



EXECUTIVE SUMMARY

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DENDROBIUM MINE – PLAN FOR THE FUTURE: COAL FOR STEELMAKING

South32 Dendrobium Mine

- Our Dendrobium Mine in the Illawarra Region of New South Wales is an existing underground mine primarily producing metallurgical coal for steelmaking. We currently employ around 400 people from the local region.
- Dendrobium began operating in 2002 and is an essential supplier of metallurgical coal to Australian steelmakers, including BlueScope Port Kembla Steelworks and Liberty Primary Steel Whyalla Steelworks.
- Dendrobium has development consent until 2030, however its current mineable reserves will be depleted by 2024.

Proposed Project

- We are proposing the continuation of mining activities in Dendrobium's next two underground mining areas (Areas 5 and 6), within the existing mining lease. This would include the use of existing infrastructure and require minimal additional surface infrastructure.
- Continued mining would sustain the employment of Dendrobium's workforce, create additional jobs and ensure the supply of metallurgical coal to local and overseas customers until 2048.
- Underground mining has been ongoing in the Metropolitan Special Area where the mine is located for more than 100 years.

Environmental Impact Statement

- We are seeking State and Commonwealth approval for the Project, with our application supported by this Environmental Impact Statement (EIS).
- The EIS has been developed through extensive consultation with our stakeholders and informed by the Secretary's Environmental Assessment Requirements for the Project.
- We have prepared specialist environmental studies for the EIS to address the assessment requirements and the feedback from our stakeholders.

Key Environmental Assessment Outcomes and Mitigation Measures

- We will not mine under water supply reservoirs, named watercourses and key stream features.
- We will compensate WaterNSW for the agreed volume of surface water diverted from the Sydney drinking water catchment, which is estimated at less than 1% of the Avon and Cordeaux catchment yields.
- We will pursue opportunities for industrial users to reuse our excess mine water.
- We will conduct or fund water quality improvement initiatives in Sydney's drinking water catchment.
- We will offset potential subsidence-related impacts to upland swamps consistent with Government policies.

Substantial Socio-economic Benefits

- The ongoing employment of 500 people, including 400 people currently employed at Dendrobium Mine and an additional 100 people for the Project.
- The creation of 200 jobs during project construction.
- The ongoing and essential supply of metallurgical coal to BlueScope Port Kembla Steelworks and our other customers. We currently supply around 60% of BlueScope Steelworks' metallurgical coal. If supply was disrupted BlueScope would need to invest an estimated \$150 million to upgrade port facilities and would incur between \$50 million and \$100 million per annum in additional costs principally due to higher logistics costs to gain access to seaborne coal.
- The ongoing operation of Dendrobium Mine and associated business opportunities for local suppliers, Illawarra industries and reliant businesses.
- Around \$272 million in net present value terms (\$714 million in real, undiscounted terms) in royalties, taxes and rates for local councils and the NSW and Commonwealth Governments.

EXECUTIVE SUMMARY

ES1 BACKGROUND

The Dendrobium Mine is an underground coal mine situated in the Southern Coalfield of New South Wales approximately 8 kilometres (km) west of Wollongong (Figures ES-1 and ES-2).

Illawarra Coal Holdings Pty Ltd (Illawarra Coal), a wholly owned subsidiary of South32 Limited (South32), is the owner and operator of the Dendrobium Mine¹.

This document is an Environmental Impact Statement (EIS) for the Dendrobium Mine – Plan for the Future: Coal for Steelmaking (the Project). The Project includes the continuation of longwall mining at the Dendrobium Mine in Areas 5 and 6 (Figures ES-1 and ES-3) to extract approximately 78 million tonnes (Mt) of run-of-mine (ROM) coal, extending the life of the Dendrobium Mine.

This EIS provides:

- a description of the Project;
- a summary of consultation undertaken;
- an assessment of potential impacts;
- the Project environmental management strategy, including continuation and extension of existing Dendrobium Mine environmental mitigation measures and monitoring; and
- a Project justification, including consideration of the requirements of relevant policies and legislation.



Plate ES-1 – Mt Kembla Memorial Pathway

The Project represents a continuation of mining at the Dendrobium Mine, providing continuation of employment for the existing Dendrobium Mine workforce and additional employment opportunities during construction and operations.

It would provide an ongoing, local supply of metallurgical coal to the BlueScope Steelworks at Port Kembla, as well as contributing to the ongoing viability of existing suppliers and customers.

ES2 APPROVAL PROCESS

ES2.1 New South Wales

The Project is “State Significant Development” to which Part 4 of the NSW *Environmental Planning and Assessment Act, 1979* applies.

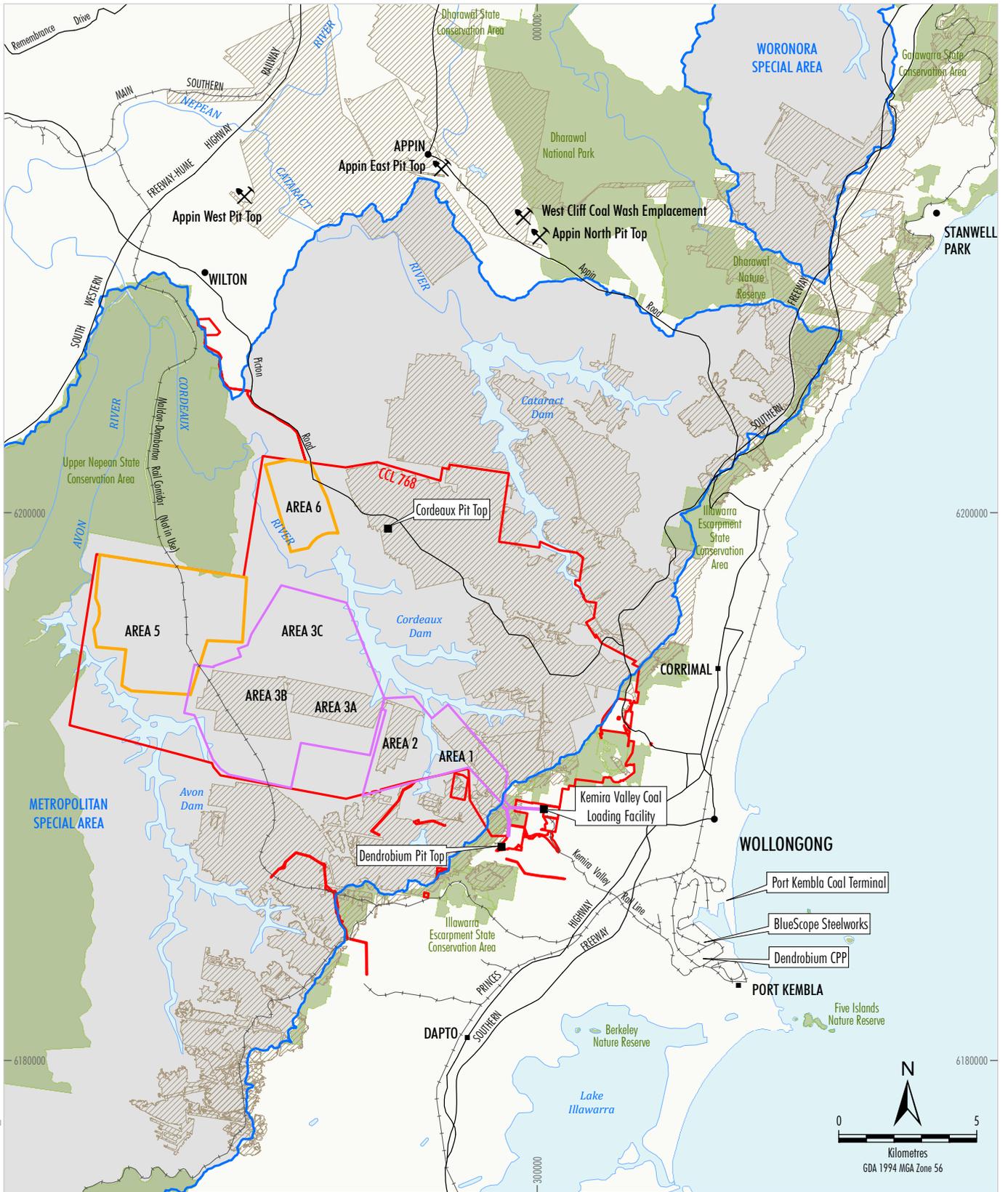
This EIS has been prepared to accompany a Development Application made for the Project, in accordance with Part 4 of the NSW *Environmental Planning and Assessment Act, 1979*. This EIS considers the potential environmental impacts of the Project in accordance with the Secretary’s Environmental Assessment Requirements (SEARs) issued by the NSW Department of Planning and Environment, including input from the Commonwealth Department of the Environment and Energy.

South32 is seeking development consent from the NSW Minister for Planning or the Independent Planning Commission for the Project.

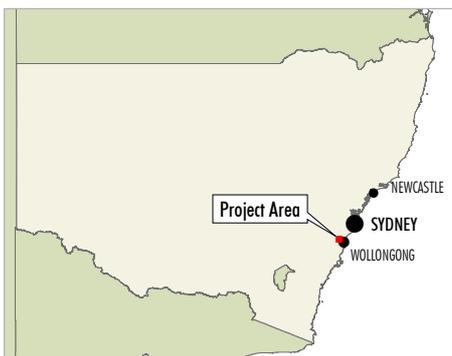
ES2.2 Commonwealth

South32 referred the relevant elements of the Project to the Federal Minister for the Environment and Energy in December 2016 (EPBC 2017/7855) (the proposed Action). A delegate of the Federal Minister determined on 6 March 2017 that the proposed Action is a “controlled action” and, therefore, the Action requires approval under the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999*.

¹ Throughout the Environmental Impact Statement Illawarra Coal is referred to as South32.



SIH-16-02-ES-SubB_2018



- 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)

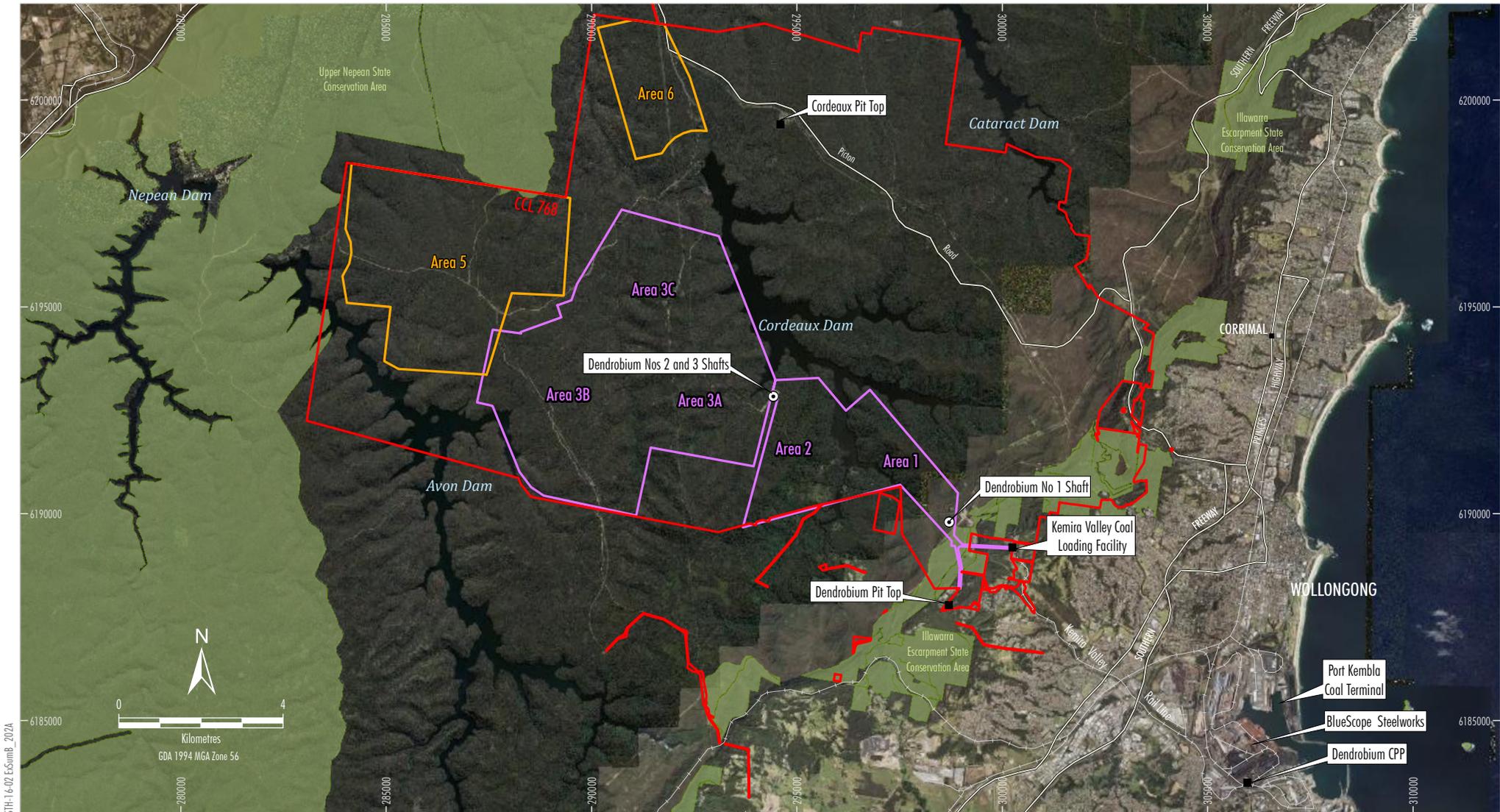
Source: Geoscience Australia, 2006; Department of Industry (2018); Department Finance, Services & Innovation (2018);



Illawarra Coal

DENDROBIUM MINE
Regional Location

Figure ES-1



SITH-16-02-ESumB-2024

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

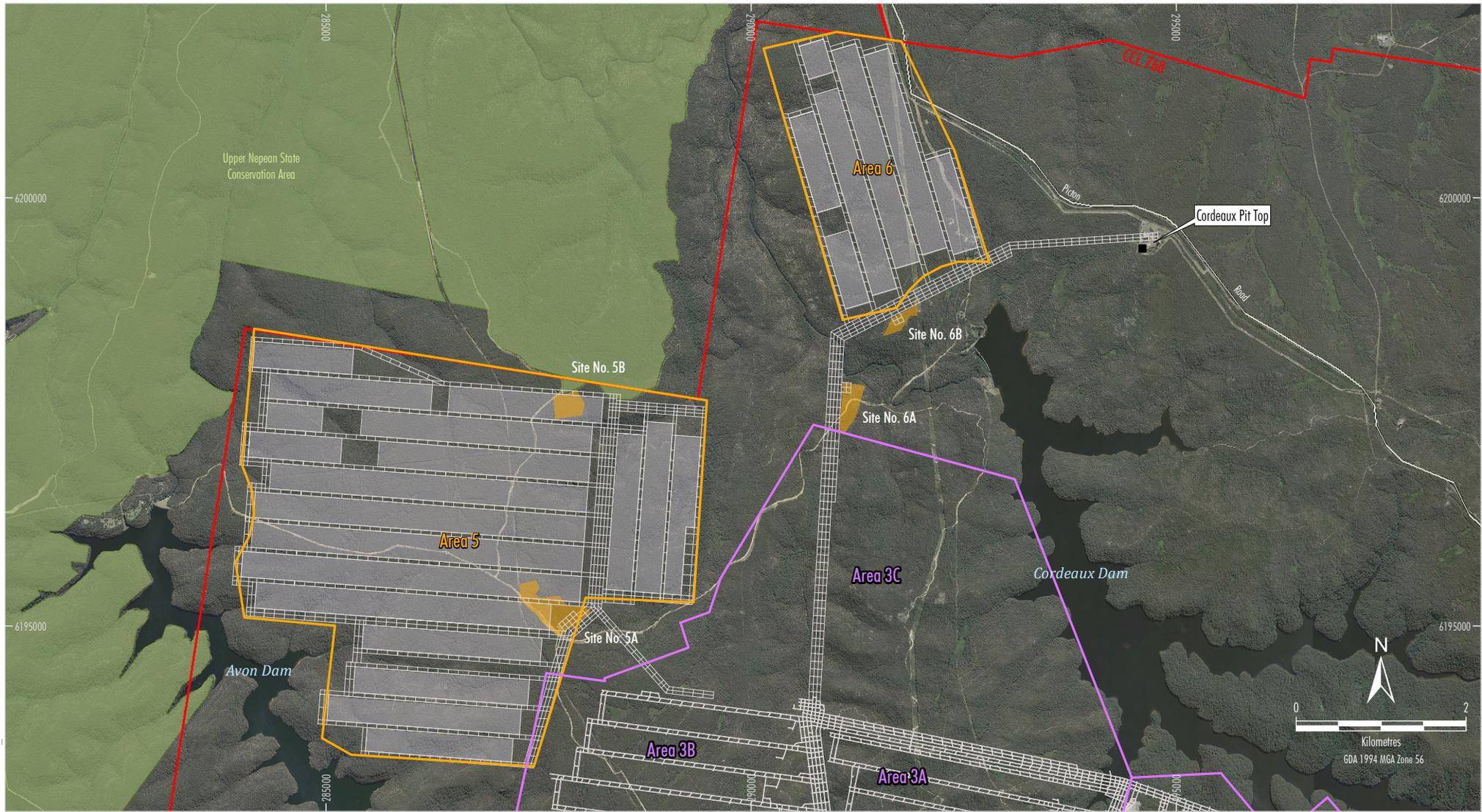


D E N D R O B I U M M I N E

General Arrangement of the Approved
Dendrobium Mine and Proposed
Underground Mining Areas 5 and 6

Figure ES-2

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



SITH-16-02-ESumB_203A

- LEGEND**
- Dendrobium Mining Lease
 - Road
 - National Park, Nature Reserve and State Conservation Area
 - Dendrobium Underground Mining Area - Proposed Project
 - Dendrobium Underground Mining Area - Existing Mine (DA 60-03-2001)
 - Proposed Ventilation Shaft Site
 - Indicative First Workings Layout
 - EIS Base Plan Longwalls

Source: Geoscience Australia, 2004; Department of Industry (2018); Department Finance, Services & Innovation (2018);



DENDROBIUM MINE
 Project General Arrangement -
 Underground Mining Areas

Figure ES-3

Therefore, this EIS provides an assessment of potential impacts on the following controlling provisions considered by the Federal Minister to be relevant to the proposed Action:

- threatened species and communities listed under the *Environment Protection and Biodiversity Conservation Act, 1999*; and
- water resources.

The proposed Action is to be assessed pursuant to the agreement between the Commonwealth of Australia and the State of NSW relating to environmental assessment.

ES2.3 Determination

Following public exhibition of this EIS by the Department of Planning and Environment, submissions from the community and government agencies will be addressed by South32.

The Project will then be determined by the NSW Minister for Planning (or the Independent Planning Commission) under the *Environmental Planning and Assessment Act, 1979*.

Following completion of the NSW assessment process, the Project will then also be determined by the Commonwealth Minister for the Environment under the *Environment Protection and Biodiversity Conservation Act, 1999*.

ES3 THE PROJECT

There has been no previous mining in the proposed Project underground mining areas. However, Figure ES-1 illustrates that underground coal mining in the Metropolitan Special Area has been extensive, and the Project is an extension to this previous development.

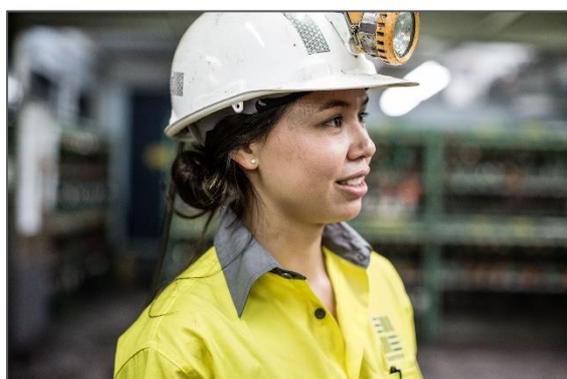


Plate ES-2 – Diverse Underground Workforce

Previous underground mining in the vicinity of the Project has included:

- Kemira Colliery;
- Wongawilli Colliery;
- Nebo Colliery;
- Elouera Colliery;
- Cordeaux Colliery;
- Corrimal Colliery; and
- Dendrobium Mine.

Historically, mining was carried out using bord and pillar methods; however, more recently, coal has been extracted using longwall mining methods at Corrimal, Cordeaux, Kemira and Elouera Collieries, and at the existing Dendrobium Mine.

Underground coal mining is currently the only major revenue generating industry that is both compatible with the catchment status of the Project area, and permissible with consent.

ES3.1 Existing Approved Dendrobium Mine

The existing operations at the Dendrobium Mine are undertaken in accordance with Development Consent DA 60-03-2001 (as modified), as well as the Approval Decision (EPBC 2001/214) under the *Environment Protection and Biodiversity Conservation Act, 1999*.

The Dendrobium Mine currently extracts coal from the Wongawilli Seam within Consolidated Coal Lease (CCL) 768. The Dendrobium Mine primarily produces hard coking (metallurgical) coal for steelmaking and has an approved operational capacity of up to 5.2 million tonnes per annum (Mtpa) of ROM coal until 31 December 2030 under Development Consent DA 60-03-2001. ROM coal is then processed at the Dendrobium Coal Preparation Plant (CPP) located at Port Kembla to produce saleable coal products (primarily metallurgical coal used for steelmaking).

Key surface facilities at the Dendrobium Mine include the:

- Dendrobium Nos 1, 2 and 3 Shafts (i.e. ventilation shafts);
- Dendrobium Pit Top;
- Kemira Valley Coal Loading Facility;
- Kemira Valley Rail Line;
- Dendrobium CPP located at Port Kembla; and
- West Cliff Stage 3 Coal Wash Emplacement.

The general arrangement of the approved Dendrobium Mine is shown on Figure ES-2.

The Cordeaux Pit Top was used for personnel and materials access for the previous Cordeaux Colliery, which is now in care and maintenance (Figure ES-1).

The Project would include adaptive re-use of the Cordeaux Pit Top to reduce travel time for men and materials while development and mining operations occur in Area 6.

The Project would avoid a discontinuity of operations for the Dendrobium Mine and support the economic viability of approved Area 3C.

ES3.2 Project Summary

The Project underground mining areas would be located wholly within CCL 768. No additional mining tenements are required for the Project.

The Project would include the following development:

- 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 other strata required to access Project mining areas;
- use of existing underground roadways and drifts for personnel and materials access, coal clearance, 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;
- 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 for 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 Environmental Protection Licence 3241 and/or beneficial industrial re-use;
- monitoring, rehabilitation and remediation of subsidence and other mining effects; and
- other associated infrastructure, plant, equipment and activities.

The Project underground mining areas are located within the catchments of the Avon and Cordeaux Rivers, and the associated Avon and Cordeaux Dams, which are part of Greater Sydney’s water supply system. These catchments are included within the Metropolitan Special Area (a WaterNSW Special Area) declared under the *WaterNSW Act, 2014* (Figure ES-1).

South32 would pursue opportunities for industrial re-use of mine water such that the re-use volume matches or exceeds the predicted Project surface water take.

South32 would pay WaterNSW for the agreed volume of surface water diverted from the catchment.

The location of Project underground mining areas relative to other historical mine workings is shown on Figure ES-1. The proximity of the existing Dendrobium Mine materials handling facilities to the urban areas of Wollongong is also shown on Figure ES-4.

The Project does not include the approved underground mining operations in the Wongawilli Seam in Areas 1, 2, 3A, 3B and 3C at the Dendrobium Mine (Figure ES-2) and associated surface activities (such as monitoring and remediation). These operations would 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 to avoid a discontinuity in mining at the Dendrobium Mine caused by high gas (carbon dioxide) coal in approved Area 3C. The surface facilities and underground roadways used by the Project would be operated in accordance with the conditions of the Development Consent for the Project, should it be approved.

Table ES-1 provides a comparative summary of activities associated with the Project compared to the approved Dendrobium Mine.

The Project involves the continuation of mining at the Dendrobium Mine with longwall panels of up to 305 metres (m) void width. Extraction heights in the Bulli Seam in Area 5 would be up to 3.2 m, and up to 3.9 m in the Wongawilli Seam in Area 6. Mining in Area 5 would occur at depths of 250 to 390 m below the surface, and 375 to 460 m below the surface in Area 6.

ES3.3 Interaction with BlueScope Steelworks

BlueScope Steel (AIS) Pty Ltd (BlueScope) owns and operates the BlueScope Port Kembla Steelworks (herein referred to as the BlueScope Steelworks) (Figure ES-4). The BlueScope Steelworks are located adjacent to Port Kembla Harbour and operate under a number of approvals. The Dendrobium Mine CPP is located within the steelworks and is integrated with its operations (Figures ES-4 and ES-5).



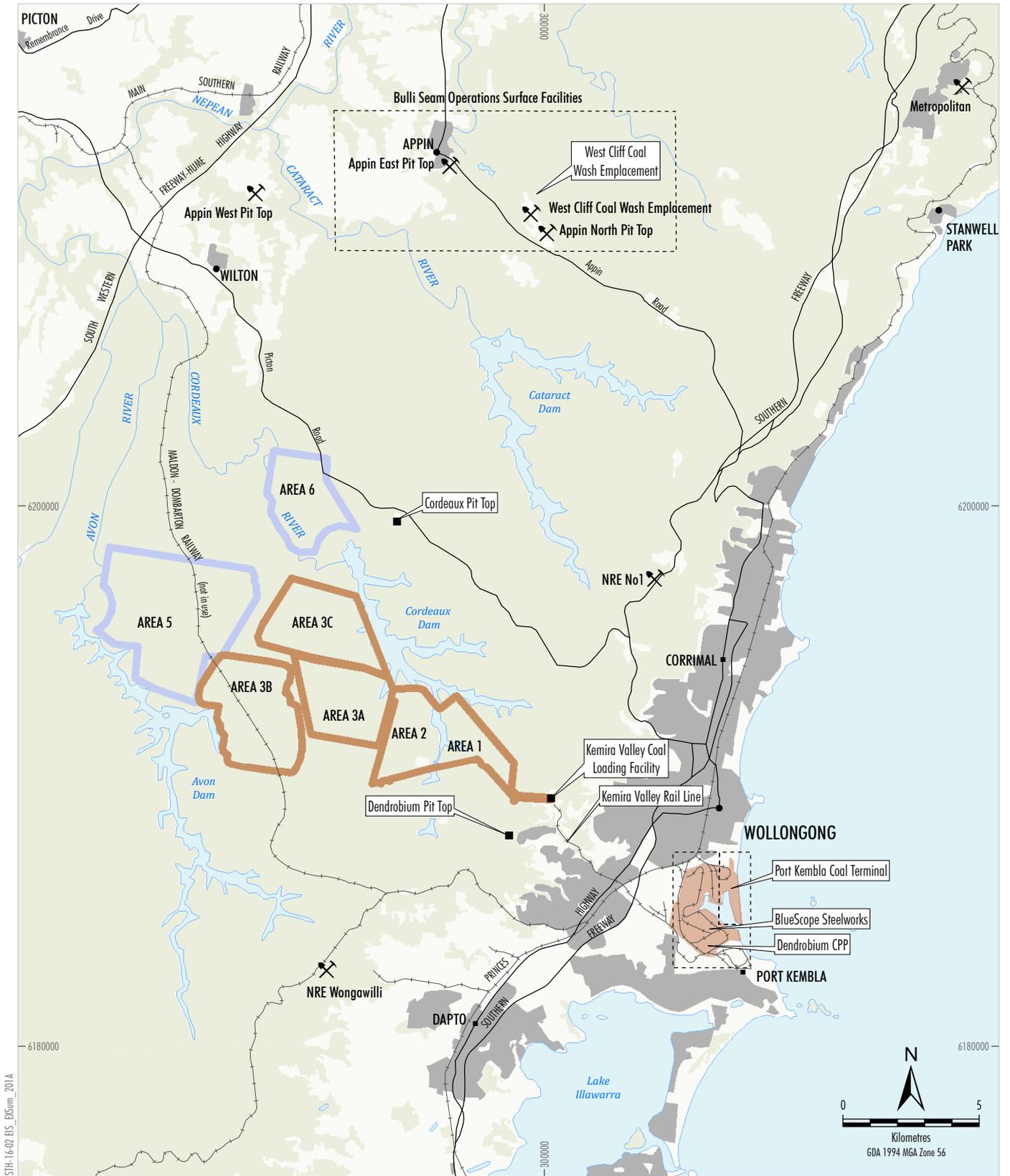
Plate ES-3 – Port Kembla Industrial Complex

Coal from the Project that is sold to BlueScope for steelmaking would continue to be transported to operations within the steelworks via infrastructure operated by BlueScope. The handling and use of Project coal at BlueScope’s operations beyond the Dendrobium CPP would occur in accordance with relevant approvals for the steelworks, and these activities are not part of the Project.

The Project would produce metallurgical coal for steelmaking.

There is currently no economically viable, commercial-scale alternative to the use of metallurgical coal in the blast furnace method of steelmaking, which is employed at the BlueScope Steelworks.

The Project would provide a local and continued supply of metallurgical coal to the BlueScope Steelworks.



SIH-16-02-EIS_EISum_2014

- 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);

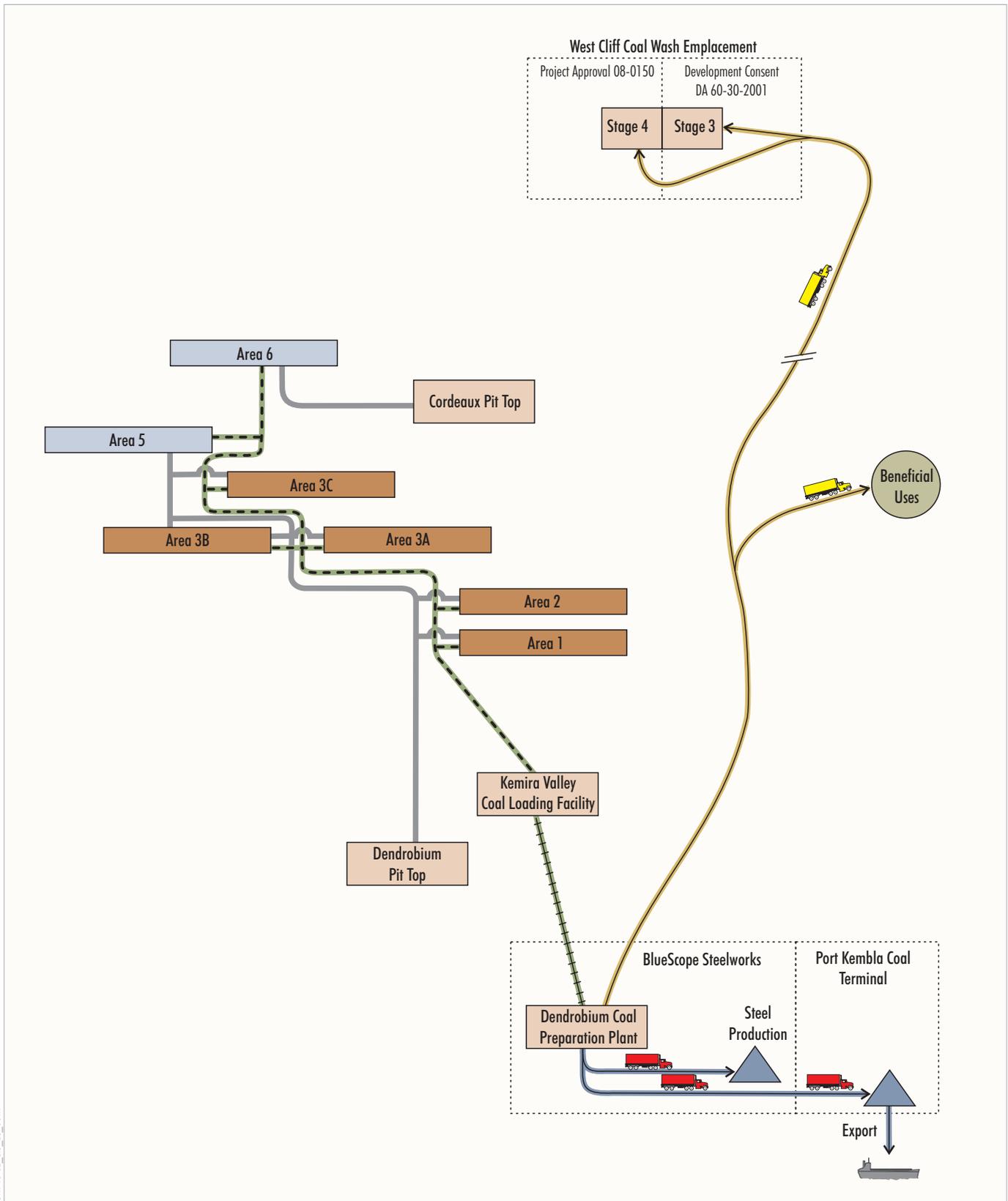


Illawarra Coal

DENDROBIUM MINE
Materials Handling
Spatial Relationship

Figure ES-4

SIH-16-02_EIS_ES_001A



Not to Scale



DENDROBIUM MINE
 Material Handling Schematic Flowsheet

Figure ES-5

**Table ES-1
Summary Comparison of the Approved Dendrobium Mine and the Project**

Component	Approved Dendrobium Mine (DA 60-03-2001)	Project
Mine Life	Until 31 December 2030 (with mining expected to be discontinued in 2024 in the absence of the Project).	Until 31 December 2048.
Mining Method	Underground extraction using longwall mining methods.	No change.
Resource	Mining of the Wongawilli Seam in Areas 1, 2, 3A, 3B and 3C within CCL 768.	Additional mining of the Bulli Seam in Area 5 and the Wongawilli Seam in Area 6 within CCL 768.
Annual Production	Handling and processing of up to 5.2 Mtpa of ROM coal.	No change.
Resource to be Recovered	At 1 July 2019, it is estimated that approximately 35 Mt of ROM coal will remain.	Approximately 78 Mt of additional ROM coal.
Coal Handling and Processing	Transport of coal from underground workings via an underground conveyor network to the Kemira Valley Coal Loading Facility for sizing and stockpiling. ROM Coal transport to the Dendrobium CPP via the Kemira Valley Rail Line. Processing of up to 5.2 Mtpa of sized ROM coal at the Dendrobium CPP.	No change.
Management of Mining Waste	Transport of up to approximately 1.1 Mtpa of coal wash by road from the Dendrobium CPP to the West Cliff Stage 3 and Stage 4 ¹ Coal Wash Emplacement. Development and rehabilitation of the West Cliff Stage 3 Coal Wash Emplacement. Supply of coal wash to customers for civil construction fill or other beneficial uses.	Transportation of up to approximately 1.6 Mtpa of coal wash by road from the Dendrobium CPP to the West Cliff Coal Wash Emplacement. No change. No change.
General Infrastructure	Dendrobium Pit Top. Kemira Valley Coal Loading Facility. Kemira Valley Rail Line. Dendrobium CPP. Dendrobium Shafts Nos 1, 2 and 3.	Continued use of existing infrastructure with minor upgrades and extensions. Augmentation of mine access arrangements, including upgrades to, and the use of, the existing Cordeaux Pit Top. Development of ancillary infrastructure including surface infrastructure associated with mine ventilation and gas management.
Product Transport	Delivery of product coal from the Dendrobium CPP to the BlueScope Steelworks or to Port Kembla Coal Terminal for transport to Liberty Primary Steel Whyalla Steelworks or for export.	No change.
Water Management	Water management infrastructure to separate clean, oily and dirty water. Use of a combination of recycled treated mine water and potable water purchased from Sydney Water in underground and surface operations. Release of excess water in accordance with the conditions of EPL 3241.	Augmentations and use of existing water management infrastructure. Continued use of a combination of recycled treated mine water and water purchased from Sydney Water. Continued release of excess water in accordance with the conditions of EPL 3241. Release volumes and release infrastructure to be modified as required based on Project mine inflow rates. Beneficial re-use of excess Project water by industrial users, where practicable.
Workforce	Current workforce of approximately 400 personnel (including South32 staff and on-site contractor personnel).	At full development, employment in the order of 500 operational personnel (including South32 staff and on-site contractor personnel). Up to approximately 200 contractor personnel would also be required for surface facility construction activities and longwall development activities.
Hours of Operation	Operated on a continuous basis, 24 hours per day, seven days per week. Trains do not travel on the Kemira Valley Rail Line between 11.00 pm and 6.00 am, unless written approval is obtained from the NSW Environment Protection Authority (EPA) for emergency use.	No change. No change.

¹ 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.

Proximity and use of Existing Infrastructure

The steelworks at Port Kembla was originally developed due to its proximity to the coal mines of the Southern Coalfield. South32 currently supplies the BlueScope Steelworks with approximately 60% of its metallurgical coal requirements.

The Project would continue to make use of the existing Kemira Valley Rail Line, which connects the Dendrobium Mine Kemira Valley Coal Loading Facility directly to Port Kembla. The Dendrobium CPP is located in the Port Kembla industrial precinct (regulated by the BlueScope Steelworks Environmental Protection Licence [EPL] 6092) and South32 pays a fee to BlueScope Steelworks for the use of the facility.

The continued use of this existing infrastructure for the Project would allow the existing integration between the Dendrobium Mine and the BlueScope Steelworks to continue.

Economic Significance of Steel-making Industry

Steel remains a fundamental material for a variety of construction and manufacturing industries, and domestic steelmaking is a strategically valuable asset for Australia's economic security and prosperity.

The importance of local (i.e. Australian) steelmaking is described in the Parliamentary Report *Australia's Steel Industry: Forging Ahead* (Commonwealth of Australia, 2017), which outlines the safety benefits and economic significance of the steel industry to the Australian economy and regional economies where steelmaking facilities are located. In the Illawarra region, the BlueScope Steelworks:

- directly employ approximately 3,000 people;
- are estimated to indirectly support about 10,000 jobs in the region (with the Illawarra Business Chamber noting in its submission to the Report that the multiplier effect of the steel industry is 3 to 5 indirect jobs for every direct job generated by the industry); and
- are estimated to contribute approximately \$1.9 billion per annum to the economy, based on analysis conducted by Wollongong City Council (without considering any multiplier effect).

The BlueScope Steelworks at Port Kembla is the largest steel production facility in Australia, and one of only two primary iron and steelmaking facilities in Australia.

Use of Coal in Steel Production

Metallurgical coal is a raw material that is essential for the manufacture of 'virgin iron' and steel (also known as 'primary steelmaking' or 'integrated steelmaking'). The other key raw material is iron ore.

While the BlueScope Steelworks produces a portion of its steel using recycled scrap steel, there is not sufficient supply of scrap steel to meet demands, and therefore the steelmaking method continues to require the use of metallurgical coal and iron ore.

Metallurgical coal is used as a reducing agent in the steelmaking process. The carbon in the metallurgical coal is used to convert iron ore to molten iron in a blast furnace.

Research into the use of alternative reducing agents in the blast furnace method, such as hydrogen, is being undertaken. However, there is currently no economically viable alternative to the use of metallurgical coal as a reducing agent in the blast furnace method (i.e. a method employed at the BlueScope Steelworks) at a commercial scale.

Importance of Local Metallurgical Coal Supply

The steelmaking industry is highly trade exposed, with Australian steelmakers competing against suppliers across the globe. Accordingly, maintaining low production costs are critical to the competitiveness and viability of the Australian steelmaking industry.

The proximity of the existing Southern Coalfield mines, including Dendrobium Mine, to BlueScope Steel's facilities at Port Kembla is a factor in BlueScope Steel's ability to make economically competitive steel.

BlueScope has previously noted that without local metallurgical coal suppliers it may struggle to remain economically viable at Port Kembla.

Coal from the Southern Coalfield is supplied to the BlueScope Steelworks on a 'just-in-time' arrangement via daily rail or truck deliveries. Coal stockpiles for feed to the Dendrobium CPP, located at Port Kembla, and steelmaking process are depleted on a weekly basis. Some coal to the BlueScope steelworks is supplied by ship, with port facilities operating at high utilisation levels.

Any increase in seaborne coal supply to the BlueScope steelworks would require substantial capital investment in additional port facilities (estimated to be at least \$150 million) and stockpiling facilities, with the additional logistics costs estimated to be between \$50 million and \$100 million per annum.

The continued supply of coal from the Dendrobium Mine to the BlueScope Steelworks, which would be facilitated by approval of the Project, would contribute to its ongoing economic viability and associated socio-economic benefits.

ES3.4 Interaction with Port Kembla Coal Terminal

The Port Kembla Coal Terminal (Figure ES-4) operates in accordance with Project Approval 08_0009. It receives coal from a number of operations in the region via a combination of public and private roads and by rail.

Coal from the Project that is not sold to BlueScope would be transported to the Port Kembla Coal Terminal via private road, where it would be stockpiled for transport to Liberty Primary Steel Whyalla Steelworks, or for export (Figures ES-4 and ES-5). The handling and stockpiling of Project coal at the Port Kembla Coal Terminal would occur in accordance with Port approvals and these activities are not part of the Project.

Coal from South32's operations currently accounts for the majority of throughput at the Port Kembla Coal Terminal.

ES3.5 Interaction with Bulli Seam Operations

Coal wash would be produced at the Dendrobium CPP as part of the Project. Opportunities for the beneficial reuse of coal wash would be maximised. Residual coal wash would be transported by road to the West Cliff Stage 3 and Stage 4 Coal Wash Emplacements (Figures ES-4 and ES-5).

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.

For the Project to proceed to its full extent, an extension of Project Approval 08_0150 from 31 December 2041 to 31 December 2048 would be required to allow for the continued use of the West Cliff Stage 4 Coal Wash Emplacement. This would be subject to a separate application and approval.

ES3.6 Project Construction

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;
- 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.

The capital investment value of the Project is approximately \$1 billion.

The Project would provide for the continuation of support for local suppliers through ongoing expenditure.

ES3.7 Mining Operations

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

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 ES-6).

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 that 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.

South32 Mine Design

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, including:

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

These avoid the direct undermining of mapped “key stream features” (i.e. pools >100 cubic metres [m³] 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.

The location of these features and an example of how these longwall constraints have been applied for the EIS base case layout is provided on Figure ES-7.

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 Department of Planning and Environment.

The longwall layout for the Project adopts mine constraints to minimise impacts, including setbacks from the Avon and Cordeaux Dam walls, dam Full Supply Levels, named watercourses (i.e. Cordeaux River, Avon River and Donalds Castle Creek).

South32 would also avoid the direct undermining of mapped “key stream features” (significant pools and waterfalls/steps) identified during site investigations.

Underground Access and Development

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 (Figure ES-5).

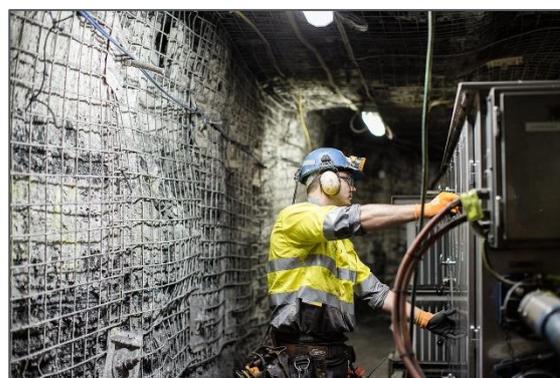
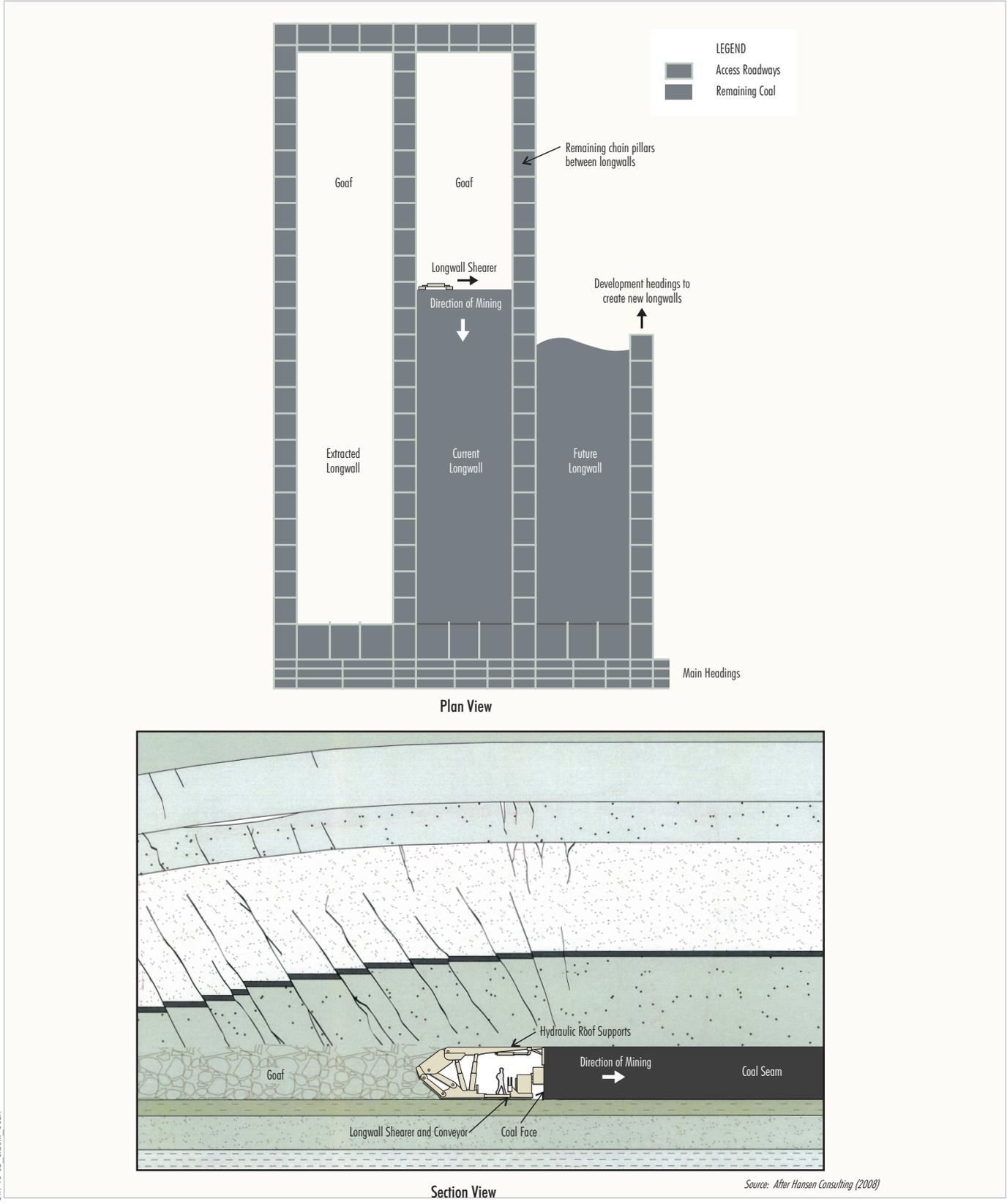


Plate ES-4 – Underground Facilities



STH-16-02_ECSum_002A

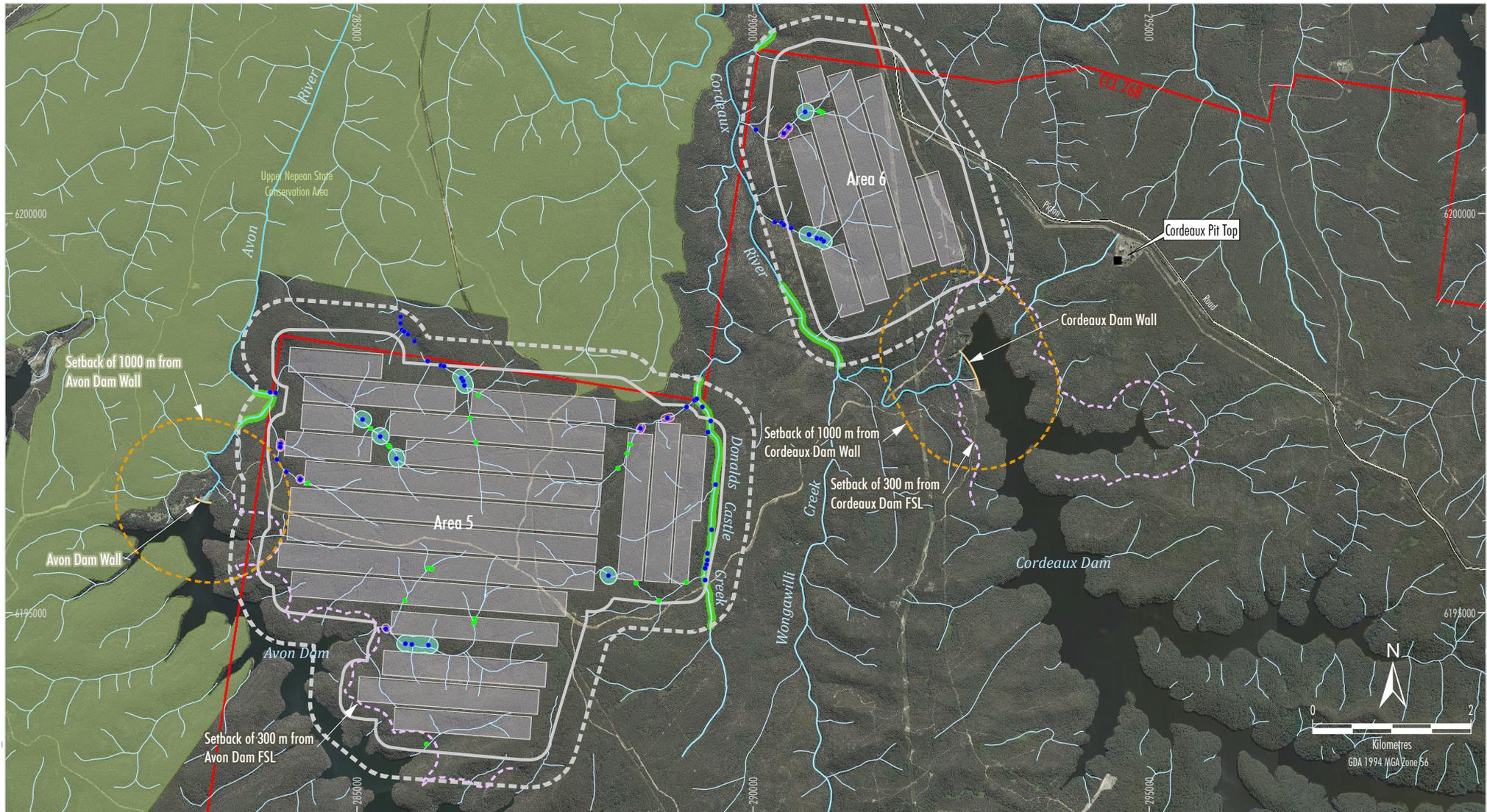


Illawarra Coal

DENDROBIUM MINE

Longwall Mining Method -
Conceptual Cross Section and Plan

Figure ES-6



SITH-16-02-ESumB-20-4A

- | | |
|--|---|
| <p>LEGEND</p> <ul style="list-style-type: none"> Dendrobium Mining Lease Road National Park, Nature Reserve and State Conservation Area EIS Base Plan Longwalls | <ul style="list-style-type: none"> 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 Study Area Based on 35° Angle of Draw |
|--|---|

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

Figure ES-7

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

ROM Coal Handling

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

A material handling schematic for the Project, conceptually showing the handling of ROM coal, product coal and coal wash is shown on Figure ES-5.

Mine Ventilation

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.

The Project would also involve the development of:

- 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).

Gas Management

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.

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

Gas would be flared or, if the gas is too low in methane content for flaring, vented to the atmosphere.

ES3.8 ROM Coal 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.

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

The Kemira Valley Rail Line is a private rail line, approximately 9 km long. Project ROM coal would continue to be transported from the Kemira Valley Coal Loading Facility to the Dendrobium CPP at Port Kembla via the Kemira Valley Rail Line (Figures ES-4 and ES-5).

Train movements on the Kemira Valley Rail Line would continue to be limited to between 6.00 am and 11.00 pm.



Plate ES-5 – Kemira Valley Coal Loading Facility

ES3.9 Coal Processing and Product Coal Transport

After train unloading, 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.

The CPP would produce the following main streams:

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

Product coal would be transported from the Dendrobium CPP to the BlueScope 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 within the Port Kembla industrial precinct would be via private internal roads.

ES3.10 Coal Wash Management

Approximately 15.2 Mt of additional coal wash from Areas 5 and 6 would be produced over the life of the Project at the Dendrobium CPP, which would be required to be used, managed or emplaced. In addition, approximately 9.4 Mt of coal wash would be produced from processing coal from remaining areas of the Dendrobium Mine during the life of the Project.

The West Cliff Coal Wash Emplacement already has approved capacity to accommodate the disposal of Project coal wash material, and this capacity would be supplemented by a range of beneficial re-use opportunities for the coal wash (e.g. civil construction fill), as is currently occurring for coal wash produced by the approved operations.

ES3.11 Water Management

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

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.

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. South32 is investigating options for the beneficial re-use of excess mine water with major water users in the Illawarra.

ES3.12 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 (except where existing curfews are in place, such as avoiding rail movements along the Kemira Valley Rail Line between 11.00 pm and 6.00 am).

The Project would continue to use existing access roads at the Dendrobium Pit Top, Kemira Valley Coal Loading Facility, Cordeaux Pit Top, Dendrobium CPP and Dendrobium ventilation 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.

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.

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

As the mining operations progress, additional service boreholes would be installed, and would generally be located adjacent to other surface infrastructure areas (e.g. new ventilation shafts), resulting in minimal additional land disturbance at the surface.

ES3.13 Workforce

The Project would provide continuation and extension of employment for the existing Dendrobium Mine workforce of approximately 400 personnel and provide an estimated 100 additional jobs during operations and 200 additional jobs during construction and development.

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, conveyor installations, during longwall change-outs, and at the Dendrobium CPP during shutdown maintenance activities.



Plate ES-6 – South32 Workforce

It is anticipated that the operational workforce would be augmented during the Project to accommodate additional development units and additional gas management works. This would continue to include a mixture of South32 staff and on-site contractor personnel.

ES4 CONSULTATION

Consultation conducted during the preparation of this EIS has provided the opportunity to identify issues of concern or interest to stakeholders and to consider these issues within this EIS.

ES4.1 Government Agencies and Infrastructure Owners

South32 consults with relevant NSW State Government agencies on a regular basis in relation to the current operations of the Dendrobium Mine.

Consultation with key NSW State Government agencies in relation to the Project commenced in 2016.

During the preparation of this EIS, a wide range of meetings and briefings were held with government agencies to ascertain and discuss issues of potential relevance to the Project.

South32 also consulted with owners of infrastructure located proximal to the Project (e.g. WaterNSW and BlueScope).

ES4.2 Public Consultation

South32 has liaised with the local community through the established Dendrobium Community Consultation Committee and the Dendrobium Community Consultation Committee – Plan for the Future Working Group.

Since September 2016 South32 has conducted a series of meetings with the Dendrobium Community Consultation Committee to discuss the Project and the key environmental studies. In June 2017 a community survey was conducted as part of the Social Impact Assessment.

Aboriginal Community

Aboriginal community consultation was undertaken in accordance with, but not limited to, clause 80C of the NSW *National Parks and Wildlife Regulation, 2009* and the Office of Environment and Heritage’s *Aboriginal cultural heritage consultation requirements for proponents 2010*. All stakeholders who registered an interest in the Project were invited to participate in the Aboriginal Cultural Heritage Assessment.

ES5 KEY ENVIRONMENTAL ASSESSMENT ISSUES AND PROJECT MITIGATION

ES5.1 Environmental Specialist Studies

This EIS was prepared by South32 and Resource Strategies Pty Ltd with specialist input provided by the following organisations:

- South32 (*project design, alternatives and justification, baseline data, stream mapping, geographical information system management, land tenure, resource economics, geological structure review, consultation, preliminary hazard analysis, rehabilitation and environmental management and monitoring*);

- Mine Subsidence Engineering Consultants (MSEC) (*subsidence predictions and impact assessment*);
- HydroSimulations (*groundwater assessment and numerical groundwater modelling*);
- HGEO (*hydrogeological data review*);
- Hydro Engineering & Consulting Pty Ltd (HEC) (*surface water assessment and site water balance*);
- Niche Environment and Heritage (Niche) (*baseline flora and fauna surveys, biodiversity assessment report and biodiversity offset strategy, Aboriginal cultural heritage assessment, historical heritage assessment*);
- GTA Consultants (*road transport assessment*);
- Ramboll Australia Pty Ltd (Ramboll) (*air quality and greenhouse gas assessment*);
- Renzo Tonin & Associates (*noise and blasting assessment*);
- Elliott Whiteing (*social impact assessment*);
- Cadence Economics (*economic assessment*);
- JBS&G Australia Pty Ltd (JBS&G) (*land contamination assessment*);
- AXYS Consulting Pty Ltd (*facilitation of environmental risk assessment*); and
- Minter Ellison (*legal review*).

In addition to the above, peer review was undertaken by the following specialists:

- Dr Frans Kalf (*groundwater*); and
- Emeritus Professor Thomas McMahon (*surface water*).

ES5.2 Key Engagement Outcomes and Associated Project Design

Regulatory and public engagement by South32 for the Project has identified a number of key assessment issues for the Project. These issues have been addressed throughout the EIS, and key Project management and mitigation measures have been developed in consideration of stakeholder consultation.

Key potential Project direct and indirect adverse impacts are described below.

The outcomes of extensive stakeholder consultation have been considered in the development of the Project and the EIS.

Key Potential Adverse Direct Impacts

Key potential adverse direct impacts can be generally grouped into:

- sub-surface impacts related to Project underground mining subsidence;
- associated impacts on the overlying physical environment; and
- impacts of the surface activities of the Dendrobium Mine that are not related to mine subsidence.

Concerns relating to mine subsidence effects, and particularly associated impacts on hydrology, aquatic ecology and biodiversity in the Special Catchment Areas have been raised by regulatory authorities, members of the public and some non-government agencies.

The longwall layout proposed for the Project reflects the adoption of South32's mine constraints to minimise impacts, including setbacks from the Avon and Cordeaux Dam walls, a minimum 300 m longwall setback from the existing dam Full Supply Levels, and setbacks from named watercourses (i.e. Cordeaux River, Avon River and Donalds Castle Creek). South32 is also avoiding the direct undermining of mapped "key stream features" identified during site investigations.

Project subsidence impacts on upland swamps and associated potential habitat effects would be offset consistent with NSW and Commonwealth Government policies.

In the event that monitoring and/or further assessment during operations indicates the potential environmental impacts associated with mine subsidence may be approaching, or are expected to exceed, those authorised for the Project, adaptive management measures would be applied. Such adaptive management measures would include potentially reducing longwall length or increasing pillar widths to reduce subsidence impacts at the surface.

Concerns relating to the continuation and extension of the operation of Dendrobium Mine surface facilities and particularly, impacts associated with surface construction activities, rail noise emissions from the Kemira Valley Rail Line, coal wash disposal and final land use, have been raised by regulatory authorities, members of the public and some non-government agencies.

Key mitigation measures for potential direct impacts are summarised in Section ES5.3.

Potential Adverse Indirect Impacts

An indirect adverse impact of the Project arising in some engagement has been the potential for Scope 1 and Scope 2 greenhouse gas emissions from the Project, and Scope 3 greenhouse gas emissions (i.e. customer greenhouse gas emissions from the burning of Project product coal) to contribute to global climate change effects.

Key mitigation measures for potential indirect impacts are summarised in Section ES5.3.

South32's company-wide Climate Change Strategy reflects key strategies of the Paris Agreement.

Key Potential Benefits

Key feedback received in regard to positive socio-economic benefits of the Project (Appendix K) related to ongoing employment benefits, benefits to local businesses and the ongoing operation of the BlueScope Steelworks.

The Project provides for the continuation and extension of underground mining and processing activities at the Dendrobium Mine to 2048.

This would provide for the continuation of employment of the existing Dendrobium Mine and generate additional jobs during construction and development activities.

The continued development of coal resources in close proximity to South32's existing infrastructure and other supporting facilities maximises the use of these established facilities and associated returns on existing financial investment.

It would also contribute to the ongoing viability of existing suppliers and customers of the Dendrobium Mine, including the BlueScope Steelworks, the Liberty Primary Steel Whyalla Steelworks and the Port Kembla Coal Terminal.



Plate ES-7 – Workforce Underground

The Project would involve the production of up to approximately 5.2 Mtpa of ROM coal, with approximately 78 Mt of additional ROM coal extracted over the life of the Project in addition to the current approved Dendrobium Mine.

The Project would include the implementation of environmental mitigation measures (including performance monitoring and adaptive management) to minimise potential impacts on the environment and community. The Project would increase the availability and longevity of employment at the Dendrobium Mine.

The Economic Assessment indicates the Project would result in a total net benefit to the NSW economy of \$1,073.2 million in net present value (NPV) terms (\$2,872 million in real, undiscounted terms), inclusive of estimated costs for environmental externalities and internalisation of environmental management costs by South32.

It is estimated the Project would result in payments of approximately \$272.1 million in NPV terms (\$714 million in real, undiscounted terms) to the NSW and Commonwealth Governments and local Councils, in the way of coal royalties, payroll tax, land taxes and Council rates.

The Project is also estimated to result in a total net benefit of \$431 million in NPV terms (\$1,149 million in real, undiscounted terms) to the Greater Wollongong Region, inclusive of estimated costs for environmental externalities and internalisation of environmental management costs by South32.

ES5.3 Key Project Outcomes

Tables ES-2 and ES-3 summarise key impacts, South32’s proposed mitigation measures to address these impacts, and the associated Project outcomes associated with:

- mine subsidence effects on water supply;
- biodiversity and Aboriginal heritage values;
- amenity effects from the continued operation of the Dendrobium Mine surface facilities; and
- indirect impacts of greenhouse gas emissions.

Proposed mitigation measures have been developed in consideration of the outcomes of the specialist environmental studies prepared for the EIS, industry best practice and what is reasonable and feasible for the Project.

Table ES-4 summarises the key potential benefits of the Project and associated Project outcomes.

**Table ES-2
Key Potential Impacts and Associated Project Outcomes – Underground Mine Extensions**

Summary of Potential Impact Mechanism	Summary of South32 Mitigation Measures and Project Outcomes
Potential reduced water yield from drinking water catchments.	
<p>Due to connective fracturing and associated groundwater depressurisation, a portion of surface water flows from streams overlying the mine would report to deeper groundwater systems. This loss has been estimated to be less than 1 per cent (%) of the Avon and Cordeaux catchment yields.</p>	<p>South32 already holds water access licences for the predicted groundwater take of the Project from the deeper groundwater systems, including the volume that may report to groundwater from surface water systems.</p> <p>South32 would pay WaterNSW for the agreed volume of surface water diverted from the Drinking Water Catchment.</p> <p>South32 would also pursue opportunities for industrial re-use of mine water such that the re-use volume matches or exceeds the predicted Project surface water take.</p>
Potential impacts on water quality in drinking water catchments.	
<p>Additional Project surface disturbance activities within the drinking water catchments may lead to sediment generation. Mine subsidence could result in localised, episodic pulses in iron, manganese and electrical conductivity in surface water systems.</p>	<p>Project sediment controls for surface disturbance activities would be designed consistent with applicable guidance materials.</p> <p>While there has been no measurable effect on water quality in Special Catchment Areas reservoirs as a result of past localised, episodic pulses in metals and electrical conductivity from longwall mining, South32 proposes water quality improvement actions such as fire management and maintenance of unsealed roads. These actions would be additional to those already funded by WaterNSW, and would target reduced sedimentation in the Special Catchment Areas.</p> <p>It is considered that the Project would, therefore, have a net beneficial effect on water quality in the Special Catchment Areas.</p>
Potential subsidence impacts on water supply infrastructure.	
<p>Mine subsidence can adversely impact surface infrastructure, including water supply infrastructure maintained by WaterNSW.</p>	<p>The Project longwall layout reflects South32’s adopted longwall mine constraints to minimise potential impacts, including 1 km setbacks from the existing Avon and Cordeaux Dam walls and 300 m setbacks from the existing dam Full Supply Levels.</p> <p>NSW Dam Safety Committee approval would be required for Project mining within Notification Areas associated with the existing Avon and Cordeaux Dams.</p> <p>No material subsidence impacts on existing WaterNSW water supply infrastructure are predicted to arise due to the Project.</p>
Potential impacts on upland swamp drying and wetting cycles.	
<p>Upland swamps include endangered ecological communities and provide habitat for threatened fauna species. Project mine subsidence may result in changes to upland swamp hydrology (i.e. longer dry periods due to increased water level recession following rainfall).</p>	<p>Reasonable and feasible measures to avoid and minimise impacts to upland swamps have been implemented for the Project. The <i>Addendum to NSW Biodiversity Offsets Policy for Major Projects: Upland swamps impacted by longwall mining subsidence</i> provides the framework for offsetting residual impacts to swamps from longwall mining.</p> <p>Potential impacts to upland swamps due to Project subsidence would be offset via the Project biodiversity offset strategy. Potential Project subsidence impacts on upland swamps and associated potential habitat effects would, therefore, be offset consistent with NSW and Commonwealth Government policies.</p>

Table ES-2 (Continued)
Key Potential Impacts and Associated Project Outcomes – Underground Mine Extensions

Summary of Potential Impact Mechanism	Summary of South32 Mitigation Measures and Project Outcomes
Potential impacts on riparian and aquatic values due to alteration of surface water flows.	
Project mine subsidence may result in changes to stream hydrology overlying the longwalls (e.g. pool recession following rainfall) with potential impacts on aquatic ecology habitat values and associated threatened fauna species.	<p>South32 has adopted longwall setbacks from named watercourses (i.e. Cordeaux River, Avon River and Donalds Castle Creek) to achieve 200 mm or less of predicted additional Project subsidence-related closure. The Project also includes avoiding the direct undermining of mapped “key stream features”.</p> <p>Significant Project impacts on aquatic ecology are unlikely. Notwithstanding, potential subsidence impacts on stream aquatic ecology values and associated potential habitat would be offset consistent with NSW and Commonwealth Government policies.</p>
Potential impacts of direct land disturbance on biodiversity and heritage values.	
Project surface development works within the Drinking Water Catchments may impact on the largely undisturbed biodiversity values and Aboriginal heritage values in protected areas.	<p>Additional Project surface infrastructure required for mine safety has been preferentially sited in close proximity to existing fire trails to minimise land disturbance, and designed to minimise disturbance of mapped endangered ecological communities and upland swamps.</p> <p>Potential Project surface disturbance impacts on biodiversity would be offset consistent with NSW and Commonwealth Government policies.</p> <p>Proposed surface infrastructure for the Project has been designed to avoid all known sandstone shelters, axe grinding grooves and natural landscape features and would avoid disturbance of known Aboriginal heritage sites where practicable.</p>

Table ES-3
Key Potential Impacts and Associated Project Outcomes – Surface Facilities

Summary of Potential Impact Mechanism	Summary of South32 Mitigation Measures and Project Outcomes
Potential amenity impacts of the continuation of the Dendrobium Mine surface facilities.	
<p>The Project proposes only minor changes to the currently approved and operating surface facilities of the Dendrobium Mine.</p> <p>Existing amenity impacts associated with the operation of these facilities would be extended from 2030 to 2048 under the Project.</p>	<p>South32 would extend the current mitigation and monitoring framework for the management of amenity impacts from Dendrobium Mine surface facilities.</p> <p>South32 would also continue the application of restricted rail haulage hours for the Kemira Valley Rail Line (between 6.00 am and 11.00 pm) and continue to implement progressive rail noise mitigation measures over the life of the Project.</p> <p>South32 would comply with the requirements and amenity criteria stipulated in the Development Consent for the Project, should the Project be approved.</p>
Potential indirect impacts of Project greenhouse gas emissions, plus Scope 3 greenhouse gas emissions from the end use of Project coal.	
<p>The Project’s contribution to global climate change effects would be proportional to its contribution to global greenhouse gas emissions.</p> <p>It is acknowledged that all sources of greenhouse gas emissions will contribute in some way towards the potential global, national, state and regional effects of climate change (subject to the efficacy of international greenhouse gas abatement measures).</p>	<p>The existing greenhouse gas emissions from the operation of the Dendrobium Mine and the Australian end of use coal from the Dendrobium Mine are already reflected in Australia’s greenhouse gas accounting. The Project would facilitate a continuation of these existing greenhouse gas emissions.</p> <p>Australia’s existing nationally determined contribution under the Paris Agreement is a greenhouse gas emission reduction target of 26-28% on 2005 levels by 2030. This would include addressing, where relevant, the continuation of combustion of Project product coal in Australia. South32’s Company-wide Climate Change Strategy reflects key strategies of the Paris Agreement.</p> <p>The Project’s direct (Scope 1) greenhouse gas emissions would be minimised as far as possible, in particular through maximising gas flaring. Project-specific greenhouse gas minimisation measures would be described in a Greenhouse Gas & Energy Efficiency Management Plan for the Project.</p> <p>Where coal from the Project is used overseas, emissions associated with the end use of this coal would be managed by any nationally determined contributions of these countries under the Paris Agreement.</p>

**Table ES-4
Summary of Key Potential Benefits of the Project and Associated Project Outcomes**

Summary of Project Benefit	Summary of Associated Project Outcome
The Project would avoid a discontinuity of operations in approved Area 3C.	It is proposed the extraction of Project Areas 5 and 6 would be integrated with the extraction of approved Dendrobium Mine Areas 3B and 3C. This would avoid a discontinuity in mining at the Dendrobium Mine caused by high gas coal in approved Area 3C. It would also avoid job losses/unemployment that would result from such a discontinuity.
The Project would provide for continued employment of the existing Dendrobium Mine workforce.	The Dendrobium Mine currently employs approximately 400 personnel. The Project would facilitate the ongoing employment of the Dendrobium Mine workforce during operations in Project Areas 5 and 6 and during the completion of mining in approved Area 3C.
The Project would provide additional employment opportunities during construction/development of the Project and during its operation.	In addition to the continuation of employment for the existing workforce, the Project would provide additional employment opportunities. Approximately 100 additional jobs would be generated for ongoing operations and approximately 200 additional jobs would be generated during construction and development activities.
The Project would provide continued supply of metallurgical coal to Australian steel producers.	The Project would provide an ongoing supply of metallurgical coal to the BlueScope Steelworks and Liberty Primary Steel Whyalla Steelworks. South32 currently supplies approximately 60% of the BlueScope Steelwork's metallurgical coal. The importance of reliable, local metallurgical coal to the economic viability of the BlueScope Steelworks has been recognised by BlueScope and the Australian Competition and Consumer Commission. The importance of the Australian steelmaking industry is described in the Commonwealth Parliamentary Report (2017) <i>Australia's Steel Industry: Forging Ahead</i> , including the economic significance of the BlueScope Steelworks to the Illawarra region (3,000 direct jobs, 10,000 indirect jobs and \$1.9 billion per annum to the regional economy). While BlueScope uses recycled steel scrap to produce a portion of its steel, there is not sufficient steel scrap to meet demands and therefore steel is predominantly made using metallurgical coal and iron ore. Metallurgical coal is used in the steelmaking process as a reducing agent to convert iron ore to iron. There is currently no economically viable alternative to the use of metallurgical coal as a reducing agent in the steelmaking process at a commercial scale.
Continued throughput to the Port Kembla Coal Terminal from the Project would contribute to its economic viability.	The majority of the throughput at the Port Kembla Coal Terminal is from South32's operations. The Port Kembla Coal Terminal currently employs approximately 80 personnel. Continued throughput to the Port Kembla Coal Terminal from the Project would contribute to its ongoing economic viability. As the Port Kembla Coal Terminal is a fully funded multi-user facility (with South32 the major user), reduced throughput of South32 coal would also affect other users, as their costs would increase.
The Project would provide continued support to local suppliers through ongoing expenditure.	South32 engages more than 140 contractors and suppliers in the region at the existing Dendrobium Mine. Wherever practicable, South32 uses the services of local providers. The Capital Investment Value for the Project is approximately \$1 billion dollars. Ongoing expenditure for the Project would allow South32 to continue to support local suppliers and contractors, providing additional security and longevity of employment in the region.
The Project would result in continued payment of royalties, taxes and rates to the NSW and Commonwealth Governments and local Councils.	It is estimated the Project would result in payments of approximately \$272.1 million in NPV terms (\$714 million in real, undiscounted terms) to the NSW and Commonwealth Governments and local Councils, in the way of coal royalties, payroll tax, land taxes and Council rates.
The Project would result in positive net benefits to the economies of NSW and the Greater Wollongong Region.	The Project is estimated to result in a total net benefit of \$1,073 million in NPV terms (\$2,872 million in real, undiscounted terms) to the NSW economy and \$431 million in NPV terms (\$1,149 million in real, undiscounted terms) to the Greater Wollongong Region, inclusive of estimated costs for environmental externalities and internalisation of environmental management costs by South32. This includes an estimated \$272.1 million in royalties, payroll tax and Council rates in NPV terms (\$714 million in real, undiscounted terms). These benefits are in addition to the Project's contribution to the continuation of manufacturing operations at the BlueScope Steelworks and Liberty Primary Steel Whyalla Steelworks, the operation of the Port Kembla Coal Terminal, NSW export income and industry in other countries that purchase Project product coal.

ES5.4 Strategic Context

Unlike some greenfield mining proposals that are developed to address general projected global commodity demand, the Dendrobium Mine is an existing metallurgical coal mine that has a high level of integration with its primary metallurgical coal customer, BlueScope Steelworks.

Strategic considerations that may be relevant in determining the Project include:

- The Project represents a continuation of mining in the Illawarra providing metallurgical coal to the BlueScope Steelworks at Port Kembla, supporting NSW regional manufacturing industries and significantly supporting the Illawarra and NSW economies.
- The Project is located in the Metropolitan Special Area, where access by the public is prohibited and most industries are thereby precluded. The extraction of coal resources by underground mining methods is currently the only major revenue generating industry that is both compatible with the catchment status of these lands, and permissible with consent.
- Review of historic underground longwall mining impacts from the Dendrobium Mine by the NSW Independent Expert Panel for Mining in the Catchment indicates there has been no observed material impact to drinking water supplies due to mining to date.
- The Project is also predicted to have negligible (less than 1%) impacts on total catchment yield and to result in a net beneficial effect on water quality.
- While it is not considered economic for the Project to avoid undermining all ephemeral drainage lines, setbacks have been adopted to reduce the likelihood of subsidence impacts to significant streams (i.e. named watercourses) and key stream features identified during field investigations. If physical damage to named streams and key stream features occurs due to the Project, remediation would be implemented to repair the damage.
- Mining constraints have also been adopted to prevent damage to water supply infrastructure, in particular, the existing Avon and Cordeaux Dam walls and Full Supply Levels. Any mining within Dam Safety Committee Notification Areas would be subject to approval by the Dam Safety Committee to confirm that dam infrastructure and safety would be protected.
- Potential impacts on some upland swamps have been avoided and minimised through Project design. While it is not considered reasonable for the Project to avoid undermining all upland swamps, biodiversity offset measures, such as the establishment of biodiversity Stewardship sites on South32 or privately-owned land, have been developed consistent with government policy to address residual impacts to upland swamps undermined by the Project.
- Conservative assumptions regarding potential Project subsidence impacts on stream features have been adopted for the derivation of biodiversity offset measures for species that may use these streams as habitat.
- The Project maximises the continued use of existing South32 surface infrastructure to support the continuation of underground mining operations.
- The Project seeks to avoid a discontinuity in mining at the Dendrobium Mine caused by high gas (carbon dioxide) coal in approved Area 3C, and avoid job losses/unemployment that would result from such a discontinuity.
- The Project represents a continuation and extension of the existing operations of a mine that provides metallurgical coal to BlueScope Steelworks at Port Kembla, supporting NSW regional manufacturing industries.
- The Dendrobium Mine also ships metallurgical coal to the Liberty Primary Steel Whyalla Steelworks, thereby supporting other steel manufacturing in Australia.
- The Project would contribute to the ongoing viability of the Port Kembla Coal Terminal, noting that South32's operations currently account for approximately 50% of throughput at the Port Kembla Coal Terminal.
- Greenhouse gas emissions from the existing Dendrobium Mine, including the end use of its product coal, would be included in current greenhouse gas inventories. The Project does not propose any increase in the currently approved rate of ROM coal production, so greenhouse gas emissions from the end use of Project coal represents a continuation of existing emissions.

The Project would result in a net benefit of \$1,073 million in NPV terms (\$2,872 million in real, undiscounted terms) to the state of NSW and \$431 million in NPV terms (\$1,149 million in real, undiscounted terms) to the local region.

ES5.5 Rehabilitation and Mine Closure

South32’s company-wide closure standard requires all South32-controlled operations to maintain closure plans, which address closure criteria and land use. The existing overall rehabilitation objectives for the Dendrobium Mine, the Cordeaux Colliery and the West Cliff Coal Wash Emplacement are that the final rehabilitated landform must be:

- safe;
- stable;
- non-polluting; and
- consistent with key stakeholder expectations (where practical) and surrounding lands.

Rehabilitation planning for the Project was informed by existing mine closure and rehabilitation objectives and current rehabilitation practices implemented for the Dendrobium Mine and the Cordeaux Colliery. Mine closure and rehabilitation objectives have also been established for underground mining areas and new surface facilities that would be developed for the Project.

The EIS provides a description of the proposed rehabilitation strategy for the Project, including decommissioning and rehabilitation of the:

- Dendrobium Pit Top;
- Cordeaux Pit Top;
- Kemira Valley Coal Loading Facility;
- Project ventilation shaft sites;
- Dendrobium/Cordeaux powerlines and Kemira Valley Rail Line infrastructure;
- Dendrobium CPP;
- West Cliff Stage 3 Coal Wash Emplacement; and
- Project underground mining areas.

A Mining Operations Plan would be developed for the Project and would incorporate the proposed changes in operations at the Dendrobium Mine and the Cordeaux Colliery.

Rehabilitation of the West Cliff Stage 3 Coal Wash Emplacement would continue to be conducted in accordance with the *West Cliff Coal Wash Area Emplacement Management Plan* (or the latest approved version) and the Bulli Seam Operations Mining Operations Plan.



Plate ES-8 – Nursery Producing Rehabilitation Plantings for South32

ES6 CONCLUSION

The Project is a continuation of the existing approved Dendrobium Mine that would comply with applicable statutory requirements and relevant strategic planning policy objectives.

This would provide for the continuation of employment of the existing Dendrobium Mine workforce of approximately 400 personnel, with approximately 100 additional operational jobs generated by the Project and approximately 200 additional jobs generated during construction and development activities.

It would also contribute to the ongoing viability of existing suppliers and customers of the Dendrobium Mine, including the BlueScope Steelworks, the Liberty Primary Steel Whyalla Steelworks and the Port Kembla Coal Terminal.

There is currently no economically viable, commercial-scale alternative to the use of metallurgical coal in making steel using the blast furnace method, which is employed at the BlueScope Steelworks. Ongoing access to a consistent and local supply of metallurgical coal, which would be produced by the Project, has been recognised as a key factor in the ongoing economic viability of the BlueScope Steelworks.

Engagement with members of the public and key regulatory agencies in NSW and at a Commonwealth level has informed South32’s design of the Project, including adoption of a range of avoidance measures to minimise impacts on named watercourses, mapped key stream features and existing WaterNSW water supply infrastructure.

South32 would apply offsets or other Project-specific measures to address key residual impacts on biodiversity, catchment yield and water quality (Table ES-2).

The site is suitable for the proposed Project use, as underground coal mining by longwall methods is compatible with the catchment area status of much of the site and the Project would generate a significant net benefit to the State of NSW.

Economic benefits potentially forgone if the Project does not proceed amounts to a net benefit of \$1,073 million in NPV terms (\$2,872 million in real, undiscounted terms) to the State of NSW and \$431 million in NPV terms (\$1,149 million in real, undiscounted terms) to the greater Wollongong Region. This includes an estimated \$272.1 million in royalties, payroll tax and Council rates in NPV terms (\$714 million in real, undiscounted terms).

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



Plate ES-9 – Mt Kembla Memorial Pathway