



BULLI SEAM OPERATIONS

EXECUTIVE SUMMARY

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ES1 INTRODUCTION

This document is an Environmental Assessment (EA) for the Bulli Seam Operations (the Project). The Project provides for the continuation of existing underground coal mining operations at the Appin Mine and West Cliff Colliery, located approximately 25 kilometres (km) north-west of Wollongong in New South Wales (NSW) (Figure ES-1).

The Appin Mine and West Cliff Colliery are owned and operated by Illawarra Coal Holdings Pty Ltd (ICHPL), a wholly owned subsidiary of BHP Billiton Pty Limited¹. ICHPL also owns and operates the Dendrobium Mine located approximately 10 km north-west of Wollongong in NSW.

ICHPL has a long history of working in the Southern Coalfield of NSW, providing high-value coking coal to the Australian steel industry and for export to overseas customers.

ES1.1 EXISTING OPERATIONS

The existing underground mining operations at the Appin Mine and West Cliff Colliery are supported by three pit tops (i.e. Appin East, Appin West and West Cliff) and other ancillary infrastructure.

Coal extracted from the underground mining operations is transferred to the surface at the Appin East and West Cliff pit tops (Figure ES-2). Run-of-mine (ROM) coal from the Appin East pit top is transported a short distance via public road to the West Cliff Washery. ROM coal is reclaimed, crushed, screened and washed at the West Cliff Washery.

Coal wash material from the West Cliff Washery and from the Dendrobium Washery is emplaced at the West Cliff Coal Wash Emplacement (Figure ES-2).

Product coal from the West Cliff Washery is transported by road to the Port Kembla Coal Terminal (PKCT) or to the BlueScope Steelworks (also located at Port Kembla). Small amounts of product coal are also transported via public roads to the Illawarra Coke Company's Corrimal and Coalcliff Coke Works.

The existing mining operations at Appin Mine and West Cliff Colliery have a combined operational workforce (including ICHPL staff and on-site contractor's personnel) of approximately 875 people. It is estimated that the Appin Mine and West Cliff Colliery make the following contribution to the regional economy:

- \$1,484 million (M) in annual direct and indirect regional output or business turnover;
- \$873M in annual direct and indirect regional value added;
- \$217M in annual household income; and
- 2,389 direct and indirect jobs.

Including the Dendrobium Mine, ICHPL employs some 2,000 staff and contractors.

ES1.2 PROJECT DESCRIPTION

The Project would involve the continuation of underground mining operations at the Appin Mine and West Cliff Colliery and would extend the life of the operations by approximately 30 years.

Table ES-1 provides a summary comparison of the existing Appin Mine and West Cliff Colliery operations and the Project components.

The main activities associated with the Project would include:

- continued development of underground mining operations within existing coal leases and new mining leases to facilitate a total ROM coal production rate of up to 10.5 million tonnes per annum (Mtpa);
- ongoing exploration activities within existing exploration tenements;
- upgrade of the existing West Cliff Washery to support the increased ROM coal production;
- continued mine gas drainage and capture for beneficial utilisation at the West Cliff Ventilation Air Methane Project (WestVAMP) and Appin-Tower Power Project;
- continued generation of electricity by the existing Appin-Tower Power Project (owned and operated by Energy Developments Limited) utilising coal bed methane drained from the underground mine workings;

¹ At all relevant times in relation to the Project, ICHPL will be acting as agent for and on behalf of Endeavour Coal Pty Ltd in respect of all mining and exploration tenements held by Endeavour Coal Pty Ltd.

**Table ES-1
Project Summary**

Project Component	Summary of Existing Appin Mine and West Cliff Colliery Operations	Summary of the Project
Underground Mining and ROM Coal Production	<ul style="list-style-type: none"> • Longwall mining methods to extract coal from the Bulli Seam. • ROM coal production of approximately 7.5 Mtpa. • There is no maximum limit on coal production at the current operations. 	<ul style="list-style-type: none"> • Continuation of longwall mining operations to extract coal from the Bulli Seam from the following areas (Figure ES-2): <ul style="list-style-type: none"> - Appin Area 7. - West Cliff Area 5. - Appin West (Area 9). - Appin Area 8. - Appin Area 2 Extended. - Appin Area 3 Extended. - North Cliff. • ROM coal production of up to approximately 10.5 Mtpa.
Product Coal	<ul style="list-style-type: none"> • Production of approximately 5.4 Mtpa of product coal for export and domestic markets. 	<ul style="list-style-type: none"> • Production of up to approximately 9.3 Mtpa of product coal for export and domestic markets.
General Surface Facilities and Supporting Infrastructure	<ul style="list-style-type: none"> • Existing general surface facilities include administration buildings, coal handling infrastructure, bath house, workshops, equipment service facilities, car park, washdown and fuel storage facilities. • Extensive supporting infrastructure including systems associated with: <ul style="list-style-type: none"> - underground drift access and conveyors; - electricity supply, reticulation and control; and - ventilation and gas management. • Remote services sites existing or under construction for provision of mine services by borehole such as power, compressed air, communication, monitoring, etc. 	<ul style="list-style-type: none"> • Existing surface facilities would be utilised. • The Project would include the upgrade of some infrastructure and progressive construction of additional components as required (e.g. service boreholes, gas drainage equipment, waste water treatment and waste water disposal). • Supporting infrastructure systems would be upgraded as required. • Development of new remote services sites utilising boreholes for installation of down-hole power, compressed air, communication, monitoring, etc.
Life of Mine	<ul style="list-style-type: none"> • The Appin Mine and West Cliff Colliery require approval under Part 3A of the <i>Environmental Planning and Assessment Act, 1979</i> by August 2010 to facilitate ongoing operations. 	<ul style="list-style-type: none"> • Current mine planning indicates an additional operational life of at least 30 years.
Employment	<ul style="list-style-type: none"> • The Appin Mine and West Cliff Colliery currently have a combined operational workforce (employees and on-site contractors) of approximately 875 people. 	<ul style="list-style-type: none"> • Long-term employment of 1,170 employees and contractors. • It is anticipated that a short-term construction workforce of up to 100 employees would be required at various stages of the Project life.
Hours of Operation	<ul style="list-style-type: none"> • 24 hour operations, seven days a week. 	<ul style="list-style-type: none"> • 24 hour operations, seven days a week.

- upgrade of existing surface facilities and supporting infrastructure;
- continued and expanded placement of coal wash at the West Cliff Coal Wash Emplacement;
- continued road transport of ROM coal from the Appin East pit top to the West Cliff Washery;
- continued road transport of ROM coal from the Appin East pit top and West Cliff pit top via the public road network to the Dendrobium Washery at Port Kembla;
- continued road transport of product coal from the West Cliff Washery via the public road network to BlueScope Steelworks, PKCT and Corrimal and Coalcliff Coke Works;
- ongoing surface monitoring, and rehabilitation and remediation of subsidence impacts; and
- other associated minor infrastructure, plant, equipment and activities.

Aerial photographs showing the key existing surface facilities and proposed upgrades are shown on Figures ES-3 to ES-6.

Parts of the Project would provide up to 100 construction jobs for ongoing capital works to support continued operations. The Project would provide ongoing employment for some 1,170 ICHPL staff and on-site contractors.

The Project underground mining areas have been divided into several domains corresponding to the extent of longwall mining areas (Figure ES-2). The longwall layouts provided in the EA (the EA Base Plan Longwalls) have been designed to meet specific impact minimisation criteria for streams, cliffs and major infrastructure items. In applying these criteria, ICHPL has significantly reduced the extent of longwall mining at the Project.

The adoption of the EA Base Plan Longwalls has resulted in a reduction of the mining reserve by approximately 72.5 Mt of ROM coal (nominal value \$9.8 billion) and a reduction in the Project life of approximately seven years. It is estimated that adoption of the EA Base Plan Longwalls has reduced potential stream related environmental impact costs by approximately 30% when compared to full extraction.

In addition to the above, and in accordance with the recommendations of the Metropolitan Coal Project Planning Assessment Commission Report, a number of environmental impact reduction alternatives have been considered to examine their relative costs and benefits. The alternatives comprise modifying the mine layout (e.g. by adjusting mining parameters or adjusting the mine plan to set back from features) to achieve various environmental outcomes for streams and upland swamps.

A range of alternatives to the EA Base Plan Longwall layout were examined. The analysis indicates that all of the environmental impact minimisation scenarios that were analysed would result in a net cost to society and would therefore be considered to be economically inefficient.

Employment and expenditure associated with the Project is predicted to have significant flow-on effects in the regional and NSW economy. The Socio-Economic Assessment indicates that the Project is predicted to generate up to 3,296 direct and indirect jobs in the regional economy and up to 5,791 direct and indirect jobs in the wider NSW economy.

The Socio-Economic Assessment has indicated the Project would provide a net production benefit of approximately \$10.3 billion and a net benefit of approximately \$8.3 billion. These are significant economic benefits to society (and the State of NSW) that would be forgone if the Project did not proceed.

Over the life of the Project, it is estimated that in total the Appin Mine and West Cliff Colliery would contribute over \$3 billion in royalties and some \$274M in employee and contractor payroll tax to the State of NSW.

Approval of the Project would secure the future employment of the ICHPL workforce and contractors, and continue to provide significant economic benefits to the region and the State of NSW.

ES2 CONSULTATION AND COMMUNITY INITIATIVES

ICHPL publishes two community newsletters in the Southern Coalfield (Illawarra Coal Coalition News and Illawarra Coal Dendrobium News). The two community newsletters are generally published on a quarterly basis and have a distribution of over 4,000. ICHPL has also produced a series of Project fact sheets for distribution to community members and copies of relevant fact sheets and newsletters are provided in the EA.

ICHPL maintains a display of information regarding its operations for the local community in the shopfront of the Appin Community Office, located in the township of Appin. ICHPL also utilises the Douglas Park Community Hall each month to display information about the company and current operations for the local community.

ICHPL supports the local community (e.g. local services and schools) through sponsorships and community initiatives. The ICHPL Community Partnerships Program was established in 2004 in order to support community projects and initiatives in the region around the Appin Mine and West Cliff Colliery. Funding is provided through base funding from ICHPL and a contribution equivalent to three cents per tonne of saleable coal from Appin Mine and West Cliff Colliery each year.

To provide for community-based decision-making on the allocation of funds, the Community Partnerships Program is administered by a board of six community representatives and two employees of ICHPL. Since 2004, the Community Partnership Program has contributed \$830,000 to 70 projects in the region.

In 2008-2009, total expenditure for ICHPL's existing community programs (Community Partnership Program and the Dendrobium Community Enhancement Program) and other initiatives was more than \$1M.

ICHPL is committed to an open and constructive consultation programme, which aims to:

- identify interested parties and stakeholders;
- inform government and other stakeholders of the nature and status of the Project by presenting information in a number of formats and venues, to facilitate a clear understanding of the Project;
- identify issues of concern to stakeholders for consideration in the Project planning and design process and in this EA; and
- establish dialogue between ICHPL and government and community stakeholders that would be ongoing, should the Project be approved.

ICHPL formed a specific Community Reference Group (CRG) for the Project in February 2009.

The CRG consists of community members from the townships and communities of Appin, Campbelltown, Douglas Park, Menangle, Pheasants Nest, Razorback and Wedderburn.

A works programme was developed by the CRG members and ICHPL consisting of several meetings and site visits to provide members of the local community the opportunity to raise issues of concern and be provided with responses and other Project-related information.

ES3 ENVIRONMENTAL ASSESSMENT

ES3.1 IDENTIFICATION OF KEY ENVIRONMENTAL ASSESSMENT ISSUES

In accordance with the Project Environmental Assessment Requirements, an Environmental Risk Assessment was undertaken in March 2009 to identify key environmental assessment issues that would require further assessment in the EA. The key issues identified in the Environmental Risk Assessment are addressed in the EA.

The Metropolitan Coal Project was the first mining proposal in the Southern Coalfield to be assessed under Part 3A of the *Environmental Planning and Assessment Act, 1979* since the findings of the Southern Coalfield Inquiry were published in 2008. A Planning Assessment Commission was constituted to assess the project application for the Metropolitan Coal Project and the Metropolitan Planning Assessment Commission Report became publicly available in June 2009.

The Metropolitan Planning Assessment Commission Report considered the Southern Coalfield Inquiry findings and recommendations and provides recommendations for future proposals for mining in the Southern Coalfield. The Metropolitan Planning Assessment Commission Report states (pages vi and 132):

The Panel considers that it would be desirable if future proposals for mining in the Southern Coalfield were required to take account of the SCL recommendations as modified by this report in preparing the Project Application and the subsequent EA. ...

The Metropolitan Planning Assessment Commission Report recommended that the Risk Management Zone concept outlined in the Southern Coalfield Panel Report be incorporated into a broader risk framework. Specifically, Recommendation 3 of the Metropolitan Planning Assessment Commission Report states (page 136):

The Panel recommends that the steps set out in Section 6.2 of this review for assessing risk be considered for inclusion in future requirements for the assessment of proposals for mining in the Southern Coalfield to ensure that appropriate information on risks to significant natural features is available in the EA.

ES3.2 RISK ASSESSMENT FOR SIGNIFICANT FEATURES

Stream, Upland Swamp, Aboriginal Heritage Site and Major Cliff Line Risk Assessments have been conducted for the Project, consistent with the steps described in Section 6.2 of the Metropolitan Planning Assessment Commission Report.

Stream Risk Assessment

A total of 47 rivers and significant streams were identified. The main rivers and significant stream catchment systems within the Project extent of longwall mining area are the Nepean River, the Cataract River, the Georges River, the Woronora River and O'Hares Creek. Baseline datasets for these streams are provided in the EA.

Risk management zones were applied to relevant streams and the predicted subsidence effects were calculated. The likelihood and level of potential impacts of subsidence on flow and water quality in streams would depend on a number of specific site attributes including the geomorphic nature and hydrological characteristics of the stream. The character of streams in the Project area varies significantly in terms of scale, geology, geomorphic character and existing landuse. Potential environmental consequences for streams are described in the EA.

At the substantial depths of cover at the Project, connective cracking from the ground surface to the mined seam is not expected. Although stream beds with exposed rock base can experience subsidence induced fracturing to a depth of 10 to 20 metres (m), there is considered to be negligible potential for the loss of surface water to the mine due to the lack of continuity of fractures from the surface to the mine. A portion of surface water flows may be diverted through the rock fractures beneath the stream bed, with emergence further downstream. As a result, the Project would not result in adverse consequences to the quantity of water reaching the Cataract Dam, Woronora Dam or Broughtons Pass Weir.

Mine subsidence effects can result in localised changes to water quality, however, the Project is not expected to impact on the water quality of Woronora Reservoir, Cataract Reservoir or Broughtons Pass Weir.

Stream impact minimisation criteria have been applied to a number of streams in the Project area. The stream impact minimisation achieved by these criteria and associated remediation commitments are summarised in Table ES-2. It should be noted that it would be possible to adjust the EA Base Plan Longwalls and still meet the same criteria. For example:

- where longwalls are on both sides of the stream, longwalls could be extracted closer to one side of the stream if longwalls on the other side of the stream were set further back;
- one or more longwalls could be extracted closer to a stream if other longwalls on the same side of the stream were set further back; or
- it is generally the case that longwalls which approach a stream by their ends (perpendicular) rather than by their sides (parallel) result in reduced levels of subsidence movement at the stream, therefore, if mining conditions permit, some longwalls could be extracted closer to a stream by changing their orientation relative to the stream.

The Project Subsidence Assessment provides a demonstration of the above with four alternative longwall layouts.

ICHPL may change the layout of the EA Base Plan Longwalls over the life of the Project. However, any such changes would be designed to meet the stream impact minimisation criteria and the requirements of the Project Approval and would be presented as a component of future Extraction Plans, for approval by the Director-General of the Department of Planning.

ICHPL would prepare Stream Risk Management Plans for streams identified in the Stream Risk Assessment. The Stream Risk Management Plans would be included in future Extraction Plans for specific mining domains. It is proposed that a detailed monitoring programme be provided in a Catchment Monitoring Programme to be prepared for the Project.

**Table ES-2
Summary of Preferred Risk Management Options - Streams**

Streams	Stream Impact Minimisation Criteria	Management Measures
<ul style="list-style-type: none"> • O'Hares Creek. • Stokes Creek (reaches 1 and 2). • Cataract River. • Lizard Creek. • Georges River (reach 2). • Nepean River (reach 1). 	<ul style="list-style-type: none"> • Minor fracturing of controlling rockbars, with negligible diversion of water from associated pools. • Potential for fracturing of stream bed and consequent stream flow diversion in stream reaches between controlling rockbars. The potential for this impact is considered to be low in stream reaches where the above criteria has been applied (i.e. the application of the above criteria at controlling rockbars is expected to significantly reduce potential impacts to intervening stream reaches as evidenced by the analysis of the EA Base Plan Longwalls presented in the EA. • Localised impacts on stream water quality. • Strata gas release. 	<ul style="list-style-type: none"> • Longwall layout design to achieve a maximum predicted closure of 200 mm at controlling rockbars. • Implementation of stream remediation measures on rivers and stream reaches of third order and above where subsidence results in the diversion of stream flow in stream reaches between controlling rockbars, and where the stream features are such that the remediation measures are considered technically feasible. The remediation effort is expected to be significantly less than that required for streams without setbacks.
<ul style="list-style-type: none"> • Georges River (reach 1) – includes perennial reaches that are less than 3rd order. • Woronora River (perennial reaches) – includes perennial reaches that are less than 3rd order. 	<ul style="list-style-type: none"> • Fracturing of controlling rockbars and/or stream bed, resulting in the diversion of some stream flow, however to a reduced degree when compared to streams with full extraction. • Localised impacts on stream water quality. • Strata gas release. 	<ul style="list-style-type: none"> • Stream not directly undermined. • Implementation of stream remediation measures (i.e. grouting) at controlling rockbars to return stream flow to pre-mining characteristics. The remediation effort is expected to be significantly less than that required for streams without setbacks. • Implementation of stream remediation measures in stream reaches between controlling rockbars where remediation measures are technically feasible.
<ul style="list-style-type: none"> • Nepean River (reaches 2 and 3) – includes reaches of the Nepean River within the Douglas Park Causeway and Menangle Weir inundation areas. 	<ul style="list-style-type: none"> • Localised impacts on stream water quality. • Strata gas release. • Minimise impacts such as cliff falls along the Nepean River. 	<ul style="list-style-type: none"> • Stream not directly undermined. • Along the Nepean River apply a minimum setback distance (i.e. whichever gives the greater distance from the Nepean River) of: <ul style="list-style-type: none"> – 50 m from the top of mapped cliff lines; and – 50 m from the transition from steep slope to the Nepean River alluvium/colluvium zone. • Minimum setback distance of a 35° angle of draw from the Menangle Weir and road/rail bridges across the Nepean River would also be applied to the longwall layout to maintain the structural integrity of the weir and road/rail bridges. • A minimum setback distance of a 35° angle of draw from the Douglas Park Twin Bridges (where the Hume Highway crosses the Nepean River) would also be applied to the longwall layout design to maintain the structural integrity of the bridge.

Table ES-2 (Continued)
Summary of Preferred Risk Management Options - Streams

Streams	Stream Impact Minimisation Criteria	Management Measures
<ul style="list-style-type: none"> All other streams. 	<ul style="list-style-type: none"> Fracturing of controlling rockbars and/or stream bed, resulting in the diversion of some stream flow, including increased leakage from pools. Localised impacts on stream water quality. Strata gas release. 	<ul style="list-style-type: none"> Implementation of stream remediation measures (i.e. grouting) on stream reaches of third order and above at controlling rockbars to return stream flow to pre-mining characteristics. Implementation of stream remediation measures on stream reaches of third order and above in stream reaches between controlling rockbars, where remediation measures are technically feasible.

Upland Swamp Risk Assessment

Upland swamps occur in headwater valleys on the Woronora Plateau, mainly on the eastern, higher parts. Upland swamps support a high diversity of plant species and are habitats of particular conservation significance for their biota. The Metropolitan Planning Assessment Commission Report states (page 140):

The Panel recommends that the framework in Section 6.2, as adapted to swamps in Section 9.4.1, be used as a guide for future Southern Coalfield proposals involving upland swamps and that the production of RMZs be obligatory for all upland swamps (ie headwater and valley infill). These RMZs should trigger a requirement to provide comprehensive information on predicted impacts and consequences that might be expected from both conventional and non-conventional subsidence sources. ...

An Upland Swamp Risk Assessment has been conducted for the EA consistent with the steps described in Section 9.4.1 of the Metropolitan Planning Assessment Commission Report.

A total of 226 swamps have been identified within the Project area. The characteristics of each swamp are described in the EA. Risk management zones were applied to the swamps and the predicted subsidence effects were calculated. For swamps to experience adverse environmental consequences, changes to swamp hydrology would have to occur that were large enough and of sufficient duration to create conditions that were favourable for drying, erosion, fire, or changes in species composition.

ICHPL’s preferred management measures for swamps are provided in Table ES-3. ICHPL has developed contingency measures to be implemented in the event that Project impacts on swamps exceed the EA predictions, and these are detailed in the EA.

Upland Swamp Risk Management Plans would be included in future Extraction Plans for specific mining domains. A monitoring programme has been developed for the swamps and is described in the EA.

Aboriginal Heritage Risk Assessment

The Sydney Region has been occupied by Aboriginal people for approximately 14,500 years. An Aboriginal Cultural Heritage Assessment was prepared for the Project in consultation with 15 registered Aboriginal stakeholder groups.

The Woronora Plateau within the eastern and southern parts of the Project area provides sandstone outcrops and overhangs suitable for shelter and platform sites. Outcropping sandstone is not as readily available in the Cumberland lowlands in the northern and western domains. These areas have deeper, more fertile soils which results in a higher frequency of larger trees, which are more suitable for engraving or removing bark. Flora and fauna species present within the study area would have provided a range of resources for Aboriginal people.

**Table ES-3
Preferred Risk Management Measures for Upland Swamps**

Swamp Type	Prediction	Management Measures
<ul style="list-style-type: none"> Swamp with low likelihood of negative environmental consequences. 	<ul style="list-style-type: none"> Minor fracturing, change in drainage line alignment and/or erosion resulting in impacts of negligible consequence within a swamp. 	<ul style="list-style-type: none"> Implementation of the monitoring programme.
<ul style="list-style-type: none"> Swamp at real risk of negative environmental consequences. 	<ul style="list-style-type: none"> Fracturing, change in drainage line alignment and/or erosion resulting in localised impacts within a swamp. 	<ul style="list-style-type: none"> Implementation of maintenance measures in response to observed impacts (e.g. knick point control, water spreading, sealing of bedrock fractures and/or injection grouting) to maintain the physical state and function of a swamp. Implementation of the monitoring programme. Implementation of the research programme to inform the management measures.
<ul style="list-style-type: none"> Swamp with potential for significant negative environmental consequences. 	<ul style="list-style-type: none"> Fracturing, change in drainage line alignment and/or erosion resulting in significant impacts within a swamp. 	<ul style="list-style-type: none"> Implementation of maintenance measures in response to observed impacts (e.g. knick point control, water spreading, sealing of bedrock fractures and/or injection grouting) to maintain the physical state and function of a swamp. Implementation of the monitoring programme. Implementation of the research programme to inform the management measures.

A total of 623 Aboriginal heritage sites have been assessed in the Aboriginal Heritage Site Risk Assessment conducted for the Project. The key characteristics of each Aboriginal heritage site are described in the EA. Risk management zones were applied to sites of high or moderate archaeological significance and/or of particular cultural significance and the predicted subsidence effects were calculated.

Eighteen Aboriginal heritage sites were assessed as having either high archaeological significance or particular cultural significance. One of these sites is considered to be more archaeologically significant than all other sites in the study area. This site is located in the North Cliff domain upslope of a minor tributary of the Woronora River and is not directly undermined by the EA Base Plan Longwalls and is expected to experience negligible subsidence effects.

The Aboriginal Heritage Risk Assessment indicates that of the 76 sites of high or moderate archaeological significance or particular cultural significance, 26 (34%) sites were assessed as having a negligible risk of impact from subsidence, 31 (41%) a very low risk, 12 (16%) sites a low risk and 7 (9%) sites a moderate risk (impacts are possible, but likely to occur in less than 10% of cases). No sites were assessed as having a high risk.

A Risk Management Plan would be prepared for each Aboriginal heritage site of high or moderate archaeological significance and/or particular cultural significance as part of the Aboriginal Heritage Plan to be prepared for the Project.

Major Cliff Line Risk Assessment

The surface geology of the Woronora Plateau is characterised by the Hawkesbury Sandstone and only infrequent remnants of Wianamatta Group shales. On the Woronora Plateau incised watercourses have formed steep blocky valleys and cliff lines that contain sandstone overhangs.

A total of 611 cliff lines have been identified and assessed in the Major Cliff Line Risk Assessment conducted for the Project. The characteristics of cliff lines is described further in the EA. Risk management zones were applied to the cliffs and the predicted subsidence effects were calculated.

Rock falls occur naturally, however subsidence has the potential to further reduce the stability of features such as cliff lines and increase the incidence of rock fall.

The Metropolitan Planning Assessment Commission Report indicates:

The SCI observed subsidence impacts on cliff lines, principally rock falls associated with river gorges or other cliffs. It concluded that most such rock falls appeared to be minor, in so far as they seem to affect a relatively small proportion of cliffs close to longwall operations.

The EA Base Plan Longwalls would not mine directly beneath the majority of cliff lines. This includes cliff lines located along the Nepean River, Harris Creek, Cataract River, O'Hares Creek and Cobbong Creek. However, it is possible that some isolated rock falls could occur as a result of the extraction of longwalls in the vicinity of these cliff lines.

The EA Base Plan Longwalls would mine directly beneath some cliff lines located along Wallandoola Creek and Cascade Creek. Any rock falls or cliff instabilities, resulting from the extraction of the longwalls, are expected to represent in the order of 3 to 5% of the total linear length of cliff lines that are directly mined beneath.

ICHPL would develop a management plan to manage potential risks to people that may be visiting or passing by cliff lines in the Project area when mining is occurring.

ES3.3 OTHER KEY ENVIRONMENTAL ASSESSMENT ISSUES

Subsidence Impacts on Infrastructure, Improvements and Private Land Holdings

A detailed Subsidence Assessment has been prepared for the Project and includes predictions of the potential subsidence effects associated with the EA Base Plan Longwalls.

A range of infrastructure, improvements and private land holdings are located within the extent of longwall mining area and surrounds, including houses and associated residential structures, railway infrastructure, public roads and associated bridges, water supply infrastructure, gas infrastructure, electrical infrastructure, telecommunications infrastructure, air strips, survey control marks, places of worship, public amenities, agriculture related facilities, rural building structures and farm facilities, industrial, commercial and business establishments, fire trails and other minor tracks.

Subsidence effects have been predicted for each building, structure and infrastructure item based on the EA Base Plan Longwalls. Potential impacts that have been identified include cracking of surfaces, opening of joints, and cracks in masonry. Potential management and mitigation measures for surface infrastructure are detailed in the EA. With the implementation of suitable management, mitigation and monitoring measures it is anticipated that surface infrastructure can be maintained in a safe and serviceable condition during the life of the Project.

A total of 1,294 dwellings were identified within the study area, of which approximately 95% are located within declared Mine Subsidence Districts. The majority of houses within the study area (approximately 80%) are predicted to experience no material impacts. While approximately 20% of the houses are expected to experience impacts from mine subsidence, the majority of these are expected to be minor. All houses within the study area are expected to remain safe, serviceable and repairable throughout the mining period, provided that they are in sound structural condition prior to mining. Further detailed subsidence assessment for houses potentially impacted by the Project would be undertaken as a component of future Extraction Plans.

All houses would be managed in accordance with the dwelling management measures and *Mine Subsidence Compensation Act, 1961* provisions outlined in the EA. This would include the development of a Built Features Management Plan incorporating recording, monitoring and repair provisions where required.

Groundwater

A number of groundwater studies and monitoring programmes have been undertaken in the Project area. Examination of the hydrogeological data has facilitated an understanding of the existing groundwater systems and the scale and nature of the existing effects of the Appin Mine and West Cliff Colliery and other nearby mines on local and regional groundwater systems.

A conceptual model of the hydrogeological regime was developed based on the review of hydrogeological data. The data supports definition of three separate groundwater systems including:

- Perched groundwater system – perched water tables are hydraulically disconnected from the regional aquifer and are associated with swamps, elevated sandstone and shales.

- Shallow groundwater system – associated with the Hawkesbury Sandstone.
- Deep groundwater system – associated with the sandstones of the Narrabeen Group and coal seam aquifers.

At the substantial depths of cover at the Project, connective cracking from the ground surface to the mined seam is not expected and there is considered to be negligible potential for the loss of surface water to the mine due to the lack of continuity of fractures from the surface to the mine.

There are 190 registered bores in the vicinity of the Project. There would be a negligible impact on water access in shallow bores in the upper Hawkesbury Sandstone, Wianamatta Group shale and Alluvium. Deeper bores in the middle and lower Hawkesbury Sandstone are expected to experience a drawdown (over 30 years) as a result of the Project. Management and compensatory measures have been developed for landholder bores that may be affected by the Project and are described in the EA.

A geological investigation programme would be developed and implemented progressively over the Project life to manage the potential for unexpected groundwater related effects. The groundwater monitoring programme would monitor groundwater conditions for changes as a result of the Project and would be used to inform progressive development of the numerical groundwater model.

Aquatic and Terrestrial Ecology

ICHPL has developed a number of research, offset and compensatory measure commitments for potential impacts related to mine subsidence and these are described in the EA.

Vegetation clearance and rehabilitation activities for the Stage 4 Coal Wash Emplacement area (including the implementation of flora and fauna mitigation and management measures) would be consistent with current practices implemented for the West Cliff Coal Wash Emplacement. Compensatory measures and ecological initiatives for particular terrestrial flora and fauna species are provided in the EA.

The Stage 4 Coal Wash Emplacement involves the clearing of approximately 65 hectares (ha) of native vegetation. The Project compensatory land package would include:

- transfer of 130 ha of native bushland from ICHPL to the NSW State Government;

- selection of suitable bushland for transfer;
- funding for costs associated with transferring the relevant land title to the NSW State Government; and
- funding for minor site improvement works if required.

Two threatened flora species, *viz.* Bynoe's Wattle (*Acacia bynoeana*) and Hairy Geebung (*Persoonia hirsuta* subsp. *hirsuta*) are located within the Stage 4 Coal Wash Emplacement area and surrounds. The Stage 4 Coal Wash Emplacement has been designed to avoid clearance of known occurrences of Bynoe's Wattle and to minimise clearance of the Hairy Geebung population in the Brennans Creek catchment area. As part of the Project and as provided in the EA, ICHPL would sponsor ecological initiatives aimed at better understanding and managing the local population of the Hairy Geebung.

Four upland swamps are located in the vicinity of the Stage 4 Coal Wash Emplacement and the facility has been designed to avoid clearing and/or emplacement in these swamps.

Non-Aboriginal Heritage

The Non-Aboriginal Heritage Assessment conducted for the Project identified 49 heritage items. These items are detailed in the EA and include a range of heritage listed buildings and heritage listed infrastructure items.

All heritage buildings would be managed in accordance with the dwelling management measures and *Mine Subsidence Compensation Act, 1961* provisions outlined in the EA. This would include the development of a Built Features Management Plan incorporating recording, monitoring and repair provisions where required.

The protection of the heritage values of the infrastructure items would be integrated with the obligation to maintain public safety and infrastructure security. ICHPL would conduct detailed engineering structural assessments and develop Heritage Management Plans for these items in consultation with infrastructure owners/managers and relevant authorities.

Detailed subsidence assessment and (if required) site-specific structural assessments would be conducted for each listed non-Aboriginal heritage item in the Project extent of longwall mining area as a component of future Extraction Plans.

Noise

A Noise Impact Assessment has been undertaken for the Project in accordance with the requirements of the *Industrial Noise Policy*.

The Appin Mine and West Cliff Colliery are existing large industrial facilities that have been operating in the local area for an extended period. Suburban and rural receivers are in some cases located in close proximity to infrastructure associated with these existing industrial facilities.

An acoustic model was developed that simulates the major noise emitting sources associated with the Project mining operations. Two scenarios were assessed: existing/approved operations and Project operations. Following analysis of the modelling results for the existing/approved operations, an initial noise reduction investigation was undertaken. A number of noise reduction measures were identified and would be implemented progressively over the Project life.

Table ES-4 presents a summary comparison of the number of receivers in the intrusive noise affectation and noise management zones between the existing/approved and the Project scenarios.

The proposed Project noise reduction measures result in a net noise reduction for the majority of Appin receivers. A limited number of receivers on the eastern fringe of Appin are predicted to experience a slight increase in noise from the Project due to the proximity of the West Cliff Stage 4 Coal Wash Emplacement.

Air Quality

An Air Quality Impact Assessment for the Project was undertaken in accordance with the *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW*.

The current air quality environment in the Project area includes existing dust and other air quality related contributions associated with the operations at the Appin Mine and West Cliff Colliery surface facilities.

As a component of the Air Quality Impact Assessment, background air quality data was collected from nearby high volume sampler stations and from on-site measurements. A description of the existing air quality is detailed in the EA and indicates compliance with applicable air quality criteria.

The air quality emissions potentially generated by the Project and the predicted impacts of these emissions in combination with the existing background air quality in the vicinity of the Project were assessed. The assessment indicates compliance with all applicable dust, suspended particulate, nitrogen dioxide and odour criteria at the nearest private receptors.

Air quality control measures that are currently used at the Appin Mine and West Cliff Colliery would continue to be used at the Project and are described in the EA.

Table ES-4
Predicted Number of Receivers in the Intrusive Noise Affectation and Noise Management Zones Existing/Approved and Project

Noise Exceedance Zone	Noise Exceedance	Predicted Number of Receivers	
		Existing/Approved	Project
Noise Affectation Zone	>5 dBA above Project specific intrusive noise levels	22	12
Moderate Noise Management Zone	3 to 5 dBA above Project specific intrusive noise levels	36	20
Marginal Noise Management Zone	1 to 2 dBA above Project specific intrusive noise levels	113	86

dBA = A-weighted decibel.

Greenhouse Gas Emissions

The direct greenhouse gas emissions of the Project are estimated to average approximately 5.35 million tonnes (Mt) of carbon dioxide-equivalent (CO₂e) per year. This equates to average emissions of 0.52 tonnes (t) CO₂e per tonne ROM coal. The total indirect greenhouse gas emissions associated with the on-site use of fuel and electricity over the life of the Project are estimated to be approximately 0.74 Mt CO₂e per year over the life of the Project.

The Appin-Tower Power Project and WestVAMP are two of the most significant greenhouse gas abatement projects in Australia.

The Appin-Tower Power Project is capable of producing some 94 megawatts (MW) of electricity from the pre-drained coal bed methane, reducing methane emissions that contribute to greenhouse gas emissions. The Appin-Tower Power Project would continue to be operated as part of the Project.

WestVAMP utilises up to approximately 20% of the available mine ventilation air to achieve a reduction in greenhouse gas emissions of approximately 250,000 t of CO₂e per year. In addition, WestVAMP consists of a steam turbine capable of generating up to 6 MW of electricity for use at the West Cliff Colliery.

WestVAMP received the Australian Institute of Energy's Excellence in Energy Award 2007 for its outstanding contribution to the energy sector in NSW. WestVAMP would continue to be used at the West Cliff Colliery.

Road Transport

Product coal from the West Cliff Washery would continue to be transported by road to PKCT or to the BlueScope Steelworks. Minor quantities of product coal would also continue to be transported via road to the Illawarra Coke Company's Corrimal and Coalcliff Coal Works.

The transport routes from the West Cliff Washery are shown on Figure ES-1. No changes to existing transport routes are proposed. Trucking of product coal and ROM coal would continue to be undertaken by a transport contractor.

A Road Transport Assessment was prepared for the Project and included traffic surveys along key routes used by the transport contractor and local roads of relevance to the Project. Intersection traffic flow data was collected at ten relevant intersections and the peak hour performance of these intersections was assessed. A review of road safety within the study area and along key haulage routes was also undertaken.

The analysis of existing traffic flows indicates that the highest contribution of the existing Appin Mine and West Cliff Colliery is along Appin Road. The existing Appin Mine and West Cliff Colliery make only a minor contribution to traffic flows on the remainder of the coal haulage routes.

The potential impacts of the Project with regard to traffic movements would include additional coal haulage primarily to PKCT and BlueScope Steelworks, and additional operational workforce traffic, additional operational deliveries and the continuation of coal haulage activities over the extended life of the Project. Predicted traffic generation would comprise both light and heavy vehicles.

The relative increase in road haulage volumes as a result of the Project are generally minor considering the existing and future background traffic levels of roads along the Project haulage routes. Notwithstanding, the intersection of the West Cliff pit top access road with Appin Road would be upgraded to accommodate the increase in Project related traffic at this intersection. Some existing safety deficiencies along Appin Road between the Appin East pit top access road and West Cliff pit top access road were identified and these would be addressed.

ICHPL would implement a Transport Management Plan for the Project and ICHPL's haulage contractors would be required to observe the PKCT Driver's Code of Conduct for deliveries to PKCT and on other haulage routes, where relevant.

ES4 REHABILITATION AND MINE CLOSURE

The EA provides a description of the proposed rehabilitation strategy for the Project, including:

- closure and rehabilitation of the Appin East, Appin West and West Cliff pit top areas;
- decommissioning and/or rehabilitation of the Appin No. 1, No. 2 and No. 3 shaft sites, North Cliff shafts site and Bulli shafts site;
- decommissioning and rehabilitation of the West Cliff Stage 4 Coal Wash Emplacement;
- rehabilitation of temporary surface disturbance areas;
- rehabilitation of subsidence impacts on natural surface features; and
- mine lease relinquishment.

BHP Billiton's company wide closure standard requires all BHP Billiton controlled operations to have closure plans which are regularly reviewed and updated and which identify, mitigate where possible, and manage both current and future health, safety, environment and community, and other business risks associated with closure.

Stakeholder consultation is recognised as an important component of the mine closure process. A stakeholder consultation strategy would be developed and implemented at an appropriate time prior to mine closure.

ES5 STATEMENT OF COMMITMENTS

ICHPL has prepared a Statement of Commitments for the Project which provides a summary of the proposed environmental management, monitoring and reporting and specific environmental commitments made in relation to the Project. These commitments are described in the EA.