no change to subsidence impacts when compared to those assessed in the Subsidence Assessment [MSEC, 2019]).

The reduced potential impacts associated with the revised longwall layout are described below.

### **4.2.1 Groundwater and Surface Water**

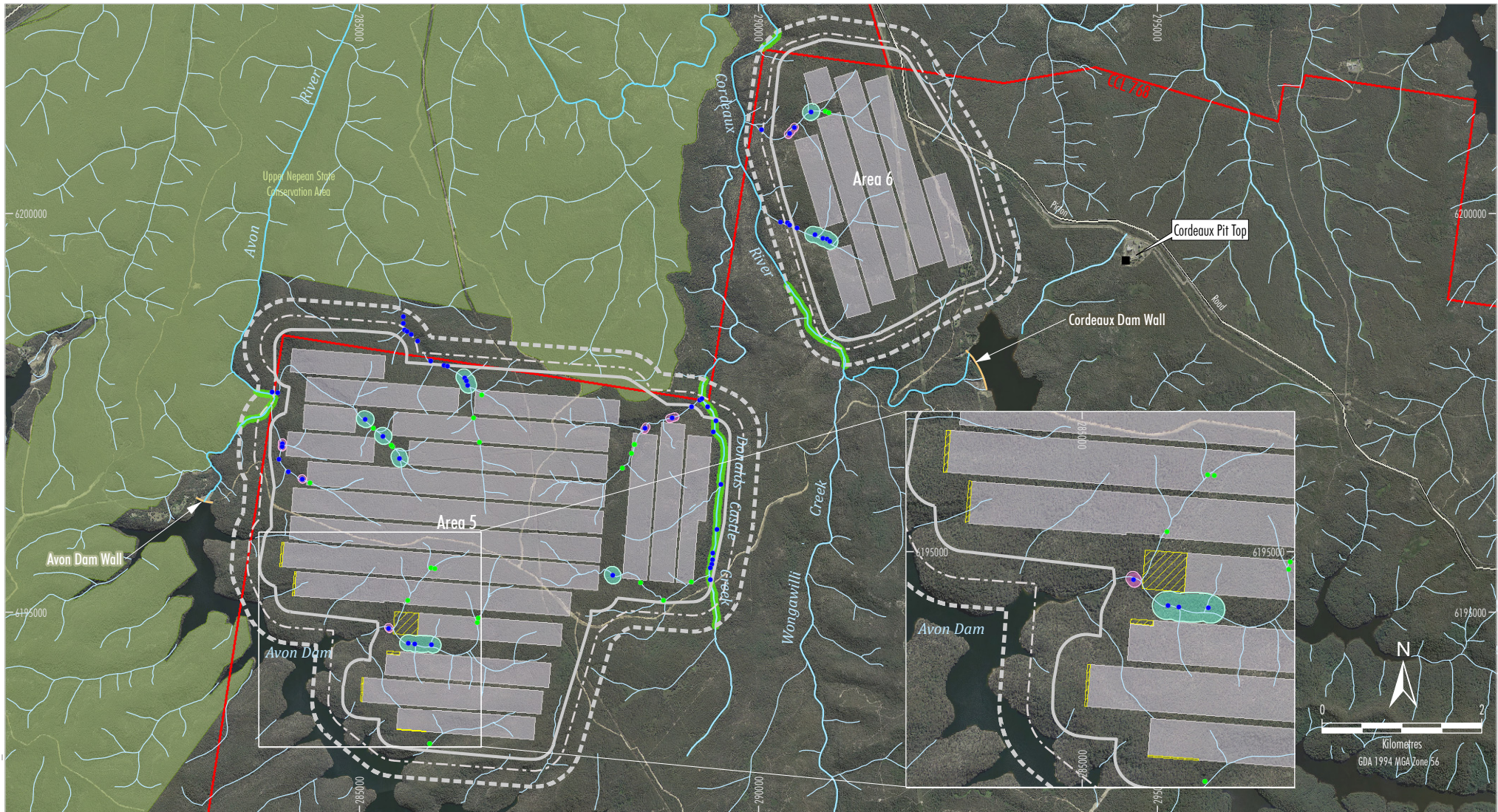
The Project groundwater model conservatively assumed that all surface water modelled as 'lost' from the ephemeral drainage lines that overlie the Project longwalls is assumed to be permanently lost from the catchment (i.e. does not re-emerge downstream).

Therefore, as a result of the avoidance of additional lengths of drainage lines that were previously located above the Project longwalls, there could be a marginal reduction in the following potential impacts:

- predicted groundwater drawdown and depressurisation;
- predicted surface water losses when compared to the predictions in the EIS; and
- a reduction in total length of streams predicted to experience potential localised impacts to surface water quality.

Given any such changes would be minor when compared to the peak predicted surface water losses reported in the EIS and Submissions Report, no update to the groundwater model is considered to be required.

There is no change to South32's commitment to offset predicted surface water losses such that there would be a net gain to Metropolitan drinking water supplies (as described in Section 2.3).



SITH-16-02 DAR\_201A

- LEGEND**
- Dendrobium Mining Lease
  - Road
  - National Park, Nature Reserve and State Conservation Area
  - Reduction in EIS Longwall Layout
  - Streams
  - Named Streams - Setback to Achieve 200 mm Additional Predicted Closure or Less
  - Key Stream Features
  - 50 m Offset for Key Stream Features
  - 100 m Offset for Key Stream Features
  - Additional Stream Features
  - Study Area Based on 600 m Boundary
  - 400 m from Project Longwalls
  - Study Area Based on 35° Angle of Draw

Source: Geoscience Australia (2006); Department of Industry (2018);  
Department Finance, Services & Innovation (2018);



**DENDROBIUM MINE**  
Setbacks Adopted in the Amendment  
Report Mine Plan from Named  
Watercourses and Key Stream Features

**Figure 3**

#### 4.2.2 Aquatic Ecology

As a result of the avoidance of additional stream lengths (and associated stream features located along these portions of the drainage lines), there would be a minor reduction in potential impacts as a result of subsidence to biodiversity and aquatic ecology with habitat in these drainage lines.

#### 4.2.3 Aboriginal Cultural Heritage

The reduction in the Area 5 longwall extent would result in the Project setting back further from an additional Aboriginal heritage site, namely site AHIMS ID #52-2-1752 (high scientific significance).

Site AHIMS ID #52-2-1752 is identified as a rock shelter of high scientific significance and is located immediately adjacent to the proposed longwalls, as described in the EIS. The Subsidence Assessment (Appendix A of the EIS) predicted that this site would experience vertical subsidence of 50 mm (Table 8).

As a result of the revised longwall layout, this site would be further setback from the Area 5 longwalls.

Site AHIMS ID #52-2-1752 is predicted to experience less than 20 mm vertical subsidence (previously 50 mm), very low levels of vertical subsidence and is not expected to experience measurable conventional tilts, curvatures or strains as a result of the revised longwall layout (Table 8).

**Table 8**  
Comparison of Subsidence Predictions for Site AHIMS ID #52-2-1752

Project Longwall Layout	Maximum Predicted Total Vertical Subsidence (mm)	Maximum Predicted Total Tilt (mm/m)	Maximum Predicted Total Hogging Curvature (km <sup>-1</sup> )	Maximum Predicted Total Sagging Curvature (km <sup>-1</sup> )
Project EIS	50	1.0	0.02	< 0.01
Amendment Report	< 20	< 0.5	< 0.01	< 0.01

Source: MSEC

The ACHA (Appendix F of the EIS) assessed potential impacts at site AHIMS ID #52-2-1752 as “partial” impact as a result of the Project. As the site would remain within 600 m of the Project longwalls, there is still potential for partial impact (as per the assessment for other sites located beyond the 35-degree angle of draw but within 600 m of the Project longwalls).

Accordingly, there is no change to the impact assessment compared to the EIS (albeit with potential reduction in the likelihood of impact occurring).

The predicted and assessed impacts in the EIS for other Aboriginal cultural heritage sites are not anticipated to change as a result of the Project amendments.

#### 4.2.4 Emissions-related Impacts

As a result of the revisions to the Area 5 longwall layout, approximately 0.4 Mt of ROM coal proposed to be extracted within Area 5 is no longer proposed to be mined as part of the Project.

As such, predicted greenhouse gas emissions for the Project would reduce as a result of the proposed amendments.

The total Scope 3 (indirect) emissions (as amended) over the life of the Project are estimated to reduce from 237.1 Mt CO<sub>2-e</sub> to 235.9 Mt CO<sub>2-e</sub> (an annual average reduction from approximately 8.2 Mt CO<sub>2-e</sub> per year to 8.1 Mt CO<sub>2-e</sub> per year). These Scope 3 emissions would be associated with the end use of coal by third parties.

Greenhouse gas monitoring, mitigation and management measures outlined in the EIS and Submissions Report would still be implemented for the Project.

#### 4.2.5 Economic Effects

The proposed amendments (i.e. reduction in total Project ROM of 0.4 Mt) affect the Project production profile (i.e. revenues and greenhouse gas emissions) and associated royalties. There are no changes to employment benefits accrued to the NSW workforce.

As a result of the revised longwall layout, the change in net benefit to NSW of the amended Project has been estimated by reducing relevant direct benefits proportionally with the reduction in ROM coal (i.e. approximately 0.5% reduction from 77.6 Mt to 77.2 Mt). The revised net benefit to NSW is estimated to be \$1,069.6 million in NPV terms (Table 9).

It is noted that the revised net benefits of the Project conservatively assumed that there is no reduction in the indirect costs associated with the Project, although the costs associated with environmental externalities would reduce as a result of the reduction in Project ROM (e.g. the minor reduction in benefits to NSW would be partially offset by a small reduction in the associated social cost of greenhouse gas emissions).

**Table 9**  
**Revised Project Economics (\$ million)**

<b>Benefits</b>	<b>NPV (EIS)</b>	<b>NPV (Revised Project)</b>	<b>Costs</b>	<b>NPV (EIS)</b>	<b>NPV (Revised Project)</b>
<b>Direct Benefits</b>			<b>Direct Costs</b>		
1. Net producer surplus attributed to NSW	74.9	74.5			
2. Royalties, payroll tax and Council rates	272.1	270.8			
3. Company income tax apportioned to NSW	150.8	150.1			
<b>Total direct benefits</b>	<b>497.8</b>	<b>495.4</b>	<b>Total direct costs</b>	<b>-</b>	<b>-</b>
<b>Direct Benefits</b>			<b>Indirect Costs</b>		
1. Net economic benefit to landholders	-	No change	1. Air quality	8.0	No change
2. Net economic benefit to NSW workers	365.8	No change	2. Greenhouse gas emissions	0.1	No change
3. Net economic benefit to NSW suppliers	217.6	216.5	3. Visual amenity	-	No change
			4. Transport impact	-	No change
			5. Net public infrastructure cost	-	No change
			6. Surface water impact	-	No change
			7. Biodiversity impact <sup>1</sup>	-	No change
			8. Noise impact <sup>1</sup>	-	No change
			9. Loss of surplus to other industries	-	No change
			10. Water <sup>1</sup>	-	No change
			11. Aboriginal cultural and historical heritage <sup>1</sup>	-	No change
			12. Subsidence <sup>1</sup>	-	No change
<b>Total indirect benefits</b>	<b>583.4</b>	<b>582.3</b>	<b>Indirect Costs</b>	<b>102.4</b>	<b>No change</b>
<b>Total Project economic benefit</b>	<b>1,081.2</b>	<b>1,077.7</b>	<b>Incremental Indirect Cost</b>	<b>8.1</b>	<b>No change</b>
<b>NPV of Project – (\$m)</b>	<b>1,073.2</b>	<b>1,069.6</b>			

<sup>1</sup> Incorporated into mitigation and management costs (Cadence Economics, 2019)

## 5 PROJECT EVALUATION

In summary, when compared to the EIS, the proposed amendment would (as described in Section 4):

- Be entirely consistent with the commitments outlined in the EIS (e.g. total native vegetation disturbance of 28.5 ha, minimum setback of the Project longwalls of 300 m from the FSLs and provision of offsets for predicted surface water losses).
- Reduce the total coal resource for the Project from 77.6 Mt to approximately 77.2 Mt.
- Result in a reduction in net benefits to NSW from \$1,073.2 million to \$1,069.6 million in NPV terms.
- Reduce indirect greenhouse gas emissions (i.e. Scope 3) from approximately 237.1 Mt CO<sub>2-e</sub> to 235.9 Mt CO<sub>2-e</sub> over the life of the Project.
- Result in no change to the total native vegetation disturbance of 28.5 ha as described in the EIS, however, result in a revised Biodiversity Offset Strategy and offset requirements.
- Not change the peak production rate, mine life, workforce or hours of operation.

The proposed amendments to the Project would not result in additional environmental impacts beyond those assessed in the EIS.

Accordingly, the conclusion in the EIS that in weighing up the main environmental impacts (costs and benefits) associated with the proposal as assessed and described in the EIS, the Project is on balance, considered to be in the public interest of the State of NSW, remains unchanged.

## 6 REFERENCES

Cadence Economics (2019). *Dendrobium Mine – Plan for the Future: Coal for Steelmaking Economic Assessment*.

Department of Planning, Industry and Environment (2019). *Guideline 5: Guidance for State Significant Projects - Preparing an Amendment Report June 2019*.

Mine Subsidence Engineering Consultants (2019). *Dendrobium Mine – Plan for the Future: Coal for Steelmaking Subsidence Assessment*

Niche Environment and Heritage (2019). *Dendrobium Mine – Plan for the Future: Coal for Steelmaking Biodiversity Assessment Report and Biodiversity Offset Strategy*.

Niche Environment and Heritage (2020). *Dendrobium Mine – Plan for the Future: Coal for Steelmaking Supplementary Biodiversity Assessment Report*.

South32 (2019). *Dendrobium Mine – Plan for the Future: Coal for Steelmaking Environmental Impact Statement*.

ATTACHMENT 1  
REVISED PROJECT DESCRIPTION

---



**DENDROBIUM MINE - PLAN FOR THE FUTURE: COAL FOR STEELMAKING**  
**AMENDMENT REPORT**

**SECTION 3**  
**UPDATED PROJECT DESCRIPTION**

JULY 2020  
Project No. STH-16-02  
Document No. 01040482

**TABLE OF CONTENTS**

<b>3</b>	<b>PROJECT DESCRIPTION</b>	3-1			
3.1	COAL RESOURCE, GEOLOGICAL FEATURES AND EXPLORATION ACTIVITIES	3-1			
3.2	PROJECT GENERAL ARRANGEMENT	3-5			
3.3	PROJECT SCHEDULE	3-5			
3.4	PROJECT CONSTRUCTION AND OTHER DEVELOPMENT ACTIVITIES	3-5			
3.4.1	Development of Access and Supporting Infrastructure for Underground Mining Areas	3-9			
3.4.2	Underground Mining Machinery Replacement and Upgrades	3-9			
3.4.3	Mine Ventilation Infrastructure	3-9			
3.4.4	Gas Management and Abatement Infrastructure	3-10			
3.4.5	Dendrobium Pit Top	3-10			
3.4.6	Cordeaux Pit Top	3-10			
3.4.7	Kemira Valley Rail Line	3-13			
3.4.8	Dendrobium CPP	3-13			
3.4.9	Water Management System Upgrades	3-13			
3.4.10	Other Surface Facilities and Supporting Infrastructure Upgrades	3-13			
3.5	UNDERGROUND MINING OPERATIONS	3-16			
3.5.1	Mining Method	3-16			
3.5.2	Project Mining Domain Constraints	3-16			
3.5.3	Project Longwall Design Constraints	3-16			
3.5.4	Underground Mine Access and Materials Handling	3-19			
3.5.5	Major Underground Equipment	3-19			
3.5.6	Mine Ventilation Systems	3-19			
3.5.7	Gas Management and Abatement	3-23			
3.5.8	Water Management Systems	3-24			
3.6	ROM COAL TRANSPORT AND PROCESSING	3-24			
3.6.1	ROM Coal Sizing, Stockpiling and Transport	3-24			
			3.6.2	Dendrobium Coal Preparation Plant	3-24
			3.7	PRODUCT COAL HANDLING AND TRANSPORTATION	3-25
			3.8	COAL WASH MANAGEMENT	3-25
			3.8.1	Coal Wash Production	3-25
			3.8.2	Coal Wash Physical and Chemical Characteristics	3-25
			3.8.3	Beneficial Use of Coal Wash	3-26
			3.8.4	West Cliff Coal Wash Emplacement	3-26
			3.9	WATER MANAGEMENT	3-29
			3.9.1	Underground Operations	3-29
			3.9.2	Dendrobium Pit Top	3-29
			3.9.3	Kemira Valley Coal Loading Facility	3-29
			3.9.4	Cordeaux Pit Top	3-31
			3.9.5	Ventilation Shafts	3-31
			3.9.6	Dendrobium CPP	3-31
			3.10	INFRASTRUCTURE AND SERVICES	3-31
			3.10.1	Surface Facilities	3-32
			3.10.2	Access Roads and Haul Roads	3-32
			3.10.3	Energy and Electricity Supply and Distribution	3-32
			3.10.4	Surface Services	3-32
			3.10.5	Site Security and Communications	3-33
			3.10.6	Water Supply and Use	3-33
			3.11	WASTE MANAGEMENT	3-33
			3.11.1	General Waste	3-33
			3.11.2	Sewage and Effluent	3-33
			3.12	MANAGEMENT OF DANGEROUS GOODS	3-34
			3.12.1	Transport	3-35
			3.12.2	Hydrocarbon Storage	3-35
			3.12.3	Explosives Storage	3-35
			3.12.4	Other Substances	3-35
			3.13	REHABILITATION AND REMEDIATION ACTIVITIES	3-35
			3.13.1	Subsidence Monitoring and Remediation	3-36
			3.13.2	Decommissioning and Rehabilitation of Surface Facilities	3-36

3.13.3	Coal Wash Emplacement Rehabilitation	3-36	Figure 3-10a	Materials Handling Spatial Relationship
3.14	WORKFORCE	3-36	Figure 3-10b	Material Handling Schematic Flowsheet
3.14.1	Construction and Development	3-36	Figure 3-11	General Arrangement of West Cliff Coal Wash Emplacement
3.14.2	Operations	3-36	Figure 3-12	Project Water Management Schematic
3.15	INTERACTION WITH DEVELOPMENT CONSENT DA 60-03-2001	3-37		

## LIST OF TABLES

Table 3-1	Characteristics of the Target Coal Seams in the Project Area
Table 3-2	Coal Resources within Project and Approved Mine Plans (Financial Year 2018)
Table 3-3	Summary of Key Project Characteristics
Table 3-4	Summary of Constraints Incorporated into the Project Longwall Mining Layout
Table 3-5	Indicative Mining Schedule
Table 3-6	Indicative Production Schedule of Coal Wash to be Emplaced at the West Cliff Coal Wash Emplacement and/or Available to be Supplied for Beneficial Re-use
Table 3-7	Waste Streams Likely to be Generated by the Project

## LIST OF FIGURES

Figure 3-1	Indicative Stratigraphic Section – Project Area
Figure 3-2	Known and Inferred Geological Features in the Vicinity of Project Underground Mining Areas
Figure 3-3	General Arrangement of the Project
Figure 3-4	Indicative Project Schedule
Figure 3-5	Project General Arrangement – Dendrobium Pit Top
Figure 3-6	Project General Arrangement – Cordeaux Pit Top
Figure 3-7	Project General Arrangement – Kemira Valley Coal Loading Facility
Figure 3-8	Project General Arrangement – Dendrobium Coal Preparation Plant
Figure 3-9	Project General Arrangement – Underground Mine Areas

### 3 PROJECT DESCRIPTION

#### 3.1 COAL RESOURCE, GEOLOGICAL FEATURES AND EXPLORATION ACTIVITIES

The Project would extract the Wongawilli Seam (also known as the No 3 Seam) and Bulli Seam in the Late Permian Illawarra Coal Measures.

The Mine currently extracts coal from the Wongawilli Seam. The Bulli Seam Operations (also owned and operated by South32) currently extracts coal from the Bulli Seam.

Further information on the characteristics of the coal resource, geological features and previous and proposed exploration activities are provided below.

##### Geology

The Project is located in the NSW Southern Coalfield within the southern portion of the Permo-Triassic Sydney Basin.

The Late Permian Illawarra Coal Measures contain a number of workable seams in the Southern Coalfield. Above the Illawarra Coal Measures, the stratigraphy consists of a sequence of sandstone, shale and claystone units within the Narrabeen Group which are, in turn, overlain by the Hawkesbury Sandstone.

A typical stratigraphic section of the Project area is shown on Figure 3-1.

Mineable areas of the Wongawilli Seam and the Bulli Seam have been identified in the Project underground mining areas. A summary of the characteristics of the target seams in the vicinity of the Project is provided in Table 3-1.

**Table 3-1  
Characteristics of the Target Coal Seams in the Project Area**

Seam	Depth of Cover (m)	Seam Thickness (m)
Wongawilli Seam	375 – 460	9 – 11*
Bulli Seam	250 – 390	2 – 3

m – metres.

\* The working section thickness is 2.5 – 4 m.

The coal seams have a regional dip to the north of about 1 in 50.

The Wongawilli Seam is the thickest and most widespread coal seam in the Southern Coalfield (Department of Mineral Resources [DMR], 2000). The Project would mine the lower portion of the Wongawilli Seam in Area 6, as the upper portion is characterised by carbonaceous claystones, tuffs and interbedded coal (DMR, 2000). The seam floor consists of sandstone.

The Wongawilli Seam has a high vitrinite content and can be blended with the Bulli Seam to produce a hard coking coal, or can produce thermal coal products.

The Bulli Seam is the uppermost seam of the Illawarra Coal Measures (DMR, 2000). The Project would generally mine the full height of the Bulli Seam in Area 5. The seam floor consists of mudstone and carbonaceous mudstone. Generally, the Bulli Seam produces a coking blend coal. There are portions of the Project area where igneous intrusions are in proximity to the Bulli Seam. These portions are termed “heat affected” and produce a thermal or PCI product.











Known and inferred geological features in the vicinity of the Project underground mining areas are shown on Figure 3-2.

A large syncline runs through Area 6 and to the east of Area 5, plunging to the north. Several north-south trending lineaments are also present in the vicinity of the Project underground mining area, including the Narellan, Cordeaux River and Avon River Lineaments.

A displacement in the Bulli Seam in the northwest of Area 5 is inferred from seismic surveys. Further exploration will be conducted to determine the characteristics of any disturbance in this area. Igneous intrusions in the middle of Area 5 have been detected in the Bulli Seam by seismic assessment and exploration drilling. The eastern extent of Area 5 is defined by a large area of intrusion in the Bulli Seam. The intrusions are altered, moderately hard and vary in thickness from 1 to 3 m.

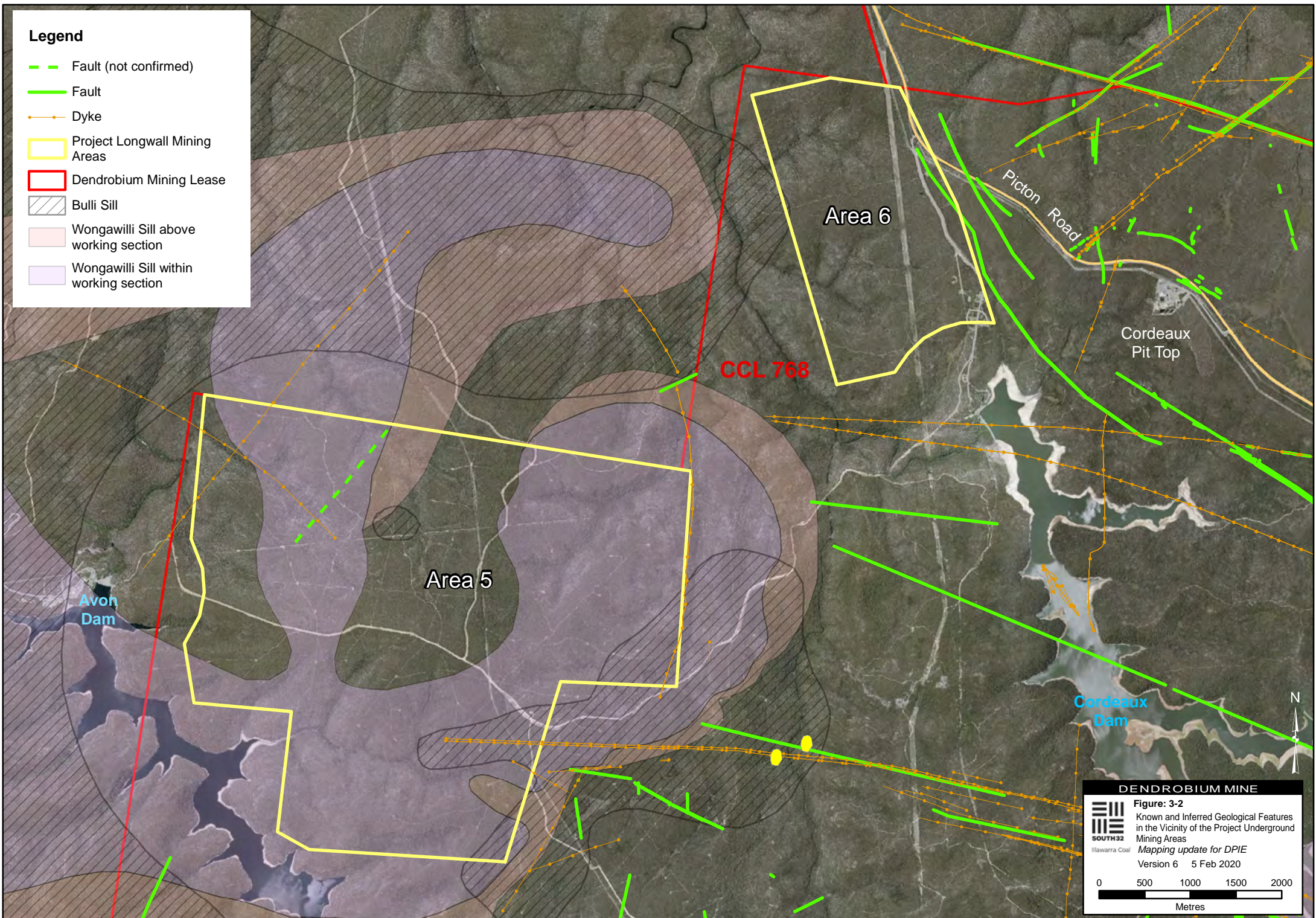
The eastern extent of Area 6 is defined by a number of faults detected by Cordeaux Mine in the 1990s. These faults have displacements of 10 to 30 m.

South32 continues to develop a geological model across the Project area that is progressively updated with the most recent and reliable data.

	INDICATIVE THICKNESS (m)	FORMATION	GROUP
	170	Hawkesbury Sandstone	HAWKESBURY SANDSTONE
	15	Newport Formation	NARRABEEN
	5	Garie Formation	
	20	Bald Hill Claystone	
	170	Colo Vale Sandstone	NARRABEEN
	40	Wombara Formation	
	2.5	Bulli Seam	
	20	Eckersley Formation	ILLAWARRA COAL MEASURES
	9	Wongawilli Seam	
	10	Kembla Sandstone	

**Legend**

- Fault (not confirmed)
- Fault
- Dyke
- Project Longwall Mining Areas
- Dendrobium Mining Lease
- Bulli Sill
- Wongawilli Sill above working section
- Wongawilli Sill within working section



**DENDROBIUM MINE**

**Figure: 3-2**  
Known and Inferred Geological Features  
in the Vicinity of the Project Underground  
Mining Areas  
Mapping update for DPIE  
Version 6 5 Feb 2020

0 500 1000 1500 2000  
Metres

### Exploration

The exploration program conducted to date to support the Project has focused on determining seam quality, gas levels, geotechnical constraints and the locations of major geological structures and igneous intrusions.

Mine exploration activities would continue during the life of the Project. These activities would investigate geological structures, seam gas content and composition, and seam morphology as input to detailed mine planning and engineering studies. This data, in combination with surface exploration and underground mapping data would be used to build robust geological models upon which detailed mine plans can be developed.

Surface exploration activities would generally require only small surface areas and would involve the use of surface drilling rigs and supporting equipment, low-impact seismic acquisition, surface mapping and airborne and ground-based geophysical surveys.

In addition to surface based exploration, in-seam drilling would be undertaken in advance of mining in order to identify minor geological structures and drain the gas from the coal seam (and adjacent strata). In-seam drilling has been undertaken since the 1970s to prevent outbursts (gas-driven ejection of coal from the active mining face), which have historically caused fatalities in the Southern Coalfield.

Exploration activities meeting the definition of “prospecting” under the *Mining Act, 1992* do not form part of the Project. Separate assessment of exploration activities would be undertaken pursuant to Part 5 of the EP&A Act.

### Coal Resource

The Project seeks the extraction of approximately **77 Mt** of ROM coal from Areas 5 and 6 over the life of the Project from CCL 768.

Table 3-2 shows a subset of South32 Illawarra Metallurgical Coal (Attachment 10) Financial Year 2018 Resources Statement within Project and approved mine plans. Resource recovery for the Project is constrained by geological, environmental and infrastructure features (Section 3.5.2).

There is a low level of geological confidence associated with *Inferred Resources* and there is no certainty that further exploration work will result in the determination of Indicated Mineral Resources or that the production target itself will be realised. Further evaluation work and appropriate studies are required to establish sufficient confidence that this target will be met. Note that the *Inferred Resources* component in Areas 5 and 6 are estimated to constitute 20% and 24%, respectively (Table 3-2).

**Table 3-2**  
**Coal Resources within Project and Approved Mine Plans (Financial Year 2018)<sup>1</sup>**

Reporting Entity and Domain	Resource Classification	Financial Year 2018 as at 30/06/18 - Coal Resources			
		Mt	Ash (%)	Volatile Matter (%)	Sulfur (%)
Bulli Area 5	Measured	-	-	-	-
	Indicated	44	12.2	22.8	0.36
	Inferred	11	12.7	23.1	0.37
	<b>Bulli Total</b>	<b>54</b>	<b>12.3</b>	<b>22.9</b>	<b>0.36</b>
Wongawilli Area 6	Measured	-	-	-	-
	Indicated	19	28.3	22.7	0.57
	Inferred	6.1	28.0	22.7	0.57
	<b>Wongawilli Total</b>	<b>25</b>	<b>28.2</b>	<b>22.7</b>	<b>0.57</b>
Wongawilli Area 3B	Measured	21	29.1	24.2	0.59
	Indicated	6.5	28.7	23.9	0.59
	Inferred	2	27.5	22.8	0.59
	<b>Wongawilli Total</b>	<b>29</b>	<b>28.9</b>	<b>24.0</b>	<b>0.59</b>
Wongawilli Area 3C	Measured	0.1	27.4	23.5	0.60
	Indicated	23	28.4	22.9	0.59
	Inferred	1	28.0	23.1	0.60
	<b>Wongawilli Total</b>	<b>24</b>	<b>28.4</b>	<b>22.9</b>	<b>0.59</b>

### 3.2 PROJECT GENERAL ARRANGEMENT

The Project proposes the extraction of additional coal within CCL 768. This would be supported by the development of supporting infrastructure and the use and augmentation of existing Dendrobium Mine surface facilities.

The Project would support the extraction of approximately 77 Mt of ROM coal from Area 5 and Area 6 (in addition to approximately 35 Mt of ROM coal from the approved Areas 3B and 3C). The life of the Project would be to 31 December 2048. The Project would include the following activities:

- longwall mining of the Bulli Seam in a new underground mining area (Area 5);
- longwall mining of the Wongawilli Seam in a new underground mining area (Area 6);
- development of underground roadways within the Bulli Seam, Wongawilli Seam and adjacent strata to access mining areas;
- use of existing underground roadways and drifts for personnel and materials access, ventilation, dewatering and other ancillary activities related to Areas 5 and 6;
- development of surface infrastructure associated with mine ventilation and gas management and abatement, water management and other ancillary infrastructure;
- handling and processing of up to 5.2 Mtpa of ROM coal;
- use of the existing Dendrobium Pit Top, Kemira Valley Coal Loading Facility, Dendrobium CPP and Dendrobium Shafts with minor upgrades and extensions;
- transport of sized ROM coal from the Kemira Valley Coal Loading Facility to the Dendrobium CPP via the Kemira Valley Rail Line;
- use of the Cordeaux Pit Top for mining support activities to reduce travel time for men and materials while development and mining operations occur in Area 6;
- augmentation of mine access arrangements, including upgrades to, and the use of, the Cordeaux Pit Top;
- [continued use of the Cordeaux Pit Top for mining support activities such as exploration, environmental monitoring, survey, rehabilitation, administration and other ancillary activities during the Project;](#)
- handling and processing of coal from the Project, the approved Dendrobium Mine and the Bulli Seam Operations at the Dendrobium CPP;

- delivery of product coal from the Dendrobium CPP to the Port Kembla Steelworks for domestic use or to the Port Kembla Coal Terminal for transport to Liberty Primary Steel Whyalla Steelworks or export;
- transport of coal wash by road to customers for engineering purposes (e.g. civil construction fill), for other beneficial uses and/or for emplacement at the West Cliff Stage 3 and Stage 4 Coal Wash Emplacement;
- development and rehabilitation of the West Cliff Stage 3 Coal Wash Emplacement (noting that opportunities for beneficial reuse of coal wash would be maximised);
- progressive development of sumps, pumps, pipelines, water storages and other water management infrastructure;
- controlled release of excess water in accordance with the conditions of EPL 3241 and/or beneficial industrial use;
- monitoring, rehabilitation and remediation of subsidence and other mining effects; and
- other associated infrastructure, plant, equipment and activities.

An indicative Dendrobium Mine general arrangement showing the proposed Project underground mining areas is provided on Figure 3-3.

Table 3-3 provides a summary of the key characteristics of the Project.

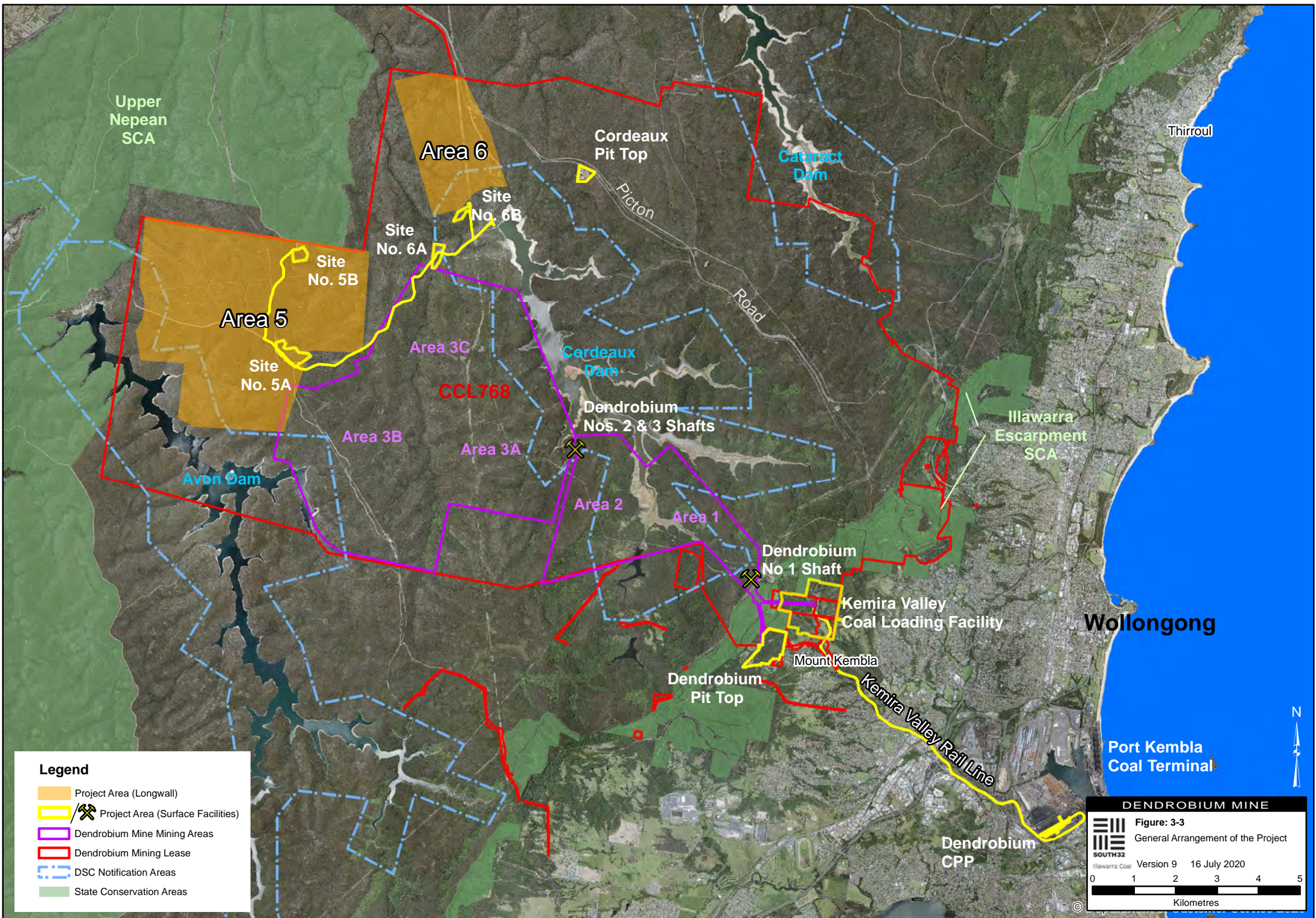
### 3.3 PROJECT SCHEDULE

An indicative Project schedule is provided in Figure 3-4.

### 3.4 PROJECT CONSTRUCTION AND OTHER DEVELOPMENT ACTIVITIES

The Project would use existing pit tops and supporting infrastructure. Additional infrastructure and upgrades to existing infrastructure that are required to support the Project would be progressively developed in parallel with ongoing mining operations, including:

- development of underground roadways, coal clearance infrastructure and other ancillary infrastructure required to access and support Project underground mining areas;



**Legend**

- Project Area (Longwall)
- Project Area (Surface Facilities)
- Dendrobium Mine Mining Areas
- Dendrobium Mining Lease
- DSC Notification Areas
- State Conservation Areas

**DENDROBIUM MINE**

**Figure: 3-3**  
General Arrangement of the Project

Version 9    16 July 2020

0    1    2    3    4    5

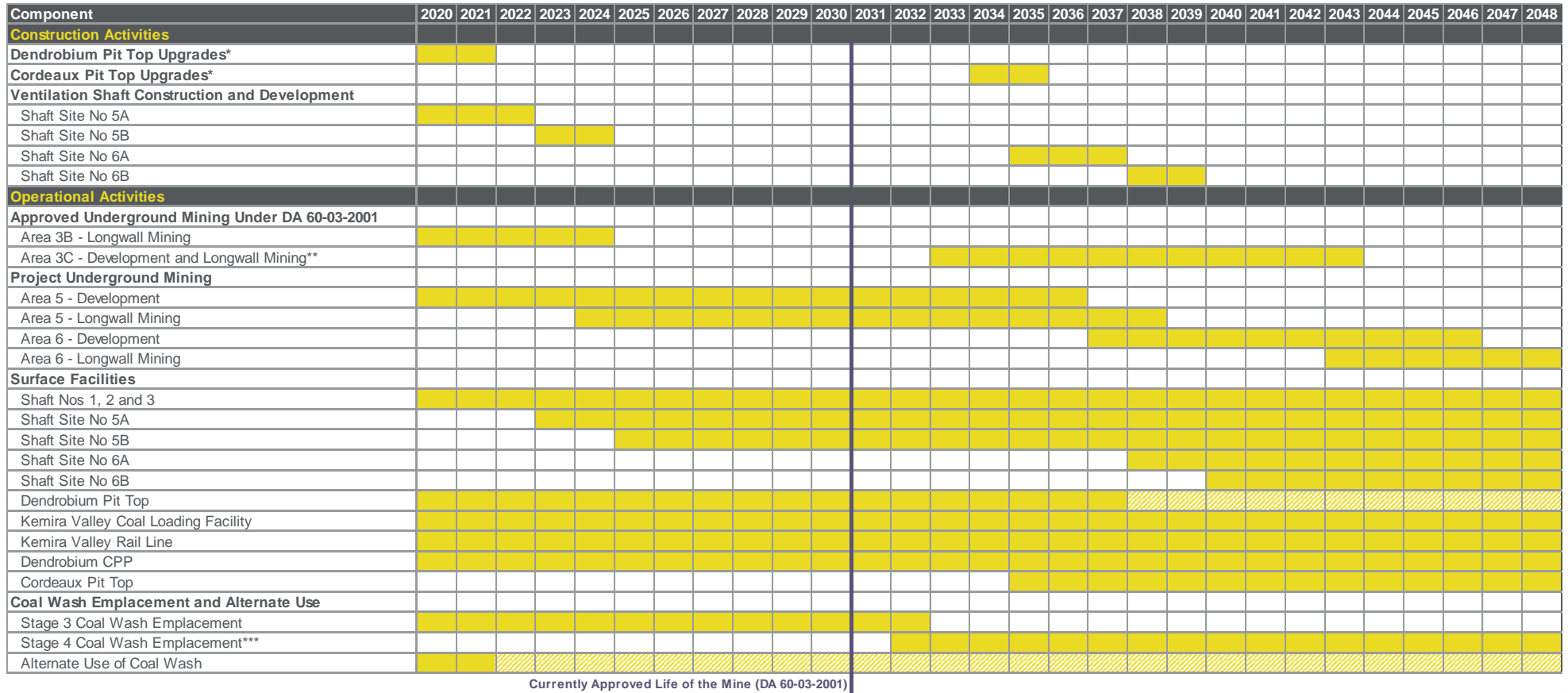
Kilometres



**Table 3-3  
Summary of Key Project Characteristics**

Component	Project
Mining Method	Underground extraction using longwall mining methods.
Resource	Mining of the Bulli Seam in Area 5 and the Wongawilli Seam in Area 6 within CCL 768.
Annual Production	Production of up to 5.2 Mtpa of ROM coal.
Mine Life	Until 31 December 2048.
Total Resource Recovered	Approximately <b>77</b> Mt of ROM coal from Areas 5 and 6.
Coal Handling and Processing	<p>Transport of coal from underground workings to the Kemira Valley Coal Loading Facility via an underground conveyor network.</p> <p>Continued sizing and stockpiling of coal at the Kemira Valley Coal Loading Facility prior to transport to the Dendrobium CPP via the Kemira Valley Rail Line, in accordance with the approved hours of operation.</p> <p>Continued processing of up to 5.2 Mtpa of sized ROM coal at the Dendrobium CPP.</p>
Management of Mining Waste	<p>Transportation of up to approximately 1.6 Mtpa of coal wash by road from the Dendrobium CPP to the West Cliff Stage 3 and Stage 4 Coal Wash Emplacement. A portion of this total would be made up of coal wash produced from the processing coal from remaining areas of the approved Dendrobium Mine (Area 3).</p> <p>Continued development and rehabilitation of the West Cliff Stage 3 Coal Wash Emplacement.<sup>1</sup></p> <p>Continued supply of coal wash to customers for engineering purposes (e.g. civil construction fill) or for other beneficial uses.</p>
General Infrastructure	<p>Continued use of the Dendrobium Pit Top, Kemira Valley Coal Loading Facility, Kemira Valley Rail Line, Dendrobium CPP and Dendrobium Shafts Nos 1, 2 and 3 with upgrades and extensions.</p> <p>Use of the Cordeaux Pit Top for mining support activities.</p> <p>Augmentation of mine access arrangements, including upgrades to, and the use of, the Cordeaux Pit Top.</p> <p>Development of surface infrastructure associated with mine ventilation and gas management and abatement, and other ancillary infrastructure.</p>
Product Transport	Continued delivery of product coal from the Dendrobium CPP to the BlueScope Steelworks or to the Port Kembla Coal Terminal for transport to Liberty Primary Steel Whyalla Steelworks or export.
Water Management	<p>Augmentations and extensions to existing water management infrastructure.</p> <p>Continued use of a combination of recycled treated mine water and potable water purchased from Sydney Water in underground and surface operations.</p> <p>Continued release of water in accordance with the conditions of EPL 3241.</p> <p>Release volumes and release infrastructure to be modified as required based on Project mine inflow rates.</p> <p><a href="#">Provision of offsets (either implementation of “direct” or funding of “indirect” offsets) for predicted surface water take as a result of the Project that would result in a net gain to Metropolitan water supplies.</a></p>
Workforce	<p>At full development, the Project would employ in the order of 500 operational personnel (including South32 staff and on-site contractor personnel).</p> <p>Up to approximately 200 contractor personnel may be required for surface facility construction and longwall development activities at any one time.</p>
Hours of Operation	<p>Operated on a continuous basis, 24 hours per day, seven days per week.</p> <p>Trains would not travel on the Kemira Valley Rail Line between 11.00 pm and 6.00 am, unless written approval is obtained from the EPA for emergency use of the rail line.</p>
Capital Investment Value	\$956 million.

<sup>1</sup> Development and rehabilitation of the West Cliff Stage 4 Coal Wash Emplacement would continue to be conducted in accordance with Project Approval 08\_0150 for the Bulli Seam Operations.



\* The construction timeframes specified (i.e. 2-year periods) represent a likely construction window, with the majority of construction activities occurring intermittently within the 2-year period

\*\* Subject to separate assessment and approval of an extension of Development Consent DA 60-03-2001 from 31 December 2030 to 31 December 2048

\*\*\* Subject to separate assessment and approval of an extension of Project Approval 08\_0150 from 31 December 2041 to 31 December 2048

**Figure 3-4 - Indicative Project Schedule**

- underground mining machinery replacement and upgrades;
- development and augmentation of mine ventilation infrastructure;
- additional gas management and abatement infrastructure;
- upgrades to the Dendrobium Pit Top and decommissioning and removal of redundant infrastructure;
- upgrades to the Cordeaux Pit Top and decommissioning and removal of redundant infrastructure to facilitate men and materials access during development and mining operations in Area 6;
- ongoing maintenance and upgrades of the Kemira Valley Rail Line and water management infrastructure;
- upgrades and replacement of infrastructure at the Dendrobium CPP and removal of redundant infrastructure; and
- minor augmentations and upgrades of other surface facilities.

Construction would generally occur 7.00 am to 5.00 pm Monday to Sunday. Some construction and development works (e.g. drilling and construction of ventilation shafts, and underground development activities) would occur on a 24 hour per day basis.

Additional mobile equipment would be required for periods during the Project construction and development activities including drill rigs, mobile cranes, excavators, loaders and delivery trucks.

The number and type of equipment would vary depending on the construction development activity being undertaken.

### 3.4.1 Development of Access and Supporting Infrastructure for Underground Mining Areas

Underground roadways would be developed to access and support the Project underground mining areas (i.e. for access, ventilation and coal clearance).

Coal clearance infrastructure and other ancillary infrastructure would be developed for the Project underground mining areas.

The existing coal clearance infrastructure would also be upgraded and augmented progressively throughout the life of the Project through replacement or upgrades of conveyors, sizers, drives, winders and supporting systems.

Other ancillary infrastructure required to support the Project underground mining areas includes infrastructure for electricity distribution, communication systems, water management, services and service delivery (e.g. boreholes to the surface).

### 3.4.2 Underground Mining Machinery Replacement and Upgrades

Over the life of the Project it is anticipated that a range of underground mining equipment would be replaced or upgraded as a component of general maintenance, or to increase efficiency.

### 3.4.3 Mine Ventilation Infrastructure

The Project would involve the continued use of Dendrobium Shafts Nos 1, 2 and 3 (Figure 3-3).

The Project would involve the development of the following ventilation infrastructure (Figure 3-3):

- an additional ventilation shaft site to support Area 5 (Site No 5A) (maximum disturbance of approximately **15** ha);
- an optional additional ventilation shaft site to support Area 5 (Site No 5B) (maximum disturbance of approximately **0.5** ha); and
- two additional ventilation shaft sites to support Area 6 (Site No 6A and Site No 6B) (maximum disturbance of approximately 4 ha each).

Construction of ventilation shaft sites for the Project would involve:

- improvement of existing tracks and construction of new tracks to allow access (where necessary);
- development of concrete-lined or steel-lined shaft(s);
- installation of ventilation fan(s) and associated power supply if the site would be used as an upcast ventilation shaft;

- installation of a power supply and transmission and associated electrical switchroom, transformer and ancillary infrastructure for the ventilation fans;
- installation of appropriate security (i.e. fencing) to prevent unauthorised access to the ventilation shaft site;
- construction of sumps for the containment of drilling process water (pending its disposal underground or off-site);
- installation of erosion and sediment control infrastructure, where required;
- installation of an access/egress winder at the ventilation shaft sites to facilitate emergency transportation to/from underground mining operations; and
- other minor associated works.

It is expected that the shafts would be constructed from the surface down to the underground workings. Using this method, the shaft construction would take place in advance of development workings, with material from the excavation being removed from the top of the shaft. The construction footprint would be as shown on Figure 1-3.

The excavated material resulting from the construction of the shafts is proposed to be used as engineered fill and for construction of sediment dams. Any excess material is proposed to be stockpiled on-site, revegetated and used for future rehabilitation of the shaft site upon decommissioning.

Excavation of the shafts would occur 24 hours per day, seven days per week, while the remainder of construction activities associated with the ventilation shafts (e.g. installation of surface infrastructure) would generally be limited to daytime hours.

Ventilation fans, electrical infrastructure and other infrastructure at the existing Dendrobium Shafts may be upgraded or replaced during the life of the Project. The ventilation fans at Dendrobium Shaft No 3 may also be removed during the life of the Project and the site converted to a downcast ventilation shaft.

#### **3.4.4 Gas Management and Abatement Infrastructure**

Gas management and abatement infrastructure would be developed as described in Section 3.5.8.

Centralised gas management infrastructure would be constructed at the upcast ventilation shaft sites.

Gas management infrastructure would be fully fenced, and may include flares, pumps, nitrogen tanks, gas monitoring, water collection, surface pipes and other ancillary infrastructure.

Gas would be flared or, if the gas was too low in methane content for flaring (or other operational reasons), vented to the atmosphere.

#### **3.4.5 Dendrobium Pit Top**

Upgrades at the Dendrobium Pit Top (Figure 3-5) would include:

- construction of additional car parking facilities on the southern side of Cordeaux Road, including an additional intersection with Cordeaux Road;
- extension and relocation of bathhouses (e.g. change rooms), locker facilities and administration buildings; and
- additional electricity distribution infrastructure.

Other minor upgrades and augmentations would occur within the current disturbance footprint.

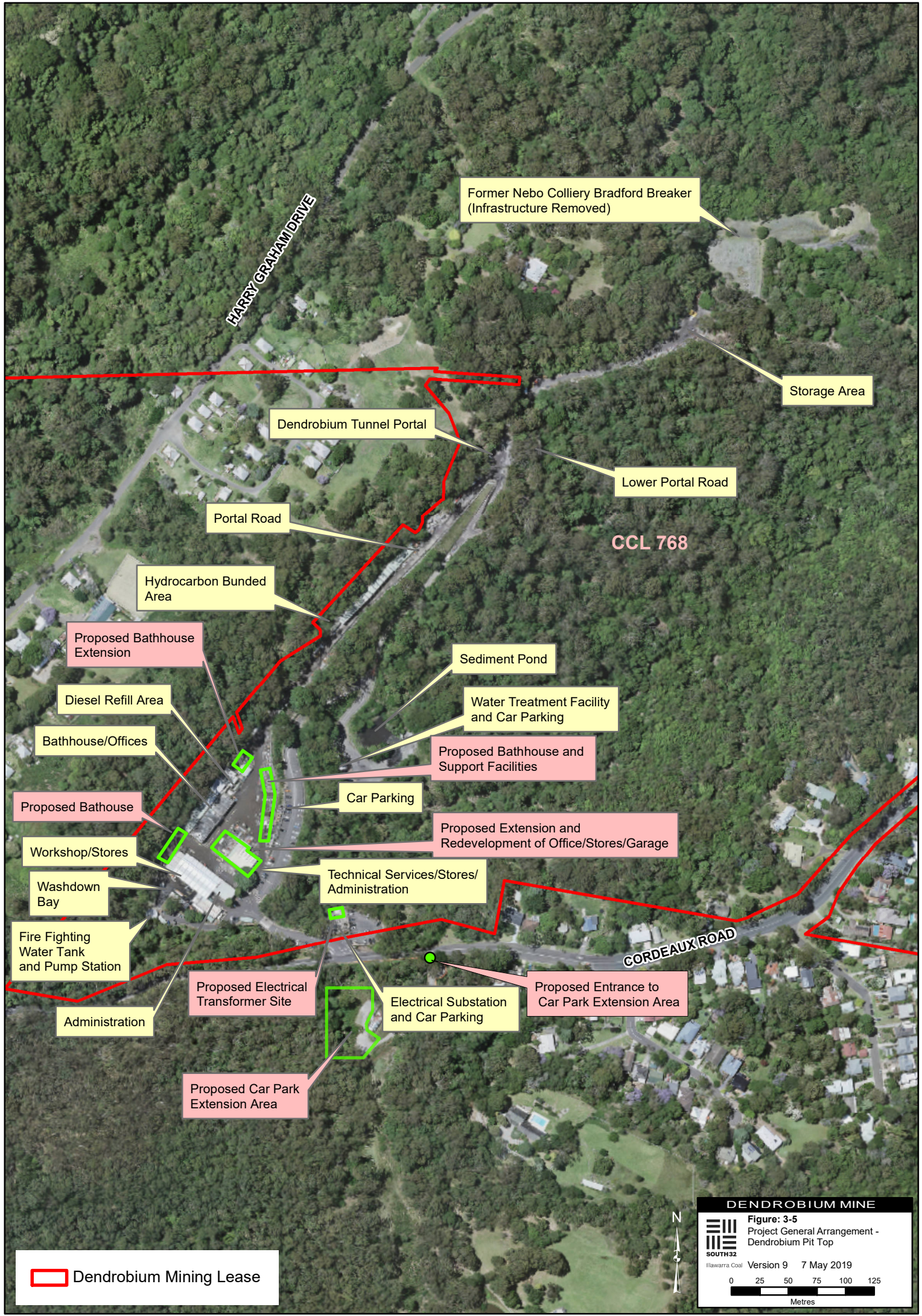
Existing infrastructure at the Dendrobium Pit Top that is no longer required may be decommissioned and removed (e.g. demountable buildings).

#### **3.4.6 Cordeaux Pit Top**

Upgrades to the Cordeaux Pit Top would occur to allow it to be used for personnel and materials access to the Project underground mining operations (for Area 6).

Upgrades at the Cordeaux Pit Top (Figure 3-6) would include, but not necessarily be limited to:

- upgrades to existing shafts, and development of new shafts and/or drifts to facilitate access to, ventilation of, and provision of services to the underground workings in Area 6;
- development of new buildings, and extension of existing buildings, within the existing surface lease to provide additional bathhouse facilities (e.g. change rooms), locker facilities, administration facilities and workshop areas;



HARRY GRAHAM DRIVE

Former Nebo Colliery Bradford Breaker  
(Infrastructure Removed)

Storage Area

Dendrobium Tunnel Portal

Lower Portal Road

Portal Road

CCL 768

Hydrocarbon Bunded Area

Sediment Pond

Proposed Bathhouse Extension

Water Treatment Facility and Car Parking

Diesel Refill Area

Proposed Bathhouse and Support Facilities

Bathhouse/Offices

Car Parking

Proposed Bathhouse

Proposed Extension and Redevelopment of Office/Stores/Garage

Workshop/Stores

Technical Services/Stores/ Administration

Washdown Bay

Fire Fighting Water Tank and Pump Station

CORDEAUX ROAD

Proposed Entrance to Car Park Extension Area

Administration

Proposed Electrical Transformer Site

Electrical Substation and Car Parking

Proposed Car Park Extension Area

Dendrobium Mining Lease

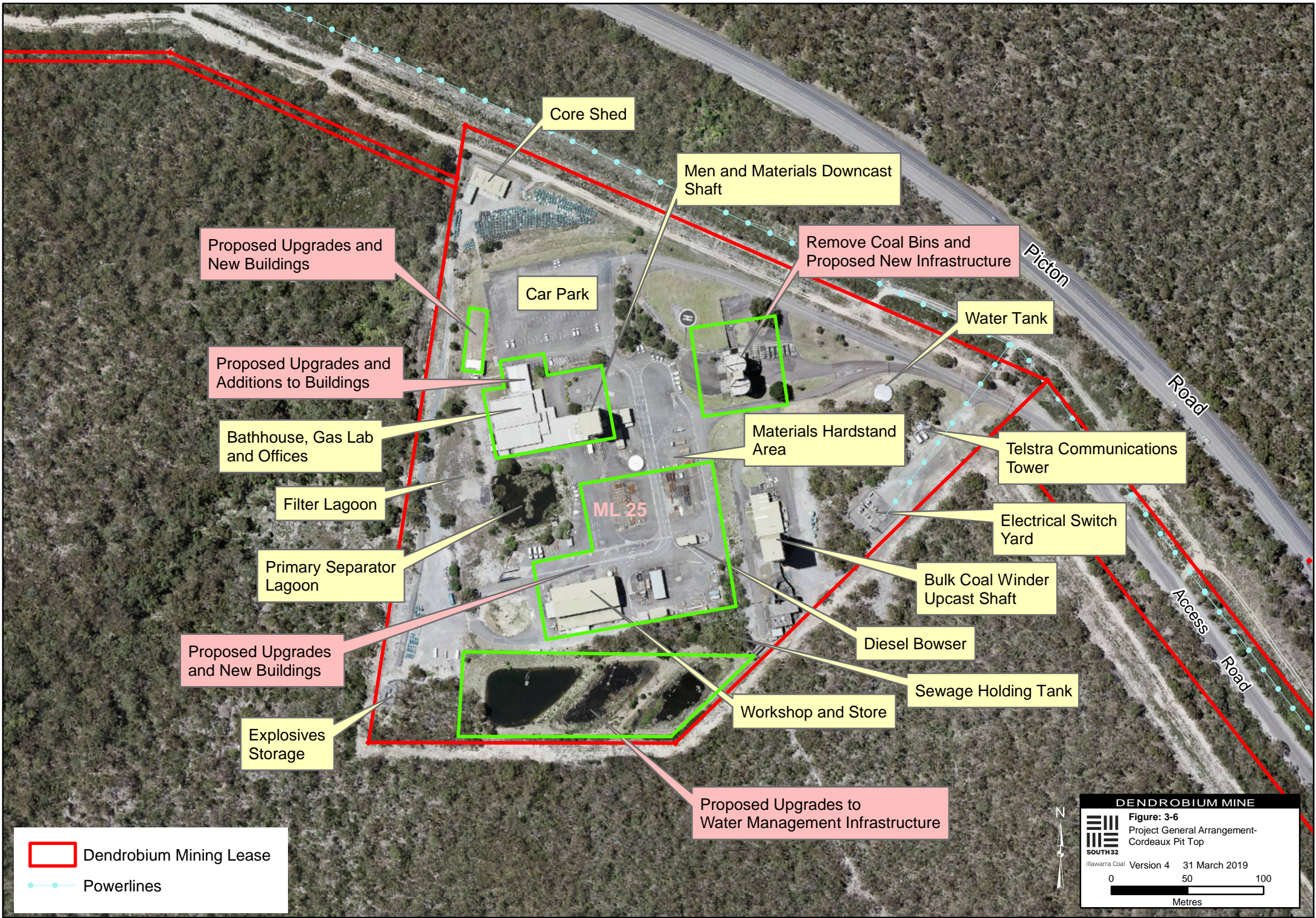
**DENDROBIUM MINE**

Figure: 3-5  
Project General Arrangement -  
Dendrobium Pit Top

**SOUTH32**

Illawarra Coal Version 9 7 May 2019

0 25 50 75 100 125  
Metres



Dendrobium Mining Lease  
● Powerlines

Core Shed

Men and Materials Downcast Shaft

Proposed Upgrades and New Buildings

Remove Coal Bins and Proposed New Infrastructure

Car Park

Water Tank

Proposed Upgrades and Additions to Buildings

Materials Hardstand Area

Bathhouse, Gas Lab and Offices

Telstra Communications Tower

Filter Lagoon

Electrical Switch Yard

Primary Separator Lagoon

Bulk Coal Winder Upcast Shaft

Proposed Upgrades and New Buildings

Diesel Bowser

Explosives Storage

Workshop and Store

Sewage Holding Tank

Proposed Upgrades to Water Management Infrastructure

ML 25

**DENDROBIUM MINE**

**Figure: 3-6**  
 Project General Arrangement-  
 Cordeaux Pit Top

Illawarra Coal Version 4 31 March 2019

0 50 100  
Metres

- upgrades to existing water management infrastructure and development of new water management infrastructure; and
- upgrades to electricity distribution infrastructure.

Existing infrastructure at the Cordeaux Pit Top that is no longer required (e.g. the existing coal bins) may be decommissioned and removed.

Other minor upgrades and augmentations would occur within the existing surface lease area and current disturbance footprint (Figure 3-6).

Prior to use of the Cordeaux Pit Top as the primary operational access to the underground mine, South32 would undertake a review of traffic movements on Picton Road and projected Project traffic movements. Based on the outcomes of this review, South32 may:

- adjust shift start and finish times to minimise the overlap between peak Project traffic exiting the Cordeaux Pit Top and peak through-traffic on Picton Road; and/or
- undertake necessary upgrades to the access road intersection in consultation with RMS.

### 3.4.7 Kemira Valley Rail Line

A rail control room would be developed for the Kemira Valley Rail Line during the life of the Project (Figure 3-7).

Additional water management and ancillary infrastructure may also be installed within the Kemira Valley Rail Line easement.

Components of the Kemira Valley Rail Line would be replaced, upgraded or augmented during the life of the Project, including track work, culverts, crossings, signalling, fencing and screening.

### 3.4.8 Dendrobium CPP

A new conveyor from the Dendrobium CPP to the washed coal stockpile (Figure 3-8) would be developed during the life of the Project.

Existing components of the Dendrobium CPP would be replaced, upgraded or augmented during the life of the Project, including, but not necessarily limited to, conveyors, surge bins, storage bins, tanks, sumps, filters, centrifuges, thickeners, chutes, skirts, scrapers, sprays and electrical infrastructure.

Existing infrastructure at the Dendrobium CPP that is no longer required (e.g. coal bins that are no longer in use) may be decommissioned and removed.

### 3.4.9 Water Management System Upgrades

Project water management studies (Appendices B and C) indicate that the expansion of the Dendrobium Mine would be accompanied by increasing groundwater inflows, which would increase the volume of water to be transferred off-site for disposal or beneficial reuse. This may require augmentation or duplication of some water management infrastructure to accommodate increased mine inflows.

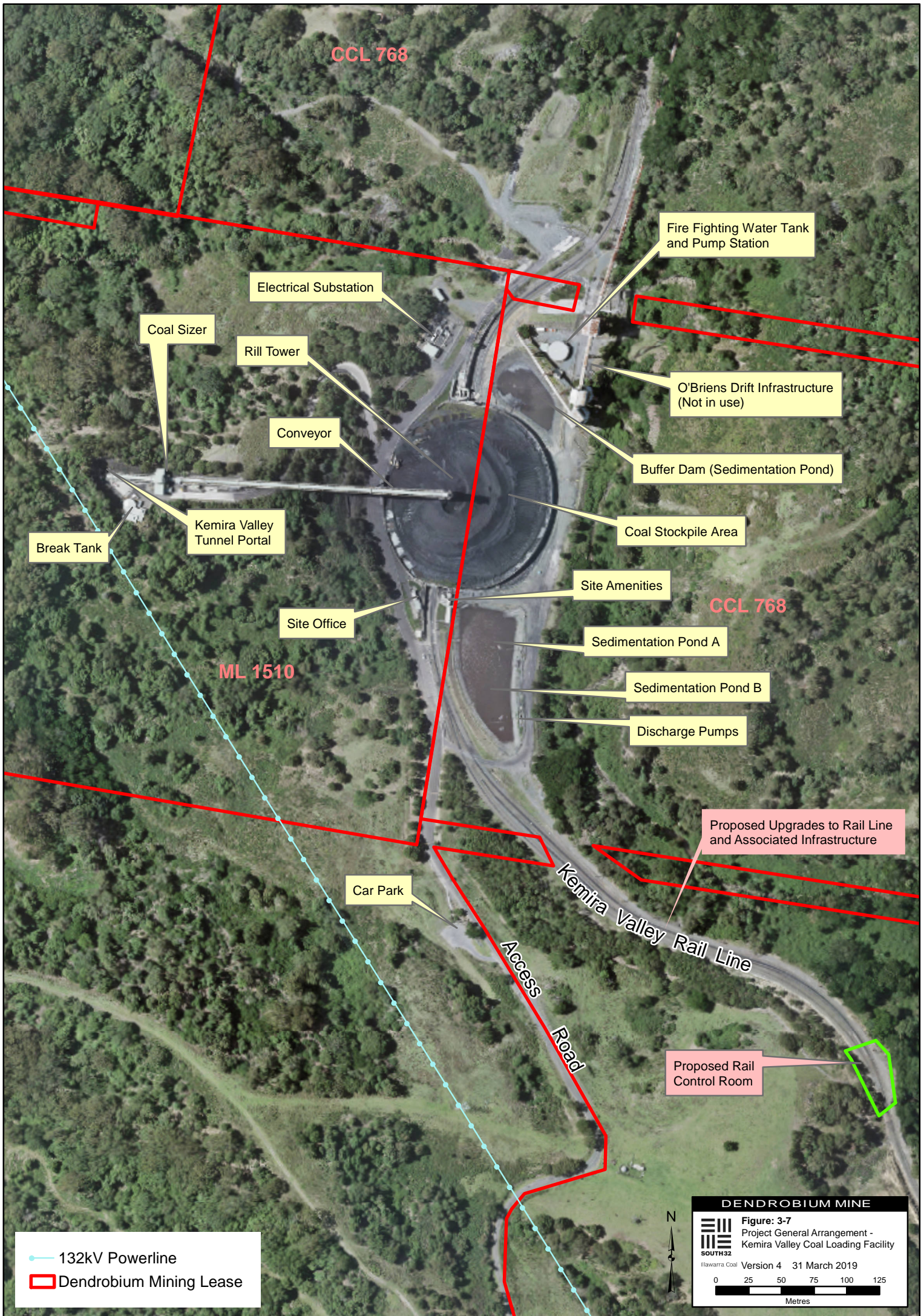
In particular, it is anticipated that the existing excess water pipeline that follows the Kemira Valley Rail Line to the licensed discharge point to Allans Creek (LDP5) under EPL 3241 at Unanderra would need to be upgraded, replaced or duplicated. Any duplicated pipeline would run parallel to the existing 7 km excess water pipeline from Kemira Valley storage tank to LDP5. The anticipated size of the duplicated pipeline required to accommodate predicted increases mine inflows is similar to that of the existing pipeline, and would therefore be located within the existing infrastructure corridor.

[Direct offsets to be provided for predicted surface water take as a result of the Project may involve the establishment of water treatment facilities and pipelines to facilitate the treatment and provision of mine water to third party users for beneficial use over the life of the Project. The treatment facilities and pipelines would be preferentially located within existing industrial areas and pipeline easements, respectively. If these facilities or a section of the pipeline were to extend beyond the DA Area for the Project and/or would result in disturbance beyond the existing infrastructure corridor, it would be subject to the necessary separate assessment and approval.](#)

[Any brine generated from water treatment facilities could be released via the existing Dendrobium Mine LDP 5 \(subject to authorisation via EPL 3241\).](#)

### 3.4.10 Other Surface Facilities and Supporting Infrastructure Upgrades

Upgrades to other supporting facilities such as the Kemira Valley Coal Loading Facility during the life of the Project would be within the current disturbance footprint and would involve replacement, upgrade or addition of existing components during the life of the Project.



CCL 768

Fire Fighting Water Tank and Pump Station

Electrical Substation

Coal Sizer

Rill Tower

O'Briens Drift Infrastructure (Not in use)

Conveyor

Buffer Dam (Sedimentation Pond)

Break Tank

Kemira Valley Tunnel Portal

Coal Stockpile Area

Site Amenities

CCL 768

Site Office

Sedimentation Pond A

ML 1510

Sedimentation Pond B

Discharge Pumps

Proposed Upgrades to Rail Line and Associated Infrastructure

Car Park

Kemira Valley Rail Line

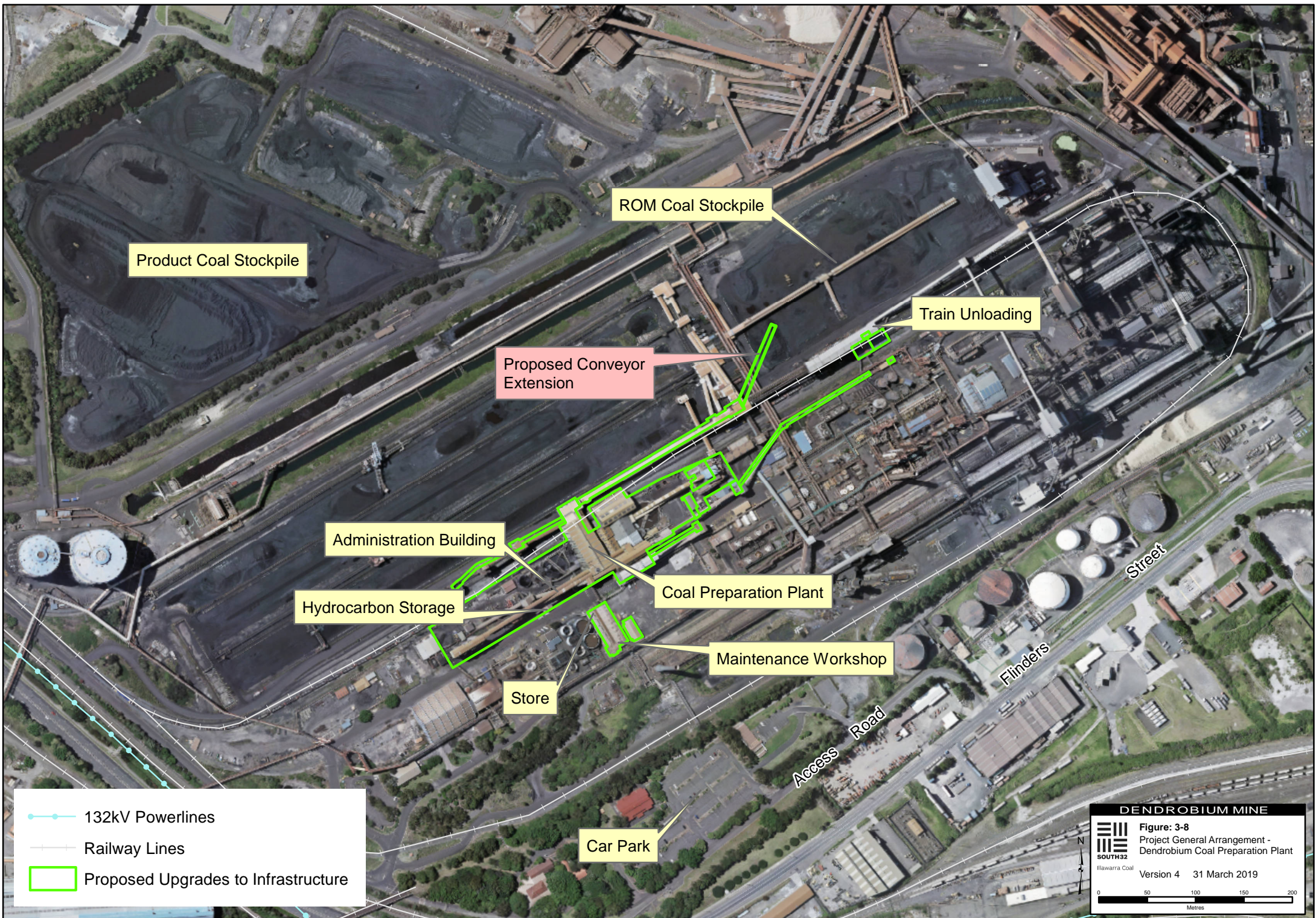
Access Road

Proposed Rail Control Room

— 132kV Powerline  
 □ Dendrobium Mining Lease



**DENDROBIUM MINE**  
 Figure: 3-7  
 Project General Arrangement -  
 Kemira Valley Coal Loading Facility  
 Illawarra Coal SOUTH32  
 Version 4 31 March 2019



Product Coal Stockpile

ROM Coal Stockpile

Train Unloading

Proposed Conveyor Extension

Administration Building

Hydrocarbon Storage

Coal Preparation Plant

Maintenance Workshop

Store

Car Park

—●— 132kV Powerlines  
—+— Railway Lines  
 Proposed Upgrades to Infrastructure

**DENDROBIUM MINE**

**Figure: 3-8**  
 Project General Arrangement -  
 Dendrobium Coal Preparation Plant

Version 4    31 March 2019  
 Illawarra Coal

0    50    100    150    200  
 Metres

### 3.5 UNDERGROUND MINING OPERATIONS

The Project involves longwall mining operations within CCL 768 to (Figure 3-3):

- extract the Bulli Seam in Area 5; and
- extract the Wongawilli Seam in Area 6.

The underground mining operations for the Project would extract approximately 77 Mt of ROM coal from Areas 5 and 6.

Over the life of the Project, ROM coal would also continue to be extracted from the approved Area 3. This coal extraction would occur under Development Consent DA 60-03-2001 (subject to obtaining an extension to the life of Development Consent DA 60-03-2001, where required).

Due to gas constraints identified in the approved Area 3C (Section 2), the Project would provide an opportunity to safely drain this gas before the approved Area 3C is mined and, therefore, maintain continuity of Dendrobium Mine longwall operations.

The Project would involve extraction of up to 5.2 Mtpa of ROM coal from the Project mining areas.

Underground mining operations would be conducted on a continuous basis, 24 hours per day, seven days per week.

#### 3.5.1 Mining Method

Longwall mining methods and equipment would continue to be employed for the Project. Longwall mining involves the extraction of rectangular panels of coal defined by underground roadways constructed around each longwall. The longwall mining machine travels back and forth across the width of the coal face, progressively removing coal in slices from the panel. Once each slice of coal is removed from the longwall face, the hydraulic roof supports are moved forward, allowing the roof and a section of the overlying strata to collapse behind the longwall machine (referred to as forming 'goaf') (Figure 2-2).

Extraction of coal by longwall mining methods results in the vertical and horizontal movement of the land surface. The land surface movements are referred to as subsidence effects. The type and magnitude of subsidence effects are dependent on a range of variables which include the mine geometry and topography, the depth of mining, the number of seams mined, the coal recovery from each seam, the nature of overlying strata and other geological factors. The subsidence effects pertinent to the Project include non-conventional and systematic subsidence movements.

Subsidence-related monitoring and remediation activities for the Project are discussed in Section 3.13.1 and described in detail in Section 7.2.

#### 3.5.2 Project Mining Domain Constraints

The Project Areas 5 and 6 underground mining areas comprise two distinct domains with differing major constraints (Section 3.1 and Figure 3-2):










- Area 5 is constrained by the extent of CCL 768 to the west and north and the extent of the approved Area 3 (under Development Consent DA 60-03-2001) to the east. Area 5 is also constrained by igneous intrusions to the east, Avon Dam and Avon River to the south and south-west.
- Area 6 is constrained by Cordeaux Dam and Cordeaux River to the south and west, the extent of CCL 768 to the north and a fault zone to the east.

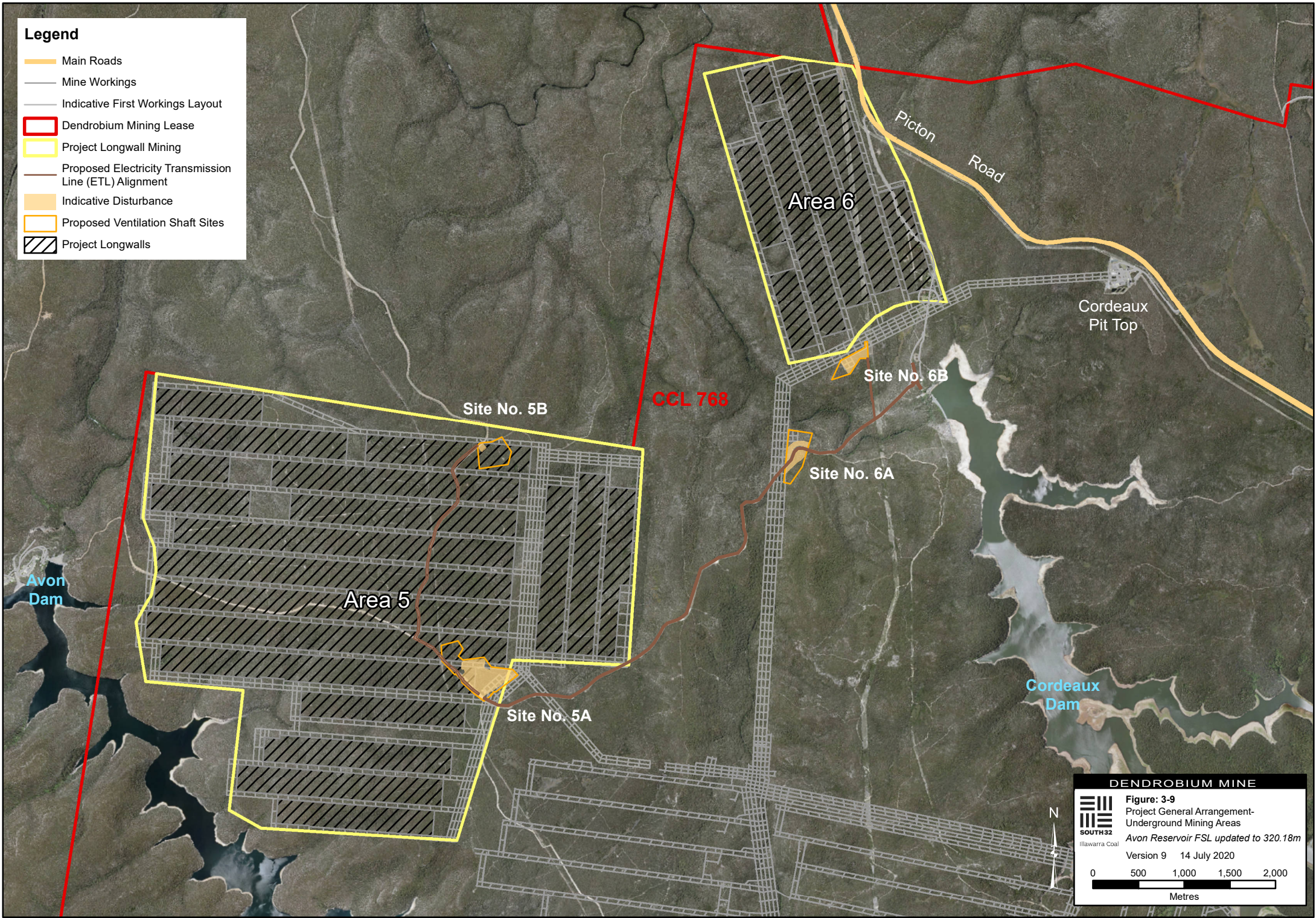
#### 3.5.3 Project Longwall Design Constraints

Longwalls for the Project would have coal face widths of up to approximately 305 m and extraction height would be restricted to a maximum of 3.9 m. A number of longwall design constraints have been incorporated in the Project underground mining layout to reduce potential environmental impacts in consideration of previous mining experience in Dendrobium Mine Area 3B and key stakeholder feedback.

The longwall layout shown on Figure 3-9 is the EIS Base Plan Longwalls. A number of longwall setbacks from both built and natural features were developed by South32 and are incorporated in the EIS Base Plan design, including:

- longwall setbacks from both the Avon and Cordeaux Dam walls (adopted minimum setback distance of 1,000 m);

- Legend**
-  Main Roads
  -  Mine Workings
  -  Indicative First Workings Layout
  -  Dendrobium Mining Lease
  -  Project Longwall Mining
  -  Proposed Electricity Transmission Line (ETL) Alignment
  -  Indicative Disturbance
  -  Proposed Ventilation Shaft Sites
  -  Project Longwalls



**DENDROBIUM MINE**

**Figure: 3-9**  
 Project General Arrangement-  
 Underground Mining Areas  
 Avon Reservoir FSL updated to 320.18m  
 Version 9 14 July 2020

0 500 1,000 1,500 2,000  
 Metres

- no direct undermining of the existing Avon and Cordeaux Dam waterbodies, with a minimum 300 m longwall setback adopted from the existing dam Full Supply Levels (FSLs); and
- longwall setbacks from named watercourses (i.e. Cordeaux River, Avon River and Donalds Castle Creek) to achieve 200 millimetres (mm) or less of predicted Project subsidence related closure.

The Project mine geometry was then further refined to include a number of additional reductions to the extent of mining to avoid the direct undermining of mapped “key stream features” (i.e. pools >100 cubic metres [m<sup>3</sup>] and permanent, waterfalls >5 m and with a permanent pool at the base) as identified during site investigations of all mapped streams overlying the Project underground mining Areas 5 and 6.

To achieve these refinements, South32 would modify individual longwall geometry, through methods such as:

- shortening of longwalls; and
- leaving un-mined coal blocks (i.e. not mining coal from a portion of a longwall, via an additional longwall movement).

The adopted longwall constraints that would be incorporated in the Project longwall mining layout are summarised in Table 3-4. There are a number of alternative longwall layouts that would also meet these same Project constraints and, therefore, achieve the same environmental outcome as assessed in this EIS.

**Table 3-4  
Summary of Constraints Incorporated in the Project Longwall Mining Layout**

Adopted Project Constraint	Context
1,000 m minimum setback from existing Avon/Cordeaux Dam walls for any secondary extraction.	<p>The Dams Safety Committee (DSC) must endorse any mining within the DSC Notification Zones. The DSC has published Guidance notes, including:</p> <ul style="list-style-type: none"> <li>• No uncontrolled extraction (e.g. full-sized longwalls) within 1.7x depth of cover of existing dam structures<sup>1</sup>.</li> <li>• No mining (any) within 1.2 x depth of cover of existing dam structures.</li> </ul>
No mining below existing Avon/Cordeaux Dams waterbodies, adopting a 300 m setback from existing dam FSL.	<p>The DSC must endorse any extraction under stored water for existing storages, including first workings and secondary workings.</p> <p>The DSC has endorsed several instances of first workings under Lake Cordeaux at the approved Dendrobium Mine.</p> <p>DSC endorsement for mining to date in the approved Area 3B has included a minimum horizontal distance to the FSL equal to 300 m.</p>
Setbacks from named watercourses (as defined by the NSW Department of Lands) to achieve 200 mm or less predicted additional Project subsidence-related closure.	<p>Relevant to Cordeaux River, Avon River and Donald Castle Creek for the Project mining domains.</p>
<p>Setbacks from mapped “key stream features”:</p> <ul style="list-style-type: none"> <li>• Setback of 50 m when mining will occur on one side of the “key stream feature”.</li> <li>• Setback of 100 m when mining will occur on more than one side of the “key stream feature”.</li> </ul>	<p>Applies to South32 mapped features along streams within the Project Study Area<sup>2</sup> as follows:</p> <ul style="list-style-type: none"> <li>• Pools (&gt;100 m<sup>3</sup> and permanent).</li> <li>• Waterfalls/Steps (&gt;5 m and with a permanent pool at base).</li> </ul> <p>Setback distances are based on observations from the Dendrobium Mine, and the setbacks are designed to maximise the likelihood that the stream feature will not be physically damaged by subsidence.</p>

<sup>1</sup> This would require approximately 750 m setback or less based on Project depths of cover, but South32 has adopted a Project setback (≥1,000 m) greater than the DSC recommendation.

<sup>2</sup> Study Area as defined in MSEC, 2019.

It is proposed that the longwall design constraints in Table 3-4 would be referenced in the Development Consent, should the Project be approved. This would facilitate subsequent detailed design of Project longwall layouts consistent with this EIS.

Final Project longwall layouts would be subject to review and approval as a component of future Extraction Plans developed in consultation with the relevant authorities and to the satisfaction of the Secretary of the DPE.

South32 would also implement an adaptive management approach to achieve any relevant performance measures to maintain the safety and serviceability of surface infrastructure during the life of the Project. Adaptive management would involve the monitoring and periodic evaluation of environmental consequences against subsidence performance measures and, if necessary, mitigation measures and/or the mine design and mining extent may be adjusted to achieve the Development Consent performance measures.

#### ***Indicative Mining Schedule***

An indicative mining schedule for the Project is presented in Table 3-5 and is based on the planned maximum ROM coal production rate of 5.2 Mtpa.

The actual timing and mining sequence may vary to take account of localised geological features, coal quality characteristics, detailed mine design, mine economics, market volume requirements, and/or adaptive management requirements.

### **3.5.4 Underground Mine Access and Materials Handling**

#### ***Underground Mine Access and Development Works***

Personnel and materials access to Area 5 would be from the Dendrobium Pit Top and the Dendrobium Tunnel. Access to Area 6 would be via the Dendrobium Pit Top and/or the Cordeaux Pit Top.

An access/egress winder would also be installed at the ventilation shaft sites to facilitate emergency transportation to/from the underground mining operations.

Underground main roads would be developed to access and support the Project underground mining areas (i.e. for access, ventilation and coal clearance).

Each longwall would be formed by developing gate roads (the tailgate and maingate roads). To construct the gate roads, roadways (headings) would be driven parallel to each other using continuous miners.

The headings that form the gate roads would be connected by driving a “cut-through” from one heading to another at regular intervals (e.g. at 130 m spacings) (Figure 2-2). This leaves a series of pillars of coal along the length of the gate road that support the overlying strata.

#### ***ROM Coal Handling***

ROM coal would be transported from the Project underground operations to the Kemira Valley Coal Loading Facility via an underground conveyor network, reaching the surface via the Kemira Valley Tunnel.

At the facility, ROM coal would continue to be temporarily stockpiled before being loaded onto trains for transport to the Dendrobium CPP. Up to 5.2 Mtpa of ROM coal from Areas 5, 6 and 3 would be handled at the Kemira Valley Coal Loading Facility over the life of the Project.

A material handling schematic for the Project, showing the handling of ROM coal, product coal and coal wash is shown on Figures 3-10a and 3-10b.

### **3.5.5 Major Underground Equipment**

Underground equipment (such as shearers, longwall machines, continuous miners, conveyors and bins) and mobile fleet (such as load haul dump vehicles, drill rigs, shuttle cars and personnel carriers) would be used for the Project.

Underground equipment would be upgraded or replaced during the life of the Project as required.

### **3.5.6 Mine Ventilation Systems**

Ventilation shafts, fans and associated surface infrastructure would be required for the Project to maintain a safe working environment within the underground workings.

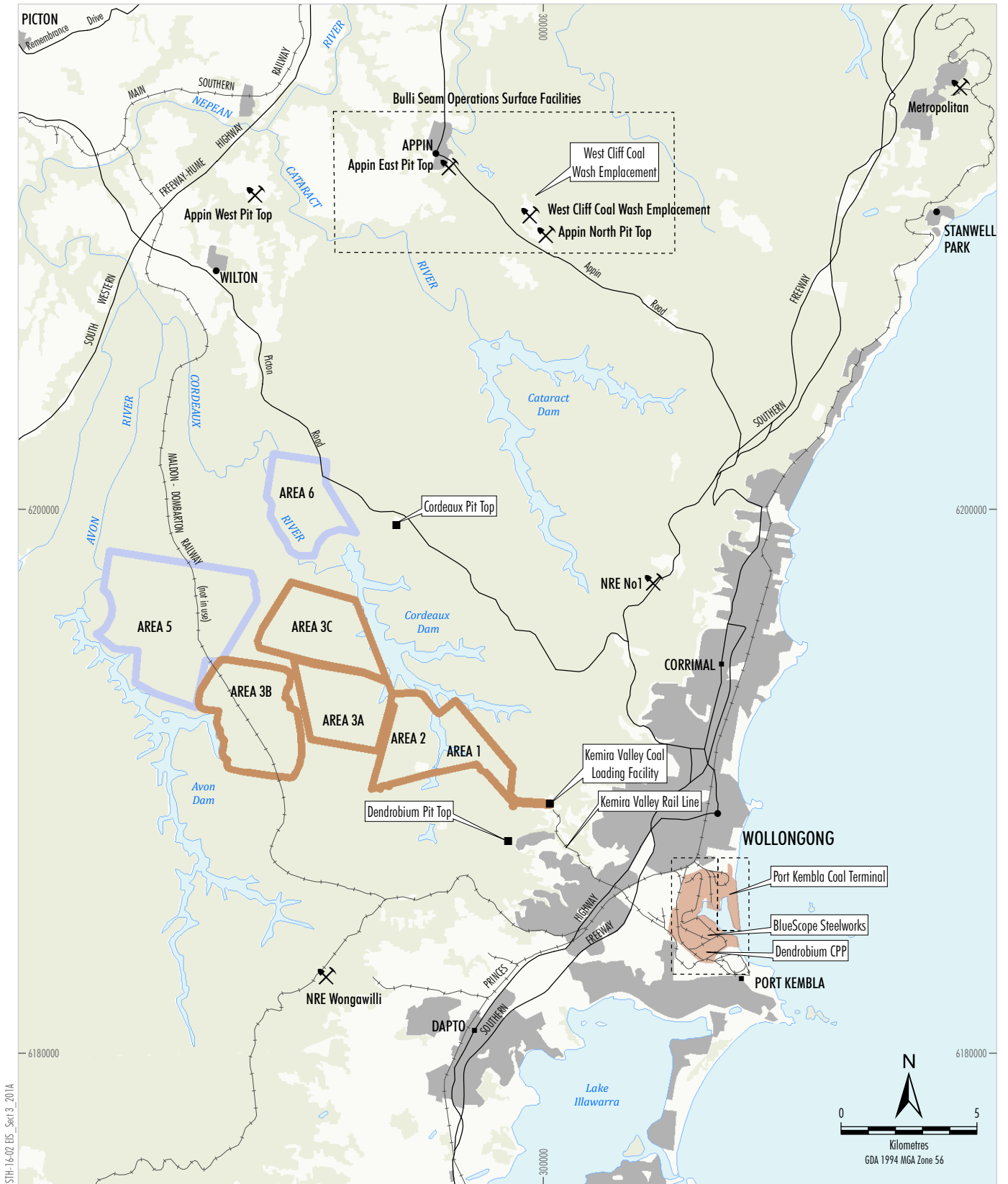
The existing Dendrobium Shafts Nos 1, 2 and 3 would continue to ventilate the Project underground mining areas.

**Table 3-5  
Indicative Mining Schedule**

Project Year	ROM Coal Production (Mt)		Project ROM Coal Handling and Processing (Mt)		
	Approved Dendrobium Mine Mining (Area 3) (DA 60-03-2001)*	Project Underground Mining Areas (Areas 5 and 6)	Total ROM Coal	Coal Wash (Wet)	Total Product Coal
1	4.7	0.2	4.9	1.3	3.7
2	4.4	0.1	4.5	1.2	3.4
3	3.8	0.2	4.0	1.0	3.1
4	3.2	0.4	3.6	0.9	2.7
5	2.0	1.2	3.2	0.8	2.6
6	-	3.4	3.4	0.5	3.0
7	-	5.2	5.2	0.8	4.6
8	-	4.9	4.9	0.7	4.4
9	-	4.4	4.4	0.6	3.9
10	-	4.3	4.3	0.6	3.8
11	-	3.7	3.7	0.5	3.3
12	-	3.8	3.8	0.5	3.4
13	0.0	4.1	4.1	0.5	3.7
14	0.2	3.8	4.0	0.5	3.5
15	0.3	3.3	3.6	0.5	3.1
16	0.3	2.9	3.2	0.5	2.7
17	0.3	3.2	3.5	0.6	3.0
18	0.2	3.6	3.8	0.7	3.2
19	0.2	3.5	3.7	0.6	3.1
20	3.1	<b>0.1</b>	<b>3.2</b>	0.9	<b>2.4</b>
21	3.6	0.3	3.9	1.1	2.8
22	3.7	0.3	4.0	1.1	3.0
23	3.3	0.3	3.6	1.0	2.7
24	1.4	2.3	3.7	1.2	2.6
25	-	3.6	3.6	1.2	2.6
26	-	4.3	4.3	1.5	3.1
27	-	4.7	4.7	1.6	3.2
28	-	4.7	4.7	1.6	3.3
29	-	0.4	0.4	0.1	0.3

Note: The combined total of product coal and coal wash is greater than total ROM coal due to changes in moisture content. Other totals may not add exactly due to rounding.

\* ROM coal extraction in Area 3 would continue to be conducted in accordance with Development Consent DA 60-03-2001.



SIH-16-02-ES\_Sect 3\_201A

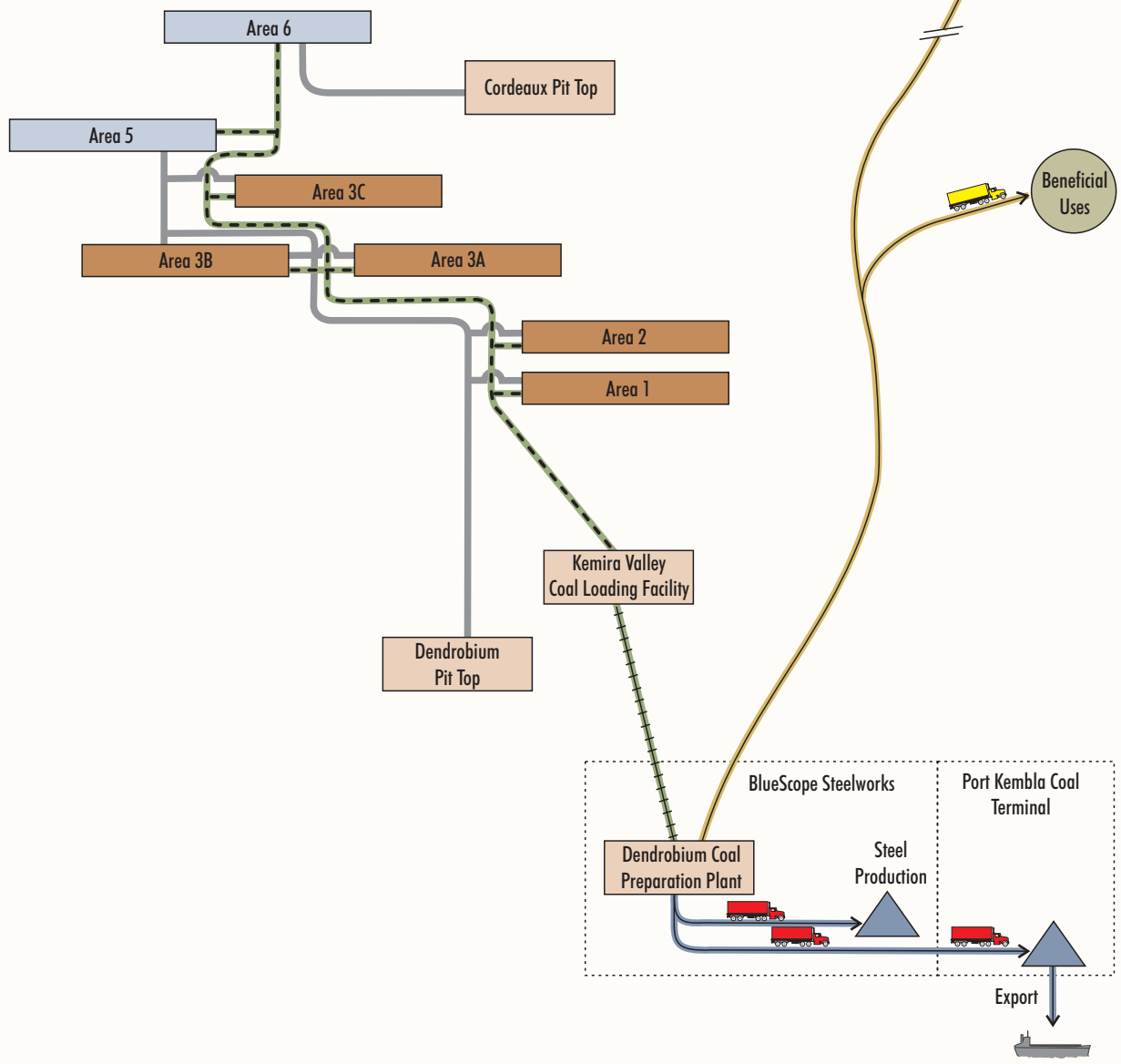
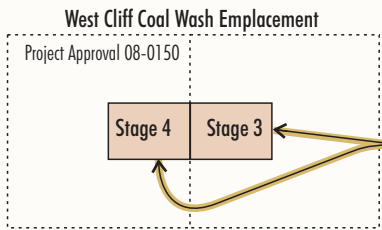
- LEGEND**
- Road
  - +— Railway
  - Urban Area
  - ▭ Dendrobium Underground Mining Area - Proposed Project
  - ▭ Dendrobium Underground Mining Area - Existing Mine (DA 60-03-2001)

Source: Geoscience Australia, 2006; Department of Industry (2018); Department of Finance, Services & Innovation (2018);



**DENDROBIUM MINE**  
Materials Handling  
Spatial Relationship

Figure 3-10a



SIH-16-02\_RTS\_002A

*Not to Scale*

- LEGEND**
- Illawarra Coal Surface Facility Area
  - Dendrobium Underground Mining Area - Proposed Project
  - Dendrobium Underground Mining Area - Existing Mine (DA 60-03-2001)
  - Men & Materials - Underground
  - ROM Coal
  - Product Coal
  - Coal Wash
  - Third Party Product Coal Storage
  - Road Transport - Surface
  - Rail Transport - Surface
  - Conveyor Transport - Underground
  - Road Transport Private Roads
  - Road Transport Public Roads



**DENDROBIUM MINE**  
Material Handling Schematic Flowsheet

Dendrobium Shafts Nos 1 and 2 are downcast (or intake) ventilation shafts that draw fresh air into the underground workings. Dendrobium Shaft No 3 is currently an upcast (or exhaust) ventilation shaft that uses fans to draw air out of the underground workings.

Dendrobium Shaft No 3 may be converted to a downcast ventilation shaft during the life of the Project.

The Project would also involve the development of the following ventilation infrastructure (Figure 3-9):

- an additional ventilation shaft site to support Area 5 (Site No 5A);
- an optional additional ventilation shaft site to support Area 5 (Site No 5B); and
- two additional ventilation shaft sites to support Area 6 (Site No 6A and Site No 6B).

Further mine planning and detailed ventilation studies would be required during the life of the Project to determine if development of a ventilation shaft at Site No 5B is required to support Area 5. In the event that Site No 5B is required, Longwall 508B may need to be shortened to allow the development of a shaft in this location. The final longwall and ventilation arrangement would be presented in the relevant Extraction Plan.

The ventilation shaft sites may be used as downcast and/or upcast ventilation shafts during the life of the Project. Only one shaft that supports Area 6 would be used as an upcast shaft at any one time.

Each upcast ventilation shaft site would have the following infrastructure:

- up to two concrete-lined or steel-lined shafts;
- up to three ventilation fans;
- power supply;
- electrical switchrooms, transformers, switchyard and other electrical infrastructure;
- gas drainage, monitoring and management systems, which may involve gas reticulation and flaring;
- site access road and appropriate security (i.e. fencing) to prevent unauthorised access to the site;
- sediment control infrastructure; and
- other associated ancillary infrastructure.

Each downcast ventilation shaft site would have the following infrastructure:

- one concrete-lined or steel-lined shaft;
- site access road and appropriate security (i.e. fencing) to prevent unauthorised access to the site;
- sediment control infrastructure; and
- other associated ancillary infrastructure.

### 3.5.7 Gas Management and Abatement

Pre-mining gas drainage and goaf gas drainage would be required for the Project to reduce the gas content in the coal seams to levels suitable for safe underground mining operations. Gas monitoring systems would be implemented for the Project to monitor gas composition of the air in the underground workings (e.g. carbon dioxide and methane levels) to maintain a safe working environment.

#### *Pre-Mining Gas Management*

Gas would be drained from the Wongawilli and Bulli Seams, and adjacent strata, by drilling in-seam (i.e. horizontal) boreholes into the coal seam in advance of mining. Pre-mining gas drainage would generally be facilitated by underground cross panel drilling. Gas would be drained through an underground collection system and delivered to centralised gas management infrastructure at the surface.

#### *Post-Mining Gas Drainage*

Gas would also be drained from the goaf area post-mining to ensure safe operations and maintain the rate of longwall mining operations. Post-mining gas drainage would be undertaken via underground drilling methods into the goaf. Gas drained from the goaf areas would be collected through the underground collection system for management at the surface.

#### *Hierarchy of Gas Management and Abatement*

Centralised gas management infrastructure would be constructed at the upcast ventilation shaft sites (Section 3.5.7).

Gas would be delivered to the centralised gas management infrastructure via gas pumps, a network of underground pipes and a shaft. Surface gas management infrastructure would be fully fenced and may include flares, pumps, nitrogen tanks, gas monitoring, water collection, surface pipes and other ancillary infrastructure.

Gas would be flared or, if the gas was too low in methane content for flaring (or other operational reasons), vented to the atmosphere.

### 3.5.8 Water Management Systems

The Project underground mining operations would use a combination of potable water and recycled water.

Treated recycled water would be used for underground dust suppression, cooling of underground equipment (development units and secondary supports) and for fire fighting purposes. Potable water from Sydney Water would be used for longwall hydraulic equipment and as a backup supply when recycled water is not available.

Water that accumulates in the underground workings, including groundwater inflows, would be collected and transferred directly into the Nebo workings and/or Kemira workings via a series of underground sumps, pumps and pipelines.

South32 would use flow meters to monitor the volume of water being pumped around the underground operations. Water that leaves the underground workings in ROM coal and ventilation air would continue to be monitored to inform periodic review of the site water balance.

Excess water that accumulates in the underground workings would continue to be discharged via the existing licensed discharge point to Allans Creek (LDP5) under EPL 3241.

South32 is also investigating options for the beneficial use of excess mine water with major water users in the Illawarra. Subject to the finalisation of feasibility studies and commercial agreements, [water treatment facilities and pipelines may be established and would be preferentially located within existing industrial areas and pipeline easements](#) to industrial and/or other water users to facilitate the transfer of excess water for beneficial use.

## 3.6 ROM COAL TRANSPORT AND PROCESSING

### 3.6.1 ROM Coal Sizing, Stockpiling and Transport

Up to 5.2 Mtpa of ROM coal from Areas 5, 6 and 3 would be transferred to the surface at the Kemira Valley Coal Loading Facility via the Kemira Valley Tunnel.

ROM coal would be conveyed from the Kemira Valley Tunnel to the existing coal sizing unit, which is a rotary breaker that reduces the top size of the coal (Figure 3-7). Sized ROM coal would be conveyed to the rill tower and temporarily stored in a stockpile with an approximate capacity of 150,000 tonnes (t), prior to being transported.

Train loading would continue to occur via feeders from the base of the stockpile, where coal is fed into rail wagons by either gravity or bulldozer.

Loaded trains would be sprayed with water to control dust emissions during transportation.

When required for stockpile management, a bulldozer or loader would operate on the stockpile between 7.00 am and 10.00 pm.

The Project would use the existing surface facilities at the Kemira Valley Coal Loading Facility, with minor augmentations and upgrades to existing equipment, as described in Section 3.4.10.

At the Dendrobium CPP, the train wagons would continue to be positioned over a rail unloading hopper system located below the rail line.

The unloaded coal would then be transferred to either the CPP feed bins or to a ROM stockpile area to the west of the rail line (Figure 3-7).

### 3.6.2 Dendrobium Coal Preparation Plant

A general arrangement of the Dendrobium CPP is provided in Figure 3-8.

The Dendrobium CPP would continue to receive small volumes of ROM coal, via the public road network, from the Bulli Seam Operations.

Sized ROM coal would be temporarily stockpiled at the Dendrobium CPP or fed directly into the CPP for processing at a rate of up to 5.2 Mtpa.

ROM coal would be fed through the existing conveyor and distributed amongst dense medium and flotation circuits for processing.

The CPP would produce the following main streams:

- metallurgical coal;
- energy coal; and
- coal wash.

The existing CPP comprises a range of components that can be generally classified into three major circuits, the coarse coal, small coal and fine coal circuits. Each of these circuits include components that separate coal materials on the basis of size (e.g. screens) and on the basis of material type (e.g. cyclones, flotation cells, jig/drum). Each circuit has links to each of the other circuits for recycling of undersize or oversize material.

The small coal and fine coal circuits also include components that are used to dewater coal products (e.g. centrifuges) and the fine coal circuit includes components that are used to dewater coal and coal wash (e.g. thickeners, filters and tailings presses).

During the life of the Project, an existing thermal drying facility may be upgraded to reinstate operations and/or replaced with other dewatering units (e.g. thickeners and filters).

Metallurgical coal and energy coal product streams would exit the CPP via conveyor and would be stockpiled separately.

Coal wash would report to the coal wash loading bin.

Further details on product coal handling and transportation and coal wash management are provided in Sections 3.7 and 3.8 respectively.

### **3.7 PRODUCT COAL HANDLING AND TRANSPORTATION**

The product coal production schedule for the Project is provided in Table 3-5.

Product coal from the Dendrobium CPP would continue to be temporarily stockpiled prior to being transported. Product coal would be transported from the Dendrobium CPP to the Port Kembla Steelworks for use in the steelmaking process or to the Port Kembla Coal Terminal for transport to Liberty Primary Steel Whyalla Steelworks and other export customers. All product coal transportation would be via private internal roads within the Port Kembla industrial precinct.

Product coal transportation would occur on a continuous basis (24 hours per day, seven days per week).

## **3.8 COAL WASH MANAGEMENT**

### **3.8.1 Coal Wash Production**

Over the life of the Project, it is estimated that up to approximately 15.2 Mt of additional coal wash would be produced from the processing of coal from Project underground mining areas. Approximately 9.4 Mt of coal wash would also be produced from processing coal from remaining areas of Area 3 during the life of the Project.

An indicative production schedule (including coal wash generation by the approved Bulli Seam Operations under Project Approval 08\_0150) of coal wash required to be emplaced at the West Cliff Coal Wash Emplacement and/or available to be supplied for beneficial re-use is provided in Table 3-6.

While the total coal wash quantities are based on planned maximum production (Section 3.6.1), the actual quantity produced in any one year may vary to take account of localised geological features, detailed mine design and the actual mine development sequence.

### **3.8.2 Coal Wash Physical and Chemical Characteristics**

Coal wash generally consists of a mixture of carbonaceous shale and mudstone with minor proportions of sandstone. Small quantities of low quality coal can also be present.

All coal wash (including coarse and fine coal wash) generated at the Dendrobium CPP reports to a single coal wash loading bin.

The coal wash material produced by the Dendrobium CPP is primarily comprised of silicon oxide, boehmite (an aluminium oxide hydroxide), carbon, iron oxide and moisture.

The material is not classified as hazardous according to Safe Work Australia criteria and is not classified as a dangerous good by the criteria of the Australian Dangerous Goods Code (ADG Code).

Contaminants in the coal wash material do not exceed the specific contaminant concentration (SCC) or toxicity characteristics leaching procedure (TCLP) test values for general waste in the *Waste Classification Guidelines – Part 1: Classification of waste* (EPA, 2014).

Monitoring data shows that the combined underdrainage from Stages 1, 2 and 3 of the West Cliff Coal Wash Emplacement, following emplacement over approximately 40 years, is generally neutral or slightly alkaline.

The presence of the West Cliff Coal Wash Emplacement for such a long period is essentially a long-term batch trial and shows that there is no evidence of acid generation from the coal wash.

The water quality impact assessment for the West Cliff Stage 3 Coal Wash Emplacement (EcoEngineers, 2007) concluded that there was unlikely to be export of significant concentrations of heavy metals or organic compounds from the emplacement area.

### 3.8.3 Beneficial Use of Coal Wash

South32 is committed to supporting the continued supply of coal wash for engineering purposes (e.g. civil construction fill) or for other beneficial uses.

Between June 2014 and June 2018, South32 diverted approximately 2.0 Mt of coal wash away from emplacement to alternate customers.

As well as current shorter-term supply contracts, South32 has commercial arrangements in place for long-term supply of coal wash to Lend Lease for use as construction fill material at the Calderwood Valley residential development. Approximately 0.6 Mt of coal wash material is forecast to be required by Lend Lease in the first two years of the Project. It is anticipated there will be further use of coal wash from the Project at this and other developments during the life of the Project.

The Project would, therefore, involve the road transportation of up to 1.6 Mtpa of coal wash material from the Dendrobium CPP to customers for beneficial use, including in the Wollongong, Shellharbour and/or Wollondilly LGAs.

### 3.8.4 West Cliff Coal Wash Emplacement

The Project would involve the continued use of the West Cliff Stage 3 and Stage 4 Coal Wash Emplacement for the emplacement of coal wash that is not diverted to alternate beneficial uses.

Coal wash from the Dendrobium CPP would be loaded into trucks from the existing coal wash loading bin. The transport of washed coal from the West Cliff Colliery to Port Kembla is currently undertaken by haul trucks operating under Bulli Seam Operations Project Approval 08\_0150, and these trucks would continue to be back-loaded for transporting coal wash from the Dendrobium CPP to the West Cliff Coal Wash Emplacement.

A dedicated truck fleet for the Project may be used in the final years of the Project life if the Bulli Seam Operations does not extend its operations to 2048 following planned cessation in 2041 (Table 3-6). The approved arrangement of the West Cliff Coal Wash Emplacement is shown on Figure 3-11.

It is anticipated there will be approximately 25.2 Mt of capacity remaining in the West Cliff Stage 3 Coal Wash Emplacement at the commencement of the Project.

The West Cliff Stage 4 Coal Wash Emplacement (not yet commenced) has an approved capacity of 26 Mt.

Therefore, the currently approved West Cliff Coal Wash Emplacement has sufficient capacity for the Project, the Approved Mine and the approved Bulli Seam Operations.

If development consent is granted for the Project, the new consent would prevail to the extent of any inconsistency with Development Consent DA 60-03-2001 in relation to development and rehabilitation of the West Cliff Stage 3 Coal Wash Emplacement.

Development and rehabilitation of the West Cliff Stage 4 Coal Wash Emplacement would continue to be conducted in accordance with Project Approval 08\_0150 for the Bulli Seam Operations.

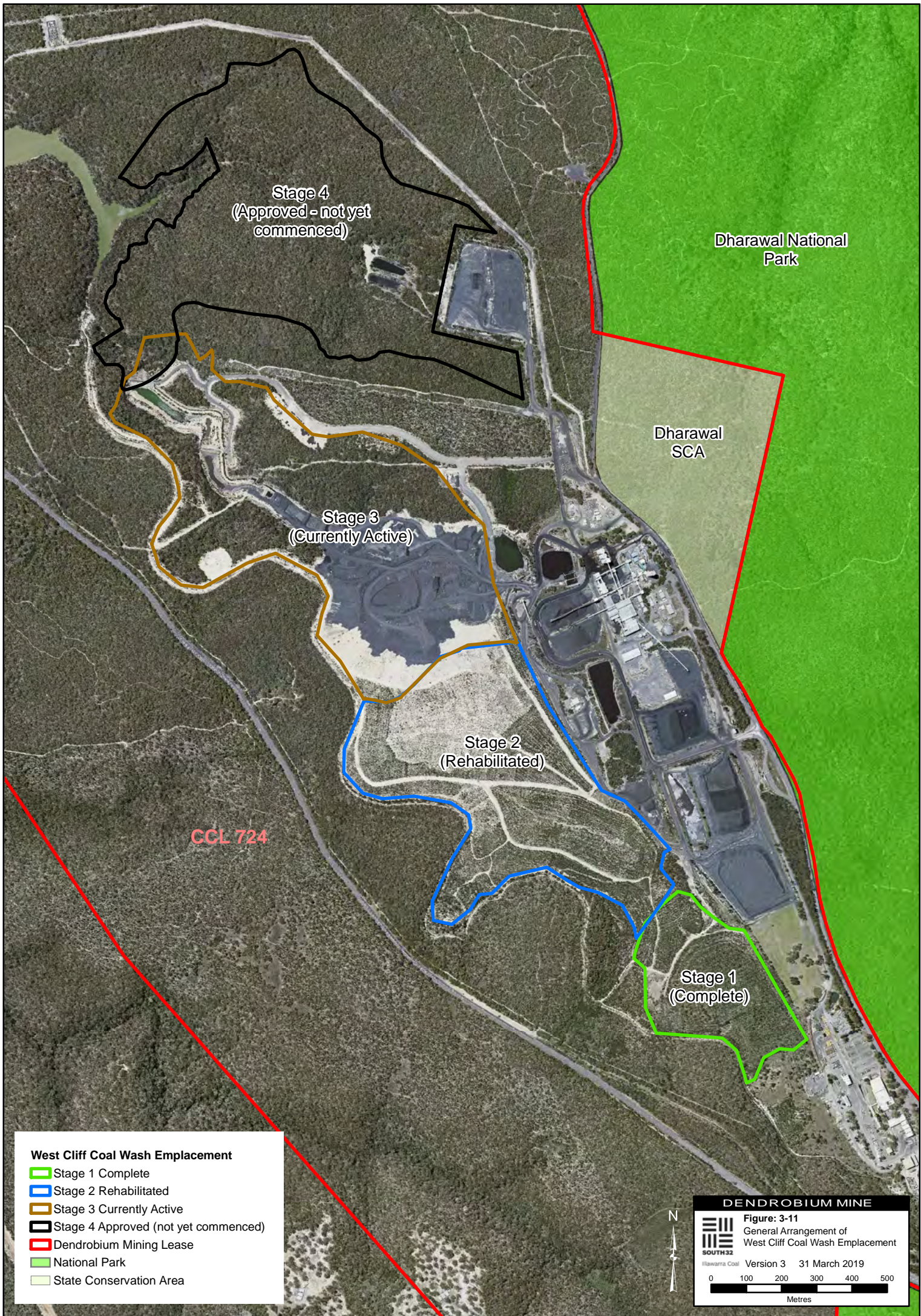
**Table 3-6**  
**Indicative Production Schedule of Coal Wash to be Emplaced at the West Cliff Coal Wash Emplacement**  
**and/or Available to be Supplied for Beneficial Reuse**

Year	Coal Wash Production from Project Processing Activities (Mt)*	Approved Bulli Seam Operations Coal Wash Production (Mt)#	Total Coal Wash Production (Mt)
1	1.3	0.8	2.1
2	1.2	1.2	2.3
3	1.0	1.2	2.2
4	0.9	1.2	2.2
5	0.8	1.2	1.9
6	0.5	1.2	1.8
7	0.8	1.2	2.0
8	0.7	1.3	2.0
9	0.6	1.3	1.9
10	0.6	1.2	1.8
11	0.5	1.3	1.8
12	0.5	1.5	2.0
13	0.5	1.4	1.9
14	0.5	1.4	1.9
15	0.5	1.5	2.0
16	0.5	1.3	1.8
17	0.6	1.4	2.0
18	0.7	0.6	1.2
19	0.6	0.7	1.3
20	0.9	0.6	1.5
21	1.1	0.6	1.7
22	1.1	-	1.1
23	1.0	-	1.0
24	1.2	-	1.2
25	1.2	-	1.2
26	1.5	-	1.5
27	1.6	-	1.6
28	1.6	-	1.6
29	0.1	-	0.1
<b>TOTAL</b>	<b>24.6</b>	<b>24.1</b>	<b>48.6</b>

Note: Totals may not add exactly due to rounding.

\* Includes coal wash generated from processing of ROM coal from the approved Dendrobium Mine (Area 3) mining areas and Project underground mining areas (Areas 5 and 6).

# Approximation based on current mine scheduling. This would continue to occur under Project Approval 08\_0150.



Stage 4  
(Approved - not yet commenced)

Dharawal National Park

Dharawal SCA

Stage 3  
(Currently Active)

Stage 2  
(Rehabilitated)

CCL 724

Stage 1  
(Complete)

- West Cliff Coal Wash Emplacement**
- █ Stage 1 Complete
  - █ Stage 2 Rehabilitated
  - █ Stage 3 Currently Active
  - Stage 4 Approved (not yet commenced)
  - Dendrobium Mining Lease
  - National Park
  - State Conservation Area



**DENDROBIUM MINE**

**Figure: 3-11**  
General Arrangement of  
West Cliff Coal Wash Emplacement

SOUTH32  
Ilwarrara Coal

Version 3    31 March 2019

0    100    200    300    400    500  
Metres

It is intended that development and rehabilitation of the West Cliff Stage 3 Coal Wash Emplacement would continue to be integrated with the management activities at the West Cliff Colliery surface facilities, including continued implementation of the West Cliff Coal Wash Emplacement Area Management Plan.

### 3.9 WATER MANAGEMENT

The Project would involve the use of the existing water management infrastructure with minor augmentations and extensions, including the progressive developments of sumps, pumps, pipelines, water storage and other water management infrastructure.

Underground and surface operations would continue to use a combination of potable and recycled water. Potable water would be supplied by Sydney Water. Recycled water would continue to be sourced from the adjacent underground mine workings.

The Project water management schematic is shown on Figure 3-12.

A description of the water management system for the Project is provided below.

#### 3.9.1 Underground Operations

The underground mining operations for the Project would be supported by water management systems to transfer accumulated water from the underground workings directly into the Nebo workings and/or the Kemira workings, which act as water storage areas for the Dendrobium Mine (HEC, 2019).

Further details on water management systems for the underground mining operations of the Project are provided in Section 3.5.9.

The site water balance demonstrates sufficient water supply is available to meet the demand of the underground operations (HEC, 2019).

#### 3.9.2 Dendrobium Pit Top

The Project would continue to use the existing water management facility at the Dendrobium Pit Top to separate clean, oily and dirty water.

Recycled water from the Nebo workings supplemented by potable water from Sydney Water would continue to be used in the bathhouse and associated office facilities. Effluent from bathhouse and office facilities would be separated into grey water and sewage streams (HEC, 2019). Sewage would be directed to the town sewerage system. Bathhouse grey water along with water from the washdown bay, workshop and sedimentation ponds would be treated at the water treatment facility prior to being injected back into the Nebo workings.

Recycled water, sourced from the Nebo workings, would also be used for:

- dust suppression;
- washdown; and
- general hose-down purposes.

Runoff from the general yard area and portal road would continue to be directed to the sedimentation pond. Water from the sedimentation pond would be pumped to the water treatment facility prior to injection into the Nebo workings. Water from the Nebo workings is dosed with sodium hypochlorite before being recycled for use in the Dendrobium Pit Top or Kemira Valley (HEC, 2019). Runoff from the washdown bay would continue to be directed to the water treatment facility, where it would be processed through an oil water separation unit prior to being injected back into the Nebo workings.

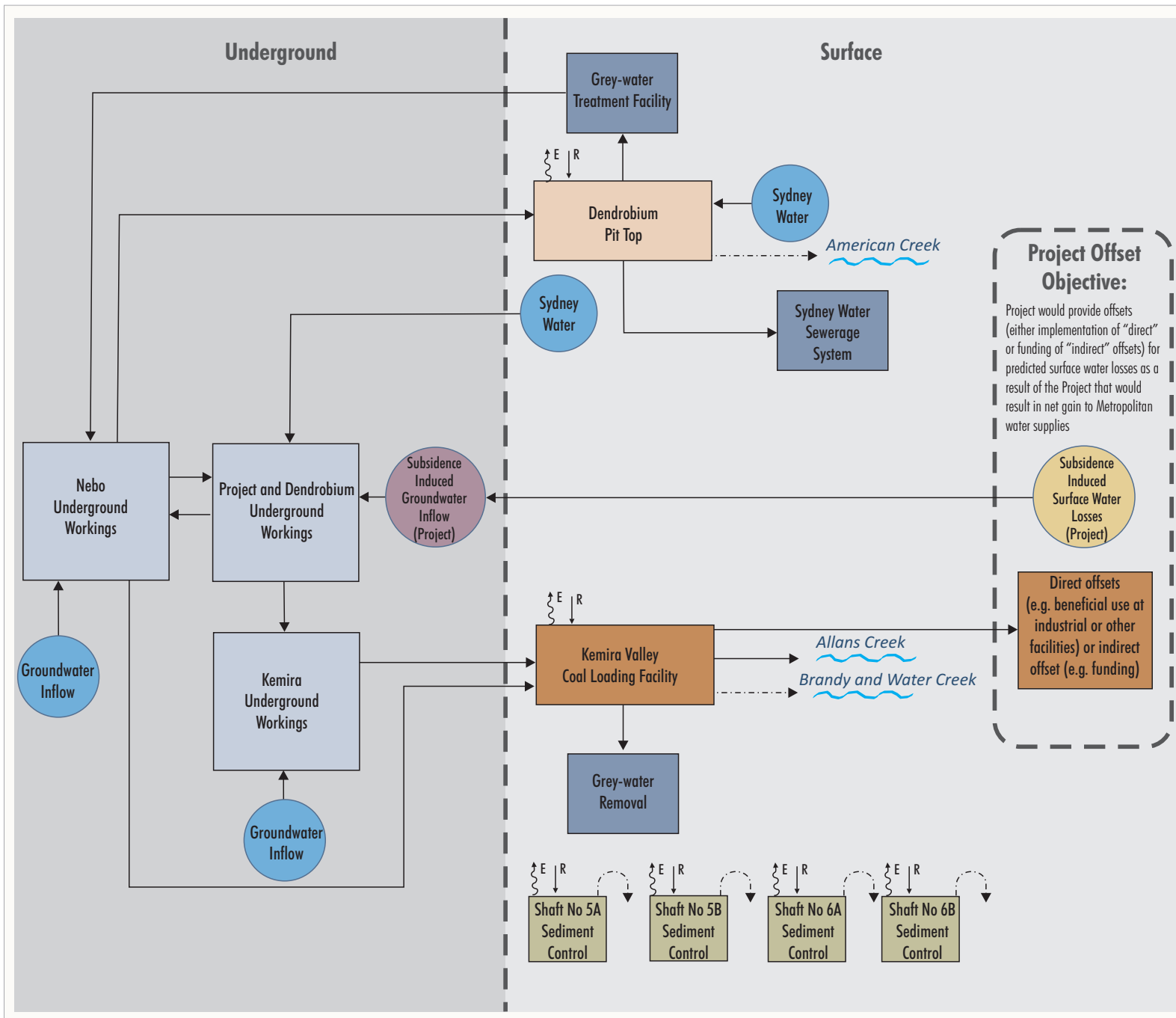
The site water balance identifies sufficient water supply is available to meet the demand at the Dendrobium Pit Top (HEC, 2019). Pumping infrastructure would recycle surplus and effluent flows to the Nebo workings.

#### 3.9.3 Kemira Valley Coal Loading Facility

Kemira Valley Coal Loading Facility would continue to use recycled water, runoff water and stormwater for the Project. Recycled water would be sourced from the Nebo workings and Kemira workings and stored on-site in the break tank.

Recycled water would be used for:

- dust suppression (backup supply);
- general hose-down purposes; and
- amenities (e.g. toilets).



**LEGEND**

- Overflow
- ↓ R Pumped Flow
- ↓ Rainfall/Runoff
- ↑ E Evaporation

**Project Offset Objective:**

Project would provide offsets (either implementation of "direct" or funding of "indirect" offsets) for predicted surface water losses as a result of the Project that would result in net gain to Metropolitan water supplies

Subsidence Induced Surface Water Losses (Project)

Direct offsets (e.g. beneficial use at industrial or other facilities) or indirect offset (e.g. funding)



D E N D R O B I U M M I N E  
Project Water Management Schematic

Figure 3-12

Stormwater would continue to be captured at the Kemira Valley Coal Loading Facility via the on-site sediment ponds and buffer dam. Stormwater would continue to be used as the primary supply for the Kemira Valley Coal Loading Facility dust suppression system and to maintain the water level in the fire tank (HEC, 2019).

Excess mine water that accumulates at the Kemira Valley Coal Loading Facility from the underground mine workings would continue to be discharged via the existing licensed discharge point to Allans Creek (LDP5) under EPL 3241. South32 is investigating options for the beneficial use of excess mine water with major water users in the Illawarra.

The site water balance demonstrates that sufficient water supply is available to meet the demand at the Kemira Valley Coal Loading (HEC, 2019).

Sewage and effluent at the Kemira Valley Coal Loading Facility would continue to be removed by a licensed waste contractor.

#### **3.9.4 Cordeaux Pit Top**

The surface facilities at Cordeaux Pit Top (Figure 3-6) have been designed to prevent dirty water runoff from the site entering WaterNSW land. Runoff from hardstand areas would continue to be directed to a holding dam (HEC, 2019).

Water from the holding dam would continue to be transferred by pump to a settlement dam. The water would then be transferred to underground mine workings via a gravity feed pipeline. This arrangement negates the need for surface discharge (HEC, 2019).

Clean area catchment runoff from the Cordeaux Pit Top (including the sealed employee car parking area) would continue to report to the sand filter lagoon and would leave site via the sand filter underflow discharge point (HEC, 2019).

Any water used at the Cordeaux Pit Top to support underground mining operations would be recycled mine water. This recycled water would primarily be used for dust suppression and for charging of fire lines.

Potable water would continue to be brought to site by road tanker as required (HEC, 2019).

The existing stormwater controls and sewage treatment system (effluent holding tank serviced by road tanker) at Cordeaux Pit Top is adequate for its current use, however, would be upgraded for the Project. New water management infrastructure would also be developed at the Cordeaux Pit Top to accommodate the Project, which would occur within the existing surface lease area and current disturbance footprint. Any such upgrades would be designed to maintain the existing performance measures (i.e. no runoff to WaterNSW land) and would be in accordance with the relevant EPL.

#### **3.9.5 Ventilation Shafts**

The Dendrobium No 1 Shaft site has been revegetated to control runoff and erosion, and runoff flows to the surrounding landscape.

The Dendrobium Nos 2 and 3 Shaft sites have been revegetated to minimise the potential for the release of sediment-laden water to the surrounding landscape.

The Dendrobium Nos 2 and 3 Shaft sites would continue to capture site water runoff in existing sediment ponds.

The additional ventilation shaft sites would be constructed with appropriate erosion and sediment control infrastructure consistent with the design principles of the existing shaft sites.

#### **3.9.6 Dendrobium CPP**

Dendrobium CPP would continue to use recycled water from BlueScope Steel for use in the Dendrobium CPP and potable water purchased from Sydney Water for the administration building and associated amenities (HEC, 2019).

Dendrobium CPP water would be reclaimed from the process through a floor drain into collection pits where pumps would be used to deliver water back to the CPP.

Sewage and effluent would continue to be directed to the site's sewerage system.

### **3.10 INFRASTRUCTURE AND SERVICES**

Existing surface infrastructure and services would continue to be used throughout the Project life, with required upgrades and extensions.

Surface infrastructure and services would continue to operate 24 hours per day, seven days per week.

The Project involves the use of the existing Cordeaux Pit Top, including current mining support activities, with minor upgrades as described in Section 3.4.6. Mining infrastructure at the Cordeaux Pit Top site is currently under care and maintenance.

### 3.10.1 Surface Facilities

The Project would use the existing surface facilities (such as administration buildings, bathhouses, workshops and storage areas) with upgrades and extensions as required (Section 3.4).

An indicative surface mobile equipment fleet, which would be used during periods of typical operations, is provided in Appendix J. Additional surface fleet may be present for short periods, for example during longwall change-outs, scheduled plant shutdowns or other maintenance programs over the life of Project (Section 3.4).

### 3.10.2 Access Roads and Haul Roads

The Project would continue to use existing access roads at the surface facilities at the Dendrobium Pit Top, Kemira Valley Coal Loading Facility, Cordeaux Pit Top, Dendrobium CPP and Dendrobium Nos 1, 2 and 3 Shafts. The Project would also involve an increase in the use of the access road at the Cordeaux Pit Top later in the Project life.

A new access road would be constructed off Cordeaux Road to service the additional car parking area for the Dendrobium Pit Top, with new pedestrian access (e.g. pedestrian road crossing or tunnel constructed under Cordeaux Road). Access roads would also be developed or improved for the new ventilation shafts.

As the underground mining operations progress, additional minor unsealed access roads would be developed, where required, to support surface monitoring, remediation or exploration activities. Wherever practical, existing access roads would be used.

Product coal transportation from the Dendrobium CPP to Port Kembla Steelworks or the Port Kembla Coal Terminal would continue to use existing private internal haul routes.

Coal wash from the Dendrobium CPP would continue to be hauled to the West Cliff Coal Wash Emplacement and to customers for beneficial use in the region via the public road network.

### 3.10.3 Energy and Electricity Supply and Distribution

Energy consumption would be in the form of diesel fuel and electricity.

Diesel fuel demand would be associated with the use of mobile equipment (such as stockpile dozers, men and materials transporters and vehicles servicing the underground mining operations).

The main electricity requirements for the Project would include:

- mine ventilation fans;
- coal conveyance equipment;
- coal cutting equipment;
- compressors;
- bathhouse heating;
- other underground mining operations; and
- coal processing at the Dendrobium CPP.

The Endeavour Energy high voltage distribution network would continue to supply most of the electricity requirements of the Project.

Electricity for the Project underground mining operations would be distributed via the existing substation located adjacent to the Kemira Valley Coal Loading Facility. Electricity would be reticulated to the underground mining operations through cables running along the coal conveyor route.

As the Project progresses, additional powerlines and/or substations (e.g. down-hole electricity supply to advancing longwall operation and surface facilities) and upgrades to existing powerlines would be required, and may be subject to separate approvals through the relevant electricity supply authority.

[This would include electricity for the new ventilation shafts which would be distributed via a new Electricity Transmission Line \(ETL\) and located largely along existing fire trails or easements \(Figure 3-9\).](#)

### 3.10.4 Surface Services

Services such as compressed air, diesel, electricity and water required for the advancing longwall operations or ventilation would be delivered from the surface via the Dendrobium Pit Top, Cordeaux Pit Top, [ventilation shaft sites](#) and service boreholes.

As the mining operations progress, additional service boreholes would be installed, and would be located adjacent to or within ventilation shaft sites, resulting in minimal additional disturbance.

Electricity transmission lines located within the proposed ETL corridor would be located largely along existing fire trails or easements (Figure 3-9).

If required outside of the proposed ventilation shaft site disturbance areas, the installation of service boreholes and other surface infrastructure would be subject to environmental assessment studies.

### 3.10.5 Site Security and Communications

Existing site security measures would be retained for the Project with upgrades as necessary. Additional security fencing for the Project would be erected where necessary (for example at ventilation shaft sites).

The existing communications systems at the surface facilities and underground mining operations would be retained for the Project with augmentations as necessary.

If required outside of the proposed ventilation shaft site disturbance areas, surface works associated with the installation of, or augmentation to, the communication systems would be subject to preparation of supplementary specialist environmental assessment studies. These studies and any associated management measures would be detailed in a Surface Services Management Plan (Section 3.10.4).

### 3.10.6 Water Supply and Use

Underground and surface operations would continue to use a combination of potable and recycled water. Potable water would be supplied by Sydney Water. Recycled water would continue to be sourced from underground workings, including adjacent underground mine workings.

Water supply for ventilation shaft construction would be provided by pipeline which would aim to use existing disturbed corridors where possible (subject to agreement from WaterNSW) and/or water truck. Top up water for the gas plant would be supplied by water truck and/or from the underground fire water system.

Further details on water supply and use for the Project are provided in Section 3.9.

## 3.11 WASTE MANAGEMENT

The Project would generate waste streams of a similar nature to current waste generation at the Dendrobium Mine. Waste sorting would be limited on-site with the majority of recyclable and general waste being recycled or disposed of off-site at an approved waste management facility. The key waste streams for the Project would comprise:

- coal wash (as described in Section 3.8);
- pre-mine/goaf drainage gas (as described in Section 3.5.8);
- general solid waste and recyclables;
- waste oil and grease;
- sewage and effluent; and
- minor quantities of other waste types from mining and workshop activities (e.g. used tyres and oil filters).

South32 would continue to apply general waste minimisation principles (i.e. reduce, re-use and recycling where practicable) to minimise the quantity of wastes that require disposal. The Project would also continue to research and, where it is relevant to do so, develop and implement waste management practices to ensure the disposal waste is minimised.

An overview of the waste types likely to be generated by the Project is presented in Table 3-7.

Further details on the management of general waste and sewage and effluent are provided below.

### 3.11.1 General Waste

General waste produced by the Project at the surface facilities would continue to be deposited into general waste bins. General waste surface bins would be disposed of by a licensed waste contractor. General waste produced at the underground mining areas would continue to be transported from underground general waste bins to an off-site approved waste handling facility for sorting and recycling or disposal.

### 3.11.2 Sewage and Effluent

Sewage produced at the Dendrobium Pit Top and sewage and effluent produced at the Dendrobium CPP would continue to be plumbed into the town sewerage system.

**Table 3-7  
Waste Streams Likely to be Generated by the Project**

Waste Stream	Indicative Waste Class <sup>1</sup>	Management Method
Coal wash	General Solid Waste (non-putrescible)	Refer to Section 3.8.
Timber, cardboard, paper, steel, scrap metal, commingle, food waste, etc.	General Solid Waste (non-putrescible and putrescible)	Transported to an approved waste handling facility and recycled or disposed as required.
Used oil filters	General Solid Waste (non-putrescible)	Temporarily stored on-site in designated bins prior to removal from site by an appropriately licensed waste contractor.
Used particulate filters		
Other workshop wastes (e.g. rags and oil-absorbent materials that only contain non-volatile hydrocarbons and do not contain free liquids)		
Tyres	Special	Used tyres would be segregated and collected for either repairs (if possible) or disposal by a licensed waste contractor.
Bathroom water	Liquid	On-site treatment at Dendrobium Pit Top water treatment facility and reuse as recycled water.
Sewage effluent	Liquid	Refer to Section 3.11.2.
Waste oil and grease	Liquid	Used containers would be drained into bulk containers and temporarily stored prior to collection by a licensed contractor for processing off-site.
Waste water from ventilation shaft construction, compressor plant and gas plant	Liquid	Temporarily contained on-site, and then either pumped underground and treated, or trucked off-site for treatment and disposal by an appropriately licensed waste contractor.
Hazardous waste (e.g. explosives, lead-acid or nickel-cadmium batteries and containers that have not been cleaned containing residue of dangerous goods)	Hazardous	Temporarily stored on-site in a designated area prior to removal from the site by licensed contractors.
Contaminated waste or asbestos (if identified)	-	Further assessment and advice would be sought regarding waste classification, handling, treatment, disposal and reporting requirements prior to appropriate disposal.

<sup>1</sup> Described or pre-classified waste in *Waste Classification Guidelines Part 1: Classifying Waste* (EPA, 2014).

Wastewater from bathhouses at the Dendrobium Pit Top would be treated at the on-site water treatment facility. Treated bathroom water from the Dendrobium Pit Top would be recycled on-site.

Sewage and effluent at the Kemira Valley Coal Loading Facility would continue to be removed by a licensed waste contractor.

Sewage and effluent at the Cordeaux Pit Top would continue to be held in the sewage holding tank and removed by a licensed waste contractor.

### 3.12 MANAGEMENT OF DANGEROUS GOODS

The transportation, handling and storage of all dangerous goods for the Project would be conducted in accordance with the requirements of the NSW *Work Health and Safety Regulation, 2017*.

The dangerous goods stored for the Project would include compressed gases, flammable and combustible liquids, and corrosive substances.

Based on the quantities proposed to be stored for the Project, it is not anticipated that a Dangerous Goods Licence would be required.

### 3.12.1 Transport

Dangerous goods required for the Project would be transported in accordance with the appropriate State legislation.

### 3.12.2 Hydrocarbon Storage

#### ***Dendrobium Pit Top***

There are three existing hydrocarbon bunded areas that would continue to be used for the Project.

Existing procedures to maintain safe working conditions of the bunded areas, including regular inspections, would continue to be employed for the Project.

The Dendrobium Pit Top has two bulk chemical storage containers within the bunded areas, one for hydraulic oil storage (approximately 16,000 L oil storage capacity) and one for diesel storage, that would be utilised by the Project. Hydrocarbon storages would be operated in accordance with the requirements of AS 1940 *The Storage and Handling of Flammable and Combustible Liquid*. Hydrocarbons would be delivered to site by tanker.

In addition to the above permanent bunded areas, portable bunds would continue to be used for transient storage or for transportation of oils and fuels around the site.

Where there is a high potential for hydrocarbon spillage, spill kits and/or bins containing oil absorbent material would be present. Surface personnel would be made aware of the locations of these spill kits and absorbent material bins in their work area. The contents of the spill kits and the oil absorbent material bins would continue to be inspected on a regular basis.

#### ***Dendrobium CPP***

There are two existing hydrocarbon bunded areas at the Dendrobium CPP that would continue to be used for the Project, including a Methyl iso-Butyl Carbinol storage tank and a diesel storage tank. A small grease and oil storage area is maintained within the main Dendrobium CPP building.

#### ***Cordeaux Pit Top***

The existing underground bulk diesel storage tank at the Cordeaux Pit Top (approximately 42,000 L holding capacity) would continue to be used for the Project. The storage tank would be managed in accordance with the *Protection of the Environment Operations (Underground Petroleum Storage Systems) Regulation, 2014* (or equivalent).

#### ***Other Surface Facilities***

Any storage of hydrocarbons at other surface facilities would use self-contained and bunded vessels.

### 3.12.3 Explosives Storage

The existing explosives storage facilities at the Dendrobium Pit Top and Cordeaux Pit Top would be maintained on-site in the event the underground operations or an emergency require the use of explosives.

The storage of explosives would be conducted in accordance with the NSW *Explosives Act, 2003* and *Explosives Regulation, 2013*.

Explosives would be stored on-site in limited quantities and within the Licence to Store Explosives currently in place at the Dendrobium Pit Top.

A Licence to Store Explosives at the Cordeaux Pit Top would be sought as part of the Project, if required for future Project activities.

### 3.12.4 Other Substances

The management and storage of chemicals for the Project would be conducted in accordance with South32's prescribed management procedures, and Australian Standards and Codes.

South32 would continue to assess new substances before their use on-site by completing a substance evaluation and risk assessment. Safety Data Sheets (SDSs) and substance evaluations would be available to site personnel.

## 3.13 REHABILITATION AND REMEDIATION ACTIVITIES

The Project includes ongoing rehabilitation and remediation activities and rehabilitation at mine closure.

### **3.13.1 Subsidence Monitoring and Remediation**

Collection of environmental baseline data and monitoring of subsidence effects, subsidence impacts and associated environmental consequences would occur throughout the life of the Project.

Remediation and rehabilitation of subsidence impacts and associated environmental consequences would occur in accordance with approved Extraction Plans and in consultation with DPE and WaterNSW.

Subsidence monitoring is described in Section 6 and subsidence remediation methodologies are described in Section 7.

### **3.13.2 Decommissioning and Rehabilitation of Surface Facilities**

Surface facilities used for the Project would be decommissioned when they are no longer required or at the end of the mine life where no further ongoing beneficial use is identified.

At closure, works would include the decommissioning and removal of infrastructure, the sealing of mine entrances and land rehabilitation.

Further details of the Project rehabilitation and mine closure activities are provided in Section 7.

### **3.13.3 Coal Wash Emplacement Rehabilitation**

It is intended that development and rehabilitation of the West Cliff Stage 3 Coal Wash Emplacement would continue to be integrated with the management activities at the West Cliff CPP surface facilities, including continued implementation of the West Cliff Coal Wash Emplacement Area Management Plan.

Progressive rehabilitation of completed sections of the Coal Wash Emplacement would be ongoing. The active emplacement area is kept to a practicable minimum, and as each section of fill reaches the designed height and landform, topsoil is applied and revegetation works are implemented.

Further details of the rehabilitation of the West Cliff Stage 3 Coal Wash Emplacement are provided in Section 7.

## **3.14 WORKFORCE**

### **3.14.1 Construction and Development**

Additional personnel would be required for construction and development activities throughout the life of the Project (Section 3.4):

- Development of underground roadways to access Project underground mining areas.
- Development of coal clearance infrastructure and other ancillary infrastructure required to support Project underground mining areas.
- Construction and development of ventilation shafts and associated infrastructure.
- Upgrades to the Dendrobium Pit Top.
- Upgrades to the Cordeaux Pit Top (later in the Project life).

It is estimated that the Project construction and development workforce would peak in 2020.

Additional short-term contractors would also be required during the operational life of the Project; for example, at the Dendrobium Pit Top or Cordeaux Pit Top during longwall change-outs, and at the Dendrobium CPP during shutdown activities.

Construction would generally occur 7.00 am to 5.00 pm Monday to Sunday. Some construction and development works (e.g. drilling and construction of ventilation shafts, and underground development activities) would occur on a 24 hour per day basis.

### **3.14.2 Operations**

The existing operations at the Dendrobium Mine have a combined operational workforce of approximately 400 people (including South32 staff and on-site contractor personnel).

It is anticipated that the operational workforce would be augmented during the Project to accommodate additional development units and additional gas management works. At full development, the Project would employ in the order of 500 operational personnel. This would continue to include a mixture of South32 staff and on-site contractor personnel. Contractor numbers would vary based on operational requirements and/or to address short-term staffing constraints.

Operations would continue to occur 24 hours per day, seven days per week. The current shift arrangements at the Dendrobium Mine are:

- Administration personnel – 8.00 am to 5.00 pm weekdays.
- Operations day shift personnel – 6.00 am to 4.00 pm Monday to Thursday, 6.00 am to 6.00 pm Friday to Sunday.
- Operations afternoon shift personnel – 2.00 pm to 12.00 am Monday to Thursday.
- Operations night shift personnel – 10.00 pm to 8.00 am Monday to Thursday, 8.00 pm to 8.00 am Friday to Sunday.
- Dendrobium CPP day shift personnel – 7.00 am to 7.00 pm Monday to Sunday.
- Dendrobium CPP night shift personnel – 7.00 pm to 7.00 am Monday to Sunday.

The current shift arrangements at the Dendrobium Mine would generally be retained. During the life of the Project alternative shift configurations may be required to meet operational and industry best practice requirements, or to minimise interaction with non-mine peak hour traffic.

The operational workforce would continue to predominantly reside locally (e.g. within the Wollongong, Shellharbour and Wollondilly local government areas).

Later in the Project life, there would be the option for the majority of personnel and materials access to relocate from the Dendrobium Pit Top to the Cordeaux Pit Top (Section 3.4).

### **3.15 INTERACTION WITH DEVELOPMENT CONSENT DA 60-03-2001**

The Project does not include approved underground mining operations in the Wongawilli Seam in Areas 1, 2, 3A, 3B and 3C at the Dendrobium Mine and associated surface activities (such as monitoring and remediation). These activities will continue to operate in accordance with Development Consent DA 60-03-2001 (as modified).

During the life of the Project it is proposed that the extraction of Project Areas 5 and 6 would be integrated with the extraction of approved Dendrobium Mine Areas 3B and 3C (Section 3.5). The extraction of Area 3C between mining of Areas 5 and 6 would occur after the current approved duration of Dendrobium Mine operational activities (2030). The necessary extension to the operational life of Dendrobium Mine under Development Consent DA 60-03-2001 would be subject to a separate application and approval.

If development consent is granted for the Project, surface facilities and underground roadways used by the Project would be operated in accordance with only the conditions of the Development Consent for the Project rather than Development Consent DA 60-03-2001. This would relate to:

- use of existing roadways and drifts for personnel and materials access, ventilation, dewatering and other ancillary activities related to Areas 5 and 6;
- use of the existing Dendrobium Pit Top, Kemira Valley Coal Loading Facility, Dendrobium CPP and Dendrobium Shafts, including the integrated water management system;
- transport of sized ROM coal from the Kemira Valley Coal Loading Facility to the Dendrobium CPP via the Kemira Valley Rail Line;
- delivery of product coal from the Dendrobium CPP to the Port Kembla Steelworks or Port Kembla Coal Terminal for transport to Liberty Primary Steel Whyalla Steelworks or export;
- transport of coal wash by road to customers for engineering purposes (e.g. civil construction fill), for other beneficial uses and/or for emplacement at the West Cliff Colliery Stage 3 and Stage 4 Coal Wash Emplacement; and
- development and rehabilitation of the West Cliff Stage 3 Coal Wash Emplacement.

---

<sup>1</sup> **Competent Person Statement:**

The information in this report that relates to estimates of Coal Resources for Illawarra Metallurgical Coal is presented on a 100% basis and represents an estimate as at 30 June 2018. It is based on information compiled by J Gale a full time employee of South32. J Gale is a member of the Australasian Institute of Mining and Metallurgy. The Competent Person has sufficient experience relevant to the style of mineralisation and type of deposit under consideration and to the activities being undertaken to qualify as a Competent Person as defined in the 2012 Edition of the 'Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves'. The Competent Person consents to the inclusion in this report of the matters based on their information in the form and context in which it appears.

ATTACHMENT 2  
SUPPLEMENTARY BIODIVERSITY ASSESSMENT  
REPORT (NICHE, 2020)

---

## **Dendrobium Mine – Plan for the Future: Coal for Steelmaking Supplementary Biodiversity Assessment Report**

Prepared for Illawarra Coal Holdings Pty Ltd (Illawarra Coal) – South32 Limited | 3 July 2020



## Document control

Project number	Client	Project manager	LGA
3365	Illawarra Coal Holdings Pty Ltd (Illawarra Coal) – South32 Limited	Simon Tweed/Luke Baker	Wollongong City Council, Wingecarribee Shire Council, Wollondilly Shire Council

Version	Author	Review	Status	Comments	Date
D1	Simon Tweed & Luke Baker		Draft 1		23 June 2020
Final	Simon Tweed & Luke Baker		Final		03 July 2020

© Niche Environment and Heritage Pty Ltd (ACN 137 111 721) 2019

Copyright protects this publication. All rights reserved. Except for purposes permitted by the Australian *Copyright Act 1968*, reproduction, adaptation, electronic storage, transmission and communication to the public by any means is prohibited without our prior written permission. Any third party material, including images, contained in this publication remains the property of the specified copyright owner unless otherwise indicated, and is used subject to their licensing conditions.

### Important information about your Report

**Your Report has been written for a specific purpose:** The Report has been developed for a specific purpose as agreed by us with you and applies only for that purpose. Unless otherwise stated in the Report, this Report cannot be applied or used when the nature of the specific purpose changes from that agreed. **Report for the sole benefit of Niche's client:** This Report has been prepared by Niche for you, as Niche's client, in accordance with our agreed purpose, scope, schedule and budget. This Report should not be applied for any purpose other than that stated in the Report. Unless otherwise agreed in writing between us, the Report has been prepared for your benefit and no other party. Other parties should not and cannot rely upon the Report or the accuracy or completeness of any recommendation. **Limitations of the Report:** The work was conducted, and the Report has been prepared, in response to an agreed purpose and scope, within respective time and budget constraints, and possibly in reliance on certain data and information made available to Niche. The analyses, assessments, opinions, recommendations, and conclusions presented in this Report are based on that purpose and scope, requirements, data, or information, and they could change if such requirements or data are inaccurate or incomplete. **No responsibility to others:** Niche assumes no responsibility and will not be liable to any other person or organisation for, or in relation to, any matter dealt with, or conclusions expressed in the Report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with, or conclusions expressed in the Report.

Niche Environment and Heritage Pty Ltd (ACN 137 111 721)  
Enquiries should be addressed to Niche Environment and Heritage  
PO Box 2443, Parramatta NSW 1750, Australia  
Email: info@niche-eh.com

## Glossary and list of abbreviations

Term or abbreviation	Definition
BARBOS	Biodiversity Assessment Report and Biodiversity Offset Strategy (Niche 2018)
BC Act	Biodiversity Conservation Act 2016
BCD	Biodiversity Conservation Division
DAWE	Commonwealth Department of Agriculture, Water and the Environment
DPIE	NSW Department of Planning, Industry and Environment
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
FL	Total Fallen Logs
NSR	Native species richness
NOS	Native overstorey cover
NMS	Native midstorey cover
NGCG	Native ground cover (grasses)
NGCS	Native ground cover (shrubs)
NGCO	Native ground cover (other)
NTH	No. Trees with Hollows
OR	Overstorey Regeneration
PCT	Plant Community Type
RTS	Response to Submissions
TEC	Threatened Ecological Community

## Table of Contents

---

<b>Glossary and list of abbreviations .....</b>	<b>i</b>
<b>1. Introduction .....</b>	<b>1</b>
1.1 Background .....	1
1.2 Refinement of Development Footprint .....	2
<b>2. Assessing Native Vegetation and Threatened Flora .....</b>	<b>4</b>
2.1 Overview .....	4
2.2 Vegetation mapping .....	4
2.3 Threatened Flora .....	7
<b>3. Assessing Threatened Fauna and Populations .....</b>	<b>8</b>
3.1 Overview .....	8
3.2 Threatened Fauna Survey .....	8
3.3 Fauna Survey Methods .....	8
3.4 Fauna Survey Results .....	12
<b>4. Update to Biodiversity Offset Requirement .....</b>	<b>14</b>
4.1 Introduction .....	14
4.2 Quantifying Offset Impacts – Vegetation Impacts .....	14
4.3 Quantifying Offset Impacts – Threatened Flora Impacts .....	14
4.4 Quantifying Offset Impacts – Threatened Fauna Impacts .....	14
<b>5. References .....</b>	<b>16</b>
<b>Figures .....</b>	<b>17</b>
<b>Annexure 1. Vegetation Plot and Transect Results .....</b>	<b>39</b>
<b>Annexure 2. Fauna Species List .....</b>	<b>47</b>
<b>Annexure 3. Response Table – Relevant BCD Comments .....</b>	<b>48</b>

## List of Figures

Figure 1. Disturbance Areas (West).....	17
Figure 2. Disturbance Areas (East) .....	17
Figure 3. Vegetation Mapping and Flora Plots (West) .....	17
Figure 4. Vegetation Mapping and Flora Plots (East) .....	17
Figure 5. Flora and Fauna Targeted Survey Methods (West).....	17
Figure 6. Flora and Fauna Targeted Survey Methods (East) .....	17
Figure 7. Dendrobium Pit Top Car Park .....	17
Figure 8. Results – Threatened Species (West) .....	17
Figure 9. Results – Threatened Species (East).....	17
Figure 10. Results – Tree Hollow Mapping (West) .....	17
Figure 11. Results – Tree Hollow Mapping (East).....	17
Figure 12. Koala Species Polygon (West).....	17
Figure 13. Koala Species Polygon (East) .....	17
Figure 14. Eastern Pygmy Possum Species Polygon (West) .....	17
Figure 15. Eastern Pygmy Possum Species Polygon (East).....	17
Figure 16. Rosenbergs Goanna Species Polygon (West) .....	17
Figure 17. Rosenbergs Goanna Species Polygon (East).....	17

## List of Tables

Table 1. Summary Table of Refined Footprint.....	3
Table 2. Direct Vegetation Disturbance Associated with Proposed Transmission line.....	5
Table 3. Vegetation disturbance at the Ventilation Shaft Sites .....	6
Table 4. Summary of direct impacts associated with surface infrastructure.....	6
Table 5: Target species for fauna survey.....	8
Table 6. Summary of survey effort.....	9
Table 7. Results of threatened species survey and species polygons .....	13
Table 8. Ecosystem Credits Required for the Project.....	15
Table 9. Threatened fauna species credits.....	15
Table 10. Plots Completed within the Transmission Line Easement.....	39
Table 11. BioBanking Transect Results.....	39
Table 12. Flora Results.....	40
Table 13. Fauna Species List .....	47

## 1. Introduction

---

### 1.1 Background

The development application for the Dendrobium Mine Extension Project (the Project) is currently being assessed by the NSW Department of Planning, Industry and Environment (DPIE). In March 2020 the South East Branch of the Biodiversity and Conservation Division (BCD) reviewed a Response to Submissions (RTS) prepared by Illawarra Coal Holdings Pty Ltd (Illawarra Coal) – South32 Limited. A number of outstanding issues were raised within the BCD review (Attachment A - Dendrobium mine extension Response to Submissions - Key Issues from EES submission 20 Sept 2019), regarding biodiversity impacts that required additional assessment or clarification.

This supplementary report seeks to address a number of aspects raised by BCD within their review (March 2020) pertaining to ecological survey effort, impact assessment and offsetting considerations.

In response to BCD's comments regarding 'fixing' the locations of infrastructure for which a disturbance allowance was proposed in the Environmental Impact Statement (EIS), the report assesses the confirmed locations of the proposed electricity transmission line (ETL) and service boreholes. This has resulted in a refinement of disturbance for the Project, however there is no increase in the total surface disturbance. The refinement has resulted in a reduction in disturbance of Shale Sandstone Transition Forest Threatened Ecological Community (TEC) (from 1.5 hectares [ha] to 0.55 ha).

In addition, the report details additional surveys performed within proposed ventilation shaft sites and along the proposed ETL (that would service those ventilation shaft sites) that address BCD comments relating to survey effort and assessment in regard to several target fauna species (Powerful Owl, Koala and Eastern Pygmy Possum).

This report updates the biodiversity offset liability associated with the additional biodiversity surveys and confirmed locations of some surface infrastructure, namely:

- An update of the biodiversity offset liability for native vegetation associated with the ETL design and ventilation shaft layout.
- An update of the biodiversity offset, incorporating results from additional survey effort, associated with threatened flora and fauna.

The report also provides a detailed response to the BCD comments.

## 1.2 Refinement of Development Footprint

### 1.2.1 Ventilation Shaft Site Design Refinement

The ventilation shaft site layout and infrastructure were described in the Section 3.4.3 of the EIS as below:

*The Project would involve the development of the following ventilation infrastructure (Figure 3-3):*

- *an additional ventilation shaft site to support Area 5 (Site No 5A) (maximum disturbance of approximately 7.5 ha);*
- *an optional additional ventilation shaft site to support Area 5 (Site No 5B) (maximum disturbance of approximately 3 ha); and*
- *two additional ventilation shaft sites to support Area 6 (Site No 6A and Site No 6B) (maximum disturbance of approximately 4 ha each).*

Since that time, the concept design for Ventilation Shaft Site 5A has been further developed by South32 (Figure 1). Ventilation Shaft Site 5A is scheduled for construction to commence in 2021 and the proposed disturbance area has been increased to approximately 15 ha in order to optimise the site to efficiently and effectively service the Area 5 mining activities. The main design features that require the additional footprint on this site include:

1. The requirement for both an upcast and downcast shaft co-located at the site, and to be constructed simultaneously, and corresponding spoil emplacement for two shafts.
2. The co-location of service boreholes at the site, to provide electricity, mine water (for gas drainage plant and firefighting), compressed air, communications, gas drainage (x 2), tube bundle (on line gas monitoring), rather than being dispersed across the landscape as allowed for in the EIS.
3. The co-location of the gas management infrastructure (including flares, pumps, nitrogen tanks, gas monitoring, water collection, surface pipes and other ancillary infrastructure).
4. Larger sediment basin sized for the increased footprint to capture the recommended design rainfall event outlined in the “Blue Book” (Landcom, 2004).

The design refinement and optimisation of Ventilation Shaft Site 5A has the following environmental benefits:

1. The co-location of service boreholes reduces fragmentation of the landscape that would otherwise be required if service boreholes were dispersed. A total of 5 ha of native vegetation clearing was assessed in the EIS and that disturbance will now be fixed at Site 5A.
2. The co-location of service boreholes avoids the requirement to clear up to approximately 1 ha of the Shale Sandstone Transition Forest TEC that was allowed for in the EIS.
3. The co-location of both upcast and downcast shafts reduces the vegetation clearing required at Ventilation Shaft Site 5B, which was assessed as requiring 3 ha of clearing in the EIS. Ventilation Shaft Site 5B is not proposed to require more than 0.5 ha of vegetation clearing, as the major ventilation infrastructure to support Area 5 will be located at Ventilation Shaft Site 5A.

Compared to the EIS proposal, the design refinements would result in the same total area of vegetation disturbance (i.e. 28.5 ha) with reduced fragmentation and reduced impact on the Shale Sandstone Transition Forest TEC.

### 1.2.2 Electricity Transmission Line Design Refinement

The ETL was described in the EIS and an allowance of up to 4.5 ha of native vegetation clearing was assessed, including allowance for 0.5 ha of Shale Sandstone Transition Forest TEC. Since lodgement of the Project EIS the concept design alignment has been confirmed by South32 (refer Figure 1 and Figure 2). The ETL is required to service proposed ventilation shafts and underground infrastructure as outlined in the EIS and construction of the ETL would be staged accordingly with indicative timing of ETL sections as follows:

1. Connection point to Ventilation Shaft Site 5A – Construction commencing in 2021 (to service mining in Area 5).
2. Ventilation Shaft Site 5A to Ventilation Shaft Site 5B – approximately 2030, if required.
3. Fire Trail 6 to Ventilation Shaft Site 6B – approximately 2042 (to service mining in Area 6).

The ETL concept design originates at a connection point from an existing Endeavour Energy transmission line located approximately 200 m north west of the Cordeaux Dam Wall. (Figure 2). This connection point is being designed in consultation with Endeavour Energy.

The ETL to Ventilation Shaft Site 5A has been designed to avoid clearing where practical by utilising existing road verges and fire breaks along Fire Trail 6. An easement width of 18 metres (m) (9 m either side of the power pole) is assumed, consistent with design advice from Endeavour Energy. Power pole foundations (spaced approximately every 100 m or closer on curved sections) are proposed to be bored and concreted to a diameter of approximately 1 m. Much of the route is within road verge/fire break that is routinely slashed by WaterNSW.

The future extension of the ETL to Ventilation Shaft Site 5B would seek to avoid clearing by utilising road verges and fire breaks along Fire Trail 6B (Figure 1).

Note that the ETL design for the section from Fire Trail 6 to Ventilation Shaft Site 6B is proposed to be trenched and cabled underground within the 330 kV Transgrid easement south of the creek. This is to avoid vegetation clearing (Figure 2).

### 1.2.3 Summary of Biodiversity Impacts in BARBOS compared to Refined Footprint

As shown in Table 1, the total area of direct clearing to native vegetation is 28.5 ha. The total calculated impact area from surface infrastructure as described in the Niche (2019) *Biodiversity Assessment Report and Biodiversity Offset Strategy* (BARBOS) has not changed as a result of the refined development footprint.

**Table 1. Summary Table of Refined Footprint**

Site	Area of Native Vegetation Impacted (ha) as per BARBOS	Proposed Vegetation Impacts (ha)
Ventilation Site No 5A (now includes service boreholes)	7.5	15.0 (now includes service boreholes)
Ventilation Site No 5B	3.0	0.5
Ventilation Site No 6A	4.3	4.3
Ventilation Site No 6B	4.0	4.0
Pit Top Carpark	0.2	0.2
Additional Service Boreholes (EIS did not propose a fixed location)	5	0 (included in Site No 5A)
Electricity Transmission Lines (to Ventilation Shaft Sites) (EIS did not propose a fixed location)	4.5	4.5 (‘fixed’ location)
<b>Total</b>	<b>28.5</b>	<b>28.5</b>

## 2. Assessing Native Vegetation and Threatened Flora

---

### 2.1 Overview

This section details the survey methods and effort used to map vegetation and detect threatened flora within selected parts of the study area in response to submissions, or updates to the location and nature of ancillary infrastructure. The original ecological surveys performed for the Project are described and documented within the BARBOS (Niche 2019).

### 2.2 Vegetation mapping

The methodology associated with the vegetation mapping for the Project has been described in the BARBOS (Niche 2019). This report also provides mapping for the proposed transmission line easement and associated biodiversity credits. Field verification therefore focused on the following key areas:

- Vegetation mapping and impact assessment of the proposed transmission line easement.
- Updates to the vegetation impacts associated with other surface infrastructure (i.e. the ventilation shaft sites).

#### 2.2.1 Vegetation mapping within the transmission line easement

To determine the extent and type of native vegetation within the proposed transmission line easement, South32 provided Niche with the proposed alignment boundary as a spatial file, which was imported into ArcGIS. A preliminary desktop vegetation map was then completed by analysing the shapefile at a scale of approximately 1:300 against aerial imagery. Polygons representing areas of remnant vegetation and areas of regenerating vegetation (native vegetation that is maintained along the Fire Road easement) were assigned based on the aerial interpretation and analysis process.

The field team (which included a BAM Accredited Assessor) validated the preliminary vegetation mapping, recorded fauna habitat (e.g. hollow-bearing trees) and searched for threatened flora within the transmission line alignment over the course of 7 field days, specifically:

- 13-15<sup>th</sup> of May 2020.
- 19<sup>th</sup> of May 2020.
- 21<sup>st</sup> May 2020.
- 29<sup>th</sup> June and 1<sup>st</sup> July 2020.

The field survey involved the completion of 12 BioBanking plots/transects amongst appropriate vegetation zones impacted by proposed transmission line easement as per the requirements of the FBA for each vegetation zone. The number of plots completed within each zone along with the raw flora data has been provided in Annexure 1.

The field analysis confirmed the presence of three Plant Community Types (PCTs) along the alignment, which are comprised of two condition classes:

- Good: vegetation that was in benchmark condition.
- Regeneration: areas of vegetation along the existing fire road/trail easements that are slashed on a regular basis.

The area of proposed disturbance associated with each of the PCTs and condition classes is provided in Table 2, and the location is shown on Figure 3 and Figure 4.

The total area of confirmed native vegetation disturbance for the proposed transmission line is approximately 4.5 ha (Table 2) which is consistent with the 4.5 ha allowance assumed to be directly impacted in the Project BARBOS.

The area of direct impact associated with the transmission line would encompass:

- A total of approximately 250 poles to be installed directly into the ground. The installation would be done via machine auger, and require an area of approximately 2 x 2 m for the installation process. Power pole foundations are proposed to be bored and concreted to a diameter of approximately 1 m. The actual disturbance areas would be the width of the pole (approximately 1 m<sup>2</sup>), however to provide a conservative impact area, we have assumed a total of 0.2 ha of impact as shown in Table 2 to account for the installation of the poles.
- Clearing of remnant vegetation (canopy, mid canopy and shrubs) to create a 18 m wide easement along the transmission line traverse.

We have assumed that the easement required for the proposed transmission line would not require the clearing of the maintained/regenerating vegetation that is currently within the Fire Road easement. The vegetation that exists along the Fire Road easement is maintained at a low height (typically below 0.5 m) by WaterNSW to act as a fire break. This maintenance regime will therefore continue, and thus not result in direct clearing.

**Table 2. Direct Vegetation Disturbance Associated with Proposed Transmission Line**

Plant Community Type (PCT)	Condition	Area of impact (ha) for the transmission line easement	Area of impact for the installation of power poles	Total (ha)
1083 Red Bloodwood - scribbly gum heathy woodland on sandstone plateaux, Sydney Basin Bioregion (HN566)	Moderate/Good	3.00	0.00	3.10
	Regeneration	0.00	0.10	
1395 Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion (HN556)	Moderate/Good	0.45	0.00	0.55
	Regeneration	0.00	0.10	
1250 Sydney Peppermint - Smooth-barked Apple - Red Bloodwood shrubby open forest on slopes of moist sandstone gullies, eastern Sydney Basin Bioregion (HN651)	Moderate/Good	0.85	0.00	0.85
<b>Total</b>		<b>4.3</b>	<b>0.2</b>	<b>4.5</b>

*NB: The 'Regeneration' condition class in the table above is represented as Moderate/Good\_High within the Biobanking Calculator and relevant exports due to limitations within the calculator regarding condition labels. This also applies to the remainder of this report.*

### 2.2.2 Vegetation mapping within the Ventilation Shafts

Vegetation mapping of the ventilation shaft sites was completed during the Project BARBOS. As detailed in Table 7 of the BARBOS, a larger area than was required for disturbance was surveyed for each ventilation shaft site to allow for flexibility during the refinement of the ventilation shaft site layouts (Figure 5 and Figure 6). An update of the vegetation mapping therefore was not required as part of this supplementary report as the revised shaft site layouts remain within the originally surveyed areas.

Since the BARBOS was submitted, a refined footprint for Ventilation Shaft Site 5A was provided to Niche (as shown in Figure 1 and Figure 3) which also incorporates service borehole sites. The amount of required clearing within the remaining ventilation shaft sites was also revised, however the exact location of clearing within these sites has yet to be determined. For the purposes of conservatively calculating clearing impacts in vent shaft sites other than Ventilation Shaft Site 5A, all clearing is assumed to be in the good condition vegetation zone. Therefore any change to the location of disturbance within the surveyed areas for the other ventilation shaft sites would not result in a change in the associated offset requirement.

The area of vegetation to be directly impacted by the ventilation shaft sites has been shown in Figure 3 and Figure 4, and includes the areas detailed in Table 3.

**Table 3. Vegetation disturbance at the Ventilation Shaft Sites**

Plant Community Type (PCT)	Condition	Ventilation Shaft Site No				Total (ha)
		5A	5B	6A	6B	
1083 Red Bloodwood - scribbly gum heathy woodland on sandstone plateaux, Sydney Basin Bioregion (HN566)	Moderate/Good	13.95	0.5	4.3	4.0	23.8
	Regeneration	1.05	0.0	0.0	0.0	
<b>Total</b>		<b>15.0</b>	<b>0.5</b>	<b>4.3</b>	<b>4.0</b>	<b>23.8</b>

### 2.2.3 Vegetation mapping within Pit-top Carpark

There is no change from that assessed in the BARBOS. The area of impact has not changed from a total of 0.2 ha of native vegetation that aligns to the PCT1245 Sydney Blue Gum x Bangalay - Lilly Pilly moist forest in gullies and on sheltered slopes, southern Sydney Basin Bioregion (HN597).

### 2.2.4 Summary of direct vegetation impacts associated with surface infrastructure

The amount of vegetation to be directly impacted for the proposed surface infrastructure is 28.50 ha (Table 4). This is consistent with the amount assumed to be impacted in the BARBOS. An update of the biodiversity offset requirement associated with the vegetation impacts has been provided in Section 4 of this report.

**Table 4. Summary of direct impacts associated with surface infrastructure**

Surface Infrastructure	Native vegetation community							Total
	PCT1083 (HN566) Mod/Good	PCT1083 (HN566) Regen	PCT1250 (HN651) Mod/Good	PCT1250 (HN651) Regen	PCT1395 (HN556) Mod/Good	PCT1395 (HN556) Regen	PCT1245 (HN597) Mod/Good	
Transmission line easement	3.00	0.00	0.85	0.00	0.45	0.00	0.00	<b>4.30</b>
Transmission line pole	0.00	0.10	0.00	0.00	0.00	0.10	0.00	<b>0.20</b>
Vent shaft 5A	13.95	1.05	0.00	0.00	0.00	0.00	0.00	<b>15.00</b>
Vent shaft 5B	0.50	0.00	0.00	0.00	0.00	0.00	0.00	<b>0.50</b>
Vent shaft 6A	4.30	0.00	0.00	0.00	0.00	0.00	0.00	<b>4.30</b>
Vent shaft 6B	4.00	0.00	0.00	0.00	0.00	0.00	0.00	<b>4.00</b>
Pit-top Carpark	0.00	0.00	0.00	0.00	0.00	0.00	0.20	<b>0.20</b>
<b>Total</b>	<b>25.75</b>	<b>1.15</b>	<b>0.85</b>	<b>0.00</b>	<b>0.45</b>	<b>0.10</b>	<b>0.20</b>	<b>28.50</b>

## 2.3 Threatened Flora

A threatened flora survey was conducted within the proposed transmission line easement by two ecologists (including a BAM Assessor). A total of 42 hours was completed for threatened flora surveys undertaken on:

- 13-15<sup>th</sup> of May 2020.
- 19<sup>th</sup> of May 2020.
- 21<sup>st</sup> May 2020.

The threatened flora surveys involved walking the entire stretch of the transmission line easement as shown on Figure 5 and Figure 6.

During the field survey, two threatened flora species were recorded:

- *Acacia bynoeana*: A total of 86 plants were recorded within the existing easement along Fire Road 6 (Figure 7). The population occurred within slashed/maintained vegetation within the existing Fire Road 6 easement. This area is managed by WaterNSW on a periodic basis to ensure that the height of the vegetation remains below approximately 0.5 m, and thus acts as a fire break. The existing management practices may have attributed to the plant's establishment given the species is known to prefer disturbed sites such as trail margins (NSW Scientific Committee 1999).
- *Epacris purpurascens* var. *purpurascens*: Three plants were recorded within 5 m of the proposed transmission line easement to Ventilation Shaft Site 6B as shown on Figure 9. All of these plants occur within an existing Transgrid easement that consists of low shrubs and native ground cover. This easement is currently managed by Transgrid for an existing transmission line.

Both recorded threatened flora species would not be directly impacted by the Project due to the following:

- The populations of *Acacia bynoeana* and *Epacris purpurascens* occur within an existing easement that is subject to regular trimming/slashing regimes. The proposed transmission line will not increase the existing management regimes.
- The transmission line pole placements will avoid the species, thus avoiding direct impacts to individual plants.
- The *Epacris purpurascens* plants occur adjacent to rather than within the proposed new transmission line easement.
- The plants would be marked by an ecologist prior to construction works, thus ensuring the species is avoided during construction.
- Contractors would be made aware of the plants prior to any construction activities.

Given both species are considered unlikely to be impacted, no biodiversity offset is required for these species.

### 3. Assessing Threatened Fauna and Populations

#### 3.1 Overview

This section details the survey methods and effort used to detect threatened fauna and their habitats within selected parts of the study area in response to BCD, or updates to the location and nature of surface infrastructure. The original suite of ecological surveys performed for the Project are described and documented within the BARBOS (Niche 2019).

#### 3.2 Threatened Fauna Survey

Field survey was confined to areas of surface infrastructure where vegetation clearing and habitat removal for proposed ventilation shaft sites and other surface infrastructure is proposed. Target fauna species are tabled below, although the methods and survey effort undertaken are relevant for other potentially occurring threatened species including other species credit species.

**Table 5: Target species for fauna survey**

Common Name	Scientific Name	Class of Credit (NSW FBA/Biobanking)
Eastern Pygmy-possum	<i>Cercartetus nanus</i>	Species
Koala	<i>Phascolarctos cinereus</i>	Species
Powerful Owl	<i>Ninox strenua</i>	Species (breeding)/Ecosystem (foraging)
Littlejohns Tree Frog/Giant Burrowing Frog	<i>Litoria littlejohnii/ Heleioporus australiacus</i>	Species

Field survey was undertaken between the 28<sup>th</sup> of April 2020 and the 22<sup>nd</sup> of May 2020 (over 11 days and nights). Additional Koala SAT plots (5) were conducted on the 29<sup>th</sup> of June and the 1<sup>st</sup> of July. Conditions during field survey were generally fine with significant rain or wind avoided for on-ground surveys.

The extent of the fauna survey effort is shown on Figure 5 and Figure 6.

#### 3.3 Fauna Survey Methods

##### **Habitat Tree Surveys**

Tree hollow surveys were conducted by traversing through the study area, inspecting every angle of the trees present if they were a candidate tree for hollows. The number of hollows present on each tree was recorded, along with size class of hollows in centimetres (0-5, 5-10, 10-15, 15-20, 20-30, >30), height above the ground and the tree species. Stags (dead trees) with hollows were also recorded. Data was collected with a GPS enabled device for later mapping.

All areas where tree clearing is proposed were mapped for hollows.

##### **SAT Plots**

Koala scats were searched for using the SAT assessment technique (Phillips and Callaghan 2011). Selected trees to use as centre trees consisted of secondary (*Eucalyptus punctata*) or supplementary (*E. eugenioides*, *E. globoidea*), feed tree species as determined within the Koala Recovery Plan (DECC 2008), noting that primary feed trees were not present at any site. If neither secondary or supplementary trees were available, other listed Koala feed trees (*E. piperita* and *E. sieberi*) according to the Koala Habitat Protection Guideline (DPIE 2020) were used as centre trees.

**Table 6. Summary of survey effort**

Method	Ventilation Shaft Sites					Other Surface Infrastructure (Areas 5 and 6)	Comments
	5A	5B	6A	6B	Total Ventilation Shaft Survey Effort		
Dusk survey	6 hours performed over 3 nights	4 hours performed over 2 nights	4 hours performed over 2 nights	4 hours performed over 2 nights	18 hours	N/A	Targeted to Powerful Owl and Koala habitat to add certainty around absence of these species within Study Area.
Nocturnal bird call playback	30 minutes performed over course of 3 nights	20 minutes performed over course of 2 nights	20 minutes performed over course of 2 nights	20 minutes performed over course of 2 nights	1.5 hours	N/A	At the end of dusk surveys close to large hollow bearing tree areas.
Nocturnal bird day habitat search	Conducted during tree hollow mapping (approx. 3 hours)						Search for potential roost trees for owls, particularly within proposed ventilation shaft sites.
Infrared cameras	9 camera sites. 180 nights	8 camera sites. 160 nights	7 camera sites. 140 nights	7 camera sites. 140 nights	30 cameras for 620 nights	N/A	Target species included the Eastern Pygmy-possum. Cameras were used in preference to Elliot traps due to access to catchment area and efficacy.
Spotlighting surveys – foot arboreal and terrestrial mammals	12 hours performed over 3 nights	8 hours performed over 2 nights	8 hours performed over 2 nights	4 hours performed over 1 night	32 hours	2 hours effort were spent along the transition forest on Fire Road 6B between Ventilation Shaft Sites 5B and 5A. Additional 4 hours at ETL connection area. 0.5 hours at Pit-top Carpark.	
Spotlighting surveys – vehicle arboreal and terrestrial mammals	-						6 hours over 1 night performed along proposed ETL easement from Ventilation Shaft Site 5B to 6B at walking pace (14.5 km). Intermittently stopping to proceed with 100 m foot-based survey.
Call-playback surveys– Koala	45 minutes performed within centre of site over course of 3 nights	30 minutes performed within centre of site over course of 2 night	30 minutes performed within centre of site over course of 2 nights	30 minutes performed within centre of site over course of 2 nights	2.25 hours combined		
Search for scats and signs – all mammals	Incorporated into all survey activities.						
Spot Assessment Technique (SAT) - Koalas	3 SAT plots	2 SAT plots	2 SAT plots	2 SAT plots	9 SAT plots (12 SAT plots combined with 2019 efforts)	5 SAT plots within PCT 1083 - Red Bloodwood - scribbly gum heathy woodland. 1 SAT plot conducted in 1395 Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest to act as a reference site.	Presence is assumed or was previously verified within all PCTs except for PCT 1083 - Red Bloodwood - scribbly gum heathy woodland, which was the focus of additional survey.

Method	Ventilation Shaft Sites					Other Surface Infrastructure (Areas 5 and 6)	Comments
	5A	5B	6A	6B	Total Ventilation Shaft Survey Effort		
Song Meter recording – Koalas/Owls	1 song meter unit. 21 nights	1 song meter unit. 21 nights	1 Song meter unit. 15 nights	1 Song meter unit. 15 nights	4 Song meter units. Combined effort of 72 trap nights	N/A	Central location within site boundary, close to large hollow bearing trees.
Frog nocturnal call playback and watercourse search	30 minutes performed over course of 3 nights	20 minutes performed over course of 2 nights	20 minutes performed over course of 2 nights	20 minutes performed over course of 2 nights	1.5 hours	N/A	Incorporated into nocturnal habitat and watercourse searches as well as dusk survey.

*NB: hours are total person hours rather than necessarily duration of survey.*

At each site, the bases (0 to 2 m from the trunk) of thirty trees were searched for evidence of Koala scat by first circling around the tree looking for scats without disturbing the leaf litter (approximately 1 minute), then by raking through the leaf litter for scats (approximately 1 additional minute). Koala scats at any tree were observed and recorded.

### ***Powerful Owl (*Ninox strenua*) Survey including Dusk Watches***

Searches for potential breeding trees for the Powerful Owl were conducted at all sites during habitat tree surveys. In addition, pellet searches were performed in combination with SAT plots.

Dusk watches were conducted for at least an hour per survey. The location of dusk surveys was biased towards depressions in areas with large hollow trees at proposed ventilation shaft sites. Spotlighting and call playback was performed immediately after dusk watches. Acoustic recording was also used to target the Powerful Owl (see details below).

### ***Songmeters***

Songmeter (SM2+) acoustic recorders were set centrally within vent shaft sites to detect Powerful Owls and Koalas with a recording schedule of 6 hours per night incorporating sunset and sunrise. The detectors were placed on the ground or elevated up to 1 m where possible and, pointed upwards at approximately a 45° angle. Recorded calls were later analysed using Kaleidoscope software.

### ***Spotlighting***

Spotlighting (walked) was conducted within each ventilation shaft site and along representative sections of the proposed transmission line. Each spotlighting session consisted of a traverse through the site sampling the identified habitats using bright LED torches. Driven spotlighting transects (approximately 15 km/hr) were completed along any areas of the ETL not walked (14.5 km total).

### ***Frog and Tadpole Surveys***

Opportunistic nocturnal and diurnal frog survey was conducted at any identified watercourses during survey for other target species (i.e. along any intermittent creeks within the vent shaft sites). Survey involved listening for frog calls and call playback (nocturnal) as well as active searching of frog habitat (diurnal) during the day, particularly for tadpoles of Littlejohns Tree Frog or the Giant Burrowing Frog.

### ***Reptile Surveys***

Reptile surveys were conducted opportunistically where rocky outcrops were identified. Survey involved checking under rock plates and partially embedded rocks.

### ***Nocturnal Call Playback (Mammals and Owls)***

Nocturnal call playback was carried out adjacent to or within proposed ventilation shaft sites and areas of potential Koala habitat (as identified by presence of preferred feed tree species). Calls of targeted species (Koala, Powerful Owl) were broadcast for up to five minutes followed by five minutes of listening time after completion of each dusk watch survey. Is this correct.

### ***Cameras***

Infrared cameras were deployed throughout each ventilation shaft site to target the Eastern Pygmy-possum. Cameras were focused on flowering shrubs such as *Banksia ericifolia* or *Lambertia formosa*. Baited tubes with a mixture of honey, oats and peanut butter were attached to branches within the field of view of the camera in some cases if flowers were not abundant (approximately half of the cameras).

### 3.3.1 Pit-top Carpark

Survey was performed at the Pit-top Carpark on the 25<sup>th</sup> of May 2018 for the Project BARBOS. Further survey was completed on the 11<sup>th</sup> of May 2020 to confirm the results of the 2018 survey, complete additional spotlight survey (0.5 hours), as well as undertake habitat tree mapping.

## 3.4 Fauna Survey Results

### 3.4.1 Tree mapping

Hollow bearing trees and stags were mapped throughout the development area (Figure 10 and Figure 11), indicating high densities of hollow bearing trees of varying size classes within remnant vegetation. The data reinforces data collected within Biobanking plots throughout areas to be cleared (see Appendix 4 of the BARBOS - Niche 2019).

Ventilation Shaft Site 5A contained 218 hollow trees or stags within the area surveyed for tree hollows (13.95 ha) where clearing is to occur amongst vegetation with mature trees. This equates to approximately 1.6 hollow trees per 1,000 m<sup>2</sup>. Biobanking data collected from ventilation shaft sites collectively during the original BARBOS estimated hollow trees at 2.2 per 1,000 m<sup>2</sup> (data averaged from 14 Biobanking plots).

Despite a high density of hollows throughout ventilation shaft sites, there were very limited sightings/densities of arboreal mammals. This is considered to be a feature of the low nutrient Sandstone Ridgetop Woodland (HN566) areas within the study area. Observations from sightings or heard calls within ventilation shaft sites during spotlighting and other activities consisted of Feathertail Glider (1), Common Ringtail Possum (2) and the Sugar Glider (1). Conversely, in higher nutrient areas of Shale Sandstone Transition Forest TEC, higher densities of arboreal mammals were observed with the Koala (2), Greater Glider (1), Sugar Glider (1) and Common Ringtail Possum (1) being recorded with far more limited survey effort.

### 3.4.2 Targeted species results

Of the targeted species surveyed for, two were recorded during survey (Figure 8 and Figure 9): the Eastern Pygmy -possum at Ventilation Shaft Sites 5A, 6A and 6B; and the Koala along the Fire Trail 6B ETL route. Details of survey for all target species are provided in Table 7, along with any other threatened species recorded.

### 3.4.3 Other species

BCD also requested a species polygon be provided for the Rosenbergs Goanna, which was listed as a species credit species at the time of preparation of the Project BARBOS. No additional surveys were required as the species was recorded during surveys for the Project BARBOS (Niche 2019).

A species polygon of 27.05 ha has been prepared which incorporates all areas of vegetation to be cleared with the exception of regenerating areas which are considered to be degraded habitat and all areas of PCT1245: Sydney Blue Gum x Bangalay - Lilly Pilly moist forest (HN 597) areas within the Pit-top Carpark as the species was not linked to this PCT within the Threatened Species Profile Database (TSPD), the habitat present at the site does not suit the species and the species is not known to occur below the top of the escarpment within the locality.

**Table 7. Results of threatened species survey and species polygons**

Species	Survey Results	Species Polygon
Eastern Pygmy-possum ( <i>Cercartetus nanus</i> )	Detected using remote cameras at three of the four ventilation shaft sites on one or two cameras at each site. Two ventilation shaft sites had definitive records of the species while one site had probable records.	A species polygon of 27.25 hectares has been prepared incorporating the entirety of all ventilation shaft sites as well as other areas of proposed clearing where there are flowering shrubs upon which the species is likely to forage (i.e. all areas except slashed road verges), excluding areas of regeneration.  Whilst limited habitat is considered to occur within the Pit Top Carpark (due to limited flowering shrubs) this area was included, as the BVT vegetation type is associated with the species within the Biobanking calculator/TSPD.
Koala ( <i>Phascolarctos cinereus</i> )	Recorded within areas of Shale Sandstone Transition Forest TEC within the ETL alignment along Fire Trail 6B. The species was spotlighted, heard calling and scat located within these areas.  6 scats were recorded under 30 trees (1 SAT plot) within an area of Shale Sandstone Transition Forest TEC within the ETL alignment. Conversely, no scats were recorded from a search of 270 trees amongst the proposed ventilation shaft site areas; nor was the species recorded during spotlighting or call playback within these areas.	A species polygon of 1.5 hectares has been determined comprising all areas outside of the ventilation shaft sites that are not Sandstone Ridgetop Woodland (HN566) and support trees (either midstorey or canopy - i.e. excluding areas of regeneration).  It was demonstrated during targeted ventilation shaft site and ETL surveys that the species is unlikely to use the Sandstone Ridgetop Woodland (HN566) areas except potentially to move through. This is consistent with the outcomes of surveys undertaken for the Project BARBOS.  Note where feed tree species listed under the Koala Recovery Plan (DECC 2008) or SEPP 44 were not present within the ventilation shaft sites, feed tree species listed under the updated Koala Habitat Protection Guideline (DPIE 2020) (which accompanies the Koala Habitat Protection SEPP) were used as centre trees for SAT plots. BCD has previously requested HN566 be included in the Koala species polygon due to the presence of feed tree species listed under the Koala Habitat Protection Guideline. No Koalas were recorded during surveys of these trees which confirms species credits are not required for the ventilation shaft sites, consistent with the Project BARBOS.
Powerful Owl ( <i>Ninox strenua</i> )	Numerous trees containing hollows of sufficient size for Powerful Owl breeding (i.e. > 20 cm) were recorded with the proposed ventilation shaft sites. Outside of the ventilation shaft sites, two trees containing hollows of sufficient size for Powerful Owl breeding (i.e. > 20 cm) are likely to be cleared for the proposed powerline.  The species was not recorded during any surveys including recent targeted survey at ventilation shaft sites.  No trees containing hollows of sufficient size for Powerful Owl breeding (i.e. > 20 cm) were identified during mapping undertaken within the Pit-top Carpark area.	A species polygon is not required for the Powerful Owl as although trees containing hollows of sufficient size for breeding were identified, the species was not recorded within the ventilation shaft sites during targeted surveys and mapped trees with suitable hollows were all within the Sandstone Ridgetop Woodland (HN566) vegetation community, which is not listed as Powerful Owl habitat within the Biobanking Calculator/TSPD. Furthermore, landscape position for the ventilation shaft sites does not align with preferred breeding habitat for Powerful Owl.
Greater Glider ( <i>Petauriodes volans</i> )	Detected during spotlighting only from areas of Shale Sandstone Transition Forest TEC within the ETL alignment along Fire Trail 6B, consistent with survey undertaken for the Project BARBOS.	A species polygon is not required as the Greater Glider is not listed under the BC Act and considered unlikely to be significantly impacted under the EPBC Act (an Assessment of Significance has been previously undertaken, refer to Appendix 7 of the Project BARBOS).

## 4. Update to Biodiversity Offset Requirement

---

### 4.1 Introduction

The biodiversity offset strategy, including the impact assessment and offset requirement associated with subsidence impacts to Coastal Upland Swamps, has been provided in the BARBOS. This report focuses on the refinement of the biodiversity offset liability associated with changes to the surface infrastructure footprints/design, namely:

- An update of the biodiversity offset to native vegetation associated with the transmission line design, and ventilation shaft layout.
- An update of the biodiversity offset, incorporating additional survey effort, associated with threatened fauna as a result of the revised ventilation shaft layout, transmission line easement and the proposed carpark.

We have included the entire offset liability (i.e. surface infrastructure impacts and subsidence impacts) within the tables of this section, however it is recommended that the BARBOS be referred to if further detail is required regarding subsidence impacts, which have not changed as a result of the additional survey.

### 4.2 Quantifying Offset Impacts – Vegetation Impacts

The FBA identifies the BioBanking Credit Calculator (BBCC) as the appropriate tool for quantifying offsets required in both ecosystem and species credit terms. Details regarding the landscape assessment and processes undertaken to establish the BBCC case file are contained within the Project BARBOS.

Through the refinement of the transmission line and revised footprint for the ventilation shaft sites, the BBCC case file submitted with the BARBOS has been updated to reflect:

- Revision of areas of vegetation directly impacted by the Project (Table 4).
- Incorporation of the BAM plot data obtained along the transmission line easement.

The ecosystem credit requirement generated for direct impacts from surface infrastructure are listed in Table 8. The table also includes the biodiversity credits for the subsidence impacts to Coastal Upland Swamps which has been detailed in the BARBOS and has not changed as a result of additional survey.

### 4.3 Quantifying Offset Impacts – Threatened Flora Impacts

No threatened flora are likely to be directly impact by the surface infrastructure (Section 2.3). There is therefore no change to the conclusions provided in the BARBOS. An offset associated with threatened flora is therefore not required.

### 4.4 Quantifying Offset Impacts – Threatened Fauna Impacts

Species polygons have considered the revised areas of impacts for the surface infrastructure and results of additional targeted survey, as well as the subsidence impacts detailed in the BARBOS which have not changed.

The updated area of impact to each of the species based on the surface infrastructure refinement, along with the subsidence impacts as per the BARBOS, has been provided in Table 9.

**Table 8. Ecosystem Credits Required for the Project**

BVT	Plant Community Type (PCT)	Updated Area of Impact (ha)	Updated Ecosystem Credit Requirement	Change in Area of Impact from EIS (ha)	Change in Ecosystem Credit Requirement from EIS	Impact Mechanism
HN566	1083 Red Bloodwood - scribbly gum heathy woodland on sandstone plateaux of the Sydney Basin Bioregion	26.9	1,051	+1.1	+29	Surface Disturbance - ventilation shaft sites and ETL alignment
HN556	1395 Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion	0.55	40	-0.95	-80	
HN651	1250 Sydney Peppermint - Smooth-barked Apple - Red Bloodwood shrubby open forest on slopes of moist sandstone gullies, eastern Sydney Basin Bioregion	0.85	68	-0.15	-12	
HN597	1245 Sydney Blue Gum x Bangalay - Lilly Pilly moist forest in gullies and on sheltered slopes, southern Sydney Basin Bioregion	0.20	6	-	-	Surface Disturbance – Pit Top Carpark
HN560	978 Needlebush - banksia wet heath on sandstone plateaux of the Sydney Basin Bioregion	16.30	227	-	-	Subsidence – Coastal Upland Swamps
HN662	1804 Needlebush - Banksia wet heath swamps on coastal sandstone plateaux of the Sydney basin	4.57	78	-	-	

**Table 9. Threatened fauna species credits**

Common name	Scientific name	Updated Species Polygon (ha)	TS offset multiplier	Updated Species Credit Requirement	Change in Species Polygon from EIS (ha)	Change in Species Credit Requirement from EIS	Impact Mechanism
Rosenberg's Goanna	<i>Varanus rosenbergi</i>	27.05	3.3	893	27.05	893	Surface Disturbance – ventilation shaft sites and ETL alignment
Koala	<i>Phascolarctos cinereus</i>	1.5	2.6	39	-	-	Surface Disturbance – Pit-top Carpark and ETL alignment
Eastern Pygmy-possum	<i>Cercartetus nanus</i>	27.25	2.0	545	27.25	545	Surface Disturbance – Pit-top Carpark, ventilation shaft sites and ETL alignment
Giant Burrowing Frog	<i>Heleioporus australiacus</i>	32.74	1.3	426	-	-	Subsidence – streams and upland swamps
Littlejohn's Tree Frog	<i>Litoria littlejohni</i>	32.74	2.6	851	-	-	
Giant Dragonfly	<i>Petalura gigantea</i>		7.7	1073			Subsidence – upland swamps with breeding and foraging habitat
Broad-headed Snake	<i>Hoplocephalus bungaroides</i>	0.28	3.3	9	-	-	Subsidence – cliff lines
Red-crowned Toadlet	<i>Pseudophryne australis</i>		1.3	94			Subsidence – streams

## 5. References

---

DECC 2008. Approved Recovery Plan for the Koala (*Phascolarctos cinereus*). State of NSW and the Department of Environment and Climate Change NSW.

Niche 2019. Biodiversity Assessment Report and Biodiversity Offset Strategy, Dendrobium Mine – Plan for the Future: Coal for Steelmaking, Prepared for South32 Illawarra Coal.

DPIE 2020. Koala Habitat Protection Guideline: Implementing State Environmental Planning Policy (Koala Habitat Protection) 2019. Accessed online: <https://www.planningportal.nsw.gov.au/draftplans/under-consideration/koala-habitat-protection-guideline>

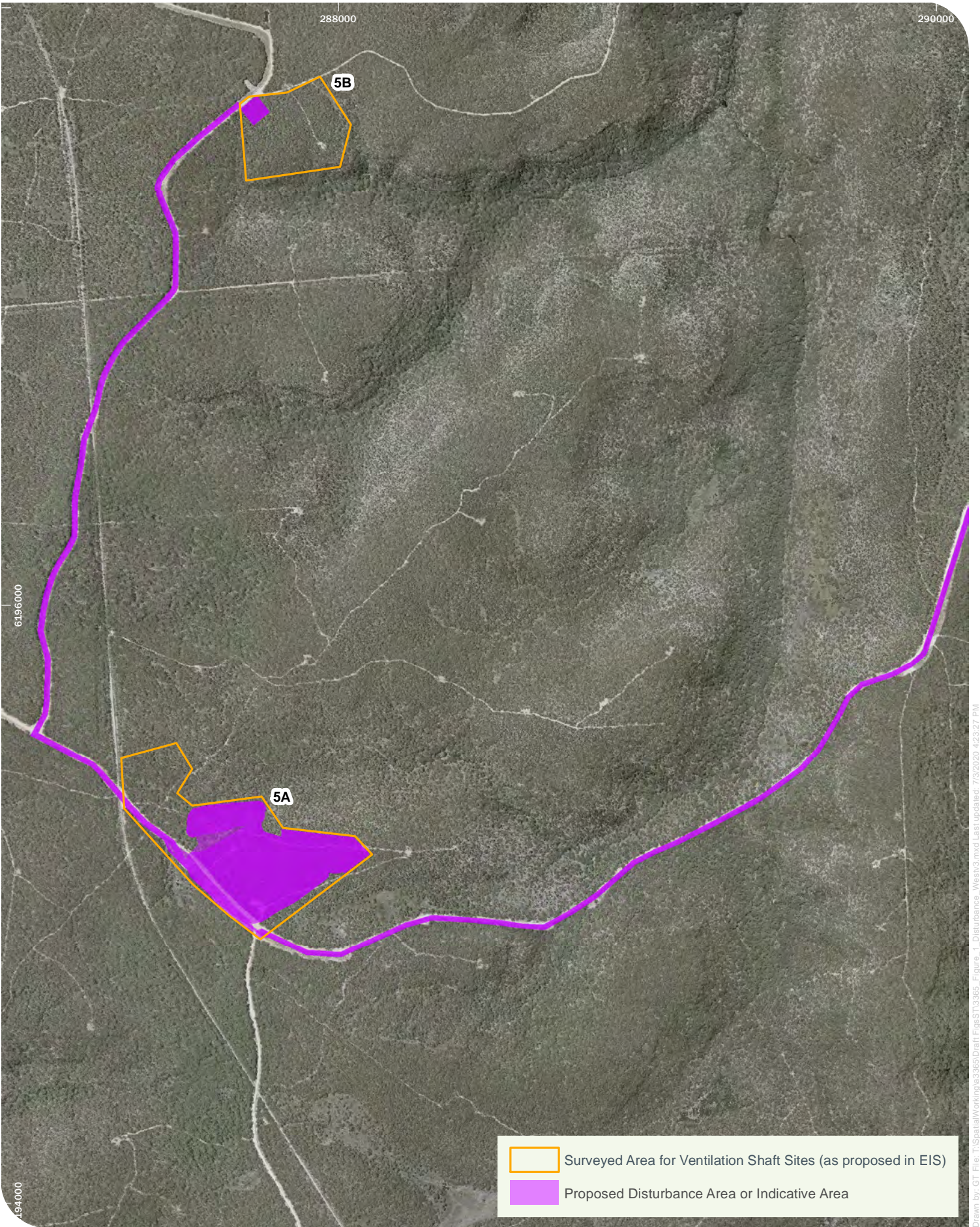
Landcom 2004. Managing Urban Stormwater: Soils & Construction, Volume 1.

NSW Scientific Committee 1999. *Acacia bynoeana* (a shrub) - Endangered species determination - final.

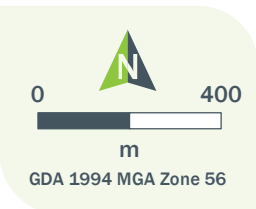
Phillips, S, & Callaghan, J. 2011. The Spot Assessment Technique: a tool for determining localised levels of habitat use by Koalas *Phascolarctos cinereus*. Australian Zoologist, 35(3), 774-780. Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) 2011.

## Figures

---



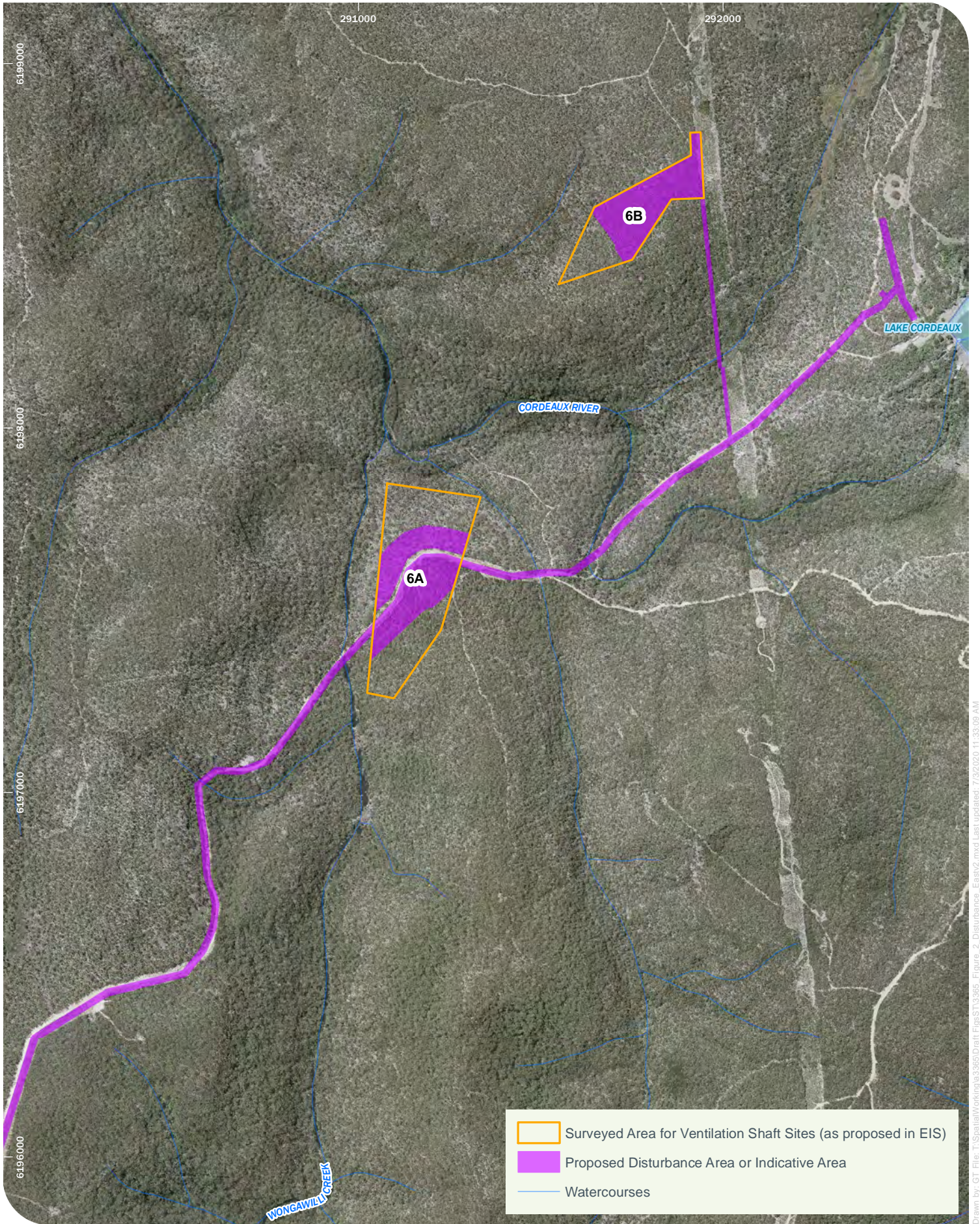
Drawn by: GT File: F:\Spatial\Working\3365\Draft Figs\T3365\_Figure\_1\_Disturbance\_Web\3365\Draft Figs\T3365\_Figure\_1\_Disturbance\_Web.mxd Last updated: 7/9/2020 4:23:27 PM



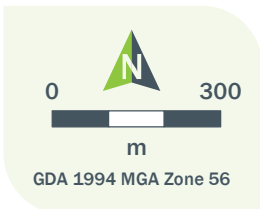
**Disturbance Areas (West)**  
**Dendrobium Mine - Plan for the Future:**  
**Coal for Steelmaking - Biodiversity Assessment**

**Figure 1**

Niche PM: ST/LB  
 Niche Proj. #: 3365  
 Client: South32 Illawarra Metallurgical Coal



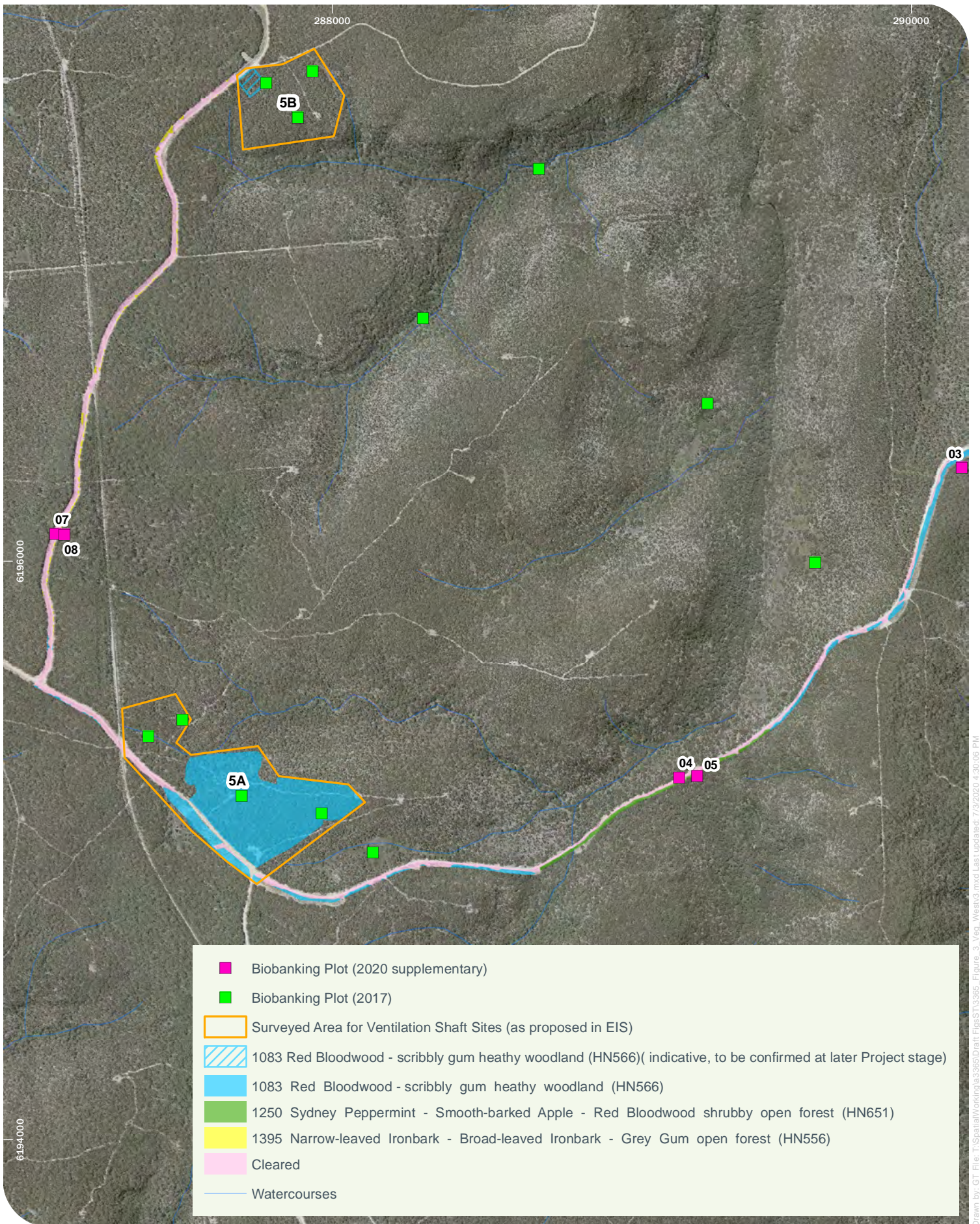
Drawn by: GT File: F:\Spatial\Working\3365\Draft Figs\T3365\_Figure\_2\_Disturbance\_EastV2.mxd Last updated: 7/3/2020 11:39:09 AM



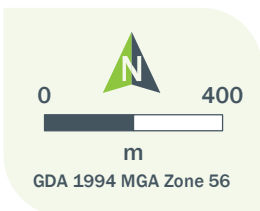
**Disturbance Areas (East)**  
**Dendrobium Mine - Plan for the Future:**  
**Coal for Steelmaking - Biodiversity Assessment**

Niche PM: ST/LB  
 Niche Proj. #: 3365  
 Client: South32 Illawarra Metallurgical Coal

**Figure 2**



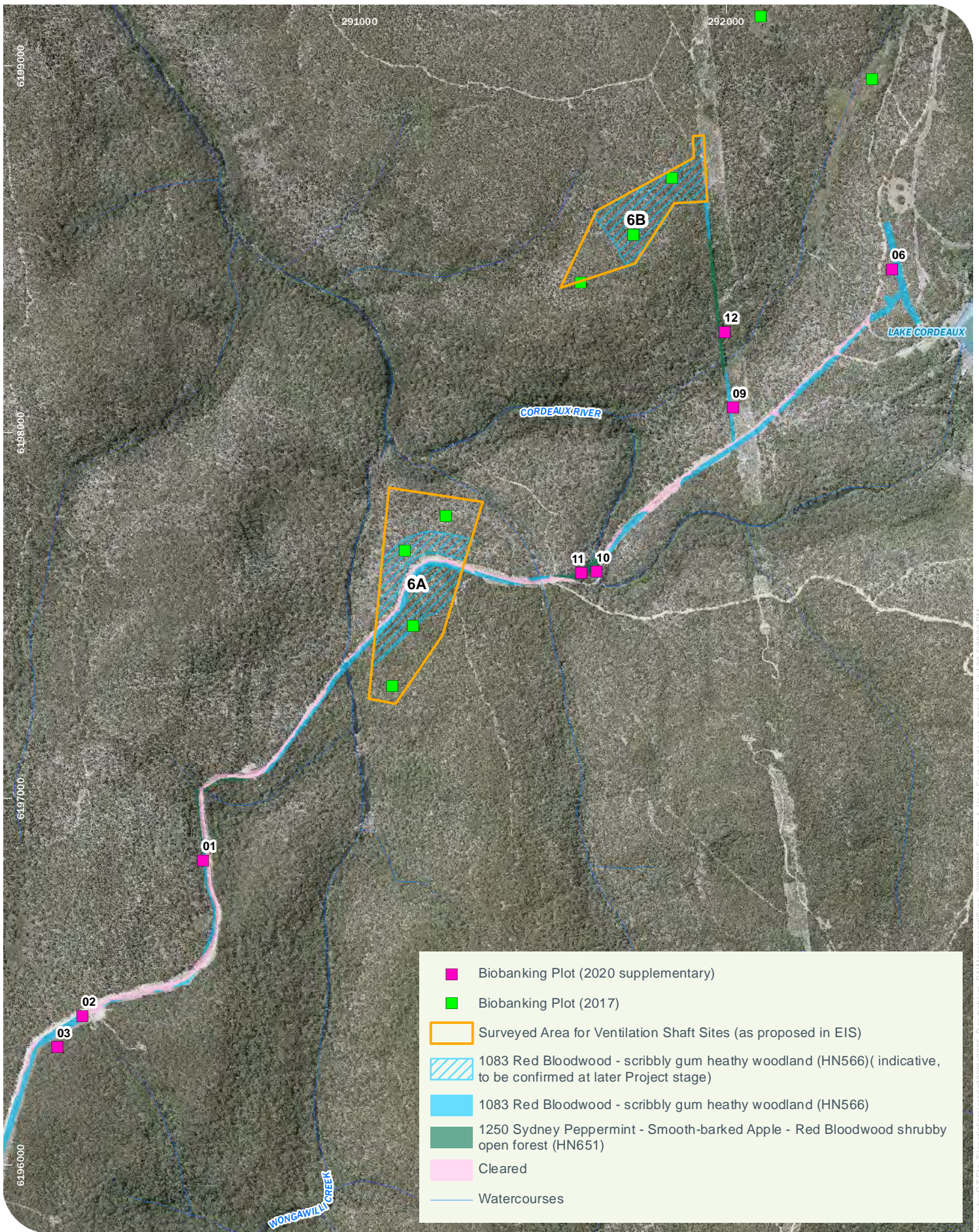
Drawn by: GT File: F:\Spatial\Working\3365\Draft\Figs\T3365\_Figure\_3\_Veg\_Weat3.mxd Last updated: 7/9/2020 4:30:06 PM



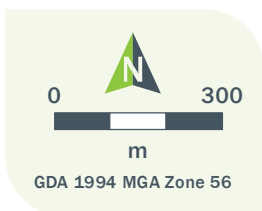
Niche PM: ST/LB  
Niche Proj. #: 3365  
Client: South32 Illawarra Metallurgical Coal

**Vegetation Mapping and Flora Plots (West)**  
Dendrobium Mine - Plan for the Future:  
Coal for Steelmaking - Biodiversity Assessment

**Figure 3**



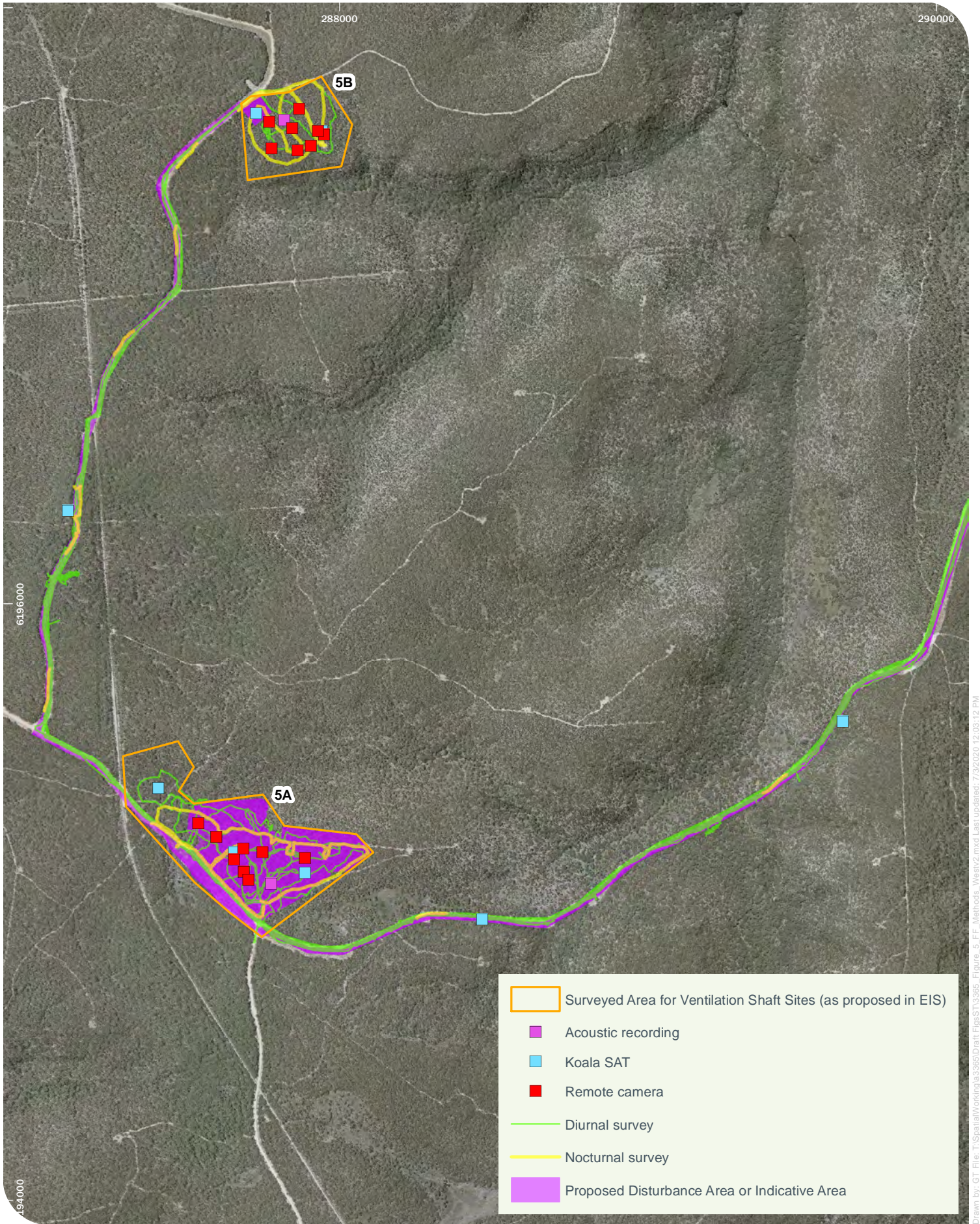
Drawn by: GT File: T:\spatial\projects\300\30365\_Dendrobium\_BA\Maps\report\Supp\_2020\3365\_Figure\_4\_Veg\_East.mxd Last updated: 01-Jul-20 5:26:38 PM



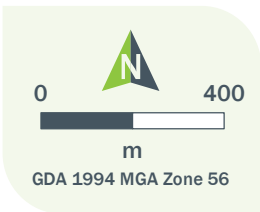
Niche PM: ST/LB  
 Niche Proj. #: 3365  
 Client: South32 Illawarra Metallurgical Coal

**Vegetation Mapping and Flora Plots (East)**  
 Dendrobium Mine - Plan for the Future:  
 Coal for Steelmaking - Biodiversity Assessment

**Figure 4**



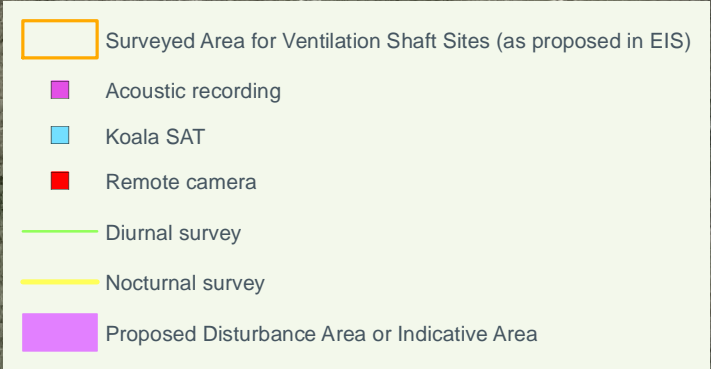
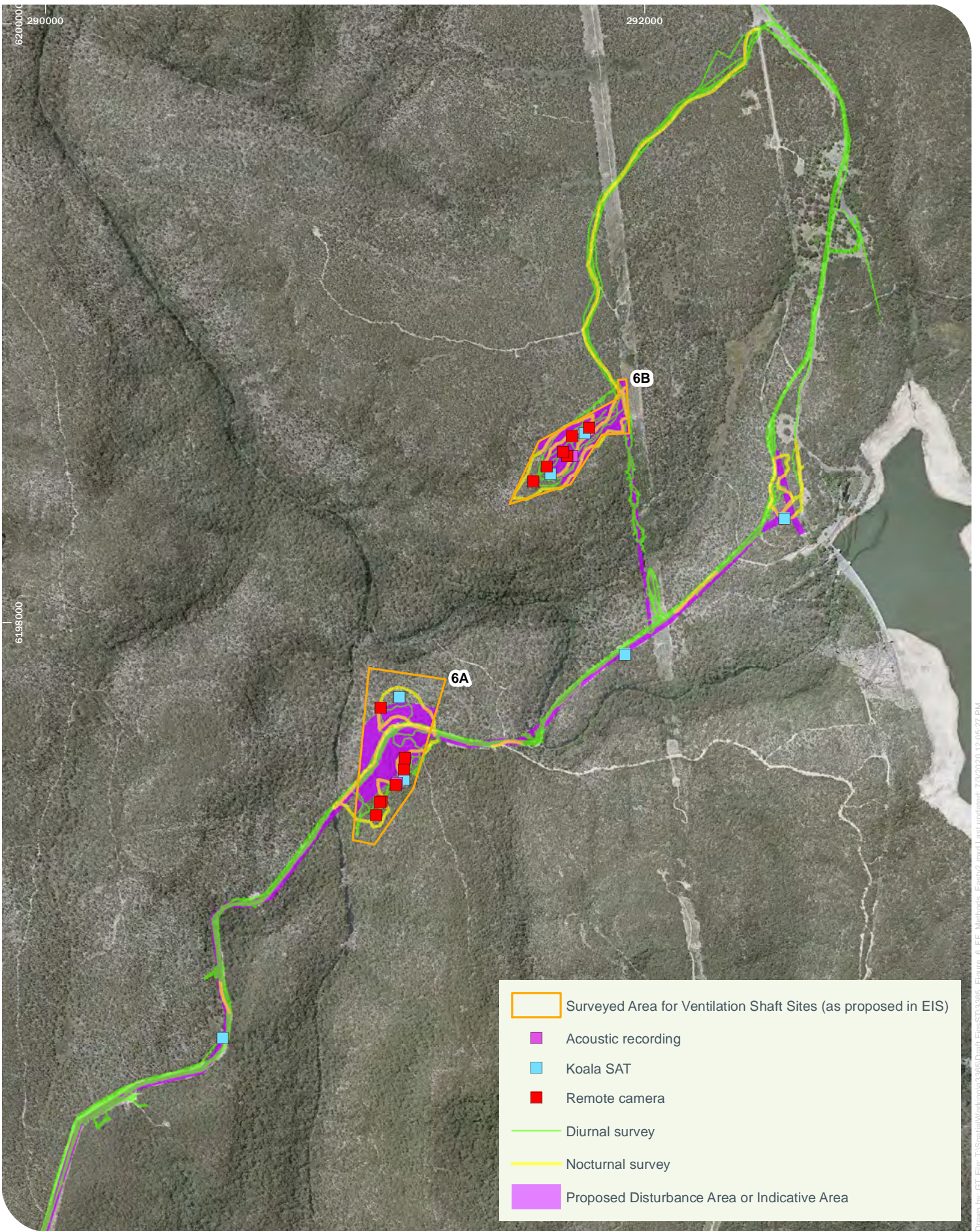
Drawn by: GT File: T:\SpatialWorking\3365\Draft\Figs\T3365\_Figure\_5\_FF\_Methods\_Westv2.mxd Last updated: 7/13/2020 12:03:12 PM



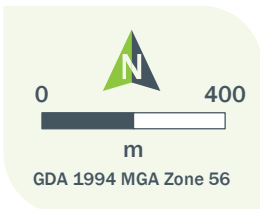
**Flora and Fauna Targeted Survey Methods (West)**  
**Dendrobium Mine - Plan for the Future:**  
**Coal for Steelmaking - Biodiversity Assessment**

**Figure 5**

Niche PM: ST/LB  
 Niche Proj. #: 3365  
 Client: South32 Illawarra Metallurgical Coal



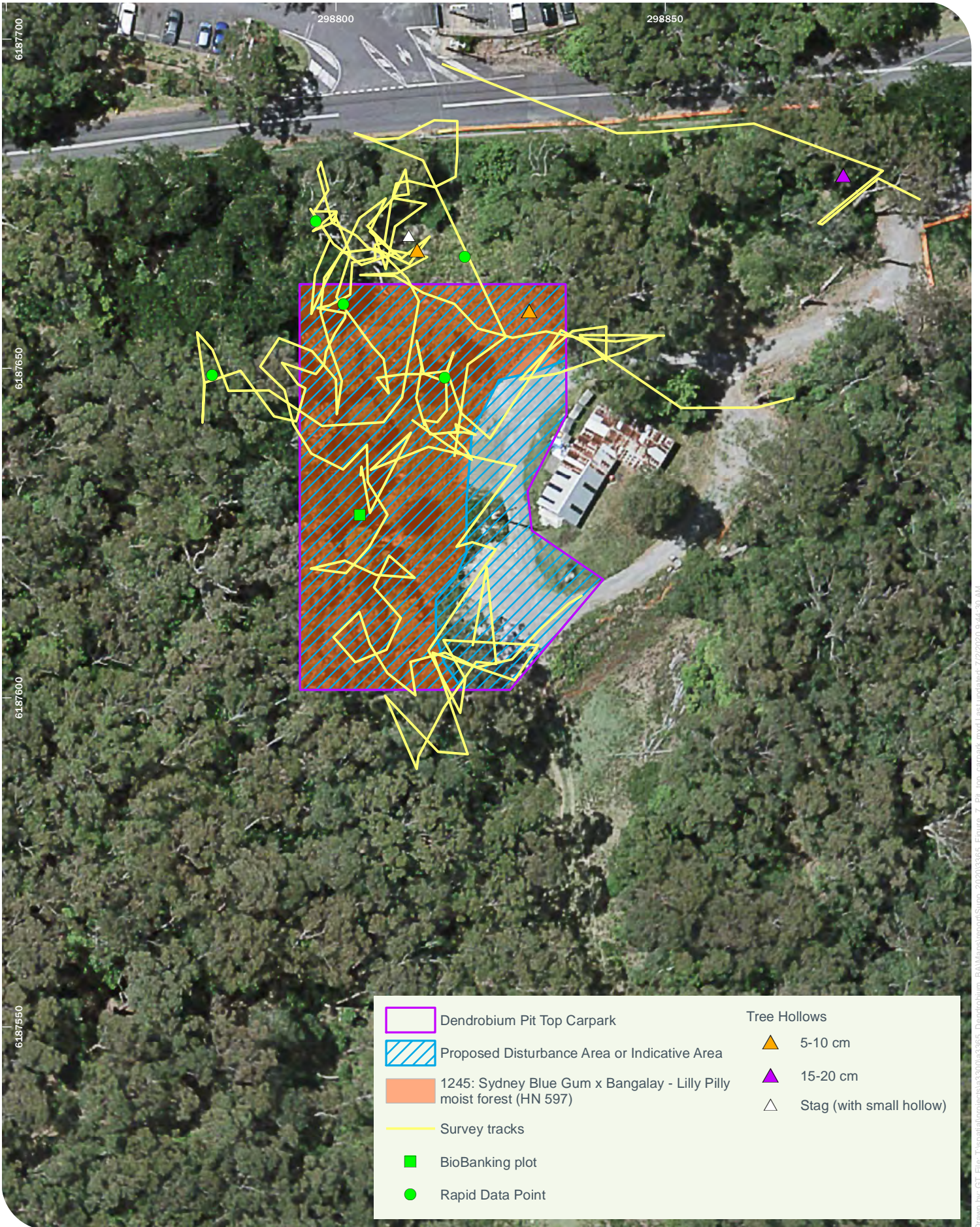
Drawn by: GT File: T:\Spatial\Working\33365\Draft\Figs\T33365\_Figure\_6\_FF\_Methods\_Eastv2.mxd Last updated: 7/9/2020 12:05:27 PM



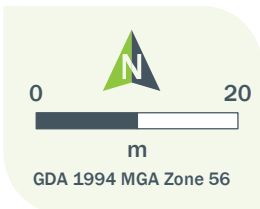
**Flora and Fauna Targeted Survey Methods (East)**  
**Dendrobium Mine - Plan for the Future:**  
**Coal for Steelmaking - Biodiversity Assessment**

Niche PM: ST/LB  
 Niche Proj. #: 3365  
 Client: South32 Illawarra Metallurgical Coal

**Figure 6**



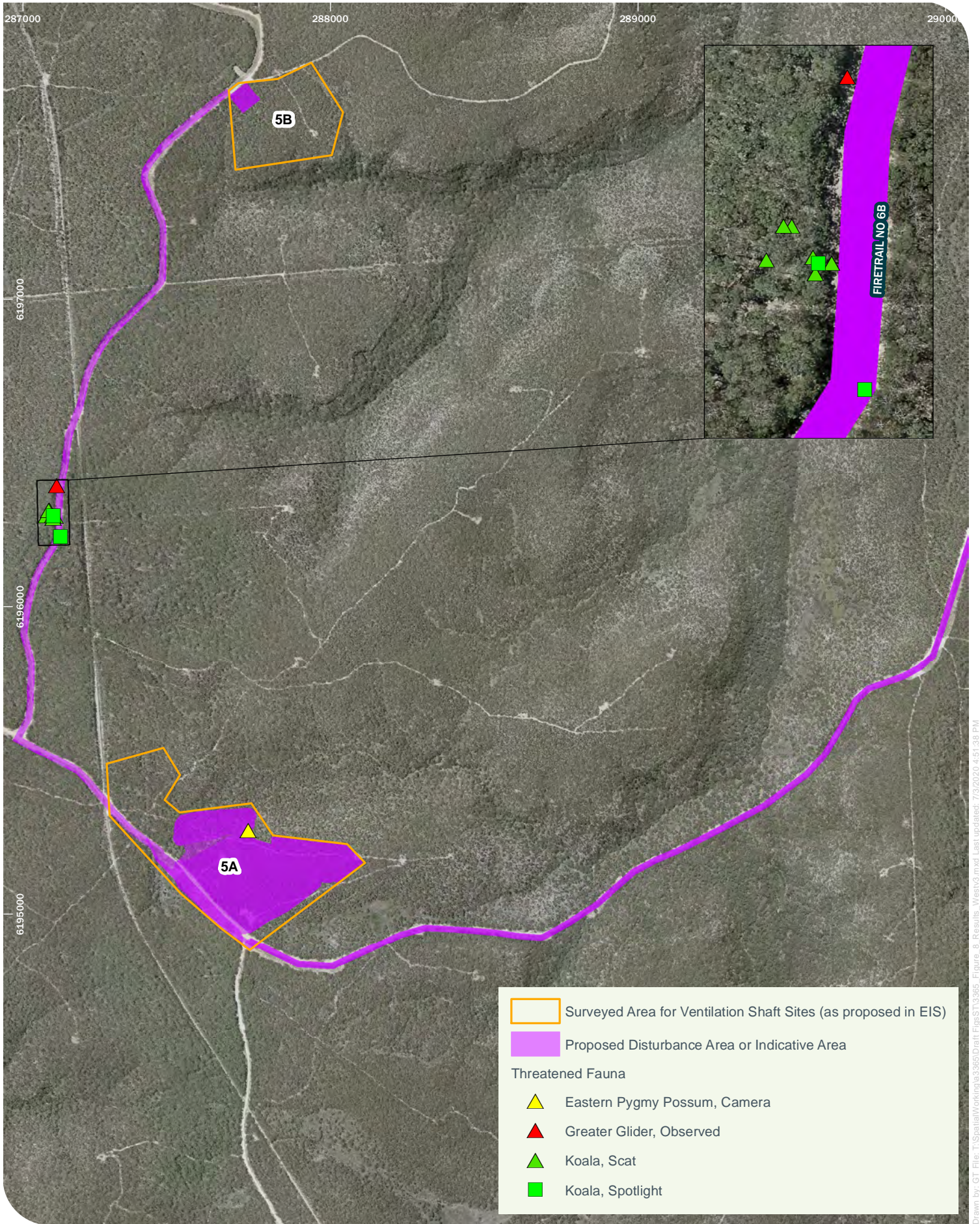
Drawn by: GT File: T:\spatial\projects\ia300\ia300\365\_Dendrobium\_BAMaps\report\Supp\_2020\3365\_Figure\_7\_Pit\_top\_carpark.mxd Last updated: 7/2/2020 9:44:30 AM



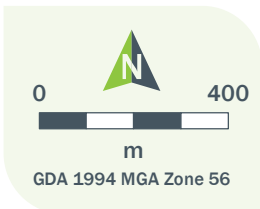
Niche PM: ST/LB  
 Niche Proj. #: 3365  
 Client: South32 Illawarra Metallurgical Coal

**Dendrobium Pit Top Car Park**  
 Dendrobium Mine - Plan for the Future:  
 Coal for Steelmaking - Biodiversity Assessment

**Figure 7**



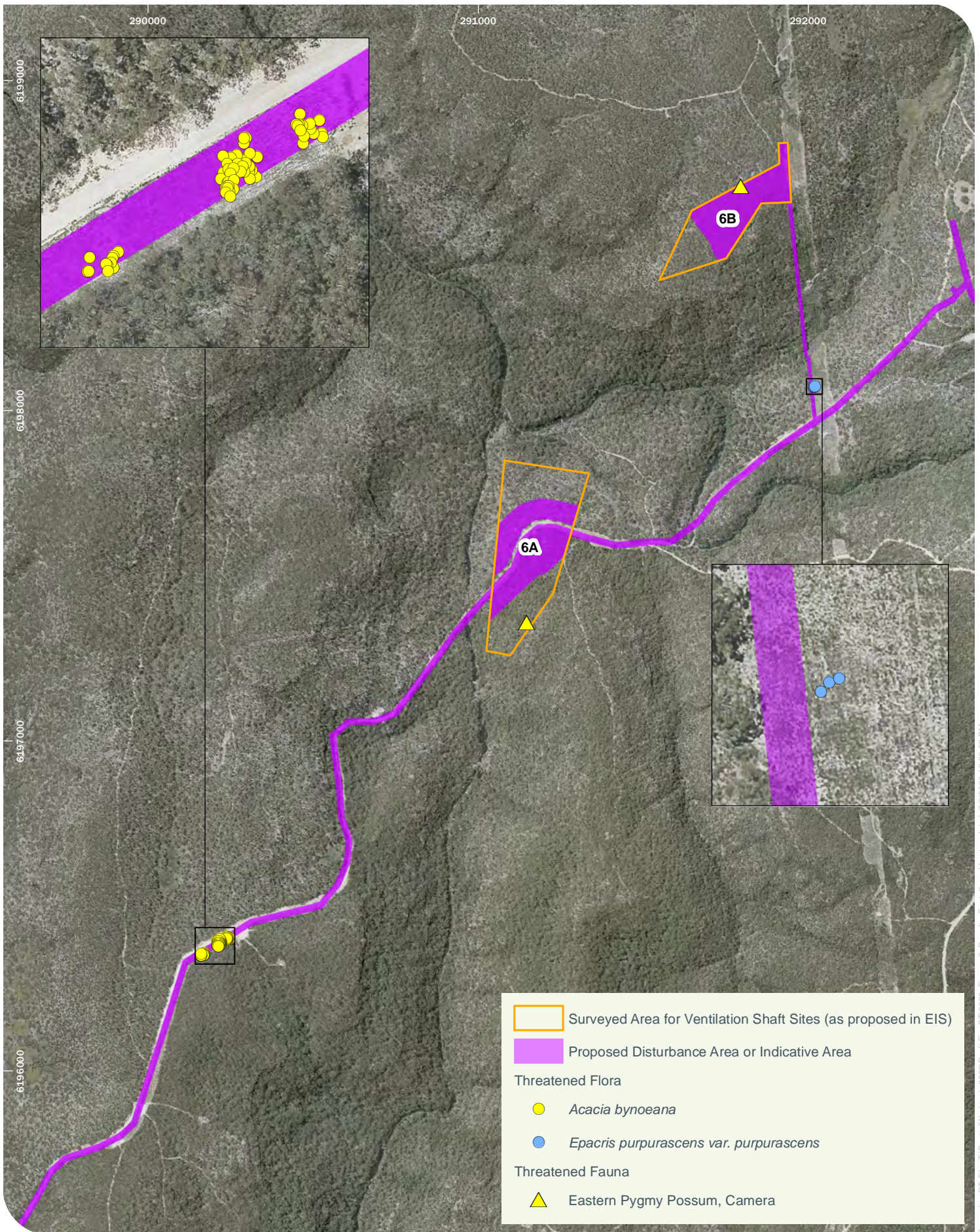
Drawn by: GT File: F:\Spatial\Working\3365\Draft\Figs\T3365\_Figure\_8\_Results\_West.v3.mxd Last updated: 7/3/2020 4:51:38 PM








**Results - Threatened Species (West)**  
**Dendrobium Mine - Plan for the Future:**  
**Coal for Steelmaking - Biodiversity Assessment**

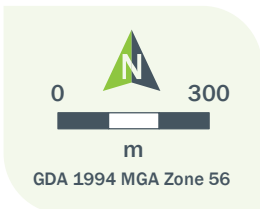
Niche PM: ST/LB  
 Niche Proj. #: 3365  
 Client: South32 Illawarra Metallurgical Coal

**Figure 8**



	Surveyed Area for Ventilation Shaft Sites (as proposed in EIS)
	Proposed Disturbance Area or Indicative Area
<b>Threatened Flora</b>	
	<i>Acacia bynoeana</i>
	<i>Epacris purpurascens var. purpurascens</i>
<b>Threatened Fauna</b>	
	Eastern Pygmy Possum, Camera

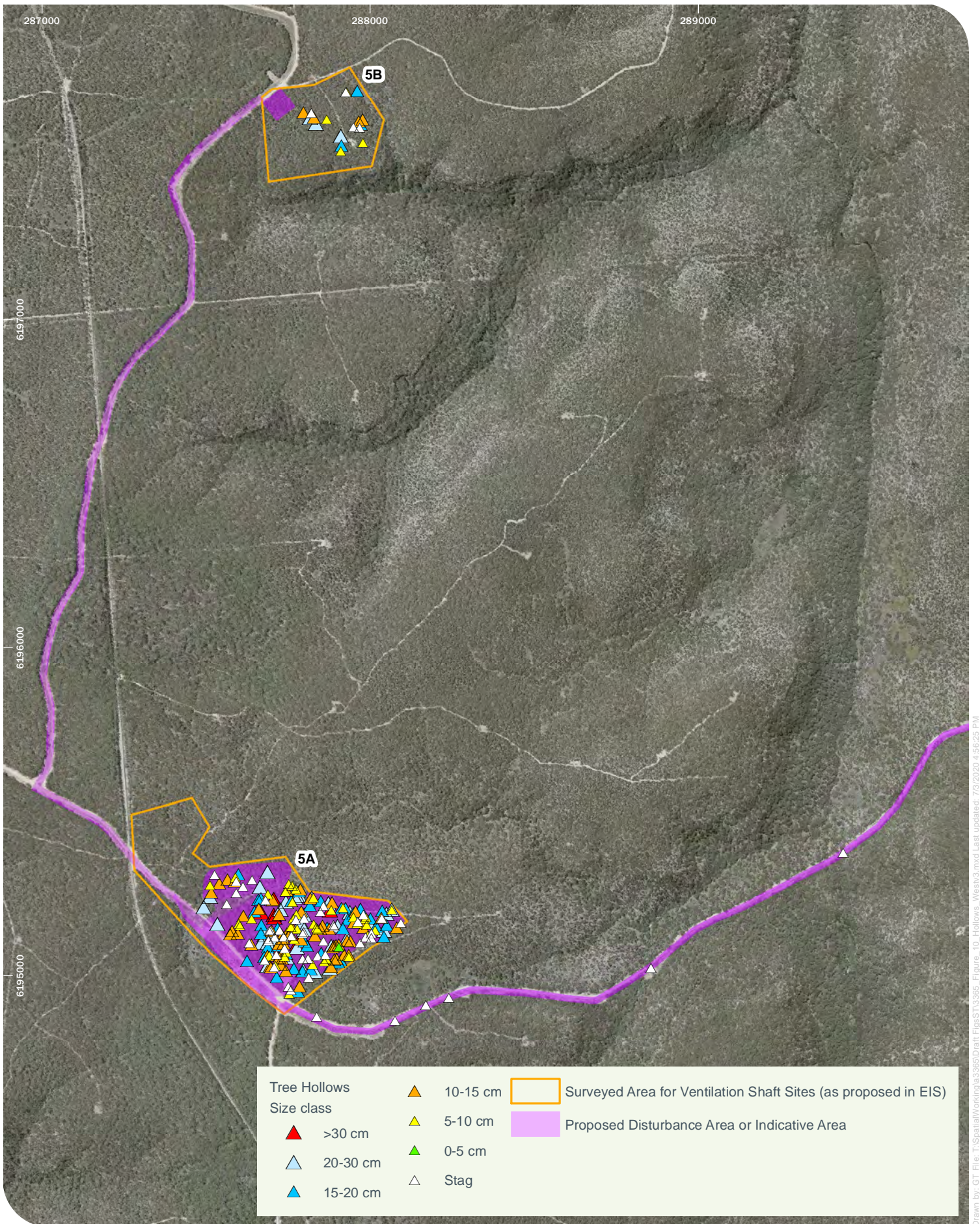
Drawn by: GT File: F:\Spatial\Working\3365\Draft\Figs\T3365\_Figure\_9\_Results\_Eastv2.mxd Last updated: 7/9/2020 12:20:53 PM



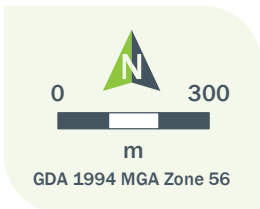
Niche PM: ST/LB  
 Niche Proj. #: 3365  
 Client: South32 Illawarra Metallurgical Coal

**Results - Threatened Species (East)**  
 Dendrobium Mine - Plan for the Future:  
 Coal for Steelmaking - Biodiversity Assessment

**Figure 9**



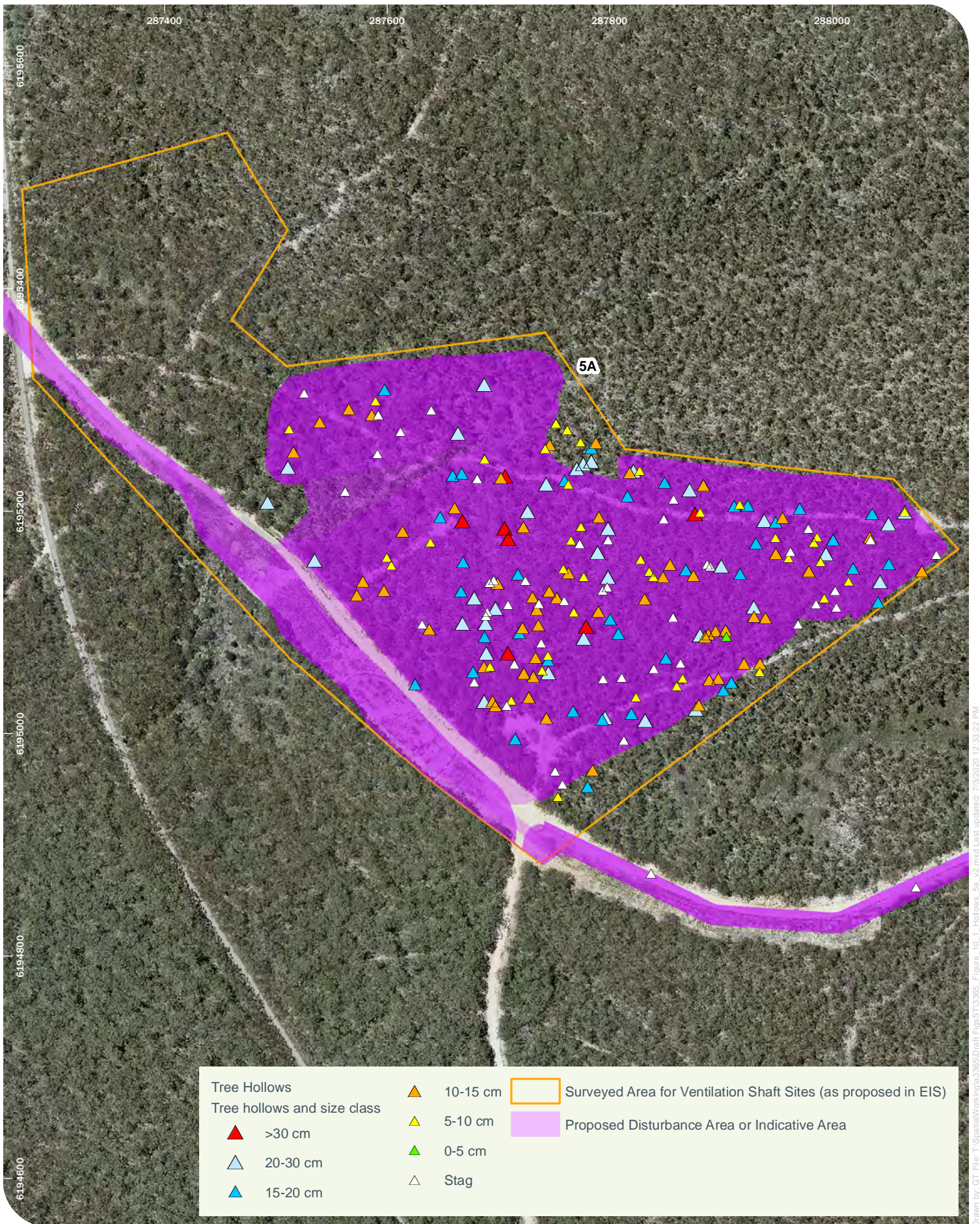
Drawn by: GT File: T:\Spatial\Working\33365\Draft\Figs\T3365\_Figure\_10\_Hollows\_West3.mxd Last updated: 7/3/2020 4:56:25 PM



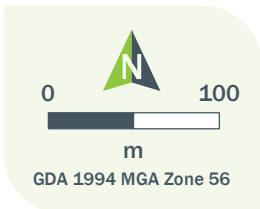
**Results – Tree Hollow Mapping (West)**  
**Dendrobium Mine - Plan for the Future:**  
**Coal for Steelmaking - Biodiversity Assessment**

Niche PM: ST/LB  
 Niche Proj. #: 3365  
 Client: South32 Illawarra Metallurgical Coal

**Figure 10**



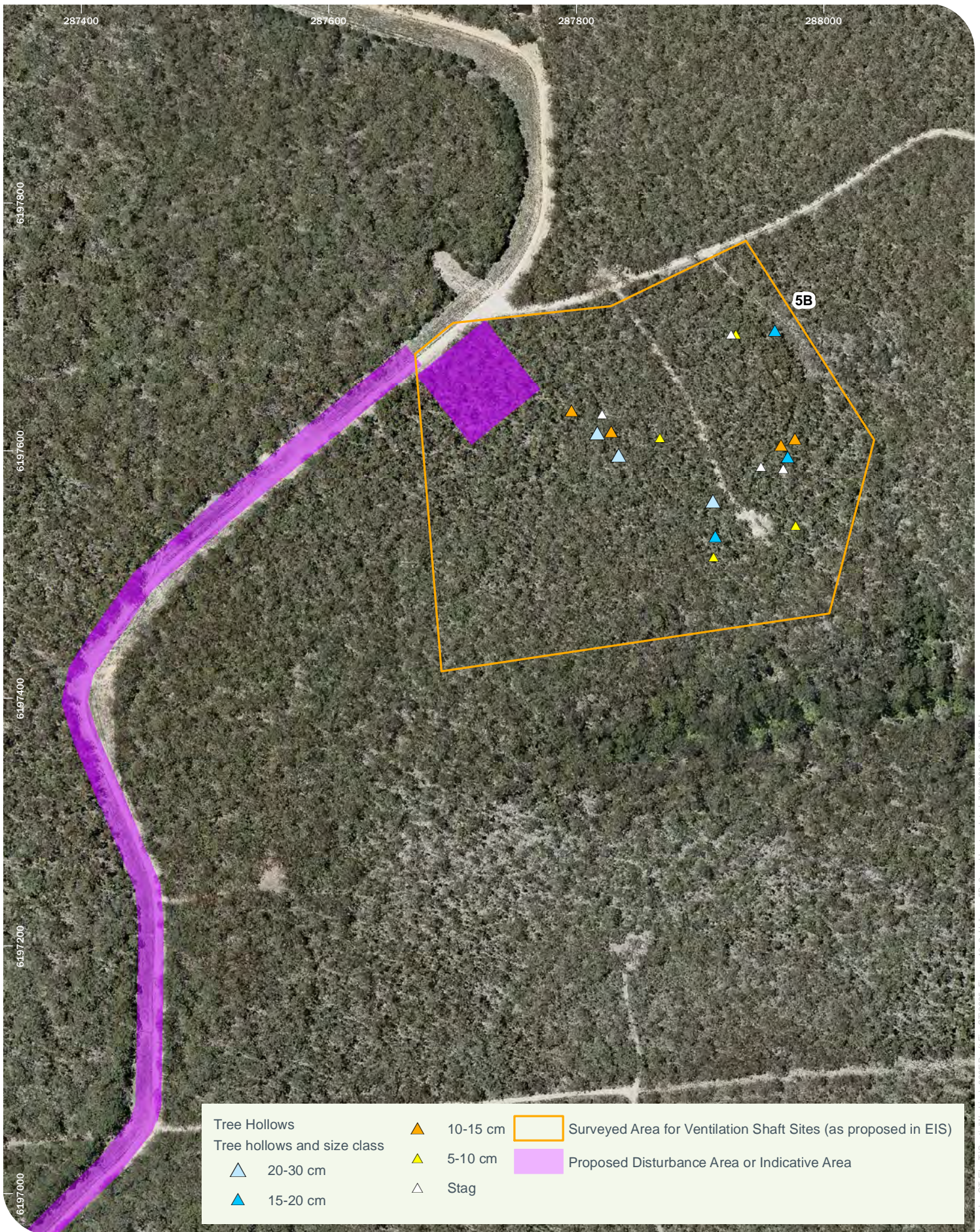
Drawn by: GT File: T:\Spatial\Working\33365\Draft\Figs\T33365\_Figure\_10\_1\_Hollows\_5a\_v2.mxd Last updated: 7/3/2020 12:33:22 PM



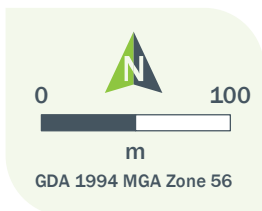
Niche PM: ST/LB  
 Niche Proj. #: 33365  
 Client: South32 Illawarra Metallurgical Coal

**Results – Tree Hollow Mapping 5A**  
 Dendrobium Mine - Plan for the Future:  
 Coal for Steelmaking - Biodiversity Assessment

**Figure 10.1**



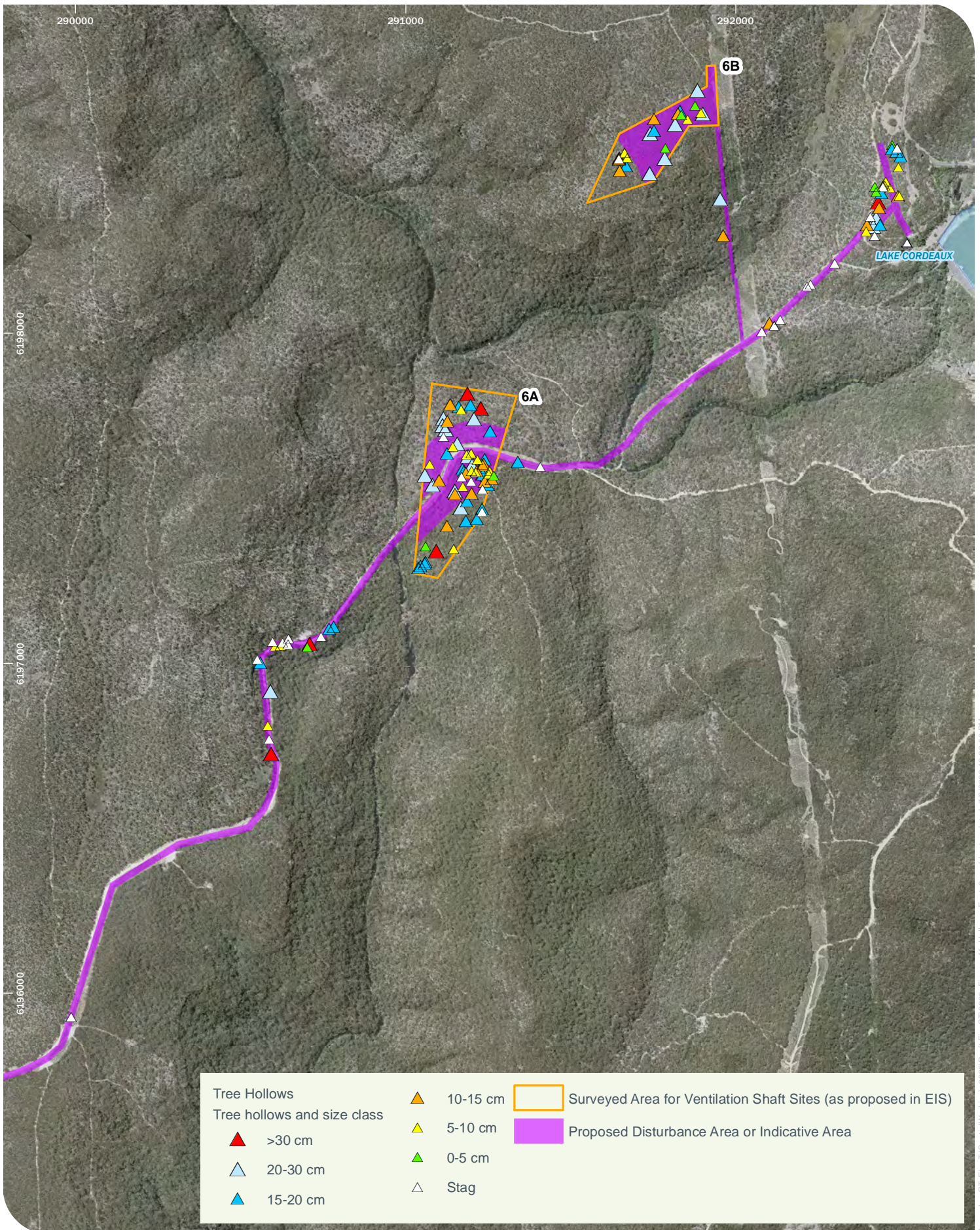
Drawn by: GT File: F:\Spatial\Working\3365\Draft\Figs\T3365\_Figure\_10\_2\_Hollows\_5Bv2.mxd Last updated: 7/9/2020 12:37:36 PM



Niche PM: ST/LB  
Niche Proj. #: 3365  
Client: South32 Illawarra Metallurgical Coal

**Results – Tree Hollow Mapping 5B**  
Dendrobium Mine - Plan for the Future:  
Coal for Steelmaking - Biodiversity Assessment

**Figure 10.2**



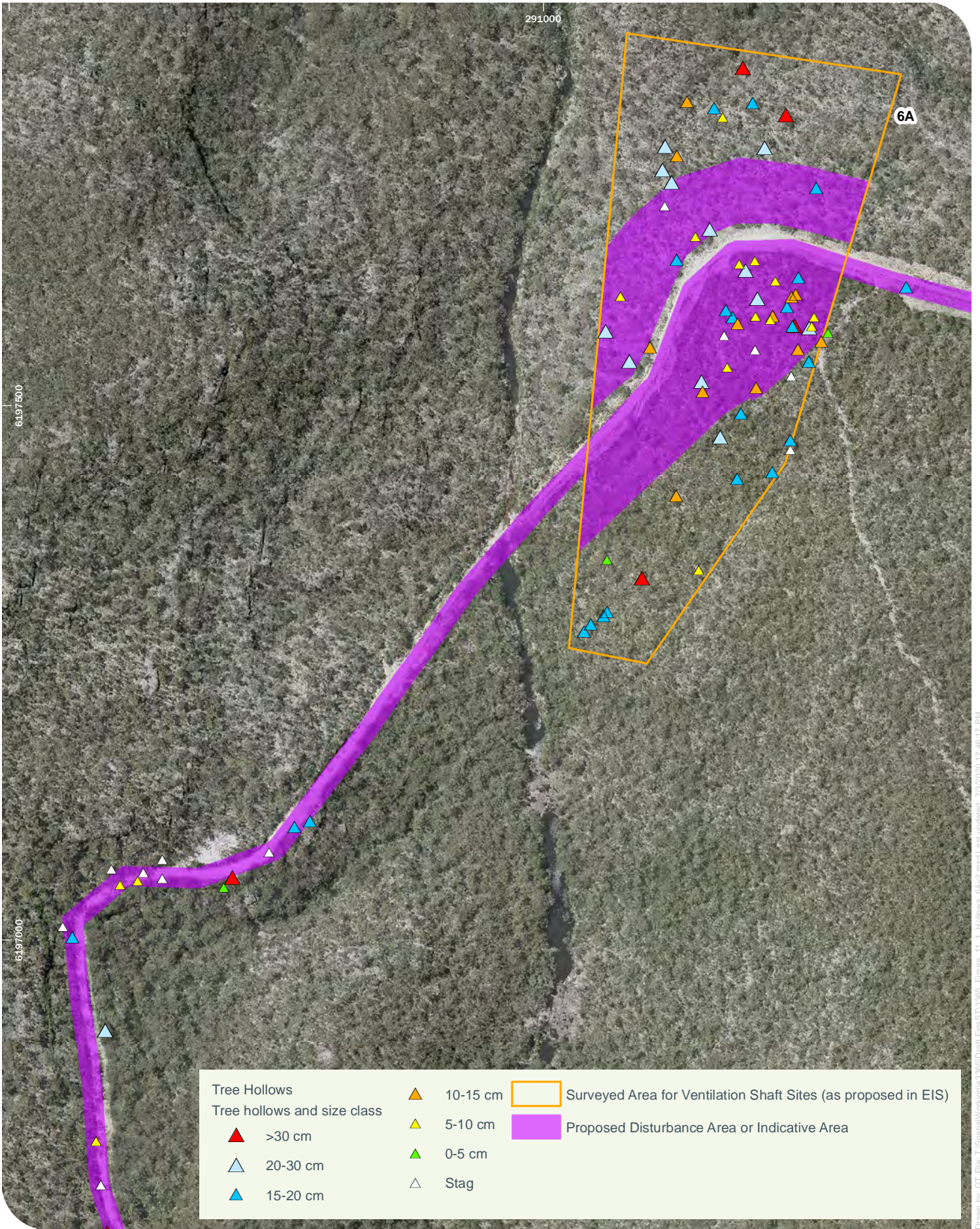
Drawn by: GT File: T:\Spatial\Working\33365\Draft Figs\T33365\_Figure\_11\_Hollows\_Eastv2.mxd Last updated: 7/3/2020 12:39:59 PM



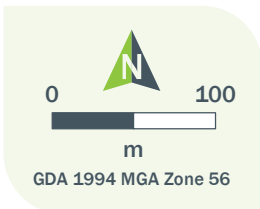
**Results – Tree Hollow Mapping (East)**  
**Dendrobium Mine - Plan for the Future:**  
**Coal for Steelmaking - Biodiversity Assessment**

Niche PM: ST/LB  
 Niche Proj. #: 3365  
 Client: South32 Illawarra Metallurgical Coal

**Figure 11**



Drawn by: GT File: T:\Spatial\Working\3365\Draft\Figs\T3365\_Figure\_11\_1\_Hollows\_6A\2.mxd Last updated: 7/3/2020 12:46:17 PM



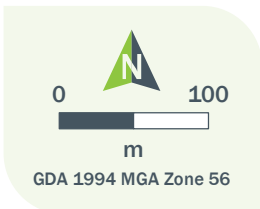
Niche PM: ST/LB  
 Niche Proj. #: 3365  
 Client: South32 Illawarra Metallurgical Coal

**Results – Tree Hollow Mapping 6A**  
 Dendrobium Mine - Plan for the Future:  
 Coal for Steelmaking - Biodiversity Assessment

**Figure 11.1**



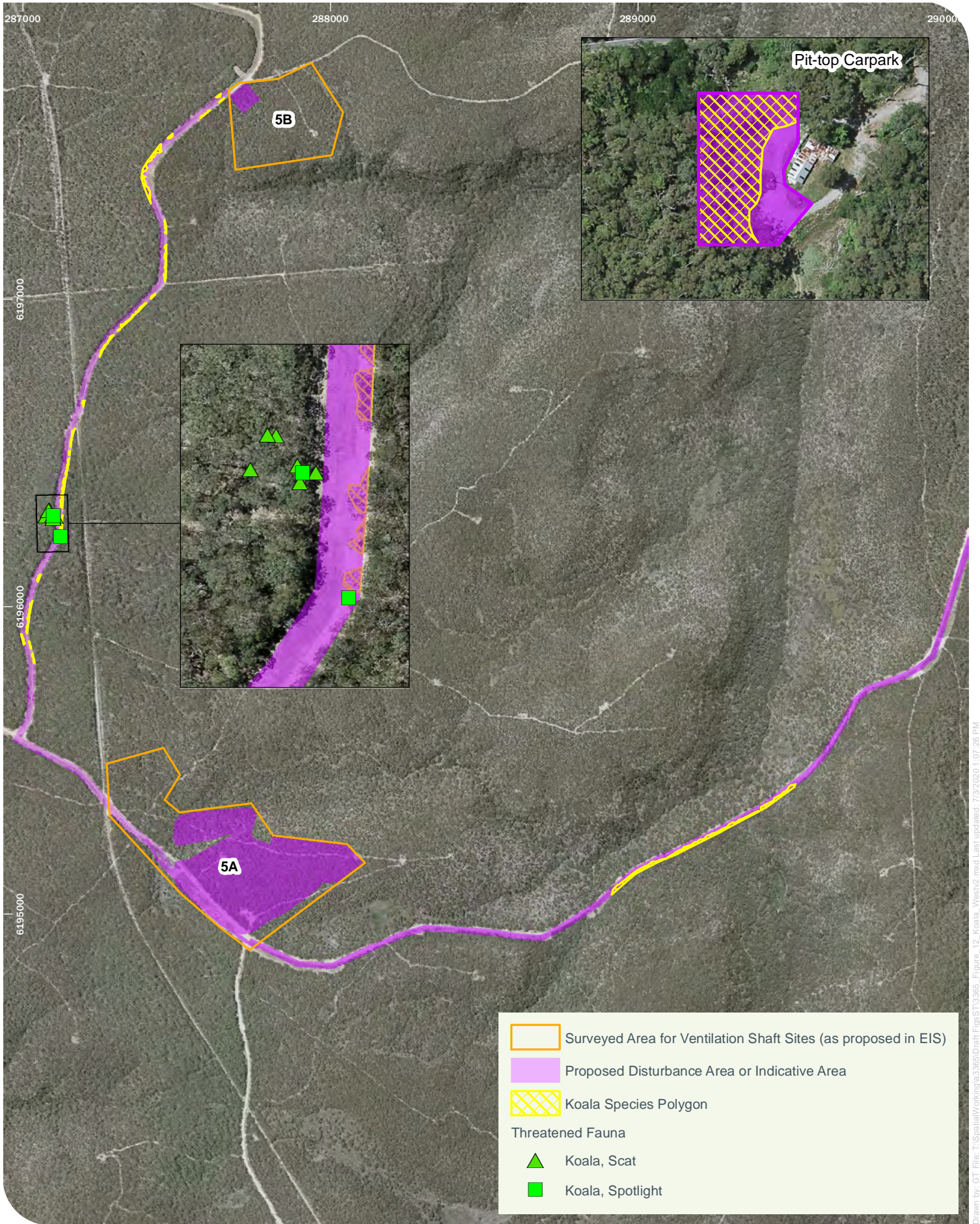
Drawn by: GT File: T:\Spatial\Working\3365\Draft\Figs\T3365\_Figure\_11\_2\_Hollows\_6B\_v2.mxd Last updated: 7/3/2020 12:52:23 PM



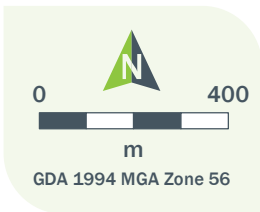
**Results – Tree Hollow Mapping 6B**  
**Dendrobium Mine - Plan for the Future:**  
**Coal for Steelmaking - Biodiversity Assessment**

Niche PM: ST/LB  
 Niche Proj. #: 3365  
 Client: South32 Illawarra Metallurgical Coal

**Figure 11.2**



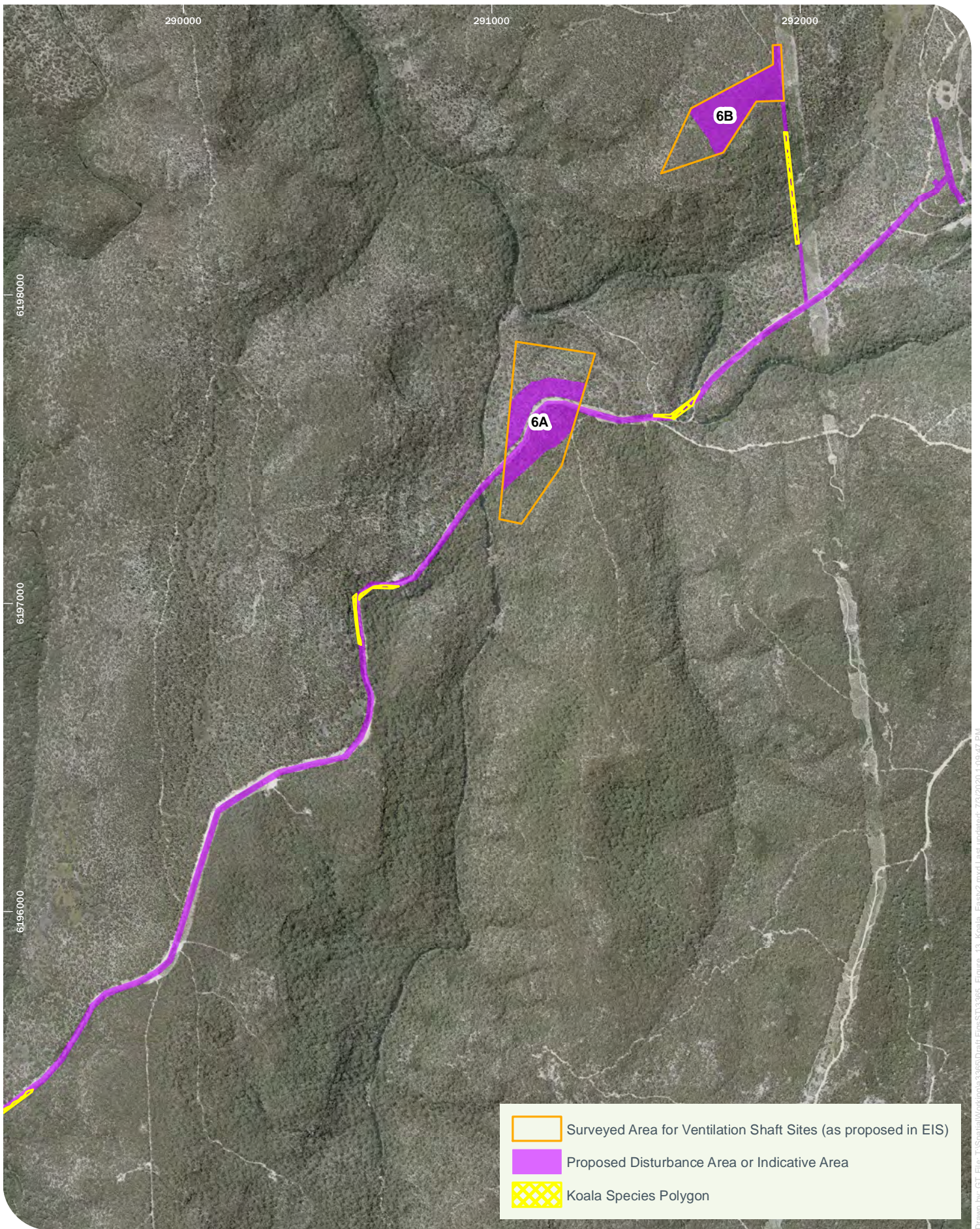
Drawn by: GT File: T:\Spatial\Working\3365\Draft\Figs\T3365\_Figure\_12\_Koala\_Westv2.mxd Last updated: 7/9/2020 1:07:26 PM



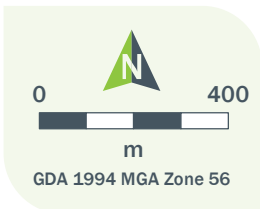
**Koala Species Polygon (West)**  
**Dendrobium Mine - Plan for the Future:**  
**Coal for Steelmaking - Biodiversity Assessment**

**Figure 12**

Niche PM: ST/LB  
 Niche Proj. #: 3365  
 Client: South32 Illawarra Metallurgical Coal



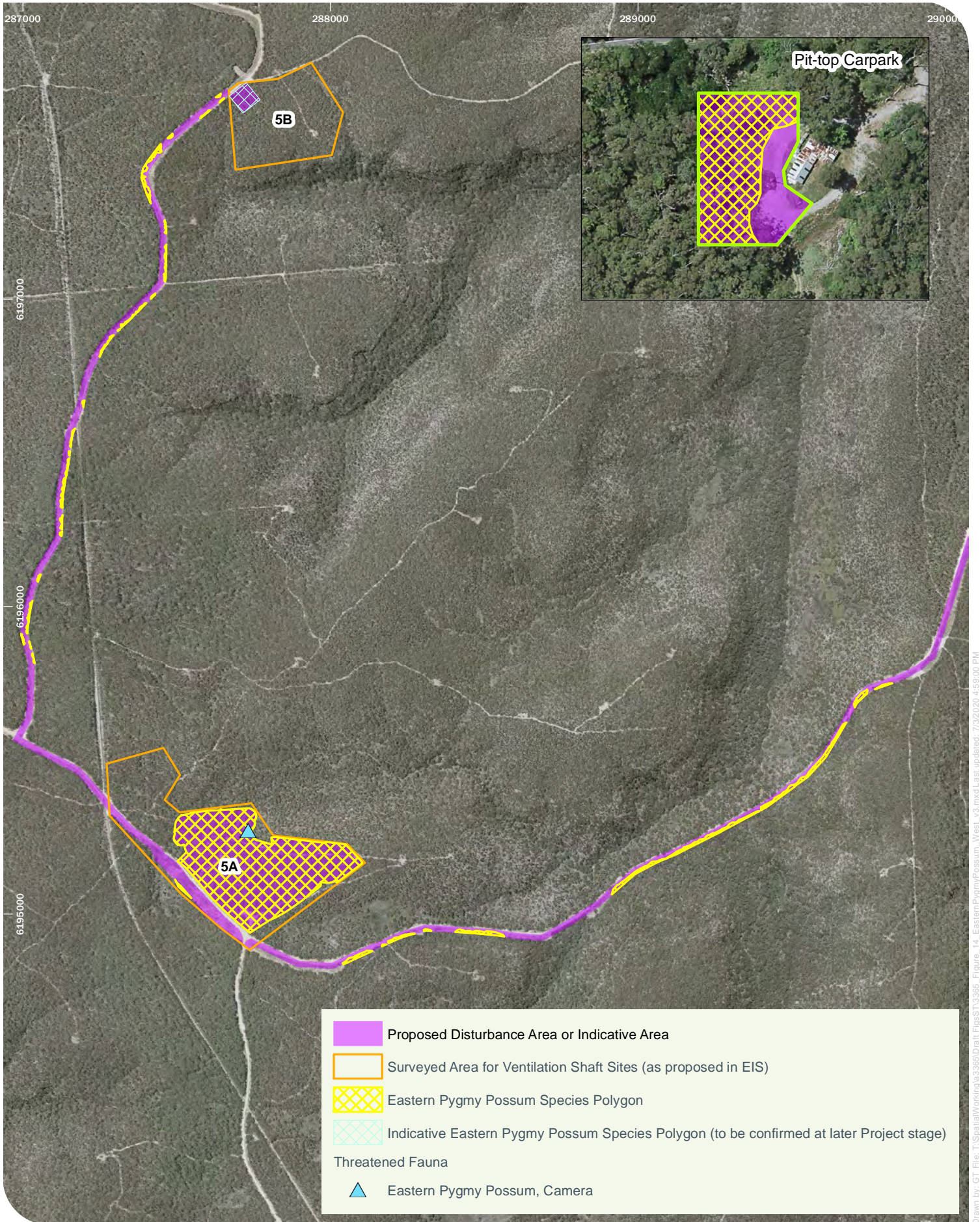
Drawn by: GT File: T:\Spatial\Working\3365\Draft\Figs\T\3365\_Figure\_13\_Koala\_East2.mxd Last updated: 7/3/2020 1:09:47 PM



**Koala Species Polygon (East)**  
**Dendrobium Mine - Plan for the Future:**  
**Coal for Steelmaking - Biodiversity Assessment**

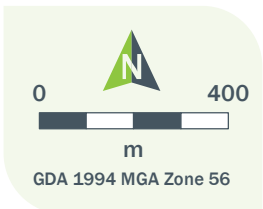
Niche PM: ST/LB  
 Niche Proj. #: 3365  
 Client: South32 Illawarra Metallurgical Coal

**Figure 13**



	Proposed Disturbance Area or Indicative Area
	Surveyed Area for Ventilation Shaft Sites (as proposed in EIS)
	Eastern Pygmy Possum Species Polygon
	Indicative Eastern Pygmy Possum Species Polygon (to be confirmed at later Project stage)
<b>Threatened Fauna</b>	
	Eastern Pygmy Possum, Camera

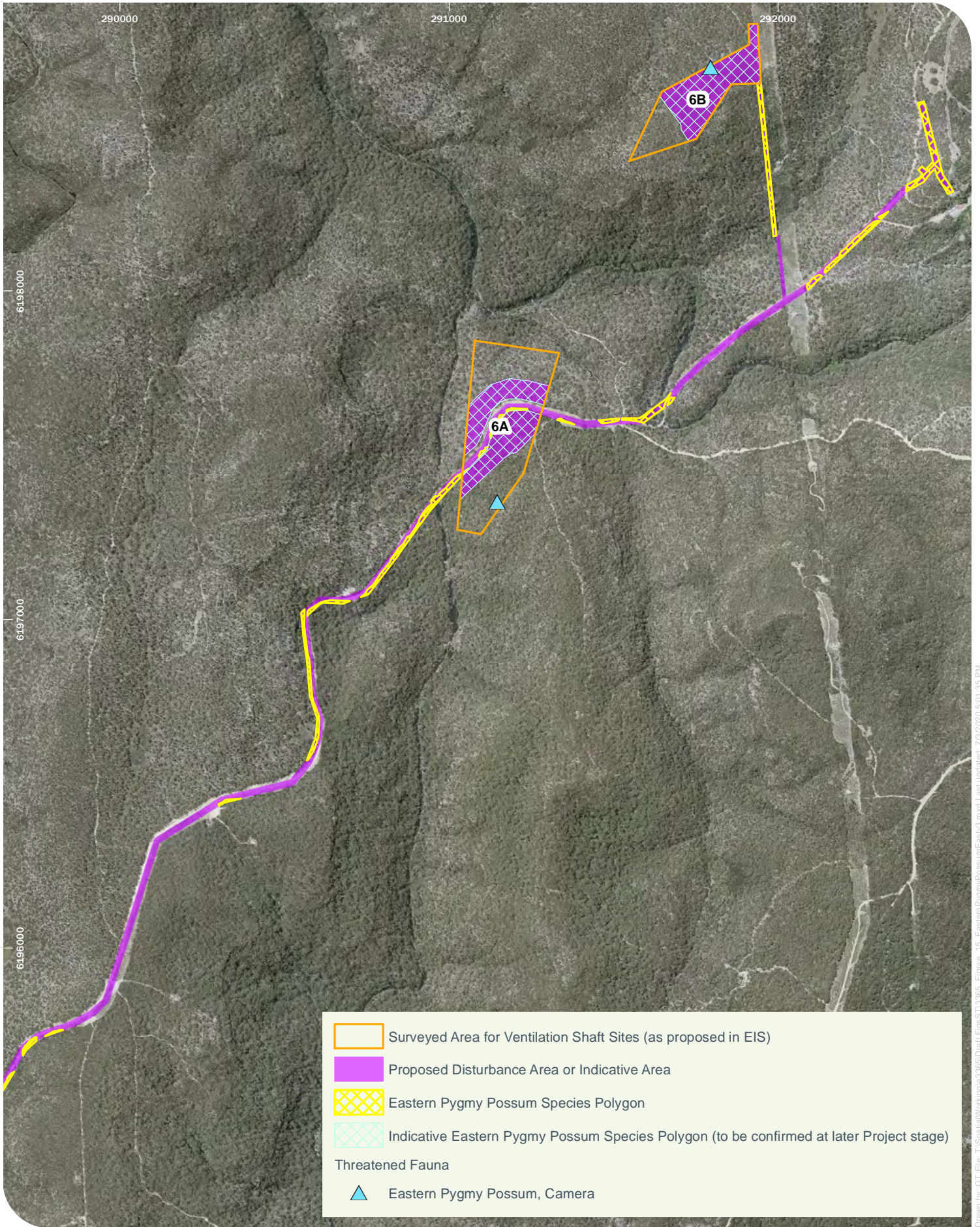
Drawn by: GT File: F:\Spatial\Working\33365\Draft\Figs\T33365\_Figure\_14\_EasternPygmyPossum\_West\_v3.mxd Last updated: 7/3/2020 4:59:00 PM



**Eastern Pygmy Possum Species Polygon (West)**  
**Dendrobium Mine - Plan for the Future:**  
**Coal for Steelmaking - Biodiversity Assessment**

Niche PM: ST/LB  
 Niche Proj. #: 3365  
 Client: South32 Illawarra Metallurgical Coal

**Figure 14**



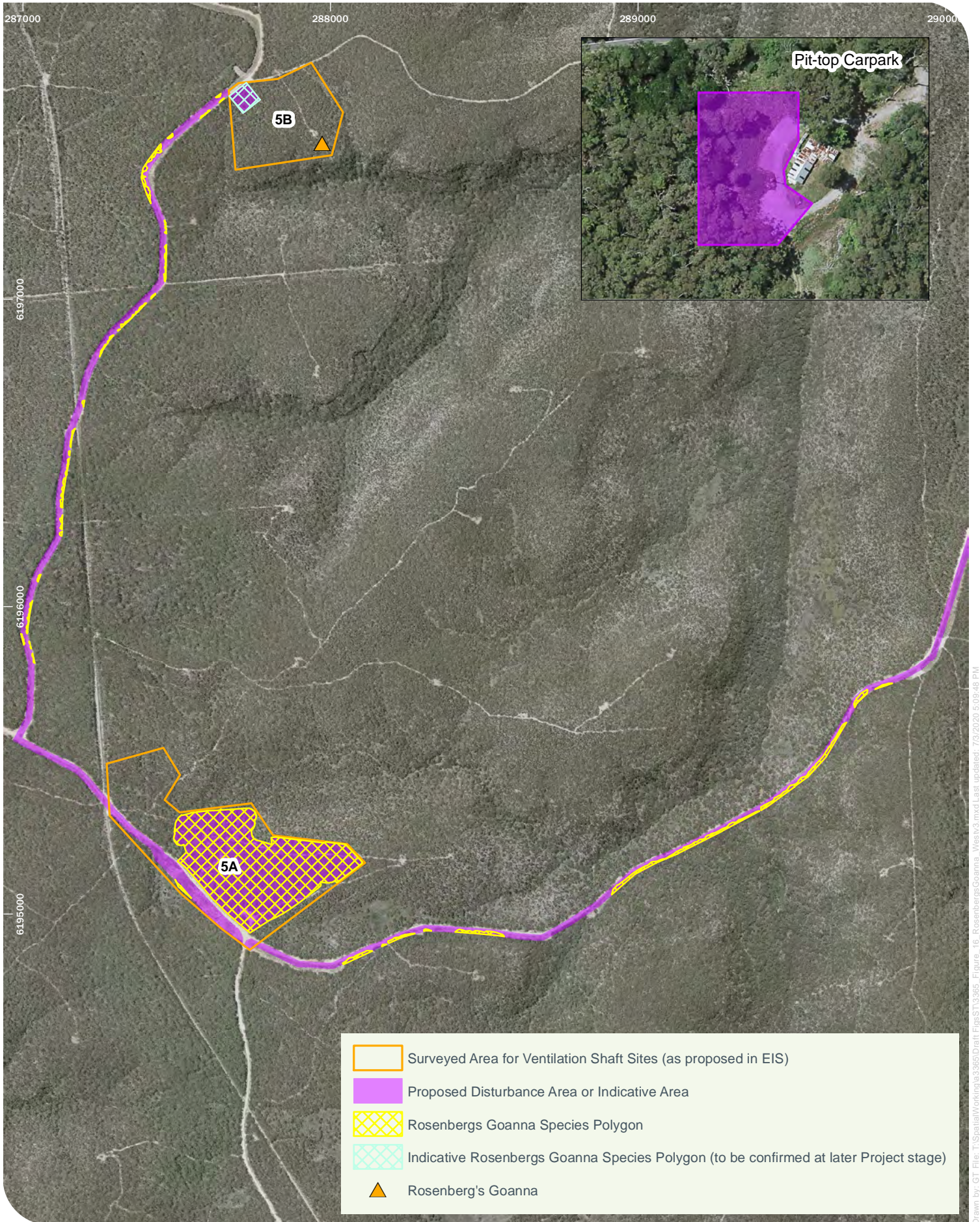
Drawn by: GT File: F:\Spatial\Working\33365\Draft\Figs\T33365\_Figure\_15\_EasternPygmyPossumEastv2.mxd Last updated: 7/9/2020 5:01:35 PM



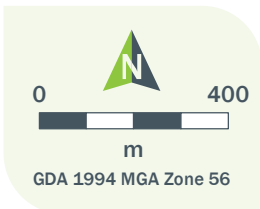
**Eastern Pygmy Possum Species Polygon (East)**  
**Dendrobium Mine - Plan for the Future:**  
**Coal for Steelmaking - Biodiversity Assessment**

Niche PM: ST/LB  
 Niche Proj. #: 33365  
 Client: South32 Illawarra Metallurgical Coal

**Figure 15**



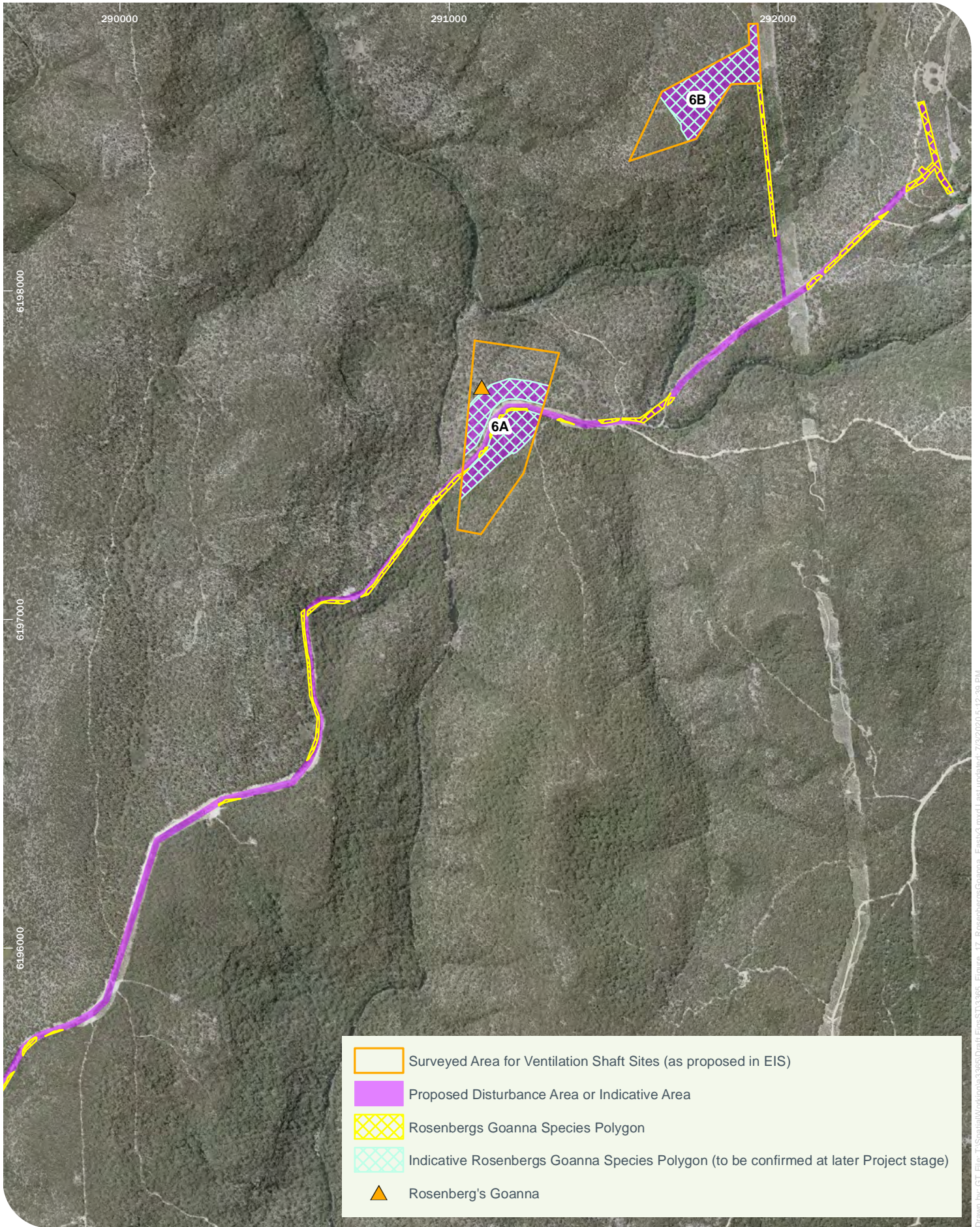
Drawn by: GT File: T:\SpatialWorking\33365\Draft Figs\TUG365\_Figure\_16\_RosenbergsGoanna\_West\3.mxd Last updated: 7/3/2020 5:09:48 PM



**Rosenbergs Goanna Species Polygon (West)**  
**Dendrobium Mine - Plan for the Future:**  
**Coal for Steelmaking - Biodiversity Assessment**

Niche PM: ST/LB  
 Niche Proj. #: 3365  
 Client: South32 Illawarra Metallurgical Coal

**Figure 16**



Drawn by: GT File: T:\Spatial\Working\33365\Draft\Figs\T33365\_Figure\_17\_RosenbergsGoanna\_Eastv3.mxd Last updated: 7/3/2020 5:12:39 PM



**Rosenbergs Goanna Species Polygon (East)**  
**Dendrobium Mine - Plan for the Future:**  
**Coal for Steelmaking - Biodiversity Assessment**

Niche PM: ST/LB  
 Niche Proj. #: 3365  
 Client: South32 Illawarra Metallurgical Coal

**Figure 17**

## Annexure 1. Vegetation Plot and Transect Results

**Table 10. Plots Completed within the Transmission Line Easement**

Plant Community Type (PCT)	Condition	Area of impact (ha) for the transmission line easement	Area of impact for the installation of power poles	Plots required as per FBA	Plots completed (supplementary report only)
1083 Red Bloodwood - scribbly gum heathy woodland on sandstone plateaux, Sydney Basin Bioregion (HN566)	Good	3.00	0.00	2	3
	Regeneration	0.00	0.10	1	3
1395 Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion (HN556)	Good	0.45	0.00	1	1
	Regeneration	0.00	0.10	1	1
1250 Sydney Peppermint - Smooth-barked Apple - Red Bloodwood shrubby open forest on slopes of moist sandstone gullies, eastern Sydney Basin Bioregion (HN651)	Good	0.85	0.00	1	4
<b>Total</b>					<b>12</b>

**Table 11. BioBanking Transect Results**

plot_name	nps	nos	nms	ngcg	ngcs	ngco	epc	nth	or	fl	Easting	Northing
3365sh02	27	0	0	54	42	23	0	0	1	0	290243	6196402
3365sh04	32	0	0	19	8	9	0	0	1	0	289197	6195250
3365sh01	54	25.6	16	34	46	12	0	2	1	32	290573	6196831
3365sh03	38	10.5	14.5	66	58	24	0	1	1	57	290174	6196321
3365sh06	36	8	33	6	10	6	0	1	1	10	292492	6198449
3365sh09	26	0	0	36	58	20	0	0	1	0	292019	6198069
3365SH12	39	0	3.5	58	92	30	0	0	1	0	291995	6198274
3365sh05	32	20	4.2	46	12	24	0	3	1	64	289262	6195251
3365SH10	38	9.5	0.5	26	24	8	0	1	1	5	291646	6197619
3365SH11	37	10.5	0	32	42	14	0	3	1	5	291604	6197616
3365sh07	31	0	0	69	7	22	0	0	1	0	287041	6196093
3365sh08	31	11.7	9.2	64	12	52	0	1	1	35	287074	6196088

NPS = native species richness, NOS = native overstorey cover, NMS = native midstorey cover, NGCG = native ground cover (grasses), NGCS = native ground cover (shrubs), NGCO = native ground cover (other), EPC = exotic cover, OR = overstorey regeneration, NTH = number of trees with hollows, FL = total length of fallen logs, BT = Banksia Thicket, TTT = Teatree Thicket, SC = Sedgeland Complex, CH = Cyperoid Heath, EFW = Eucalypt Fringing Woodland

**Table 12. Flora Results**

Species	3365sh01	3365sh02	3365sh03	3365sh04	3365sh05	3365sh06	3365sh07	3365sh08	3365sh09	3365sh10	3365sh11	3365sh12
Acacia binervata							0.2	1				
Acacia bynoeana		0.1										
Acacia irrorata										1	0.1	
Acacia linifolia	0.1			0.1					0.1	0.5	0.1	
Acacia longifolia	5									0.1		
Acacia longifolia subsp. longifolia				0.1	0.1	0.1						
Acacia myrtifolia	0.3										0.1	
Acacia obtusifolia										0.1		
Acacia terminalis							0.1			1		
Acacia ulicifolia		0.1		0.1							0.1	
Acianthus exsertus	0.1											
Acianthus spp.												0.1
Actinotus minor		0.1										
Allocasuarina littoralis									0.1	0.1	0.2	0.1
Allocasuarina torulosa					2							
Aristida ramosa									0.5			
Aristida vagans									0.1			
Aristida warburgii		0.2										
Astrotricha latifolia								0.1				
Banksia ericifolia	0.1											0.5
Banksia serrata	1	0.1					15					
Banksia spinulosa	5				0.1				0.3		0.1	0.2
Banksia spinulosa var. spinulosa							0.2					
Billardiera scandens	0.1				0.1		0.1			0.1	0.1	
Blechnum cartilagineum										0.2		
Bolboschoenus spp.							0.1					
Boronia parviflora									0.3	0.1		0.1
Boronia spp.												0.1

Species	3365sh01	3365sh02	3365sh03	3365sh04	3365sh05	3365sh06	3365sh07	3365sh08	3365sh09	3365sh10	3365sh11	3365sh12
<i>Bossiaea heterophylla</i>	0.1						0.1					0.1
<i>Bossiaea obcordata</i>	0.3				0.1							0.1
<i>Bossiaea prostrata</i>		0.1										
<i>Brunonia australis</i>					0.1							
<i>Brunoniella australis</i>				0.1								
<i>Brunoniella pumilio</i>												
<i>Brunoniella</i> spp.	0.1											
<i>Callitris rhomboidea</i>										0.1		
<i>Carex appressa</i>												0.1
<i>Carex inversa</i>										0.2	0.1	
<i>Cassutha glabella</i>	0.1									2		
<i>Caustis flexuosa</i>	0.2	0.1										0.2
<i>Centella asiatica</i>								0.3				
<i>Ceratopetalum apetalum</i>										0.5		
<i>Cheilanthes sieberi</i> subsp. <i>sieberi</i>							0.1					
<i>Chloanthes stoechadis</i>	0.1											
<i>Clematis aristata</i>					0.1			0.1				
<i>Conospermum ellipticum</i>		0.1										
<i>Conospermum longifolium</i>		0.1										
<i>Correa alba</i> var. <i>alba</i>										0.1	0.1	
<i>Corybas aconitiflorus</i>	0.3											
<i>Corybas</i> spp.								2				
<i>Corymbia gummifera</i>	20	0.2			10	1						
<i>Cryptandra spinescens</i>										0.1		
<i>Cryptostylis</i> spp.						0.1						
<i>Cyathochaeta diandra</i>		0.5				0.1			0.2		0.1	
<i>Cynodon dactylon</i> var. <i>dactylon</i>				0.1			0.5					
<i>Dampiera purpurea</i>				0.1	0.1		0.1	0.1				
<i>Dampiera stricta</i>		0.1		0.1		0.1						
<i>Daviesia ulicifolia</i>					0.1							

Species	3365sh01	3365sh02	3365sh03	3365sh04	3365sh05	3365sh06	3365sh07	3365sh08	3365sh09	3365sh10	3365sh11	3365sh12
Daviesia ulicifolia subsp. ulicifolia				0.1								
Desmodium spp.											0.1	
Dianella caerulea							0.1	0.1			0.2	
Dianella caerulea var. caerulea	0.1											
Dianella revoluta	0.1											
Dianella revoluta var. revoluta				0.2								
Dichondra repens							0.1					
Dillwynia retorta										0.2		
Dodonaea triquetra	0.2									0.2		
Doodia aspera								5		0.3		
Echinopogon caespitosus							0.1	0.1				
Empodisma minus												0.1
Entolasia marginata							0.1	0.1	0.2			
Entolasia stricta		0.2		0.1						0.5	0.3	0.1
Entolasia whiteana	0.2			0.1	0.2	0.1						
Epacris pulchella												0.1
Epacris purpurascens var. purpurascens									0.1			
Eragrostis brownii				0.1					0.1			
Eriostemon australasius	0.1					0.3						0.1
Eucalyptus crebra								2				
Eucalyptus eugenioides	0.1				5		0.2	15				
Eucalyptus globoidea												
Eucalyptus piperita				5	30							
Eucalyptus punctata								10				
Eucalyptus punctata subsp. punctata	10						0.1					
Eucalyptus racemosa			30						0.1			
Eucalyptus sclerophylla		0.1				10						
Eucalyptus sieberi										30	45	0.2
Gahnia aspera								1				
Genoplesium spp.		0.1				0.2						0.1

Species	3365sh01	3365sh02	3365sh03	3365sh04	3365sh05	3365sh06	3365sh07	3365sh08	3365sh09	3365sh10	3365sh11	3365sh12
<i>Glycine tabacina</i>							0.1					
<i>Gompholobium grandiflorum</i>	0.1											
<i>Gonocarpus tetragynus</i>	0.1					0.1						
<i>Gonocarpus teucroides</i>				0.1			0.1	0.1			0.1	
<i>Goodenia hederacea</i>	0.1			0.1			0.3					
<i>Grevillea mucronulata</i>	0.2			0.1	0.1						0.3	0.1
<i>Grevillea oleoides</i>									0.5	0.1		0.1
<i>Hakea dactyloides</i>		0.4			0.1						0.1	1
<i>Hakea gibbosa</i>	0.1					1						
<i>Hakea sericea</i>					0.3				0.1	0.2	0.1	0.5
<i>Hardenbergia violacea</i>	0.1				0.1						0.1	
<i>Hibbertia aspera</i>			0.1	0.1				5			0.1	
<i>Hibbertia aspera</i> subsp. <i>aspera</i>							0.2					
<i>Hibbertia circumdans</i>												0.1
<i>Hibbertia</i> spp.												0.4
<i>Hovea linearis</i>	0.1				0.1						0.1	
<i>Hypericum gramineum</i>							0.1					
<i>Imperata cylindrica</i>									0.2			
<i>Isopogon anemonifolius</i>	0.1				0.2	0.3			0.2			1
<i>Kennedia rubicunda</i>								0.1				
<i>Kunzea ambigua</i>							0.2		10			
<i>Lagenifera stipitata</i>							0.1	0.1				
<i>Lagenophora gracilis</i>	0.1			0.1								
<i>Lambertia formosa</i>	0.2	0.1				0.1						
<i>Lasiopetalum parviflorum</i>										0.1	0.2	0.1
<i>Laxmannia gracilis</i>						0.1						
<i>Lepidosperma laterale</i>						0.1	0.1	5	0.2			
<i>Lepidosperma limicola</i>											0.1	0.2
<i>Lepidosperma</i> spp.	0.2											
<i>Leptocarpus tenax</i>												0.1

Species	3365sh01	3365sh02	3365sh03	3365sh04	3365sh05	3365sh06	3365sh07	3365sh08	3365sh09	3365sh10	3365sh11	3365sh12
<i>Leptomeria acida</i>	0.1			0.1				0.1				
<i>Leptospermum arachnoides</i>		0.1				0.2			1			
<i>Leptospermum juniperinum</i>												0.1
<i>Leptospermum morrisonii</i>										2		
<i>Leptospermum polygalifolium</i>				0.2								
<i>Leptospermum squarrosus</i>									0.2			
<i>Leptospermum trinervium</i>	1	1				10				0.2	0.2	5
<i>Lepyrodia scariosa</i>						0.1			2			
<i>Leucopogon lanceolatus</i>								0.2		0.1	0.1	
<i>Leucopogon microphyllus</i>						0.1			2			
<i>Leucopogon setiger</i>					0.1							
<i>Leucopogon</i> spp.									0.1			
<i>Lindsaea linearis</i>		0.2	0.1									
<i>Lindsaea microphylla</i>							0.1					
<i>Lissanthe strigosa</i>	0.5											
<i>Lissanthe strigosa</i> subsp. <i>strigosa</i>				0.1								
<i>Lissanthe strigosa</i> subsp. <i>subulata</i>					0.1							
<i>Lomandra cylindrica</i>	0.2											
<i>Lomandra filiformis</i>										0.1	0.1	
<i>Lomandra filiformis</i> subsp. <i>coriacea</i>					0.1	0.2						
<i>Lomandra longifolia</i>	0.1			0.1	0.2	0.1	0.1			0.5	0.1	0.5
<i>Lomandra multiflora</i> subsp. <i>multiflora</i>	0.2	0.1				0.1				0.1		0.1
<i>Lomandra obliqua</i>	0.1	0.1		0.1	0.1	0.1	0.1					0.1
<i>Lomatia silaifolia</i>	0.1				0.1							
<i>Microlaena stipoides</i>				0.1	0.1		5		0.1		0.1	
<i>Microlaena stipoides</i> var. <i>stipoides</i>	0.1							5				
<i>Myrsine variabilis</i>	0.1											
<i>Notelaea longifolia</i>								2				
<i>Opercularia aspera</i>										0.1		
<i>Opercularia diphylla</i>							0.1					

Species	3365sh01	3365sh02	3365sh03	3365sh04	3365sh05	3365sh06	3365sh07	3365sh08	3365sh09	3365sh10	3365sh11	3365sh12
<i>Oxalis perennans</i>							0.1	0.1		0.1	0.1	
<i>Patersonia glabrata</i>	0.1	5		0.1	0.1							
<i>Persoonia levis</i>	0.2	0.1			0.2							
<i>Persoonia linearis</i>				0.1	0.3			3				
<i>Persoonia pinifolia</i>	0.1					0.1						
<i>Petrophile sessilis</i>		0.3			0.1	10			0.5			2
<i>Phyllanthus hirtellus</i>	0.1			0.1		0.1						
<i>Phyllota grandiflora</i>												
<i>Pimelea linifolia</i> subsp. <i>linifolia</i>	0.1											
<i>Platysace linearifolia</i>	0.1					0.1			0.1	0.2	0.1	
<i>Pomax umbellata</i>		0.1		0.1	0.1		0.1			0.1		
<i>Pratia purpurascens</i>				0.1			0.1	0.5				
<i>Pteridium esculentum</i>	0.2				15		0.5	0.1		1	0.2	1
<i>Pterostylis</i> spp.							0.2	5				
<i>Pultenaea ferruginea</i>	0.1											
<i>Rytidosperma</i> spp.				0.1				0.1				
<i>Schoenus brevifolius</i>											0.1	
<i>Smilax glyciophylla</i>						0.1						
<i>Solanum prinophyllum</i>											0.1	
<i>Stylidium graminifolium</i>						0.1						
<i>Stylidium</i> spp.												0.1
<i>Styphelia tubiflora</i>				0.1		0.3						
<i>Telopea speciosissima</i>												
<i>Tristaniopsis laurina</i>										2	0.5	
<i>Tylophora barbata</i>								0.1				
<i>Veronica plebeia</i>							0.1					
<i>Viola</i> spp.											0.1	
<i>Xanthorrhoea</i> spp.									0.1			
<i>Xanthosia pilosa</i>	0.1									0.1		0.2
<i>Xanthosia tridentata</i>	0.1					0.1				0.1		0.1

Species	3365sh01	3365sh02	3365sh03	3365sh04	3365sh05	3365sh06	3365sh07	3365sh08	3365sh09	3365sh10	3365sh11	3365sh12
Xylomelum pyriforme												
Xyris spp.				0.1								
(blank)								0.1		0.1	0.1	0.1

## Annexure 2. Fauna Species List

**Table 13. Fauna Species List**

Common Name	Scientific Name	BC Act Status	EPBC Act Status	Site 5A	Site 5B	Site 6A	Site 6B	Transition Forest (Fire Road 6B)	Observation Type
Eastern Rosella	<i>Platycercus eximius</i>	P	-		X				Remote Camera
Eastern Spinebill	<i>Acanthorhynchus tenuirostris</i>	P	-		X	X			Remote Camera
Eastern Yellow Robin	<i>Eopsaltria australis</i>	P	-			X			Remote Camera
Feathertail Glider	<i>Acrobates pygmaeus</i>	P	-						Remote Camera
Greater Glider	<i>Petauroides volans</i>	P	V					X	Spotlighting
Koala	<i>Phascolarctos cinereus</i>	V	V					X	Spotlighting/SAT survey
Lesueur's Frog	<i>Litoria lesueuri</i>	P	-	X					Remote Camera
White-striped Freetail Bat	<i>Tadarida australis</i>	P	-	X					Spotlighting
New Holland Honeyeater	<i>Phylidonyris novaehollandiae</i>	P	-			X			Remote Camera
Eastern Pygmy Possum	<i>Cercatetus nanus</i>	V	-	X		X	X		Remote Camera
Red Wattlebird	<i>Anthochaera carunculata</i>	P	-	X					Remote Camera
Common Ringtail Possum	<i>Pseudocheirus peregrinus</i>	P	-		X			X	Spotlighting
Satin Bowerbird	<i>Ptilonorhynchus violaceus</i>	P	-				X		Remote Camera
Stripped Marsh Frog	<i>Limnodynastes peronii</i>	P	-	X					Remote Camera
Sugar Glider	<i>Petaurus breviceps</i>	P	-				X	X	Spotlighting/Remote Camera
Swamp Wallaby	<i>Wallabia bicolor</i>	P	-	X	X	X			Remote Camera
Yellow-faced Honeyeater	<i>Lichenostomus chrysops</i>	P	-		X	X			Remote Camera
Yellow-tailed Black Cockatoo	<i>Calyptorhynchus funereus</i>	P	-	X					Remote Camera
Brown Antechinus	<i>Antechinus stuartii</i>	P	-	X			X		Remote Camera

## Annexure 3. Response Table – Relevant BCD Comments

BCD Comment No.	EES Group Comment:	Niche Response
6	<p><i>The response in the RTS does not demonstrate that the FBA has been appropriately applied in relation to the Pit Top Carpark extension and further information is still required.</i></p> <p><i>The FBA must be applied to all aspects of the proposed development as presented. The development includes an allowance for clearing 9.5 ha of vegetation in ancillary areas that have not been determined. Key aspects of the FBA, including avoidance, mitigation and offsetting cannot be addressed in the absence of necessary details.</i></p>	<p>The Project EIS included an allowance for clearance of 9.5 ha of native vegetation in the Project offset liability to account for ancillary surface infrastructure where, at that stage, the location could not be defined.</p> <p>Since lodgement of the Project EIS, South32 has undertaken further design development of this ancillary surface infrastructure, including:</p> <ul style="list-style-type: none"> <li>• amendment of the disturbance extent of Ventilation Shaft Site No 5A to incorporate: <ul style="list-style-type: none"> <li>– additional service boreholes which previously did not have a fixed location; and</li> <li>– ventilation and gas management infrastructure previously located at Ventilation Shaft Site No 5B; and</li> </ul> </li> <li>• finalisation of the alignment of Electricity Transmission Lines (ETLs) that will supply the ventilation shafts.</li> </ul> <p>The final ETL alignment was selected to avoid clearing where practical via use of existing fire access trails and road reserves. There is no change with regard to South32's commitment to avoid direct impacts to Upland Swamp vegetation from Project surface disturbance works.</p> <p>Additional survey work has recently been completed for surface infrastructure where the location was not fixed and a disturbance allowance was proposed, in response to BCD comments and to address refinements to the design of the surface infrastructure. Sections 2 and 3 of this report details methods of additional survey completed within surface infrastructure areas.</p> <p>The outcomes of the surveys for targeted threatened fauna species are shown in (Figure 7 to Figure 9). New or updated species polygons for threatened fauna are described in detail below and associated species credit requirements are provided in Section 4 (Tables 8 and 9). Updated survey and species polygons include surveys within the Pit-top Carpark and assumptions of presence within that area for any relevant species credit species associated with the vegetation or habitats to be removed.</p>
7	<p><i>To date no map of hollow bearing trees has been supplied. A map of hollow bearing trees is required to ensure the key FBA component of avoiding biodiversity values is met, in addition to determining whether certain species credit species occur (eg powerful owl).</i></p>	<p>Hollow bearing trees have been mapped within areas of proposed clearing (Figure 10 and Figure 11). The capacity to avoid hollow bearing trees was limited due to their high densities within proposed ventilation shaft sites and wider catchment generally. The location of ventilation shaft sites were biased towards ridgetops, away from watercourses and other more ecologically constrained ecosystem types such as Shale Sandstone Transition Forest TEC.</p> <p>There is a high abundance of hollows throughout the catchment area particularly in scribbly gum (<i>E. racemosa</i>) trees prevalent within the ventilation shaft sites. It was demonstrated that while hollows are abundant, hollow use is limited with a paucity of fauna recorded from ventilation shaft sites during repeated survey over months and years. This contrasts to fauna abundance in higher fertility areas of the study area including Shale Sandstone Transition Forest TEC, clearance of which is largely avoided by the Project.</p>
8	<p><i>SEPP 44 has been revised to reflect improved understanding of regional koala habitat use trees in the new Koala Protection SEPP. Scribbly Gum (<i>E. sclerophylla</i>) is recognized as a key koala habitat use tree in this region (OEH 2018 – A review of koala tree use across NSW – link here) and PCTs with this as a dominant species, including PCT 1083, must be included in calculations for koala habitat. Koala was recorded during surveys for the EIS and is known to be present.</i></p> <p><i>The proponent has not confirmed that the Koala is not present or unlikely to be present at the development site, as required by s6.5.1.11 of the FBA. We therefore maintain that all Koala habitat must be offset.</i></p>	<p><u>Relevant State Environmental Planning Policy</u></p> <p>The Project BARBOS considered core and potential Koala habitat within the Project area consistent with the definitions and tree species listed in <i>State Environmental Planning Policy 44 – Koala Habitat Protection (SEPP 44)</i>. Since lodgement of the Project EIS, SEPP 44 has been repealed and replaced with the <i>State Environmental Planning Policy (Koala Habitat Protection) 2019</i> (The Koala Habitat Protection SEPP) which commenced on 1 March 2020.</p> <p>The transitional provisions of the Koala Habitat Protection SEPP states (Part 4, Clause 15):</p> <p style="padding-left: 40px;"><i>A development application made, but not finally determined, before the commencement of this Policy in relation to land to which this Policy applies must be determined as if this Policy had not commenced.</i></p> <p>Consideration of Koala habitat consistent with the definitions of the Koala Habitat Protection SEPP is not required for the Project.</p>

BCD Comment No.	EES Group Comment:	Niche Response
		<p>A Koala Plan of Management (Niche, 2019a) (KPoM) has also been prepared for the Project (Appendix 11 of the Appendix D of the EIS) in accordance with the requirements of SEPP 44. The KPoM outlines management strategies to be implemented to minimise impacts to the Koala for the Project.</p> <p><u>Koala Survey Extent</u></p> <p>Threatened fauna surveys undertaken for the BARBOS did not definitively identify Koalas within the ventilation shaft sites. Surveys around the ventilations shaft sites where PCT 1083 is present recorded a single calling Koala, however its exact location could not be determined given the call was heard distantly at the time of survey. It was reasoned within the BARBOS that if the Koala was present from the vent shaft site it was likely moving through the area rather than resident. It was also noted that area where the Koala was heard is relatively close to known areas of Koala occupation in nearby Sandstone Transition Forest. Koalas were assumed to be present in the allowance of disturbance of 1.5 ha of Shale Sandstone Transition Forest TEC associated with infrastructure that did not have a fixed location at the time of EIS lodgement.</p> <p>As a component of additional fauna surveys undertaken for surface disturbance areas (Sections 2 and 3), further survey for the Koala was undertaken within the ventilation shaft sites and along the confirmed ETL alignment. Survey was undertaken in accordance with the methods described in Appendix C of the draft Koala Habitat Protection Guideline (DPIE, 2020) and included the following:</p> <ul style="list-style-type: none"> <li>• SAT plots at each of the ventilation shaft sites, Sandstone Ridgetop Woodland areas of the ETL (PCT 1083) as well as a reference site within Shale Sandstone Transition Forest TEC along the ETL alignment.</li> <li>• Songmeter recording within the ventilation shaft sites.</li> <li>• Spotlighting within the ventilation shaft sites and along portions of the ETL alignment.</li> <li>• Nocturnal call playback within and adjacent to ventilation shaft sites and areas of potential Koala habitat.</li> </ul> <p>Note, where feed tree species listed under the Koala Recovery Plan (DECC 2008) or SEPP 44 were not present within the ventilation shaft sites, feed tree species listed under the updated Koala Habitat Protection Guideline (DPIE 2020) (which accompanies the Koala Habitat Protection SEPP) were used as focus trees. BCD has previously requested HN566 be included in the Koala species polygon due to the presence of feed tree species listed under the Koala Habitat Protection Guideline. No Koalas were recorded during surveys of these trees.</p> <p>Koalas were recorded at the Shale Sandstone Transition Forest TEC reference site along the ETL alignment during spotlighting, call playback and SAT plot recording. No Koala presence was recorded at any of the ventilation shaft sites, consistent with the results of the surveys undertaken for the BARBOS.</p> <p>The survey effort and results confirm that the Koala is not present or unlikely to be present in HN566 other than to move through the area, as required by s6.5.1.11 of the FBA.</p> <p><u>Refined Koala Species Polygon</u></p> <p>The Project EIS assumed presence of Koalas in the allowance of disturbance of 1.5 ha of Shale Sandstone Transition Forest TEC associated with infrastructure that did not have a fixed location at the time. The species credit requirement associated with this assumed presence totalled to 39 credits.</p> <p>The additional design development and surveys since lodgement of the Project EIS has refined the extent of Shale Sandstone Transition Forest TEC and additional confirmed potential habitat. The refined Koala species polygon (Figure 12 and Figure 13) also totals to 1.5 ha, consistent with the Project EIS allowance, and comprises:</p> <ul style="list-style-type: none"> <li>• 0.45 ha of HN556 (Shale Sandstone Transition Forest TEC) within the ETL alignment.</li> <li>• 0.85 ha of HN651 (Peppermint Gully Forest) within the ETL alignment (assumed presence based on preferred tree species and recorded with cameras from this vegetation type within the BARBOS).</li> <li>• 0.2 ha of HN597 within the Pit Top Carpark Extension area (assumed presence).</li> </ul> <p>Therefore, the Koala species credit requirement has not changed from the Project EIS (refer Section 4, Table 9). Koala species credits are not required due to disturbance of the ventilation shaft sites.</p>

BCD Comment No.	EES Group Comment:	Niche Response
9	<p><i>Inadequate assessments have been undertaken given the magnitude of potential loss of threatened aquatic and swamp species. No electrofishing was conducted in areas of the streams above the proposed longwalls for Dendrobium Area 5 &amp; 6.</i></p> <p><i>We do not agree with the proponent's rationale to treat all surface development areas as a single stratification unit, thus eliminating the need to carry out targeted surveys at individual development sites. Stratification should not be based purely on PCT type. Other factors including landscape position, disturbance and fire history, distance to water etc. must be considered when determining survey effort. There is considerable distance between each ventilation shaft (up to 5km), and all sites are easily accessible and of a size able to be surveyed.</i></p> <p><i>The FBA requires a proponent to determine if a candidate species is present on a development site or is likely to use the potential habitat on that site. If adequate surveys are not carried out to determine whether a candidate species is present or likely to use potential habitat on that site, the species should either: 1) be assumed present, or 2) an expert report prepared to confirm that it does not occur.</i></p> <p><i>The BAR needs to provide clarity that all candidate species credit species were adequately surveyed at each ventilation shaft (and other surface areas to be cleared).</i></p> <p><i>Specific advice for relevant species is provided below:</i></p> <ul style="list-style-type: none"> <li><i>Powerful owl: The proponent has not provided detail on hollow bearing trees so it is difficult to conclude the site does not contain breeding or roosting habitat for this species. We do not accept the conclusion that landscape positioning was not appropriate for breeding and roosting habitat for this species. Niche (2019a) states powerful owls roost and nest "in sheltered gullies....within 100m of streams or minor drainage lines...". All ventilation shafts contain either sheltered gullies or watercourses.</i></li> <li><i>Rosenberg's goanna: This species is listed as a species credit species under the FBA. A species polygon is required. The proponent should determine if biobanking credits are available for this species and describe evidence of efforts to source these credits. If credits are unavailable this species may be offset via ecosystem credits.</i></li> <li><i>Eastern pygmy possum: The RTS relies on the rationale that adequate survey was done based on combined survey effort across the project area. We do not consider this is adequate to confirm the species does not occur at sites where targeted survey was not done.</i></li> <li><i>Survey effort, as shown in Figure 10 and detailed in Section 6.3 of the EA, still requires clarification. Further targeted surveys may be required for surface areas that were not adequately surveyed.</i></li> </ul>	<p>Additional survey for the Project was undertaken between 28 April 2020 and 22 May 2020 across 11 days and nights and focused on the ventilation shaft sites and confirmed ETL alignment. Additional Koala SAT plots (5) were conducted on the 29th of June and the 1st of July. Surveys included vegetation validation and threatened flora and fauna and were undertaken in accordance with the NSW Offset Policy and OEH survey guidelines and databases.</p> <p>Two additional threatened flora species were identified along the ETL alignment during vegetation validation surveys:</p> <ul style="list-style-type: none"> <li><i>Acacia bynoeana</i> – within slashed vegetation within the existing fire trail easement.</li> <li><i>Epacris purpurascens</i> – adjacent to the ETL alignment.</li> </ul> <p>Disturbance associated with the ETL alignment (i.e. construction of poles) would be managed in accordance with a vegetation clearance protocol to avoid direct impact of any threatened flora species and on this basis this species is not relevant to the Project offset liability.</p> <p>In consideration of BCD's comments, the following threatened fauna species were targeted during the surveys:</p> <ul style="list-style-type: none"> <li>Eastern Pygmy Possum (<i>Cercartetus nanus</i>).</li> <li>Powerful Owl (<i>Ninox strenua</i>).</li> <li>Koala (<i>Phascolarctos cinereus</i>).</li> </ul> <p>Survey methods were selected to detect the target species listed above, however are also relevant to other potentially occurring threatened fauna within the Project disturbance area.</p> <p>The survey effort within each disturbance area is shown on Figure 5 to Figure 7 and described in Section 2 and 3. The survey methodology and species polygon specific to the Koala is described in detail in the response to Comment 8 above.</p> <p>The outcomes of the surveys for other targeted threatened fauna species are also shown in Figure 5 to Figure 7. New or updated species polygons for threatened fauna are described in detail below and associated species credit requirements are provided in Section 4 (Tables 8 and 9).</p> <p><u>Powerful Owl</u></p> <p>Vegetation surveys undertaken for the Project EIS identified trees with hollows within the ventilation shaft areas, however Niche (2019) concluded it is highly unlikely the Powerful Owl would roost in the identified hollows due to the landscape positioning of the surface disturbance areas on ridgetops as well as vegetation present and prey availability. As such, breeding habitat was not considered to be present in Project surface disturbance areas and Powerful Owl species credits were not considered required for offsetting.</p> <p>In response to BCD's comments regarding the Powerful Owl, detailed mapping and assessment of hollow bearing trees has been undertaken (Figure 10 and Figure 11) within the Project surface disturbance areas. Further targeted survey for the Powerful Owl was also undertaken within Project surface disturbance areas, including assessment of tree hollow size, incidental owl pellet survey during SAT plots, dusk watches, acoustic recording and spotlighting.</p> <p>Powerful Owl was not recorded during the targeted surveys. Trees containing hollows of sufficient size for breeding were identified in the surface disturbance areas, however they are located within HN566 vegetation which is not listed as Powerful Owl breeding habitat under the OEH databases used by the BioBanking Credit Calculator (TSPD). Therefore, Powerful Owl species credits are not required for any proposed surface disturbance.</p> <p>The offset liability described in the Project EIS included an allowance for clearance of 1.5 ha of Shale Sandstone Transition Forest TEC (HN651) to account for ancillary surface infrastructure where, at that stage, the location could not be defined. Powerful Owl habitat has been assumed present in the Shale Sandstone Transition Forest TEC, however no potential breeding hollows would be cleared from this area and therefore the species would be offset via ecosystem credits.</p> <p><u>Eastern Pygmy-possum</u></p> <p>The Eastern Pygmy-possum was not detected during targeted surveys of the ventilation shaft sites undertaken for the Project EIS and the presence of the species was not considered likely within the Pit-top Carpark Extension area due to degraded habitat.</p> <p>However, in consideration of comments received from the BCD, additional targeted survey has been undertaken of the ventilation</p>

BCD Comment No.	EES Group Comment:	Niche Response
		<p>shaft areas. During these surveys the Eastern Pygmy-possum was detected at three of the four ventilation shaft sites (Figure 8 and Figure 9).</p> <p>On the basis of confirmed records of the Eastern Pygmy-possum in the Project areas, the species' presence was assumed at the Pit-top Carpark Extension area as the mapped vegetation (HN597) is listed as Eastern Pygmy-possum habitat within the OEH databases used by the BioBanking Credit Calculator and targeted surveys were not undertaken. The species' presence was also assumed in mapped areas of HN651 and HN556 vegetation (excluding regeneration) within the ETL alignment due to the general absence of flowering shrubs and lack of vegetation cover.</p> <p>The species polygon for the Eastern Pygmy-possum totals 27.25 ha (Figure 14 and Figure 15) which incorporates:</p> <ul style="list-style-type: none"> <li>• the ventilation shaft areas (i.e. 25.75 ha of HN566, excluding regenerating vegetation);</li> <li>• vegetation within the ETL alignment which contains flowering shrubs (i.e. 0.85 ha of HN651 and 0.45 ha of HN556, excluding regenerating vegetation); and</li> <li>• the Pit-top Carpark Extension area (i.e. 0.2 ha of HN597).</li> </ul> <p>The species credit requirement for the Eastern Pygmy-possum is provided in Table 9. Potential impacts to regenerating Eastern Pygmy-possum habitat have been offset using ecosystem credits.</p> <p><u>Rosenberg's Goanna</u></p> <p>OEH databases used by the BioBanking Credit Calculator (i.e. Archived BioMetric and Threatened Species Profiles Datasets, current at the time that the calculator was submitted for the EIS) list the Rosenberg's Goanna as a species credit species.</p> <p>However, the FBA and BioBanking Credit Calculator have been superseded by the <i>NSW Biodiversity Assessment Method</i> (OEH, 2017) (BAM). Under the BAM, the credit status for the Rosenberg's Goanna has been revised to an ecosystem credit species. Therefore, it is understood that species credits for the Rosenberg's Goanna would not be able to be generated using the BAM within potential offset areas in order to satisfy any species credit offset requirement for the Project.</p> <p>On that basis a species polygon and credit requirement for the Rosenberg's Goanna was not incorporated in the Project offset liability presented in the EIS.</p> <p>BCD's comments requested a species polygon be prepared for the Rosenberg's Goanna to determine an associated Biobanking credit requirement. Note additional survey for the species was not undertaken as it has been previously identified during surveys across the Project area and was also recorded during surveys undertaken for the BARBOS within the Project area, including records within Ventilation Shaft Site Nos 5B and 6A.</p> <p>The species polygon determined for the Rosenberg's Goanna totals 27.05 ha (Figure 16 and Figure 17) which incorporates:</p> <ul style="list-style-type: none"> <li>• the ventilation shaft areas (i.e. 25.75 ha of HN566, excluding regenerating vegetation); and</li> <li>• vegetation within the ETL alignment which contains flowering shrubs (i.e. 0.85 ha of HN651 and 0.45 ha of HN556, excluding regenerating vegetation).</li> </ul> <p>The species credit requirement for the Rosenberg's Goanna is provided in Table 9. South32 will continue to consult with DPIE-BCD regarding consideration of the 'reasonable equivalence' of species credits for the Rosenberg's Goanna. Potential impacts to relevant Rosenberg's Goanna habitat as a result of surface disturbance would likely be satisfied by ecosystem credits given the species re-assignment to an ecosystem credit species under the BAM.</p> <p><u>Giant Dragonfly</u></p> <p>A species polygon was previously prepared for the Giant Dragonfly based on assumed presence within any swamps with breeding or potential foraging habitat (as determined within specialist reporting by Cardno 2019) and within 60 m of proposed longwall areas. No amendments to the species polygon are proposed.</p>

BCD Comment No.	EES Group Comment:	Niche Response
10	<i>To date, no credit calculator updates or shapefiles have been provided.</i>	<p>Updated ecosystem and species credit requirements for the Project are provided in Section 4 (Tables 8 and 9), incorporating refined disturbance extents for surface infrastructure as well as results of additional biodiversity surveys.</p> <p>Two additional species credit species have been incorporated in the Project offset liability, namely the Eastern Pygmy-possum and Rosenberg's Goanna. There is no change proposed for the offset liability associated with Upland Swamp vegetation, vegetation within the Pit Top Carpark Extension area or species credit species that were assessed in the BARBOS (i.e. Giant Burrowing Frog, Littlejohn's Tree Frog, Giant Dragonfly, Red-crowned Toadlet, Broad-headed Snake or Koala).</p> <p>Updated credit reports and shapefiles of species polygons and vegetation mapping within disturbance extents will be provided to BCD.</p>

## Contact Us

Niche Environment and Heritage  
02 9630 5658  
info@niche-eh.com

NSW Head Office – Sydney  
PO Box 2443 North Parramatta  
NSW 1750 Australia

QLD Head Office – Brisbane  
PO Box 540 Sandgate  
QLD 4017 Australia

Sydney  
Brisbane  
Cairns  
Port Macquarie  
Illawarra  
Coffs Harbour  
Central Coast  
Gold Coast  
Canberra



## Our services

### Ecology and biodiversity

Terrestrial  
Freshwater  
Marine and coastal  
Research and monitoring  
Wildlife Schools and training

### Heritage management

Aboriginal heritage  
Historical heritage  
Conservation management  
Community consultation  
Archaeological, built and landscape values

### Environmental management and approvals

Impact assessments  
Development and activity approvals  
Rehabilitation  
Stakeholder consultation and facilitation  
Project management

### Environmental offsetting

Offset strategy and assessment (NSW, QLD, Commonwealth)  
Accredited BAM assessors (NSW)  
Biodiversity Stewardship Site Agreements (NSW)  
Offset site establishment and management  
Offset brokerage  
Advanced Offset establishment (QLD)