NSW GOVERNMENT | Planning & Infrastructure

MAJOR PROJECT ASSESSMENT
Bulli Seam Operations Project

Director-General's
Environmental Assessment Report
Section 75I of the
Environmental Planning and Assessment Act 1979

December 2011

Cover Photo: Douglas Park Bridges, http://en.wikipedia.org/wiki/File:Douglas_Park_Bridge_F5_Freeway.jpg

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EXECUTIVE SUMMARY

The Bulli Seam Operations Project (the BSO Project) comprises continued and extended coal mining operations at the existing Appin Mine and West Cliff Colliery, two underground mines located approximately 25 kilometres northwest of Wollongong in NSW. The two mines are owned and operated by Illawarra Coal Holdings Pty Ltd (Illawarra Coal), which is a wholly owned subsidiary of BHP Billiton Pty Ltd. Underground mining operations are supported by three pit tops (West Cliff, Appin East and Appin West) and other ancillary infrastructure.

Illawarra Coal is seeking to continue longwall mining operations at the Appin Mine and West Cliff Colliery within existing and new mining leases, which would extend the life of mining operations by approximately 30 years. Illawarra Coal is seeking approval to extract up to 10.5 million tonnes per annum (Mtpa) of run-of-mine (ROM) coal from the Bulli Coal Seam over this period. The proposal has a capital investment value of $1.4 billion.

The proposal constitutes a major project under Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act) as it is development for the purpose of coal mining, and consequently requires the Minister's approval.

The Department exhibited the original project from 20 October 2009 to 2 December 2009. The Department received a total of 81 submissions during the exhibition period, of which 56 objected to or raised concerns about the proposal. The two key areas of concern raised in submissions were subsidence-related impacts on natural features including swamps, streams, cliffs and ecology; and impacts relating to the expansion of the coal wash emplacement at West Cliff Colliery.

Following the exhibition period, the then Minister for Planning directed the Planning Assessment Commission (PAC) to carry out a review of the subsidence-related impacts of the project on significant natural features, built infrastructure and the values of Sydney's drinking water catchment. The PAC held public hearings, which took place during February 2010 at Appin. The PAC provided a review of the project (the PAC Report) to the Minister on 23 July 2010.

In recognition of concerns raised in the PAC Report, on 17 September 2010 the Department required Illawarra Coal to prepare a Preferred Project Report (PPR) under section 75H(6)(b) of the EP&A Act. Illawarra Coal submitted a PPR to the Department on 24 September 2010, supplementary information regarding the PPR on 19 October 2010 and a further Addendum to the PPR on 4 October 2011.

The original mine plan involved mining operations in seven large areas or "domains". Three of these domains (in the south and east of the overall project application area) were located largely beneath areas that are in pristine or near-pristine condition and which are either conservation areas under the *National Parks and Wildlife Act 1974* or are parts of Sydney's and Wollongong's drinking water catchments.

The PPR contains a new mine plan that substantially revises and reduces the scope of the original, exhibited mine plan. The PPR removed proposed longwall mining operations from nearly all of the three southern and eastern domains, which significantly reduced potential subsidence-related impacts on natural features. For example, the potential for subsidence-related impacts on upland swamps has been completely removed. Potential subsidence-related impacts on other key natural features, including cliffs, streams and biodiversity, have also been greatly diminished. Impacts on the Metropolitan Special Area are very limited, and could be considered as peripheral.

The originally exhibited project proposed a very substantial amount of longwall mining within the Dharawal State Conservation Area, which is a conservation reserve under the *National Parks and Wildlife Act 1974*. The Government has announced that the great majority of this reserve will have its status upgraded to become a national park. The PPR removes the great majority of the project's originally proposed longwall mining from this reserve. The PPR excludes 98.7% of all lands within the Dharawal SCA from within the

project application area. The project's impacts on the reserve would now be limited to an area of 76 ha. Only first workings, continued operation of the existing West Cliff Pit Bottom, and mining of a small section of one longwall panel would be allowed to take place.

The Department has assessed the project application, the EA, submissions on the project, Illawarra Coal's response to submissions, Illawarra Coal's responses to the PAC Report and its PPR and supplementary information in accordance with the relevant requirements of the EP&A Act, including the objects of the Act and the principles of ecologically sustainable development.

The Department has closely considered the PAC's findings and recommendations as part of its assessment of the merits of the project. The PAC Report is very extensive, comprising 18 chapters extending over 445 pages. A significant number of the PAC's 136 recommendations are no longer relevant due to the reduced scope of the proposal under the PPR. However, the Department has carefully considered all the remaining relevant recommendations. The Department has proposed conditions of approval that give effect to these recommendations.

The project would result in some adverse residual environmental impacts including minor subsidence-related impacts on limited sections of the Georges River. The Department has recommended conditions to monitor and manage these impacts, and to remediate them where reasonable and feasible. The development of Stage 4 of the coal wash emplacement at West Cliff Colliery may also result in some adverse impacts on flora and fauna, including the Hairy Geebung (a threatened flora species), as well as impacts from waste water on the upper Georges River. However, the PAC and the Department agree that the proposed location of the Stage 4 Emplacement Area is the only viable option at this time to support continued mining. The Department is satisfied that the impacts can be minimised, mitigated or managed through the imposition of a comprehensive range of conditions of approval.

On balance, the Department believes that the project represents a logical progression of Illawarra Coal's existing mining operations, is satisfied that its benefits sufficiently outweigh its costs, it is in the public interest, and it should be approved, subject to strict conditions.

1 BACKGROUND

1.1 Project Location

The Bulli Seam Operations (BSO) Project comprises both the Appin Mine and West Cliff Colliery, which are two underground mines located approximately 25 kilometres (km) northwest of Wollongong in NSW (see Figure 1 below). The two mines are owned and operated by Illawarra Coal Holdings Pty Ltd (Illawarra Coal), which is a wholly owned subsidiary of BHP Billiton Pty Ltd.

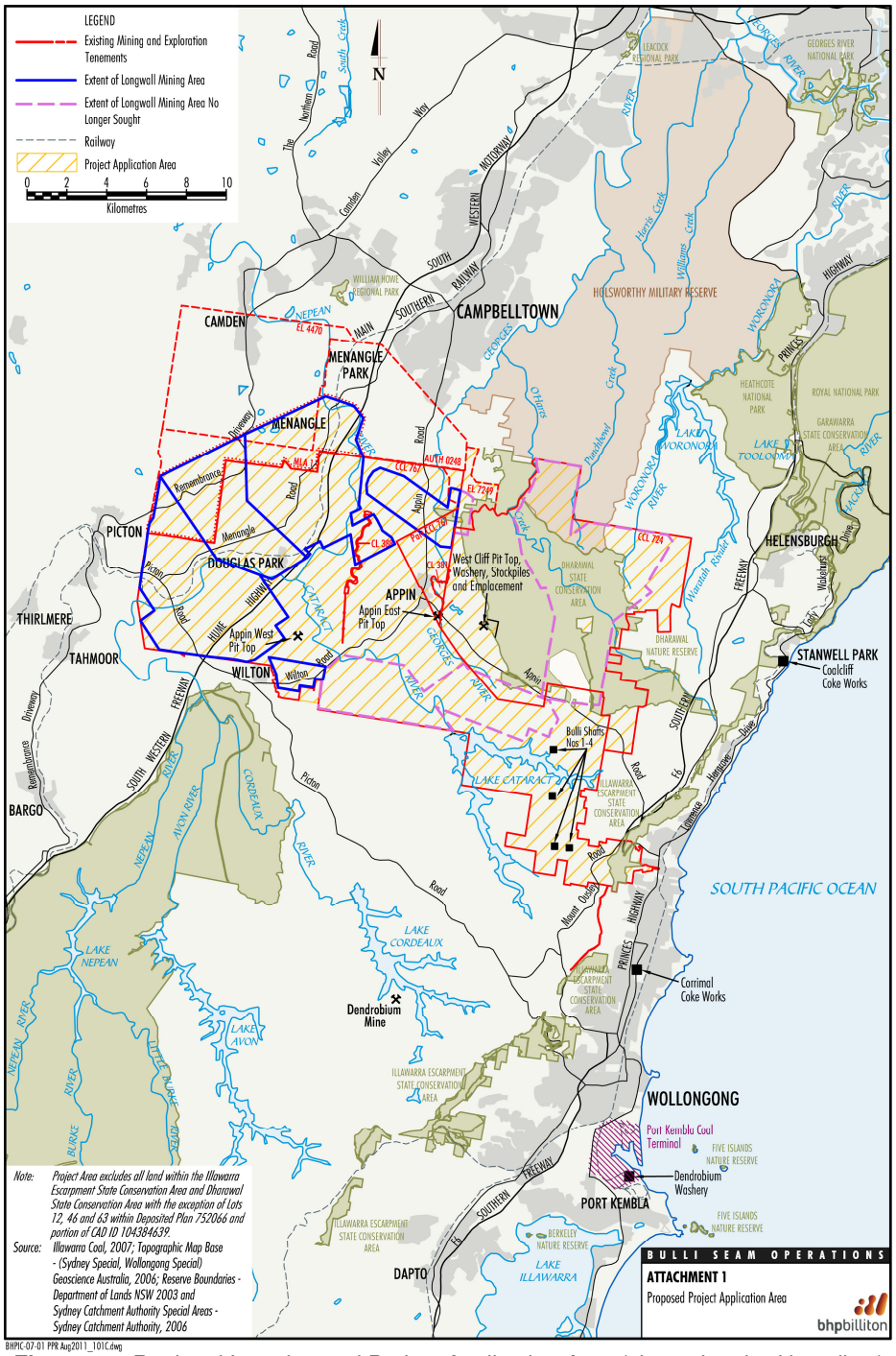

Figure 1 – *Regional Location and Project Application Area (shown hatched in yellow)*

1.2 Project Setting

The BSO Project is located within 60 km of Sydney, and in close proximity to the regional cities of Wollongong and Campbelltown. The final project application area extends over 290 km^2 (see Figure 2) and contains a great diversity of natural and built features. The area of proposed longwall mining includes key elements of the water supply infrastructure for the Sydney Metropolitan Area, a national highway, a national railway line, national gas supply pipelines, national telecommunication networks, industrial complexes, farms, recreational areas, air strips, and a variety of other local and regional infrastructure. It also includes thousands of other built structures (including 1,290 houses and 4,250 rural buildings).

The key features within those parts of the project area where longwall mining is now proposed are:

- the Hume Highway (ie the South Western Freeway or F5) and Main Southern Railway Line;
- the Nepean and Georges Rivers;
- the townships of Menangle, Wilton, Douglas Park and Wedderburn;
- service infrastructure including water pipelines and canals, electricity transmission lines, gas pipelines and telecommunications lines;
- farming and agricultural land, including some wineries and horse studs; and
- a small section of the Dharawal State Conservation Area (Dharawal SCA) and a limited section of the Metropolitan Catchment Area.

Other key features located close to the area of proposed longwall mining include:

- the Woronora Catchment Area and the O'Hares Creek Catchment Area;
- the Holsworthy Military Reserve;
- the Cataract and Woronora Rivers; and
- the towns of Appin, South Campbelltown, Camden, Picton, Thirlmere, Tahmoor and Menangle Park.

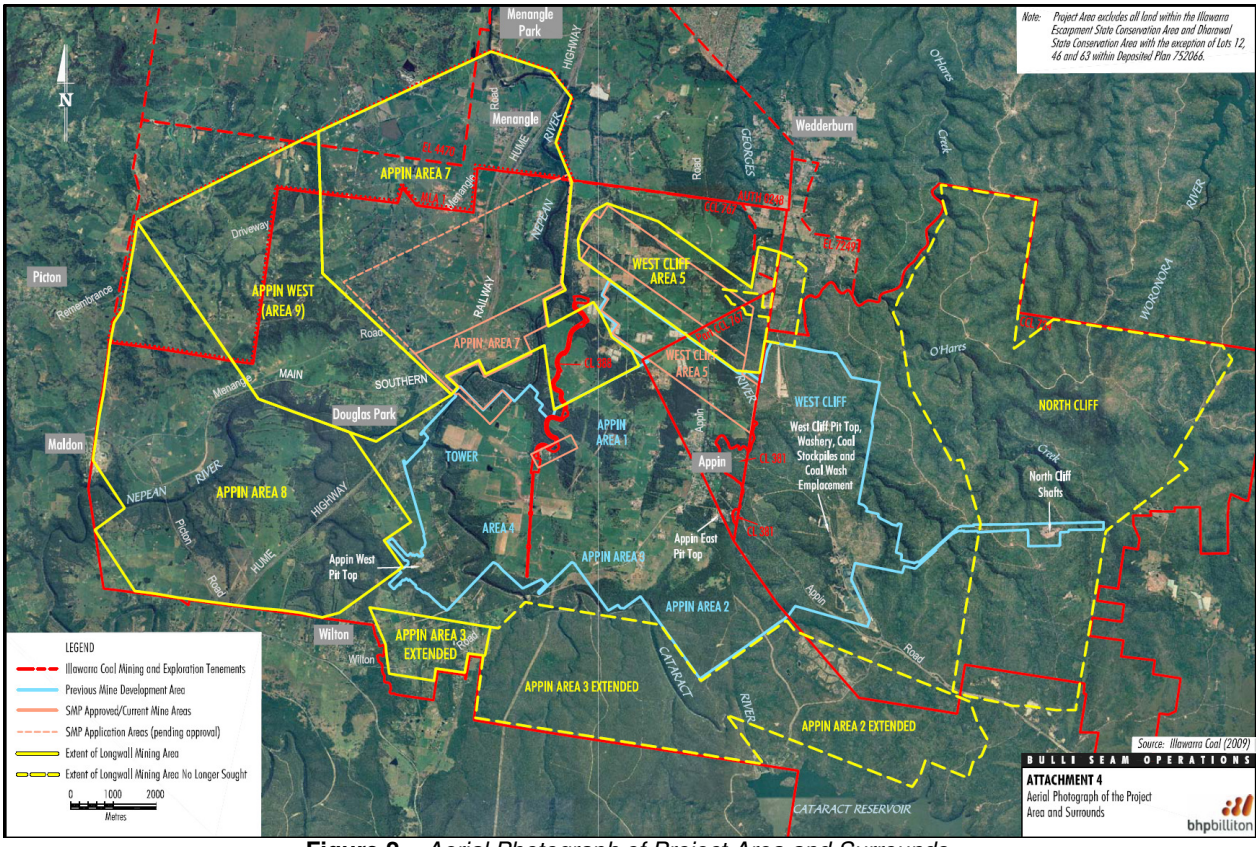

Figure 2 – *Aerial Photograph of Project Area and Surrounds, showing areas of existing, proposed and no-longer-proposed underground coal mining*

1.3 Existing Operations

Existing underground coal mining operations are supported by three existing pit top facilities (West Cliff, Appin East and Appin West) and a considerable amount of related ancillary infrastructure. Coal mining began at Appin East in 1962 and at West Cliff in 1976. Coal extracted from underground mining operations is transferred to the surface at the Appin East and West Cliff pit tops.

Run-of-mine (ROM) coal is reclaimed, crushed, screened and washed at the West Cliff Coal Handling and Preparation Plant (CHPP). Coal wash reject material from both the West Cliff CHPP and the Dendrobium CHPP is emplaced at the West Cliff Coal Wash Emplacement.

2 PROPOSED PROJECT

Illawarra Coal proposes to continue longwall mining operations at the Appin Mine and West Cliff Colliery within existing and new mining leases, which would extend the life of mining operations by approximately 30 years.

The project as originally submitted and exhibited involved mining operations in seven large areas or "domains" (see Figure 2 and Table 1). Three of these domains (in the south and east of the overall project application area, see Figures 2 and 3) were located largely in areas that are in pristine or near-pristine condition and which are either conservation areas under the *National Parks and Wildlife Act 1974* (primarily the Dharawal SCA) or are parts of Sydney's and Wollongong's declared drinking water catchments (the Woronora, O'Hares Creek and Metropolitan Special Areas).

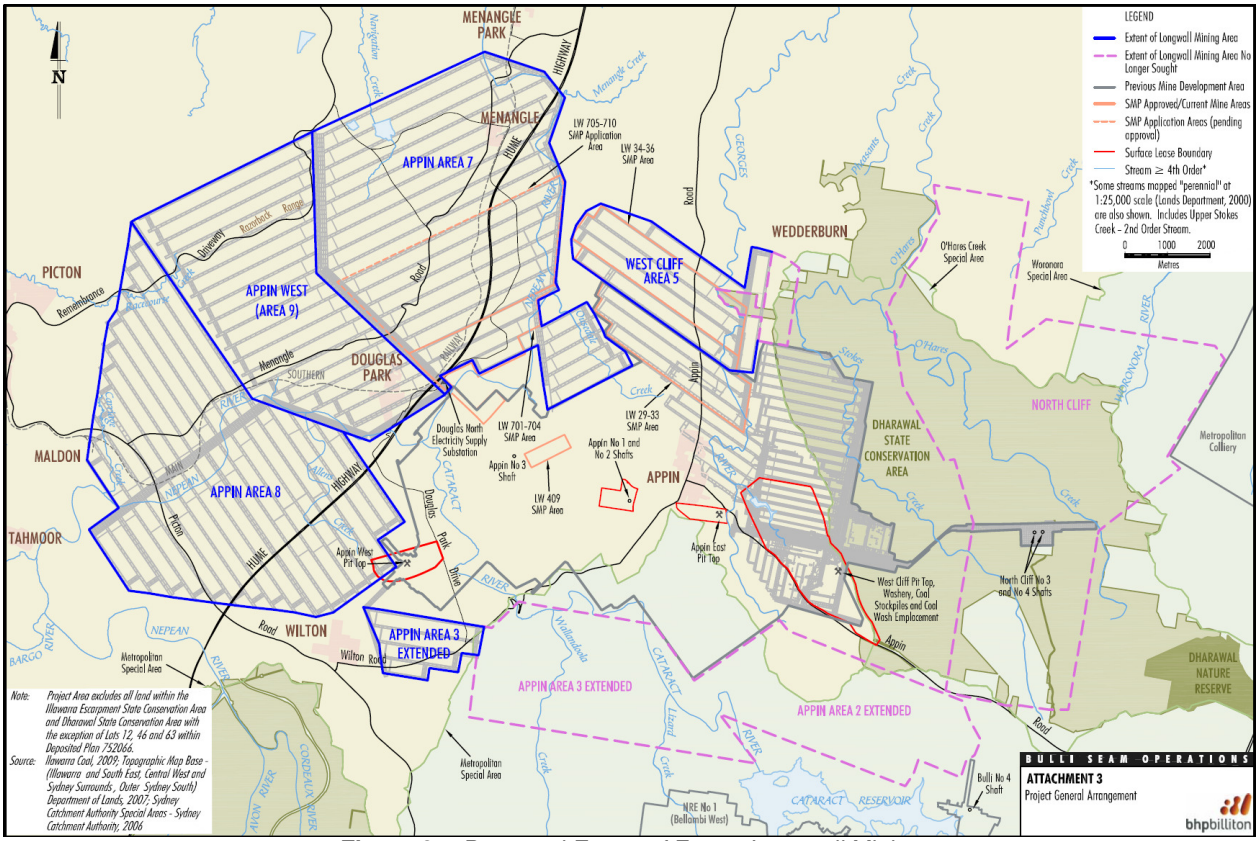

Figure 3 – *Proposed Extent of Future Longwall Mining*

The project as originally exhibited is fully described in the environmental assessment (EA) which was submitted in support of the project application (see **Appendix A**). Illawarra Coal has since prepared a Preferred Project Report (PPR), as required by the Department. The PPR contains a new mine plan that substantially reduces the scope of the original, exhibited mine plan. The PPR removed the proposal for longwall mining operations in almost all of the three southern and eastern domains. In total, around 40% of the originally-proposed longwall mining domains were removed in the PPR. Figure 3 shows the extent of longwall mining now proposed as marked by solid blue lines, while the areas where longwall mining is no longer proposed are marked by dashed pink lines.

The PPR withdrew the proposal for any mining operations throughout the entire North Cliff and Appin Area 2 Extended domains and in the great majority of the Appin Area 3 Extended domain. It also removed two proposed longwalls from the West Cliff Area 5 domain. It amended the project application area such that only a small area of approximately 76 hectares would remain within the Dharawal SCA. This small area is located within West Cliff Area 5 and would involve first workings, mining of a small part of one longwall panel (5E1) and continued underground operation and maintenance of those parts of the West Cliff Pit Bottom which are already located within the reserve.

The potential for subsidence-related impacts on upland swamps has been completely removed under the new mine plan. Potential subsidence-related impacts on other key natural features including cliffs, streams and biodiversity have also been greatly diminished. The PPR proposes longwall mining operations in the following domains (see Figure 3):

- Appin Area 7;
- Appin Area 8;
- Appin West (Area 9);
- West Cliff Area 5 (four longwalls not yet extracted in this existing domain);
- Appin Area 3 Extended (three small longwalls in the west of this domain).

Existing mining operations are located within existing mining leases, being Consolidated Coal Lease (CCL) 724, CCL 767, CCL 381 and Coal Lease (CL) 388. The project would also extend into new mining lease application (MLA) areas, as follows:

- MLA 1 – within existing Authorisation 248 and Exploration Licence (EL) 4470 which adjoins CCL 767 to the north-west;
- MLA 2 – within existing EL 7249 which adjoins CCL 767 to the north-east; and
- MLA 3 – adjoining CCL 767 in the south-west.

The sections of the overall project application area now proposed to be affected by underground longwall mining covers approximately 110 km^2 (within the solid blue lines on Figure 3). The original project is compared with the preferred project in Table 1 below. Figures 4, 5, 6 and 7 show key current surface infrastructure sites and Figure 8 shows the West Cliff Coal Wash Emplacement. Existing infrastructure is shown in white, proposed new or upgraded infrastructure is shown in yellow.

Table 1: *Summary of Original Project and Preferred Project*

Aspect	Original Project	Preferred Project
Project Summary	• Continuation of longwall mining operations to extract coal from the Bulli Seam in seven major domains: - North Cliff; - Appin Area 2 Extended; - Appin Area 3 Extended; - West Cliff Area 5; - Appin Area 7; - Appin Area 8; and - Appin West (Area 9). • ROM coal production of up to approximately 10.5 Mtpa for a period of up to 30 years. • Continued exploration activities within existing exploration and	• Continuation of longwall mining operations to extract coal from the Bulli Seam in five domains: - Appin Area 7; - Appin Area 8; - Appin West (Area 9); - West Cliff Area 5 (four longwalls not yet extracted); - Appin Area 3 Extended (three small longwalls).

	mining tenements. • Continued generation of electricity using coal seam methane and further development of gas drainage infrastructure. • Ongoing surface monitoring and rehabilitation and remediation of subsidence impacts.	• All other key project parameters remain the same.
Mining and Reserves	• Reserves of approximately 306 Mt of ROM coal. • Production of up to 9.3 Mtpa of product coal for export and domestic markets.	• Reserves of approximately 209 Mt of ROM coal. • No change to annual production of product coal.
Coal Processing	• Processed at West Cliff Coal Handling and Preparation Plant (CHPP), to be upgraded to increase throughput.	• No change.
Water Demand and Supply	• Continued use and upgrade (where required) of existing water management infrastructure. • Water demand is met by sourcing groundwater from old workings and surface water runoff from mine operational areas, with purchase from Sydney Water as required.	• No change.
Coarse Reject Management	• Coal washery reject to be emplaced in the West Cliff Coal Wash Emplacement (Stages 3 and 4). Proposed quantity of reject to be emplaced in Stage 4 is 40 Mt. Stage 4 projected height of 365 m AHD, with required vegetation clearance of 65 hectares (ha). • Undertake underground emplacement trial and consider alternative coal wash management options.	• Reductions in Stage 4 emplacement: - quantity of coal wash to 26 Mt; - projected height to 331m AHD; and - clearance to 60 ha.
Project Life	• An additional operational life of at least 30 years.	• No change.
Employment	• Long-term employment of 1,170 employees and contractors. Short-term construction workforce of up to 100 employees at various stages of the project.	• No change.
Construction and Use of Surface Infrastructure	• Continued utilisation and upgrade of existing pit top facilities at West Cliff, Appin East and Appin West). • Upgrade of infrastructure and progressive construction of additional components (eg service boreholes, gas drainage infrastructure, wastewater treatment and waste water disposal), marked in yellow on Figures 4-7. • Development of new remote services sites utilising boreholes for installation of down-hole power, compressed air, communication and monitoring.	• No change.
Hours of Operation	• 24 hour operations, seven days a week.	• No change.
Product Coal Transport	• Transportation of product coal from the West Cliff CHPP by road to the Port Kembla Coal Terminal (PKCT) for export or shipping to Whyalla, or by road to the BlueScope Steelworks, Corrimal and Coalcliff Coke Works and other domestic customers.	• No change.
Mine Access	• Appin East and West Cliff pit tops.	• No change.
Rehabilitation and offsets	• Rehabilitation Management Plan to be prepared and implemented in consultation with relevant stakeholders. • Progressive rehabilitation of minor project surface disturbance areas and the now sealed Bulli Shaft site. • At completion of the project, rehabilitation of West Cliff, Appin East and Appin West pit top areas, Vent Shaft Nos 1, 2 and 3 and any residual minor surface disturbance areas. • Stage 4 Coal Wash Emplacement Area progressively rehabilitated under a separate Management Plan.	• No change.
Economic Contributions	• The project would contribute $2,074 million in annual direct and indirect business turnover and $298 million in annual household income.	• Annual business turnover $1,581 million and annual household income $236m.
Capital Value	• The capital investment value over the life of the Project is estimated at $1.4 billion.	• No change.

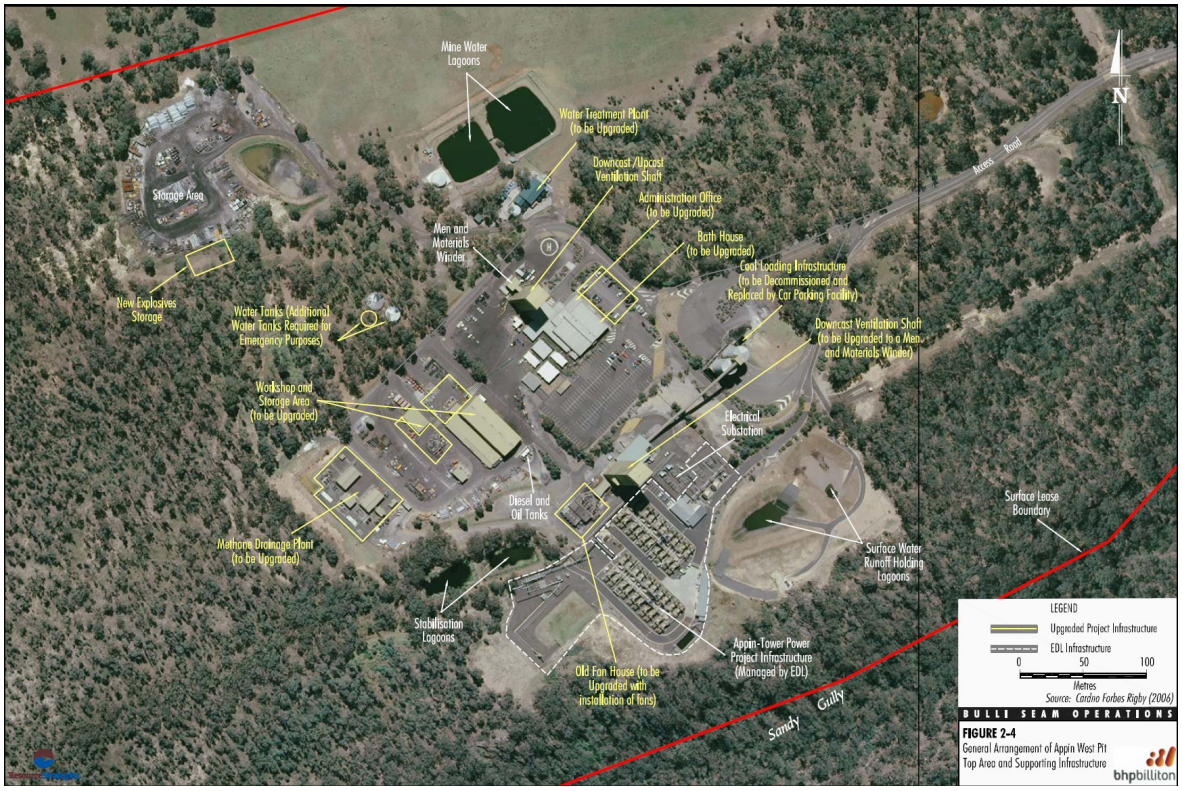

Figure 4 – *Surface Infrastructure - Appin West Pit Top*

Figure 5 – *Surface Infrastructure - Appin East Pit Top*

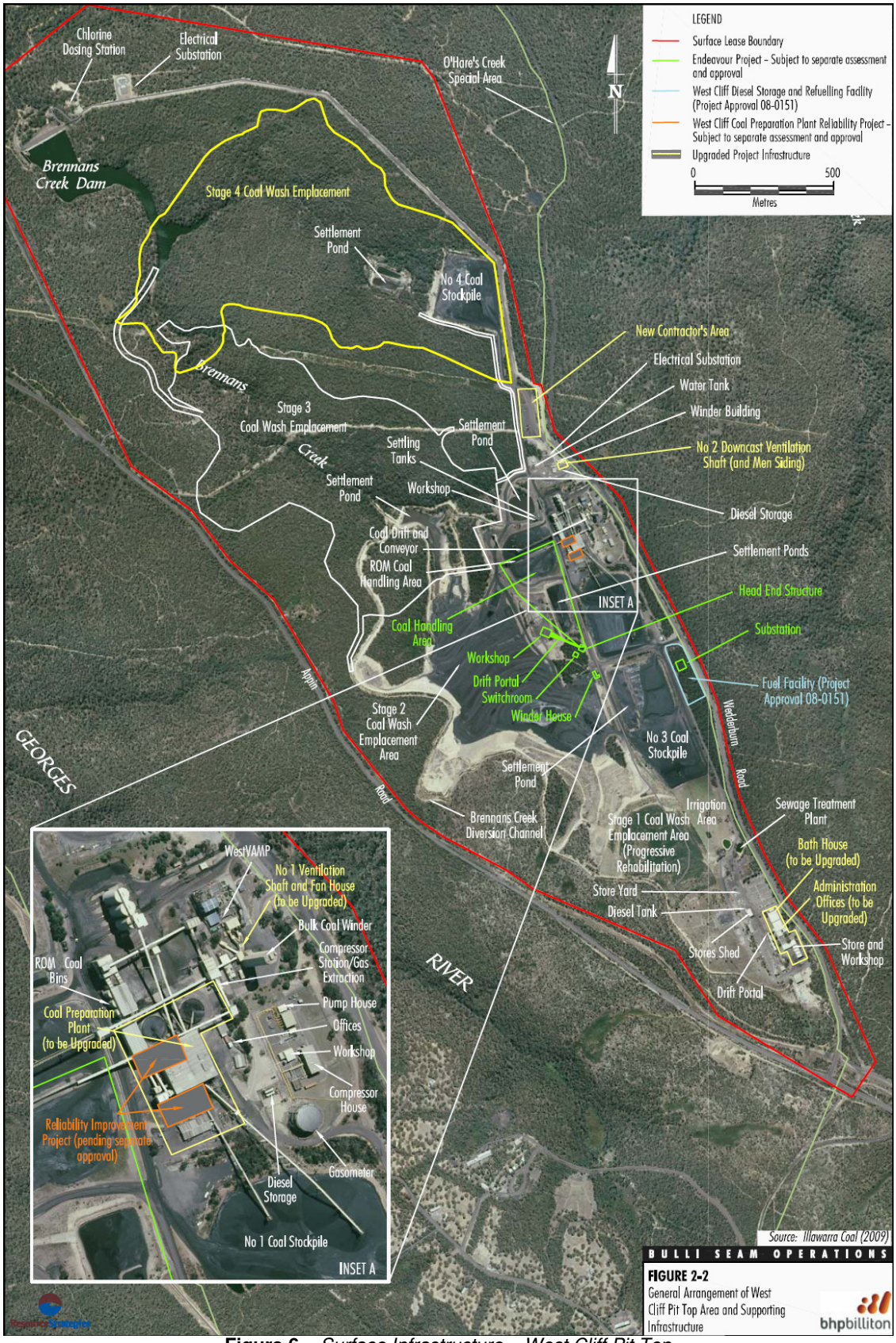

Figure 6 – *Surface Infrastructure – West Cliff Pit Top*

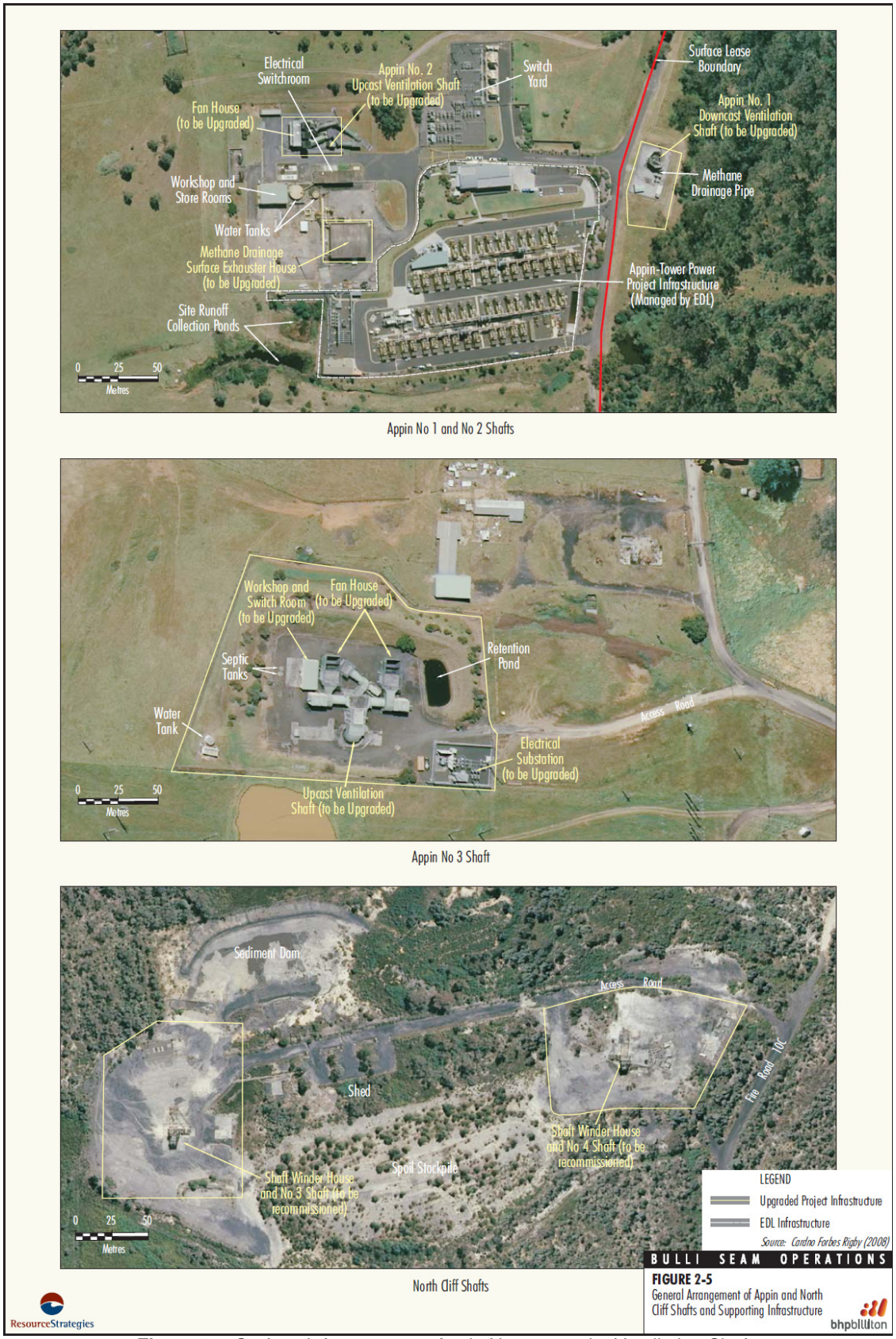

Figure 7 – *Surface Infrastructure - Appin No. 1, 2 and 3 Ventilation Shafts*

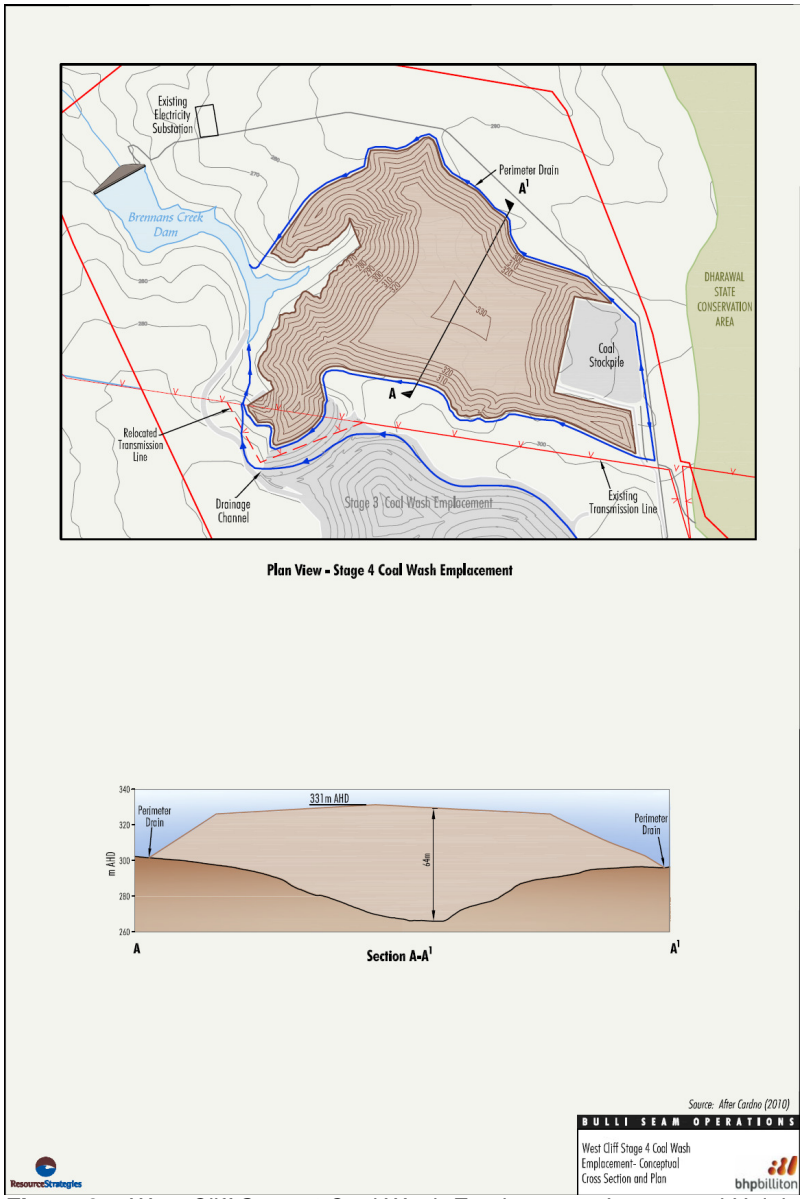

Figure 8 – *West Cliff Stage 4 Coal Wash Emplacement Layout and Height*

3 STATUTORY CONTEXT

3.1 Major Project

The proposal was declared to be a project under Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act) because it met the requirements of the *State Environmental Planning Policy (Major Development) 2005* (as then applying) in that it is development for the purpose of coal mining. Part 3A of the EP&A Act, as in force immediately before its repeal on 1 October 2011 and as modified by Schedule 6A to the Act, continues to apply to the project application, since it is a "transitional Part 3A project" for the purposes of Schedule 6A. Consequently, the Minister (or his delegate) may approve or disapprove the carrying out of the project under Section 75J of the Act.

The Planning Assessment Commission (PAC) must determine the application under the Ministerial delegation of 14 September 2011, as the Department received more than 25 objections to the proposal.

3.2 Permissibility

The project application area falls within three local government areas (LGAs). The majority of the proposed longwall mining area is located within the Wollondilly LGA, while a small portion in the north is located within the Campbelltown LGA. The south-eastern portion of the project area is within the Wollongong LGA, although no longwall mining is now proposed in this area.

The land within the project area comprises a wide range of rural, environmental protection, special use and residential/rural residential zonings under the following local environmental planning instruments:

- *Wollondilly Local Environmental Plan 2011*;
- *Campbelltown Local Environmental Plan No. 1*;
- *Campbelltown Interim Development Order (IDO) 15*; and
- *Wollongong Local Environmental Plan 2009*.

The EA considered in detail the permissibility of mining within each affected zone within each of these local environmental plans (LEPs). Mining is permissible with consent within the majority of the affected zones. Mining is prohibited development within a number of zones under the Wollondilly LEP, the Campbelltown LEPs, and the Wollongong LEP. However, *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007* (the Mining SEPP) makes development for the purposes of underground mining permissible with consent on any land. Consequently, the entire project is permissible with consent, notwithstanding the prohibitions in particular zones within the various LEPs. The Minister's delegate may therefore determine the project application.

3.3 Other Approvals

Section 75U of the EP&A Act provides that a number of other statutory approvals are integrated into the Part 3A assessment and approval process, and are therefore not required to be separately obtained for the project. These include various approvals under the:

- *Water Management Act 2000*, relating to groundwater and surface water works, use and activities;
- *National Parks and Wildlife Act 1974*, relating to Aboriginal heritage; and
- *Heritage Act 1977*, relating to non-Aboriginal heritage.

Under Section 75V of the Act, a number of other approvals are required to be obtained, but these approvals cannot be refused and must be "substantially consistent with" any Part 3A approval for the project. These include:

- mining leases under the *Mining Act 1992*;
- environment protection licences under the *Protection of the Environment Operations Act 1997*; and
- consents under section 138 of the *Roads Act 1993*.

The Department has consulted with the relevant government authorities responsible for these other approvals, and considered the relevant issues relating to these approvals in its assessment of the project (see Section 5).

There are additional approvals required by Illawarra Coal which are not specifically addressed by either section 75U or 75V. Consent from the Minister administering the *Mining Act 1992* is required to conduct mining operations within the notification areas for dams prescribed under the *Dams Safety Act 1978*. The Dams Safety Committee advises the Minister administering the *Mining Act 1992* on the extent and type of mining to be permitted, and on any special conditions which should apply.

The revised project application area includes a small part of the Dharawal State Conservation Area (see Figure 1). Landowner's consent from the Minister for the Environment is required under clause 8F of the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation) before the grant of the project approval within any part of the Dharawal State Conservation Area. Landowner's consent for the project application (as amended by the PPR and PPR Addendum) was given by the Minister for the Environment on 15 November 2011 (**see Appendix G**). The statutory requirement under clause 8F of the EP&A Regulation relating to the Minister for the Environment has therefore been met, and the Minister's delegate is now able to determine the project application.

3.4 Exhibition and Notification

Under Section 75H(3) of the EP&A Act, the Director-General is required to make the environmental assessment (EA) for a project publicly available for at least 30 days. After accepting the EA for the project (see **Appendix A**), the Department:

- notified relevant State government agencies, Campbelltown Council, Wollondilly Shire Council and Camden Council;
- made the EA publicly available from 20 October 2009 until 2 December 2009:
  - on the Department's website;
  - at the Department's Information Centre, Campbelltown Council, Wollondilly Shire Council and Camden Council; and
  - at the offices of the Nature Conservation Council; and
- notified landowners in the vicinity of the project about the exhibition period by letter.

During the assessment process the Department also made a number of documents available for viewing or download on the Department's website. These documents included the:

- project application;
- Director-Generals environmental assessment requirements;
- Illawarra Coal's EA;
- Illawarra Coal's responses to issues raised in submissions;
- the Planning Assessment Commission's (PAC's) Report;
- Illawarra Coal's PPR and supplementary information; and
- Illawarra Coal's responses to the recommendations of the PAC Report.

3.5 Planning Assessment Commission

On 13 November 2009, under section 23D(1)(b)(iii) of the EP&A Act, the Minister for Planning directed the Planning Assessment Commission (PAC) to carry out a review of the subsidence-related impacts of the project on significant natural features, built infrastructure and the values of Sydney's drinking water catchment. The Minister appointed a panel of permanent and casual PAC members to undertake this review. The PAC Panel consisted of:

- Dr Neil Sheppard (Chair);
- Professor Jeffrey Bennett;
- Professor Jim Galvin;
- Dr Colin Mackie; and
- Dr John Tilleard.

The PAC held public hearings in Appin in late February 2010, and reported to the Minister on 23 July 2010 (see **Appendix D**). The PAC Report is very extensive, comprising 18 chapters extending over 445 pages. A significant number of the PAC's 136 recommendations are no longer relevant due to the reduced scope of the proposal under the PPR. Illawarra Coal also submitted a response to the PAC Report and recommendations (**Appendix E**).

Except insofar as discussed in the later sections of this report, the Department accepts and supports all recommendations of the PAC Report which relate to management of the project under the PPR.

3.6 Preferred Project Report (PPR)

In recognition of a number of concerns raised in the PAC Report about aspects of the proposal, on 17 September 2010 the Department required Illawarra Coal to prepare a PPR under section 75H(6)(b) of the EP&A Act. Illawarra Coal submitted a PPR to the Department on 24 September 2010 and supplementary information regarding the PPR on 19 October 2010 (see **Appendix F**). Illawarra Coal also submitted an Addendum to the PPR on 4 October 2011 (see **Appendix F**).

3.7 Environmental Planning Instruments

Under Section 75I(2)(d)&(e) of the EP&A Act, the Director-General's report is required to include a copy of or reference to the provisions of environmental planning instruments (EPIs) that substantially govern (or

would substantially govern, if they were not otherwise overridden by Part 3A) the carrying out of the project and that have been taken into consideration in the report.

The Department has reviewed section 7.2 and Attachment 5 of the EA and is satisfied that they fully summarise the provisions of all such EPIs. The Department is satisfied that there are no State Environmental Planning Policies (other than the *State Environmental Planning Policy (Major Development) 2005*) which substantially govern the carrying out of the project.

3.8 Objects of the *Environmental Planning and Assessment Act 1979*

The Minister should consider the objects of the EP&A Act when he makes decisions under the Act. The objects of most relevance to the Minister's decision on whether or not to approve the proposed project are found in Section 5(a)(i),(ii), (vi) and (vii). They are:

> *The objects of this Act are:*
> *(a) to encourage:*
> > *(i) the proper management, development and conservation of natural and artificial resources, including agricultural land, natural areas, forests, minerals, water, cities, towns and villages for the purpose of promoting the social and economic welfare of the community and a better environment,*
> > *(ii) the promotion and co-ordination of the orderly and economic use and development of land;*
> > *…*
> > *(vi) the protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities, and their habitats; and*
> > *(vii) ecologically sustainable development.*

The Department is satisfied that the project encourages the proper use of resources (Object 5(a)(i)) and the promotion of orderly and economic use of land (Object 5(a)(ii)), particularly as the subject coal resources are located within existing mining leases currently being mined by Illawarra Coal. In addition, the project would represent an economic use of existing mining facilities and infrastructure, including at the West Cliff, Appin East and Appin West pit tops. The encouragement of environmental protection (Object 5(a)(i)) is considered in detail in Section 5 of this report.

Finally, the Department has fully considered the encouragement of ecologically sustainable development (ESD) as required by Object 5(a)(vii), and has sought to integrate all significant environmental and economic considerations and avoid any irreversible damage to the environment based on risk-weighted consequences. Based on these considerations, the Department is satisfied that the project can be carried out in a manner that is consistent with the principles of ESD. The Department is satisfied that the proposed project encourages the proper use of resources while also being designed in a manner that would protect and conserve biodiversity values of the locality in the medium to long term.

3.9 Statement of Compliance

Under Section 75I of the EP&A Act, the Director-General's report is required to include a statement relating to compliance with the environmental assessment requirements of the project. The Department is satisfied that the environmental assessment requirements have been complied with.

4 CONSULTATION

The Department received a total of 81 submissions on the project comprising:

- 10 from public authorities,
- 35 from special interest groups; and
- 36 from the general public.

Of the 71 submissions from special interest groups and the general public, 15 supported the proposed project and 56 objected or raised concerns about it. A full copy of these submissions is attached in **Appendix B**. Illawarra Coal provided a response to submissions from both the public authorities and the general public (see **Appendix C**).

The PAC also held public hearings during the third week of February 2010. A total of 23 oral submissions were presented, comprising 2 on behalf of local government authorities, 11 from special interest groups, 9 from individuals and 1 from a mining company.

The key issues raised by the agencies, special interest groups and members of the public are carefully considered in the PAC Report and were fully taken into account in the PAC's recommendations to the Department. For that reason, this report does not seek to comprehensively outline all the issues raised in submissions but rather to provide a brief summary of the key issues for contextual purposes.

Illawarra Coal's PPR and Supplementary Information and its responses to the PAC report were all made publicly available by the Department on its website. No additional submissions were received.

4.1 Key Areas of Concern

The two key areas of concern that were raised in submissions were subsidence-related impacts (on swamps, streams, cliffs and ecology) and impacts relating to the proposed expansion of the West Cliff coal wash emplacement. Figure 9 below summarises the number of times various issues were raised in the 81 submissions.

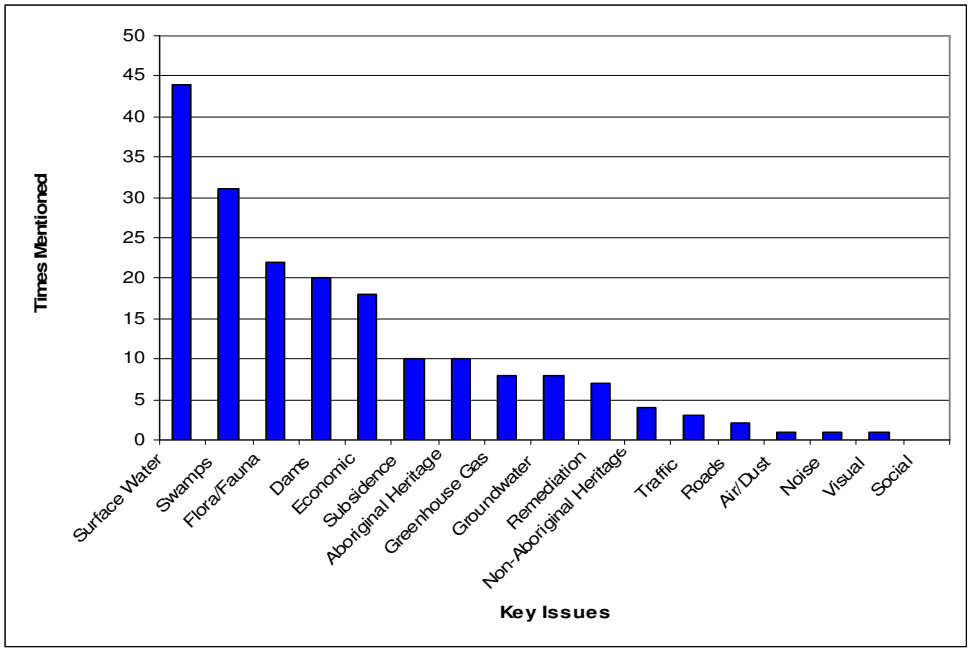

Figure 9 – *Key Issues*

The potential subsidence-related impacts were significantly reduced as a result of the PPR, which removed proposed longwall mining operations from nearly all of the three more environmentally-sensitive eastern and southern domains. This means that there would be no subsidence-related impacts on any upland swamps and very limited (primarily negligible) subsidence impacts on just two of the 13 waterways of special significance identified by the PAC (the Nepean River and the Georges River). The reduced extent of longwall mining would limit the number of Aboriginal heritage sites affected from 600 to 160. The reduced extent of longwall mining under the PPR would also decrease the capacity, footprint and height of Stage 4 of the West Cliff coal wash emplacement, which would consequently reduce its potential impacts.

4.2 Agency Submissions

The **Office of Environment and Heritage** (OEH, formerly known as the Department of Environment, Climate Change and Water) raised a number of concerns relating to the various natural features within the project area. Some of the major concerns raised by OEH related to upland swamps and streams in the North Cliff and Appin Area 2 Extended domains and potential impacts on the Dharawal SCA, which are either no longer relevant or else greatly reduced due to the reduced scope of proposed longwall mining.

However, the key area of concern in OEH's submission was the location of Stage 4 of the coal wash emplacement, which OEH opposed due to the potential impacts on threatened species and Aboriginal heritage sites. OEH also had concerns about the discharge of minewater from Brennan's Creek Dam and its impacts on the Georges River. OEH also raised some issues relating to the socio-economic impact assessment in the EA, including the appropriateness of using the Choice Modelling technique. The Department has also considered OEH's recommendations in drafting performance criteria for noise, air quality and greenhouse gas emissions.

The **Division of Resources and Energy, within the Department of Trade, Investment and Regional Infrastructure Services** (DRE within the DTIRIS, formerly known as Industry and Investment NSW) supported the project as an appropriate use of the State's coal resources, but expressed a number of minor concerns. In particular, DRE considered the rehabilitation strategies relating to streams, cliffs, ecology and groundwater to be inadequate and recommended more stringent requirements.

DRE considered the location of the Stage 4 coal wash emplacement and noted that the proposed site should only be permitted if no other feasible option is available. The PAC concluded in its review that there is no other feasible option, and the Department also notes that the scale and impacts of the coal wash emplacement area have been reduced under the PPR.

DRE also provided supplementary information relating to the uniqueness of the project in terms of the magnitude, scale and potential distribution of subsidence impacts, and recommended strong mechanisms to ensure the success of the Extraction Plan process. The Department agrees with this approach and has drafted clear performance criteria for all natural and built features, as well as noise, air quality and greenhouse gas emissions.

Campbelltown City Council raised a wide range of concerns, with some of the key residual concerns being the impacts on the Nepean and Georges Rivers, and the coal wash emplacement area. Council recommended that longwall mining should be removed entirely from beneath the Georges and Nepean Rivers. The Department notes that no longwall mining would occur directly beneath these rivers and there is unlikely to be greater than negligible environmental consequences (except for a very small section of the Georges River).

Council recommended that alternative coal wash emplacement options are considered. The Council also raised a concern about the proposed period of the approval, and recommended a staged series of approvals with subsidiary plans. The Department does not support a staged approval process, but is satisfied that the Extraction Plan process would achieve the appropriate post-approval management regime and positive environmental outcomes. Council also raised issues about greenhouse gas emissions, cumulative water quality impacts, groundwater loss, vegetation clearance, aquatic and terrestrial ecology.

The **NSW Office of Water** (NOW) raised a number of concerns relating to the impacts on certain streams and waterways. NOW identified various waterways that are significant to the catchment and highlighted the importance of streams of third order and above. Many of these are not relevant due to the reduced scope of the proposed longwall mining, including the Woronora and Cataract Rivers, and the O'Hares, Stokes and Punchbowl Creeks. NOW recommended that potential impacts on surface water should not reduce water flows from the Georges and Nepean Rivers and made a recommendation for negligible environmental impacts on these two rivers.

Roads and Maritime Services (RMS, formerly the Roads and Traffic Authority) indicated that its major area of concern is the ongoing management of State-classified roads, including the Hume Highway, Picton Road and Appin Road. RMS stated that the longwall mining operations must not compromise in any way the functionality of these roads, the infrastructure itself or road safety, and must not directly impact on any bridges. RMS also sought clarification about predictions relating to key intersections, which was later provided by the company and agreement reached between the two parties.

The **Sydney Catchment Authority** (SCA) noted that it is has been working with Illawarra Coal on a framework to govern the management of SCA assets within the project area. Only a few of the key assets (including the Nepean Tunnel, the Upper Canal and Broughtons Pass Weir) are still affected due to the reduced scope of the proposed longwall mining. SCA recommended performance criteria for each of its assets and these have been considered by the Department in drafting conditions of approval.

The **Sydney Metropolitan Catchment Management Authority** (SMCMA) raised concerns about various vulnerable upland swamps, watercourses, cliffs and Aboriginal sites. The SMCMA's main concern related to cracking under upland swamps and in river beds. Other concerns included cliff failure and impacts of coal wash emplacement on Aboriginal cultural heritage sites. All upland swamps and the majority of significant cliffs and streams now would not experience subsidence impacts as a result of the PPR.

Wollondilly Shire Council raised a range of concerns across all areas of potential impacts. One of Council's key concerns was that the six weeks of public exhibition did not provide sufficient time for public consultation. The Department notes this concern but emphasises that six weeks is longer than statutory provisions require and that the PAC also held public hearings at a later date. Council also recommended careful consideration of streams, swamps, cliffs and ecology.

The **Dams Safety Committee** (DSC) was mainly concerned that Illawarra Coal obtains all necessary approvals prior to any mining operations commencing within its dam notification areas, including Cataract Dam, Broughtons Pass Weir and Brennans Creek Dam. The notification areas for both Brennans Creek Dam and Cataract Dam are not affected by proposed longwall mining under the PPR. The notification area for Broughtons Pass Weir may be peripherally affected by longwall 306. DSC was concerned that Illawarra Coal undertakes appropriate levels of dam surveillance to ensure that mining operations do not compromise the safety of dams.

A substantial number of discussions took place between the Department and representatives of affected agencies. These discussions involved a series of multi-agency meetings (also involving Illawarra Coal and its consultants) as the project was being developed, and discussions and meetings on a variety of issues following exhibition, receipt of the PPR and Supplementary Information, and the PPR Addendum. These discussions involved many agencies, but particularly the Office of Environment and Heritage, the Sydney Catchment Authority, the Division of Resources and Energy within DTIRIS, and the NSW Office of Water.

5 ASSESSMENT

5.1 SUBSIDENCE

5.1.1 Introduction

This assessment report adopts the approach taken in the Southern Coalfield Inquiry, recent Departmental assessment reports and resulting project approvals for underground coal mines and the PAC Report in considering subsidence effects separately to their impacts and consequences. The term "subsidence effect" describes subsidence itself. The term "subsidence impact" refers to any physical change to the fabric or structure of the ground, its surface, or man-made features. The term "environmental consequence" or "consequence" is used to describe any change in the amenity or function of a feature that arises from an impact.

Subsidence effects refer to deformation of the ground mass due to mining including all mining-induced ground movements. "Conventional subsidence" includes vertical displacement, tilt, and tensile and compressive strain. These effects are normally associated with a flat-dipping seam in level topography, unaffected by major geological structures such as faults and dykes.

Additional "non-conventional subsidence" components can arise in steep or incised topography, especially in the presence of high horizontal stresses, such as occur in the Southern Coalfield. Non-conventional subsidence includes valley closure, upsidence and far-field horizontal movements. Valley closure is a phenomenon whereby one or both walls of a valley move horizontally towards the valley centreline, due to changed horizontal stress conditions. Upsidence is a relative upward movement or uplift, created by the horizontal compression and buckling behaviour of rock strata in the vicinity of a valley floor.

As has been indicated above, the area which is proposed to be subject to future longwall mining, and therefore potentially subject to either subsidence effects, subsidence impacts or localised environmental consequences, is limited to 110 km^2 of the overall 290 km^2 project application area. In this assessment report, the term "site" is used to describe parts of the project application area which might be disturbed by the project.

5.1.2 Prediction of Subsidence Effects, Impacts and Consequences

The EA's subsidence impact assessment was undertaken by Mine Subsidence Engineering Consultants (MSEC). The subsidence impact assessment was prepared to best practice contemporary standards and was peer reviewed by Professor Bruce Hebblewhite, who chaired the independent inquiry into the *Impacts of Underground Coal Mining on Natural Features in the Southern Coalfield*.

Incremental Profile Method

MSEC used its Incremental Profile Method (IPM) to predict the systematic subsidence, tilt and curvatures resulting from the extraction of longwalls. To make predictions, the model uses surface level contours, seam floor contours and seam thickness contours. The IPM is an empirical technique and therefore its accuracy is dependent on it being accurately calibrated to reflect site specific conditions. The PAC noted that it results in final vertical displacement profiles that are quite sensitive to local changes in the mining environment and allows predictions to be made at any point on the surface. The PAC concluded that the IPM prediction technique is appropriate for the proposed project and the Department supports this view.

The prediction and assessment of subsidence effects, impacts and consequences in the EA are premised on the EA's Base Case mine plan layout. However, the EA states that this layout could change if Illawarra Coal alters the mine plan in the future. These changes may include modifying the widths of the longwalls and/or the chain pillars. The PAC was concerned that increasing the panel width may result in changes to predicted maximum subsidence effects. There are currently no longwall panels wider than 325 m in the Southern Coalfield and none wider than 410 m in Australia. The PAC points out that there is therefore no local database for deriving predicted incremental subsidence profiles and recalculating the effects of wider longwall panels.

The Department agrees with the PAC that the IPM technique should be recalibrated regularly to reflect variations in site conditions across the project area. The Department also accepts that any increase in longwall panel width in the future could increase subsidence effects. As a result, the Department has included conditions of approval requiring Illawarra Coal to prepare and implement a program to improve its prediction and understanding of subsidence effects and impacts, including regular recalibration of the IPM method as it is applied within the project area. The Department also notes that any proposal by Illawarra Coal to widen longwalls beyond that considered in the EA's Base Case would be thoroughly described in draft Extraction Plans and assessed as part of the approval of those plans. Each draft Extraction Plan would be required to include updated predictions of potential subsidence effects, subsidence impacts and consequences, which would be based on the expanding body of empirical measurements used in the IPM. Acceptance of any proposal for widened longwalls would be contingent on Illawarra Coal satisfying the Department that the proposed subsidence impact performance measures would still be met under the varied mine plan.

Conventional Subsidence Effects

The depth of cover to the Bulli Seam varies between 400 and 850 m, which means that it is a "deep" coal mine by Australian standards. The maximum seam thickness is 3.6 m, the proposed maximum longwall void width is 340 m, the minimum width is 190 m and the typical width is approximately 310 m. When two adjacent points undergo a different amount of vertical displacement, the slope of the ground surface between them changes, which then induces tilt in features located on the surface. Tilt is expressed in terms of millimetres change per metre (mm/m). The maximum predicted total vertical subsidence and tilts for the site are shown in Table 2.

Overall, tilt and vertical subsidence are not expected to have great impacts in the project area due to the relatively high depth of cover. Because of the relatively high depth of cover within the BSO Project area, subsidence effects would develop incrementally, and not plateau above a longwall panel until a number of panels have been extracted. This means that movement at a point on the surface may not stabilise until a number of adjacent longwall panels have been subsequently extracted. There are two types of strain in rocks associated with subsidence, tensile and compressive, and they result in two corresponding types of curvature of the ground. Curvature in an outwards direction results in the ground swelling or "hogging", which occurs when the ground is subjected to tensile strain. Curvature in an inwards direction results in the ground "sagging", which occurs when the ground is subjected to compressive strain.

Table 2 – *Predicted Maximum Total Vertical Subsidence and Tilt*

Mining Domain	Maximum Predicted Total Subsidence (mm)	Maximum Predicted Total Tilt (mm/m)
Appin Area 3 Extended	1250	7.5
West Cliff Area 5	1300	7.0
Appin Area 7	1600	8.0
Appin Area 8	1200	6.5
Appin West (Area 9)	1600	6.5

The most relevant impact that may result from conventional subsidence in the project area is fracturing of the surface zone. Fracturing in stiff surface rocks (such as sandstones) has the potential to fracture stream beds and perched water tables, to increase the permeability of the surface zone, to connect near-surface water to deeper aquifers and to provide an enhanced flow path for near-surface water to report to upsidence fracture networks in stream beds. Fracturing has generally only been observed in the Southern Coalfield where systematic tensile and compressive strains have exceeded 0.5 mm/m and 2.0 mm/m, respectively.

Strain is more difficult to predict than total subsidence or tilt as it is affected by many localised factors. In fact, the PAC noted that the poorest correlations between measured and predicted ground movements relate to strain. Within the project area, some surface features are likely to experience concentrated strains rather than uniformly-distributed strains, whilst predicted strains may not eventuate at other surface features. The PAC reported that fracturing is of greatest concern in relation to natural features which have an association with surface or near surface water. The PAC specifically identified the potential impacts on swamps, rivers and streams and aquatic ecology. The EA predicted that fracturing above longwall panels would extend to the surface over extensive portions of Area 2, Area 3 and North Cliff mining domains. The Department notes that longwall mining in these areas of particular concern has been removed as a result of the PPR. Table 3 below provides the EA's predictions for both tensile and compressive strain.

Table 3 – *Predicted Average and Maximum Tensile and Compressive Strains*

	Tensile strain (mm/m)		Compressive strain (mm/m)	
	Average	Maximum	Average	Maximum
Above goaf	0.26	3.4	0.44	16.6
Above solid coal	0.16	1.3	0.14	5.9

In addition, the PAC concluded that it is unlikely that the highly connected fractured zone would extend upwards into and beyond the Bald Hill Claystone (which is below the sandstone layer) for longwall panel widths up to 310 m. This conclusion was based on a range of field measurements and observations, the

most recent being extensometer measurements conducted over Longwall 32 (310 m width) in West Cliff Area 5, where more than 90% of fracture displacements have occurred at or below the claystone.

Non-Conventional Subsidence Effects

Non-conventional subsidence effects such as upsidence, valley closure and far-field horizontal movements have only come to be recognised in the last 15 to 20 years, largely as a result of observations and measurement in the Southern Coalfield. Prediction of non-conventional subsidence effects is therefore a relatively young and inexact science. Predictions of non-conventional subsidence for the BSO Project are based on methodology developed by coal-industry-funded research undertaken by MSEC about 8 years ago. The MSEC non-conventional subsidence prediction methodology is based on an adjusted surface landform profile called "equivalent valley height", calculated by multiplying the measured overall valley depth by a factor intended to reflect the shape of the valley. MSEC has applied a 0.7 reduction factor to this methodology for the BSO Project, compared with its previous version (used in 2009 for the Metropolitan Coal Project). MSEC now considers its assessment at Metropolitan to be excessively conservative. It considers that a 0.7 reduction factor remains "conservative", and proposes that it be used until further research proves that lower reduction factors are appropriate. MSEC reports that after applying this reduction factor, the majority of the observed closures were still less than half of those predicted and only 2% of measured closures exceeded those predicted.

MSEC's predictions of valley closure and upsidence are described as "upper bound" predictions, rather than probabilistic predictions. This approach is conservative, and places predicted upper limits on potential valley closure and upsidence. Therefore observed valley closure and upsidence is generally less than MSEC's predictions.

However, as pointed out by the PAC, this conservative approach to predicting upsidence and closure effects does not translate to a conservative approach when predicting upsidence and closure impacts. Basing predictions of *actual* impacts on *predicted* values of closure (rather than *measured* values) means that the conservatism inherent in MSEC's predictions of subsidence effects no longer has relevance. That is, the predicted level of impact is directly associated with the predicted level of subsidence effect, no matter that this was predicted conservatively.

MSEC considers that the threshold value where valley closure is likely to cause increased rock bar leakage in streams is where closure is predicted to be 200 mm or more. This value is the same as proposed by MSEC in its subsidence impact assessments for the recent Dendrobium and Metropolitan assessments. The Department notes that the 200 mm valley closure threshold is also based solely on MSEC's qualitative review of watercourse-related subsidence impacts at its clients' mines. The Department considers (and it is generally accepted) that this threshold figure is far from empirically or theoretically established and should be viewed as indicative, rather than determinative. It remains possible that significant buckling and shearing of sections of stream beds, particularly in fragile rock types, will eventually be observed where predicted valley closure is less than 200 mm.

5.1.3 Adequacy of Subsidence Information

Notwithstanding that the EA's subsidence impact assessment was prepared to contemporary standards, the PAC was critical of the adequacy of much of the information provided about subsidence impacts relating to significant natural features. For that reason, the PAC included the following recommendation:

> *That, where information is deemed to be inadequate for a proper assessment of the subsidence-related impacts on significant natural features or items of built infrastructure, approval should only be considered where the performance criteria are sufficiently robust to ensure that the recommended levels of protection will be achieved by the proposed Extraction Plans for the mining operation.*

To increase the theoretical knowledge base in NSW regarding non-conventional subsidence effects, the Department has proposed conditions of approval that would require Illawarra Coal to prepare and implement a program to improve its prediction and understanding of subsidence impacts. The Department has also proposed an approval condition that would require Illawarra Coal to invest at least 1

million dollars over 7 years into improving the understanding and prediction of subsidence impacts, especially on significant natural features.

5.1.4 Conclusion

Many of the key subsidence impacts raised by the PAC were located in areas of proposed longwall mining that were removed under the PPR. As a result of the PPR, the area which is potentially subject to subsidence is 110 km^2 of the overall 290 km^2 project application area.

Tilt and vertical subsidence are not expected to lead to major impacts within the project area due to the relatively high depth of cover, which ranges from 400 to 850 m. The key conventional subsidence impact that may result from the proposal is fracturing of the surface zone due to tensile and compressive strains. As strain is affected by many localised factors, some surface features are likely to experience locally-concentrated strains, whilst predicted strains may not eventuate at other places. Non-conventional subsidence effects, such as upsidence, valley closure and far-field horizontal movements, may also occur. Strains, upsidence and valley closure are all of greatest concern for natural features associated with surface or near surface water (ie watercourses).

The Department is satisfied that the EA (as amended by the PPR) contains an adequate prediction of subsidence effects and an adequate assessment of likely impacts and consequences anticipated to be associated with the project. Specific subsidence impacts are discussed in greater detail in sections 5.2 – 5.11 below.

5.2 SURFACE WATER

5.2.1 Potential Impacts on Rivers and Streams

A surface water assessment for the EA was prepared by Gilbert & Associates and was peer reviewed by Dr Tom McMahon (Emeritus Professor of the Department of Civil and Environmental Engineering at the University of Melbourne). The EA also contains a detailed stream risk assessment. It was broadly accepted in the EA, in many agency and public submissions and by the PAC that longwall mining beneath or close to streams in the Southern Coalfield may cause extensive streambed cracking and potential environmental consequences such as the partial or complete draining of pools, loss of surface flows through the bed of the stream, iron staining, opacity and water quality deterioration.

Loss of surface flows means that water is lost from the stream to a new sub-surface fracture network. This can leave reaches of stream channel dry, or with reduced flows. As an example, the PAC referred to some sections of the Georges River where flow monitoring data suggested that up to 1 ML/day was being diverted via the sub-surface fracture network prior to remediation initiatives. Drainage of pools may result in loss of associated stream values, including ecological values, environmental quality and visual amenity.

Iron staining of stream beds and associated opacity and iron-bearing bacterial mats in the water column may occur where stream water infiltrating to the new sub-surface fracture network dissolves iron-bearing minerals such as siderite, haematite and marcasite. These same features can result from natural causes, but generally on a very small scale. Mining-induced impacts of this type can be far more extensive. As the PAC notes, there is a lack of information about natural examples.

5.2.2 Special Significance of Rivers and Streams

Both the EA and the PAC Report consider the values of all streams within the project application area in order to identify which streams are of “special significance” and therefore warrant special protection. However, there was considerable disagreement between Illawarra Coal and the PAC over recognition of “special significance”.

Figure 10 below depicts the layout of watercourses within the project application area. In the EA, no river or creek is accepted as being of special significance, although it suggests that Government agencies “may consider” the Nepean River to warrant this status. In this absence of a clear identification of stream significance in the EA, the PAC reconsidered the issue, reviewing a variety of factors including importance

to catchment yield, significance to water supply, the scale of the watercourse, ecological importance, regional significance and community value. Based on these considerations, the PAC concluded that the following streams should be considered to have special significance:

- Nepean River;
- Cataract River (from Cataract Dam to Broughtons Pass Weir);
- O'Hares Creek;
- Stokes Creek;
- Dahlia Creek;
- Cobbong Creek;
- Tributaries 1 & 2 to O'Hares Creek;
- Woronora River and tributaries;
- Wallandoola Creek;
- Wallandoola East Creek; and
- Cataract Reservoir Tributaries 1 & 2.

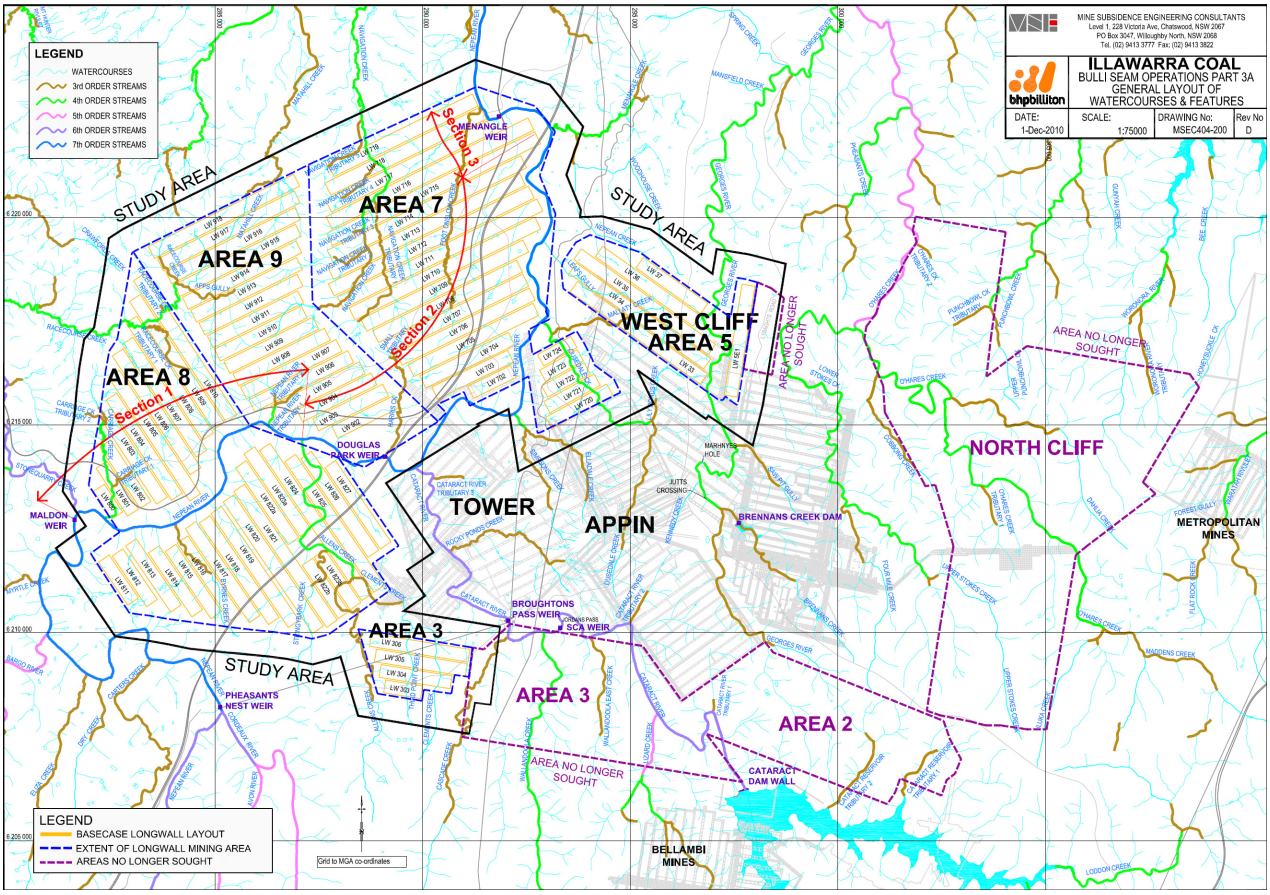

Figure 10 – *Location of key watercourses in the project area*

5.2.3 Surface Water Performance Criteria

The PAC then recommended that the 11 stream systems assessed as being of special significance, plus Lizard and Cascade Creeks and the Georges River in West Cliff Area 5, be protected by requiring, as part of any approval, a performance criterion of "negligible subsidence-related impact" as defined below:

> *no diversion of flows, no change in the natural drainage behaviour of pools, minimal iron staining, minimal gas releases and continued maintenance of water quality at its pre-mining standard.*

While the Department supports the intent of the PAC recommendation, there are difficulties incorporating the recommendation as drafted into the project approval context. As an example, "no diversion of flows" creates a significant measurement problem, since it would require detection of any movement of water into or out of hairline fracture systems, even if such movement amounted only to millilitres. Measurement at this scale is simply not practicable.

The alternative proposed by the Department is to define "negligible environmental consequences" in terms that strictly limit the consequences, but allow for application of the necessary monitoring and assessment processes at a level considered appropriate to the circumstances. This has been discussed with PAC at length and forms the basis of the following proposed performance criteria:

> *Negligible environmental consequences (including negligible diversion of flows or changes in the natural drainage behaviour of pools, negligible gas releases and iron staining, and negligible increase in water cloudiness).*

5.2.4 Predicted Impacts on Rivers and Streams under the PPR

The Department notes that of the 11 stream systems identified by the PAC as being of special significance and the 3 additional rivers and streams for which the PAC also proposed a performance criterion of "negligible subsidence-related impact", only 3 would remain subject to subsidence impacts under the PPR. The 3 affected rivers and streams are the Nepean River, Georges River and Cascade Creek. A discussion of the project's potential impacts on these 3 streams is provided below.

Nepean River

The Nepean River flows through three of the longwall mining domains – Appin Area 7, Appin Area 8 and Appin Area 9 (Appin West). It is a "regulated" river – that is, flows and river levels are not natural, but are artificially controlled. This is achieved both through the four dams in the Upper Nepean Catchment and a system of weirs within the affected length of the stream (see Figure 10). These three weirs have the effect that, throughout most of the area that may be impacted by longwall mining, the Nepean comprises long, slow moving, relatively shallow impoundments or ponds.

Illawarra Coal has already had substantial experience of mining beneath and adjacent to the Nepean River. The EA states that, as yet, there has been no reported or observed loss of surface water as a result of previous mining directly beneath or near the Nepean River. However, there is indirect evidence of riverbed fracturing, leading to observed releases of methane and other strata gases from the rocks beneath the riverbed. The EA considers that these impacts are "negligible" and predicts that similar levels of fracturing and gas emissions would occur for the proposed project. Consequently, the EA predicts that it is unlikely that more than negligible subsidence-related impacts would occur.

For the purposes of assessment, the EA divides the Nepean River into three separate sections (see Figure 10). Section 1 comprises the river upstream of its confluence with Allens Creek, Section 2 comprises the river between that confluence and Menangle Bridge and Section 3 comprises the river downstream of Menangle Bridge. The predicted valley closure movements are less than 200 mm for Section 1, generally in the range of 100 to 300 mm for Section 2, and less than 60 mm for Section 3. The maximum valley closure movement of 500 mm occurs in a short length of Section 2 (see Figure 11). This closure has already occurred as a result of the previously completed longwalls 16 and 17.

The location of proposed longwalls with respect to the river are shown as pink or blue dashed rectangles in Figure 11. The blue indicates proposed longwalls that have already been approved, and the pink indicates longwalls which have not been approved yet. The variable size of each rectangle represents the extent of the river which runs adjacent to the longwall. It can be seen that predicted valley closure exceeds 200 mm for about 3,000 m of the river bed, and exceeds 300 mm for about 200 m. Of that 3,000 m, about 1,200 m already has approval, without limits on closure.

The Department accepts the PAC's position that impacts on the Nepean River should be constrained so as to be "negligible". The critical question is whether the degree of predicted closure will lead to "greater-than-negligible" impacts. This question does not strictly require to be answered in this assessment. If

approval conditions simply require that impacts do not exceed the negligible criterion (as defined), then achievement of that standard becomes a matter for Illawarra Coal, as managed through the Department's Extraction Plan process. Any additional setbacks of longwalls (perhaps near longwall 708, where closure is predicted to exceed 300 mm) would be assessed and approved through that process. However, the Department notes that, due to the artificial nature of flow in the river, any fractures within the river's continuous pools are expected to be quickly saturated by the overlying water column. Further, given that the minimum depth of the river is typically greater than 2 m and the maximum predicted net upsidence is generally less than 300 mm, it is highly unlikely that any sections of the river bed would become exposed.

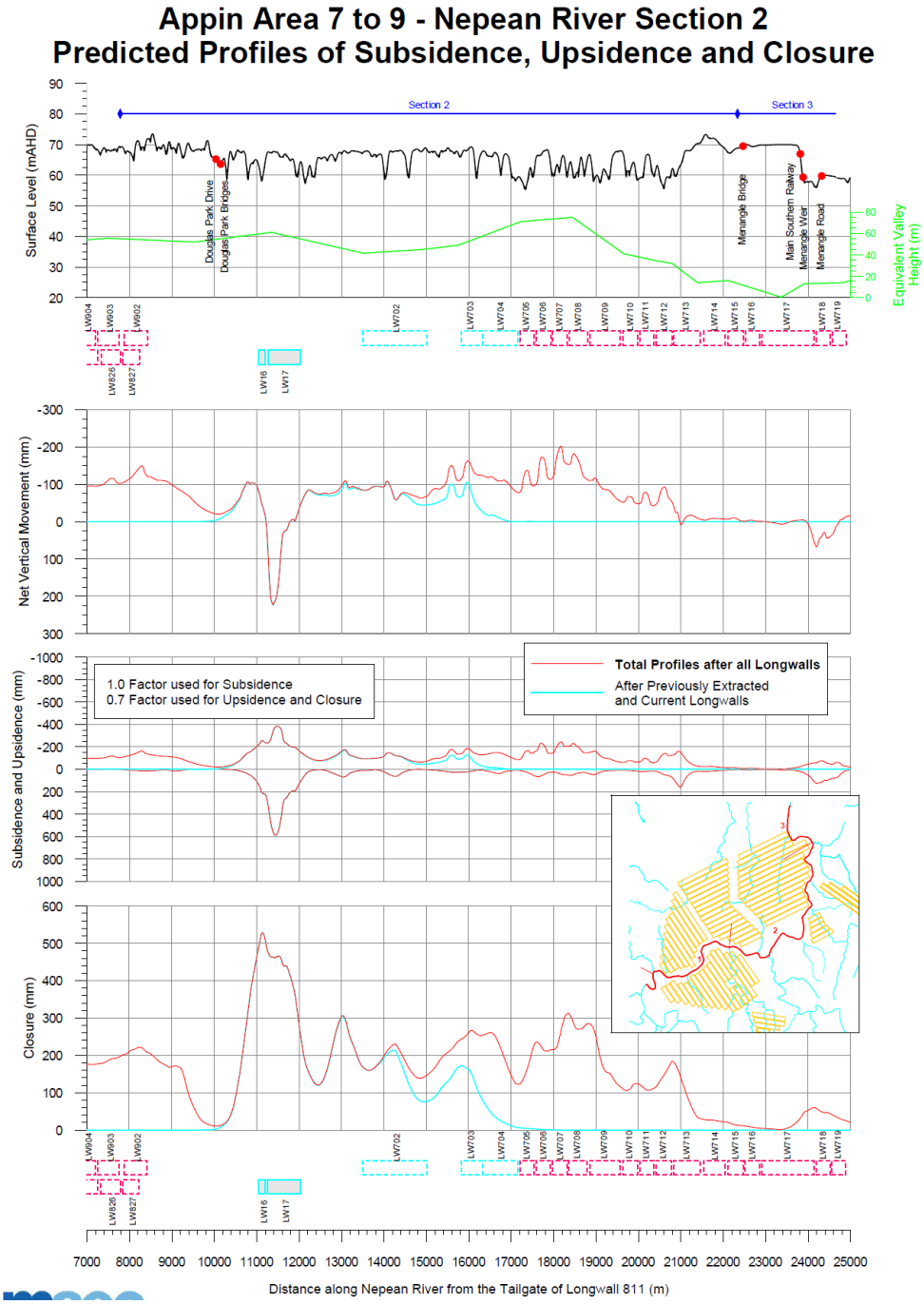

Figure 11 – *Predicted Profiles of Subsidence, Upsidence and Closure on Section 2 of Nepean River*

Georges River

The Georges River is affected by West Cliff Area 5 (see Figure 3). The EA did not propose that the River would be directly undermined, with setbacks of longwalls sufficient to reduce impacts to levels considered to be "minor". As part of the PPR, proposed longwalls 5E2 and 5E3 have been removed from the proposed project, and so would not impact on the Dharawal SCA. Longwalls 36 and 37 would also not impact directly on the SCA, since their finishing roads are located west of the Georges River, and therefore west of the reserve. The PPR and its Addendum make it clear that only longwall 5E1 would now mine directly beneath the SCA. In addition, the main development roadways and gateroads for longwalls 36, 37 and 5E1 would still traverse the reserve (see Figures 1, 3 and 9). Figure 12 below shows predicted maximum subsidence, upsidence and valley closure movement in the Georges River, based on this revised mine plan.

The changes to the mine layout within the PPR result in a reduction in the maximum predicted closure for the Georges River from approximately 215 mm to 160 mm, which occurs at the small eastwards bend in the river adjacent to longwall 5E1. This location, 1400 m downstream of longwall 33 and just east of longwall 35 and south of the Dharawal SCA, is predicted to be subject to a large spike in subsidence and net vertical movement (see Figure 12). It is therefore more likely to be more sensitive to subsidence movements than the majority of the stream bed, which would be considerably further away from any longwall. Illawarra Coal states that it is likely that predicted valley closure would not cause dilation fracturing leading to flow diversion. Potential impacts would be expected to be limited to iron staining, transient spikes in water quality parameters, and strata gas releases in some pools. However, this small rectilinear diversion in the generally-northerly direction of the river channel is considered likely to be joint-controlled, which may lead to some anomalous (ie locally-concentrated) movements.

Partly because of the location of this small section of potentially-sensitive riverbed close to proposed longwall 5E1, it is unlikely that a "negligible" standard can be effectively applied throughout this reach of the Georges River. This is exacerbated by the fact that at least 13 individual fractures or areas of closely-spaced fracturing have already occurred on adjacent sections of the river, in association with the recent mining of longwalls 32 and 33. Some of these existing impacts could be characterised as "minor", rather than "negligible". In addition, there have been 6 areas of minor, temporary gas release and 2 areas of minor, temporary iron staining. Longwall 34 will approach the river over the next 12 months. The current West Cliff Area 5 SMP approval permits continued mining of longwalls 34 - 36 at a similar standard, at least up until 31 December 2011.

Illawarra Coal has also reported that it is critical for its mine continuity to maintain access to the full proposed extent of longwalls 35-37 and 5E1. The reason for this is that the large reduction in the project extent has forced more rapid development of the 3 western longwall domains. Development works (ie main headings and a "float" of longwall gateroads) will not be sufficiently advanced in Appin Area 9 at the projected completion of longwall 37. Illawarra Coal states that extraction from longwall 5E1 is therefore critical to maintaining high levels of production of Bulli Seam coal.

For these reasons, the Department has drafted the performance criterion in the approval conditions for the Georges River to allow the possibility of "minor" environmental consequences in the small section of the river over Longwall 5E1. The condition requires that there are "negligible" environmental consequences over at least 80% of the affected stream length, and that any other impacts or consequences are minor.

Although the PAC accepted that the Georges River did not meet its criteria for special significance, its report proposed that subsidence impacts in the Georges River should be constrained to be "negligible". The revised mine plan for the Georges River area was considered by the PAC Panel's Chair, Dr Neil Shepherd, in a later report prepared for the Department on 22 February 2011 (see **Appendix D** and also refer to section 5.8). The PAC recognised the difficulties of imposing a 100% target on an already impacted stream in an environment where the relationship between subsidence predictions and environmental consequences is incompletely understood and is not quantifiable.

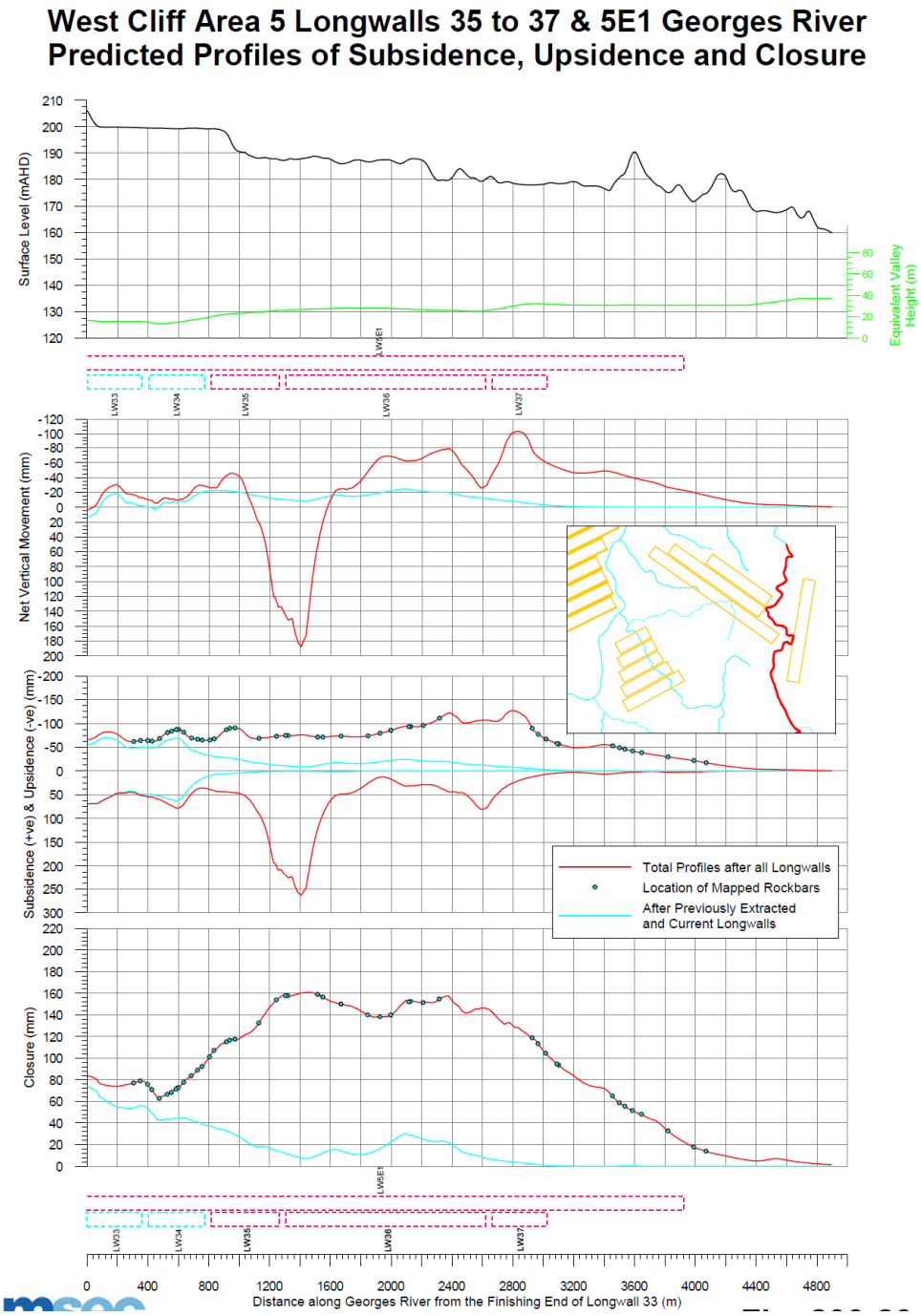

Figure 12 – *Predicted Profiles of Subsidence, Upsidence and Closure on the Georges River*

Cascade Creek

Cascade Creek is located in Appin Area 3 Extended. It would have been substantially impacted under the original mine plan, but the PPR has removed the 7 proposed longwalls east of the creek, leaving only 4 small longwalls to the west. The creek is located well to the east of the predicted 20 mm vertical subsidence line. Figure 13 below shows the predicted subsidence, upsidence and closure in Cascade Creek. The maximum predicted closure is 55 mm, while the maximum predicted subsidence is less than 20 mm. The Department is satisfied that it is unlikely that there would be greater than negligible subsidence-related impacts on Cascade Creek.

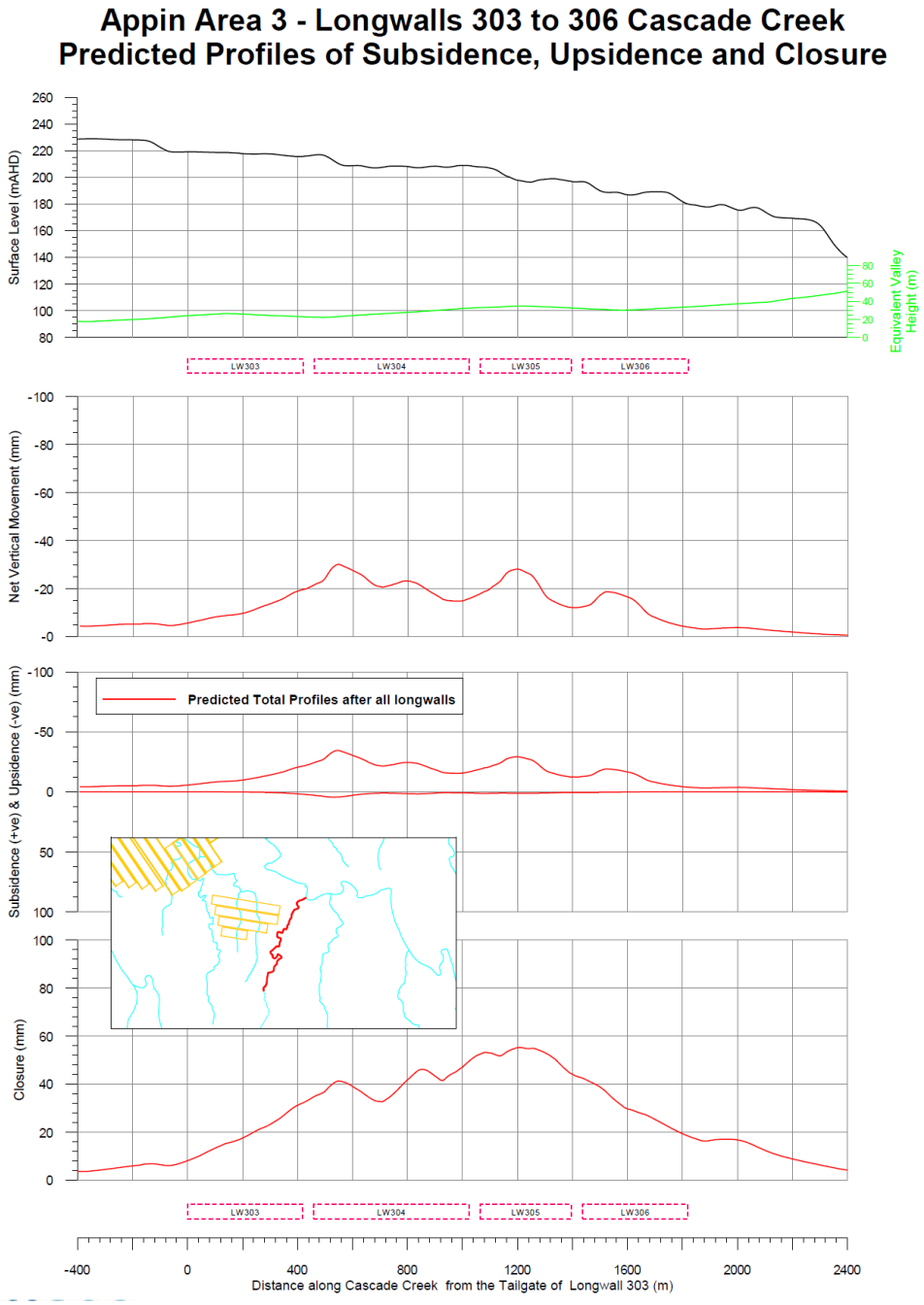

Figure 13 – *Predicted Profiles of Subsidence, Upsidence and Closure of Longwalls near Cascade Creek*

All Other Waterways

The PAC recommended that, for all other watercourses, mining be permitted subject to the stream impact minimisation criteria and management measures proposed in the EA. The EA provided stream impact minimisation criteria that allow localised impacts on stream water quality and strata gas release. If fracturing of controlling rock bars or the stream bed occurs in third order and above streams, resulting in the diversion of flow or increased leakage from pools, then remediation measures would be implemented. If this is not successful, then additional remediation measures would be implemented or offsets provided. Therefore, for all other watercourses, the Department has proposed a performance measure of "no greater subsidence impact than predicted in the EA and PPR".

5.2.5 Surface Water Management

The Department has included a condition of approval that would require Illawarra Coal to prepare and implement a Surface Water Management Plan by suitably qualified experts, in consultation with NOW and OEH. The plan must include a comprehensive water balance and a management plan for the surface facilities. In addition, prior to the approval of any Extraction Plan, Illawarra Coal would be required to prepare a Water Management Plan in consultation with OEH, SCA and NOW. The Water Management Plan would manage potential impacts and consequences of proposed second workings. Loss of surface baseflow to any watercourse would be required to be accounted for through obtaining water access licences under the *Water Management Act 2000*, in accordance with applicable policies of the NOW.

5.2.6 Conclusion

Potential subsidence impacts on the 47 streams assessed within the project application area were greatly diminished by Illawarra Coal's PPR, submitted in response to the PAC Report. There are now only 3 key streams still potentially subject to subsidence impacts. The Department accepts that a standard of "negligible environmental consequences" should be applied to potential subsidence impacts on the Nepean River. The same standard should be applied over the majority of the Georges River affected by longwall mining which takes place after the date of any project approval. However, some limited allowance should be made for "minor" impacts and consequences, given the impacts which have already taken place, the risk of additional impacts under existing approvals, and the proximity of a small bend in the river to longwall 5E1. All other watercourses, including Cascade Creek, should be subject to the performance criteria outlined in the EA and the PPR. Subsidence impacts and consequences, and any necessary remediation, should be managed under the Department's Extraction Plan and associated water management plan processes. The Department is satisfied that the conditions proposed would provide appropriate protection for all surface watercourses within the site.

5.3 GROUNDWATER

The EA contains a Groundwater Impact Assessment prepared by Dr Noel Merrick, of Heritage Computing. Groundwater (aquifer) systems within the site can be broadly defined as either shallow or deep. Shallow systems include soils and the underlying weathered bedrock on hill slopes, plateaus, swamps and minor alluvial deposits. Where these shallow systems constitute upland swamps, they are separately considered below (see section 5.6). Deep systems involve consolidated rocks, comprising rock strata with a porous matrix (commonly sandstone units) sometimes enhanced by fracturing. These two types of groundwater systems are recharged by rainfall and runoff over geological time. The process involves infiltration of rainwater, first to the surficial regolith and swamp lands, and then downwards percolation from these generally-perched systems to a deeper, fully saturated zone.

Within the site the uppermost geological unit is the Ashfield Shale, which exhibits low primary intergranular permeability so groundwater flow rates are likely to be extremely low. The Hawkesbury Sandstone underlies the Ashfield Shale and has some layers that are particularly conducive to groundwater storage and transmission. The Bald Hill Claystone sits below the Hawkesbury Sandstone and generally impedes groundwater, again due to low permeability. Figure 14 below provides a cross-section of the typical geological layers within the project area.

For deep groundwater systems, the potential environmental impacts are related to strata depressurisation (or "drawdown') associated with drainage of the fractured subsidence zone above extracted longwall panels. For shallow systems, the potential impacts of mining include added infiltration of surface water from cracking of stream beds and rock bars as a result of tensile failure and/or bedding shear associated with normal subsidence, or with valley closure mechanisms. Possible depressurisation in the Hawkesbury Sandstone is expressed in terms of drawdown, which is the drop in water level from its current position to the levels anticipated at the end of mining. Drawdown of a substantial degree could affect access to water by landowners from registered bores and/or result in stream baseflow reductions.

5.3.1 Predicted Impacts on Groundwater Systems

Mines in the Appin area are regarded as "dry mines" (as is the neighbouring Metropolitan Coal Mine) and the EA estimates inflow in current and historical workings at approximately 1.2 ML/day. The EA estimates

overall inflow for the BSO Project to peak at about 4 ML/day, with an average over 30 years of about 2 ML/day each year.

However, the EA reports that significant mining-related drawdown in the Hawkesbury Sandstone is only likely to take place beneath the Razorback Range in Area 9 (Appin West), across Area 7 and in the northern half of Area 8, with a predicted maximum of 26 m. Drawdown of this extent would likely cause additional impacts in aquifers in the Narrabeen Group, although these aquifers are not known to be used for consumptive purposes and are not high-yielding. Modelling results indicate a period of 200 to possibly more than 400 years for full recovery of pore pressures in the Hawkesbury Sandstone and other affected aquifer systems.

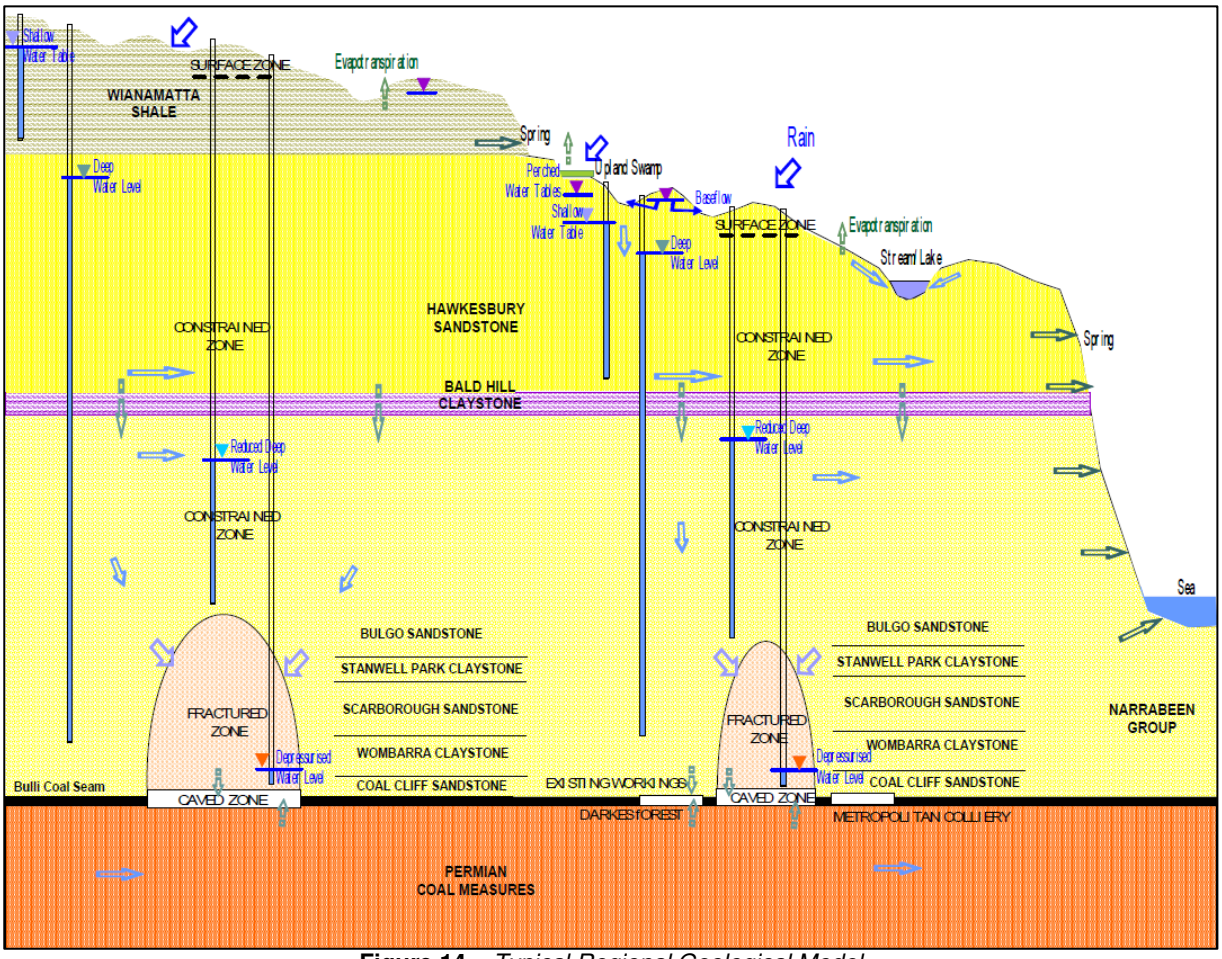

Figure 14 – *Typical Regional Geological Model*

During its review process, the PAC identified numerous issues with the Heritage Computing groundwater model and informed Illawarra Coal that the impacts of depressurisation on shallower groundwater systems and on surface drainages and swamps "could not be sensibly assessed from the information provided in the EA". As a result, the company conducted additional work and presented a revised model. The revised groundwater model was peer reviewed by Dr Frans Kalf, an independent consultant who concurred with the report's conclusions and management measures proposed.

5.3.2 Groundwater Impact Modelling and Management

The PAC was not entirely satisfied with the revised model and considered that additional studies were still required. However, the PAC did not consider these issues sufficient to prevent an approval for the project. Instead, it made a number of detailed recommendations concerning improved groundwater monitoring and better analysis and prediction of impacts. The PAC made recommendations relating to:

- additional hydrological testing of geological core samples to validate the model's assumptions regarding regional continuity of hydraulic properties within individual strata;
- installing a network of pore pressure monitoring bores, with vertical arrays of pore pressure transducers be established to quantify the height of connected and freely drainable fracturing above extracted longwall panels;
- conducting a borehole census on all potentially yield (or structurally) affected boreholes, and initiating a long term monitoring program;
- undertaking a comprehensive independent audit of the revised groundwater model, in view of the numerous abnormalities identified in the EA's modelling outcomes, and the marked changes in outcomes reported for the revised groundwater model; and
- using numerical modelling of subsidence effects to enhance prediction of subsidence zone fracture distributions, connectivity and potential fracture conduit (groundwater) transmission capacities (similar to that conducted in the Hunter Valley and the Bowen Basin by Gale (*Aquifer Inflow Predictions Above Longwall Panels*, 2008)).

Illawarra Coal, in its responses to the PAC Report, accepted the first two recommendations, but raised objections to the latter three. Illawarra Coal:

- did not object to the borehole census as such (considering that it fell within its proposed broader groundwater monitoring program), but rather the PAC's proposed timing (inferred as immediate, rather than progressive);
- considered that the peer review by Dr Kalf of the revised groundwater model was sufficient, and that the numerical groundwater model would, in any case, be subject to continual improvement during the life of the project; and
- accepted that "research may be warranted" regarding numerical modelling of subsidence effects and prediction of fracture networks, but considered that it could not be completed prior to assessment of the first Extraction Plan application (as proposed in the PAC's recommendation 10) and that Gale's published work itself indicated that:
  - it was more applicable to shallow depths of cover;
  - it may not adequately address the local existence of strata which might retard fracturing (eg the Bald Hill Claystone); and
  - verification studies would still be needed.

5.3.3 Conclusion

The Department has considered the PAC's recommendations carefully, together with Illawarra Coal's response to them. Illawarra Coal's objections relate more to timing and the detail of the proposed recommendations, rather than any fundamental objection. The Department accepts, for example, that Illawarra Coal's proposed approach towards groundwater impact monitoring is generally consistent with the PAC's approach and is in some ways more comprehensive. Appropriate conditions of approval have been developed which reflect both the PAC's criticisms of the existing groundwater information set and Illawarra Coal's concerns over these matters of detail.

Recommended conditions of approval therefore require Illawarra Coal to prepare and implement a program to improve prediction and understanding of subsidence impacts (in particular sub-surface impacts and impacts on groundwater resources), to the satisfaction of the Director-General, including:

- testing (including core testing and in situ testing) to further define the mechanical, hydrogeological and geochemical properties of rock strata within each longwall domain, including:
  - testing and validation of assumptions regarding regional continuity of modelled hydraulic properties (including mass porosity and permeability);
  - identifying hydraulic properties of rock strata close to water-dependent ecosystems; and
  - identifying the presence and distribution of iron-bearing minerals that might contribute to surface water quality impairment;
- installation of a regional network of deep pore pressure monitoring bores with vertical arrays of pore pressure transducers to assess and quantify the height and impacts of subsurface fracturing;

- a census of boreholes which may be impacted by subsidence, the gathering of relevant borehole and groundwater quality data and a regular monitoring program;
- regular enhancement, calibration and verification of the project's regional groundwater model, and the further development of this model on a mining-domain scale; and
- regular recalibration of methodologies and models used for subsidence effect and impact prediction, as they are applied within the project area.

Prior to any Extraction Plan approval, Illawarra Coal would also be required to prepare a Water Management Plan in consultation with OEH, SCA and NOW. The Water Management Plan would provide for detailed identification and management of potential impacts and consequences of the proposed second workings on groundwater. In addition, the Department has included a condition of approval that would require Illawarra Coal to provide a compensatory water supply to any owner of privately-owned land whose water supply is adversely impacted as a result of the BSO Project. The compensatory water supply measures must provide an alternative long term supply of water that is equivalent to the loss attributed to the BSO Project. Either party may refer the matter to the Director-General of the Department of Planning for resolution.

5.4 CLIFFS

The EA includes a Major Cliff Line Risk Assessment, based on information and data provided by MSEC, Gilbert & Associates, FloraSearch and Biosis Research. Figure 15 below shows the location of cliffs (in red) and steep slopes (in green) within the project application area. It can be seen that the cliff lines are primarily associated with gorges carved in the Hawkesbury Sandstone by the key rivers in the area (particularly the Nepean River, the Cataract River and Lizard Creek). However, many key cliffs (including all of those along the Cataract Gorge and Lizard Creek) are no longer at risk of impact under the PPR.

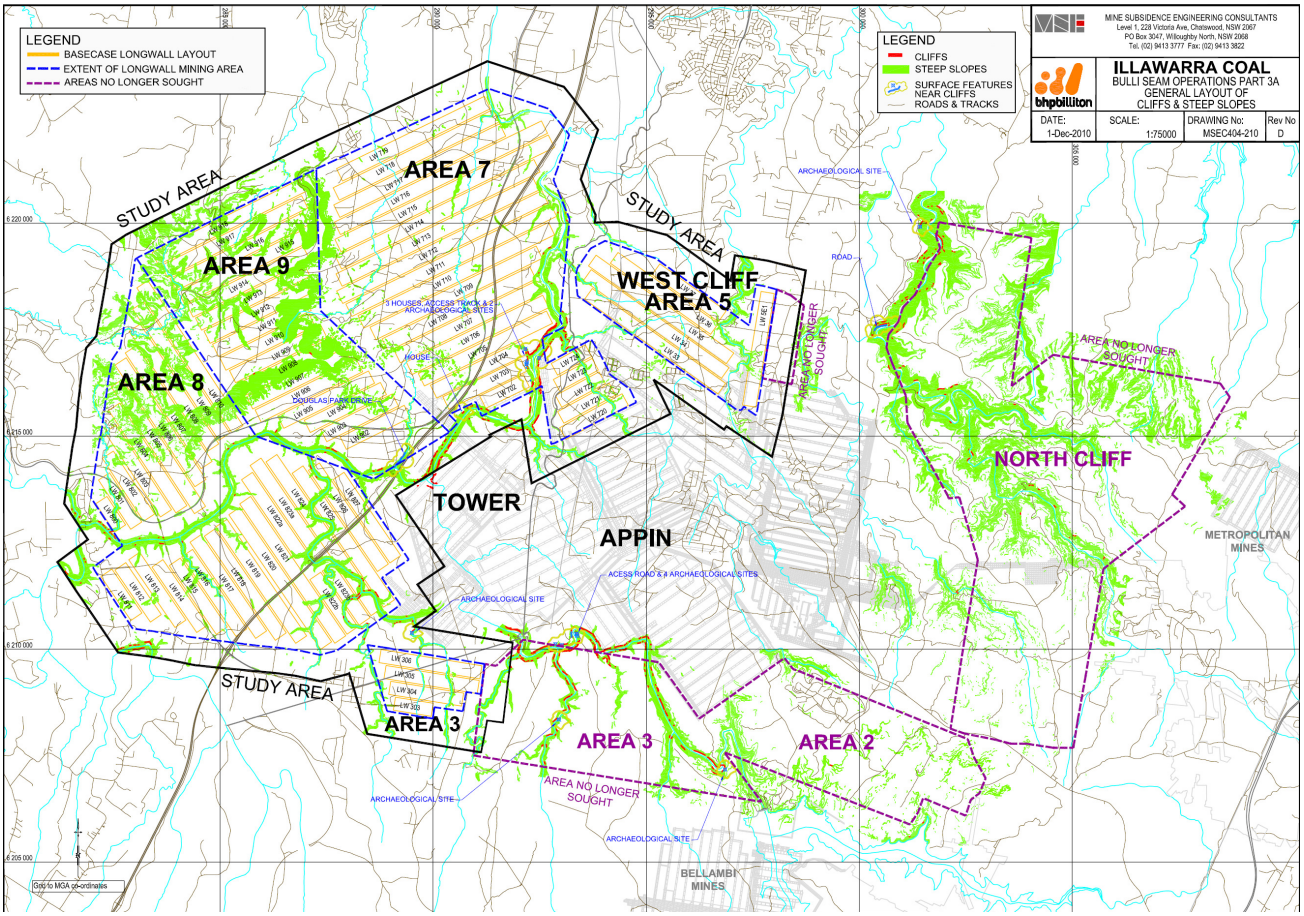

Figure 15 – *Cliffs and Steep Slopes*

The EA defines a cliff as a continuous rock face having a minimum height of 10 m and a minimum slope of 2 to 1. A steep slope is defined as an area of land having a gradient between 1 in 3 (33% or 18.3º) and 2 in 1 (200% or 63.4º). The PAC noted that there are no universally-agreed definitions for cliffs and steep slopes, and accepted the EA's definitions as reasonable.

A number of submissions to the PAC raised cliff instabilities at Dendrobium Colliery as examples of subsidence-related impacts of longwall mining. The PAC undertook an aerial inspection of cliff lines above Dendrobium Colliery and identified a number of cliff instabilities that it described as "rock falls" and at least two that it considered to be "cliff falls".

The EA states that it is difficult to assess the likelihood of cliff instabilities based upon predicted ground movements, such as curvatures and strains. The PAC stated that the information in the EA has limited value because the EA does not directly relate curvatures and strains to predicted impacts and consequences on cliffs. In addition, the PAC was concerned that conclusions drawn in the EA from case studies may have underestimated impacts associated with the wider longwall faces and shallower depths of mining proposed in the BSO Project.

Therefore, the PAC requested Illawarra Coal to undertake sensitivity analysis of potential cliff fall impacts based on a range of longwall panel widths. Illawarra Coal declined to do this, preferring instead to allow the PAC to assess impacts on cliffs and set performance criteria based on the EA's Base Case layout.

5.4.1 Cliffs of "Special Significance"

The EA states that no cliffs in the project application area warrant being considered to hold "special significance", as defined in the PAC's previous report into the Metropolitan Coal Project. The PAC did not accept Illawarra Coal's position on this matter, and reviewed its approach to identifying special significance. It suggested key criteria that any such cliff should be longer than 200 m, or greater than 40 m in height. Of the 14 such cliffs in the project application area, only 4 remain potentially affected under the PPR. These four cliffs are termed in the EA as A7_0088, A7_0102, A8_0001 and A8_0030 and are all located in the Nepean River gorge, in Appin Areas 7 and 8. Further, the PAC considered that cliff-like rock faces more than 5 m in height that function as waterfalls warrant special significance. The Department accepts the PAC's identification of cliffs of special significance.

The PAC recommended a subsidence impact performance criterion of "negligible environmental consequence" for all cliffs of special significance. It also recommended the same criterion for any other cliff, regardless of its height or length, which flanks a stream of special significance. The only stream of special significance impacted under the PPR is the Nepean River, and so this proposed performance criterion would affect all cliffs along the Nepean River, regardless of height or length. The PAC suggested an indicative definition of negligible environmental consequence for cliffs as follows:

> *…negligible has the meaning ascribed in the Metropolitan Coal Project Approval of small and unimportant so as not to be worth considering. Occasional displacement of boulders, hairline fracturing and isolated dislodgement of slabs from overhangs that in total do not impact on more than 0.5% of the total length of a cliffline are indicative of the scale of impacts falling within this category.*

While the Department supports the intent of the PAC recommendation, there are difficulties in fully applying the suggested text in a project approval. As an example, the suggested definition does not does not relate to cliff height, or the function of length and height, ie overall cliff face area. This has been discussed with the PAC and forms the basis of the Department's proposed performance criteria:

> *Negligible environmental consequences (that is occasional rockfalls, displacement or dislodgement of boulders or slabs, or fracturing, that in total do not impact more than 0.5% of the total face area of such cliffs within any longwall mining domain).*

This performance criterion would be applied to the four cliffs of special significance within the site, any cliff-like rock faces higher than 5 metres that constitute waterfalls, and all cliffs flanking the Nepean River, as proposed by the PAC.

5.4.2 Other Cliff Lines

For all other cliffs, the PAC has recommended a performance criterion of "minor environmental consequences". It proposed the following indicative definition:

> *… minor has the meaning of relatively small in quantity, size and degree. Isolated rock falls of less than 30 m³ that do not impact on Aboriginal heritage, endangered ecological communities, public safety and the like; which affect less than 5% of the total length of cliffs and associated overhangs; and which affect less than 10% of any 100 m interval of cliff line are indicative of the scale of impacts falling within this category.*

Again, the Department supports the intent of the recommendation, but notes difficulties in incorporating the suggested text in a project approval. Following further discussion with the PAC, the Department proposes the following subsidence impact performance measure for "other cliffs", again, modelled on the PAC's recommendation:

> *minor environmental consequences (that is occasional rockfalls, displacement or dislodgement of boulder or slabs, or fracturing that in total do not impact more than 3% of the total face area of such cliffs within any longwall mining domain).*

5.4.3 Conclusion

The Department accepts the PAC's definition of cliffs of special significance, and supports its proposal that these cliffs (and other cliffs flanking the Nepean River) are subject to a performance measure requiring not greater than negligible environmental consequences. It considers that its proposed definition for this performance measure fully achieves the PAC's intention, while providing more certainty, comprehensiveness and equity. The proposed performance measure for "negligible environmental consequences" would provide strong protection for these cliffs, their associated scenic values, and public safety. The Department is also satisfied that other cliffs would be adequately protected by its proposed performance measure limiting impacts to "minor environmental consequences". Performance measures for Aboriginal heritage and endangered ecological communities are separately addressed below.

As part of any future Extraction Plan, Illawarra Coal would be required to prepare a Land Management Plan, in consultation with affected public agencies. The Land Management Plan would provide for the management of potential impacts and consequences of the proposed second workings on cliffs and steep slopes, and be the mechanism by which Illawarra Coal demonstrates to agencies that its proposed mining layout is able to achieve the performance measures imposed in the project approval.

5.5 TERRESTRIAL ECOLOGY

The EA includes a Terrestrial Flora Assessment, conducted by FloraSearch, and a Terrestrial Fauna Assessment, conducted by Biosphere Environmental Consultants. Both documents were peer reviewed by Dr David Goldney of Cenwest Environmental Services. The PAC and OEH criticised the EA's survey design for flora and fauna, stating that it did not sample high conservation value habitats at an appropriate intensity. Rather than targeting the habitats of the highest ecological significance where populations of highly-threatened habitat specialist species are most likely to occur, the survey effort was spread more evenly across the entire site. The PAC also criticised the survey work for threatened species as being inadequate to support an assessment of risk from potential subsidence-related impacts.

Illawarra Coal responded to the PAC's criticism, saying that it had:

> *"failed to acknowledge the substantial ecological data sets that exist across the Project area. In addition to the results of the surveys specifically undertaken for the EA, the EA utilised all relevant reported data, including the extensive data sets prepared by government agencies and extensive monitoring data accumulated by ICHPL operations.*
>
> *Evaluations of potential impacts of the Project on threatened species and ecological communities undertaken as part of the EA assessed potential impacts on all potential habitat as opposed to only known records for species. In this way, the impact assessment is considered to be conservative"*

The Department has taken the PAC's criticism into account but has to acknowledge the substantial ecological data that exists for terrestrial ecology and was presented in the EA. More significantly, it must also be noted that the three eastern and southern domains have been removed from the proposed mine plan as a result of the PPR. These three domains contain most of the pristine vegetation with the least degree of fragmentation or degradation and a high concentration of the potential threatened fauna species. Consequently, the starting point for the Department's assessment is that potential impacts on terrestrial flora and fauna have been radically reduced under the PPR.

The potential impacts of the proposed project on flora and fauna in the Stage 4 coal wash emplacement area have been assessed separately in section 5.11.

5.5.1 Potential Impacts on Flora

The EA mapped a total of 28 vegetation communities within the project application area and surrounds. The EA reported that there were 18 threatened flora species and seven endangered ecological communities (EECs) potentially occurring on the site. Only 7 of these species were actually recorded during the EA's baseline surveys – the remainder were known from previous surveys.

The great majority of the area now proposed to be subject to longwall mining has been cleared for agricultural and residential development. Remnant vegetation remains in some areas such as Nepean River, Allens Creek and their tributaries, and in areas characterised by inaccessibility, steepness and poor soils. As a result of the reduced extent of proposed longwall mining under the PPR, Illawarra Coal reports that known records indicate that there are now 14 threatened flora species and 5 EECs potentially occurring on the site.

Apart from the proposed 60 ha expansion of the West Cliff Coal Wash Emplacement, the EA reports that the project is expected to result in 37 ha of vegetation clearance. This proposed clearing is required for ongoing surface exploration, the upgrade and extension of existing surface infrastructure (eg gas wells and service boreholes), access tracks, environmental monitoring and management, remediation, etc. Each individual clearance would be small in scale, and take place over many years.

Clearing is listed as a key threatening process under both the *Threatened Species Conservation Act 1995* (TSC Act) and the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). However, the project's impact on threatened species and EECs is expected to be minor. Clearing of *Shale/Sandstone Transition Forest* EEC would not exceed 9 ha, and clearing of *Moist Shale Woodland in the Sydney Basin Bioregion* EEC would not exceed 3 ha. The PAC and the Department are satisfied that impacts on these EECs would be adequately managed under Biodiversity Management Plans, proposed as a component of each Extraction Plan, or other management plans proposed under the approval. The Biodiversity Management Plan must have a specific focus on EECs and would be prepared in consultation with OEH and DPI (Fisheries). It must also include additional targeted surveys for threatened species, sufficient to identify any actions required to protect significant populations from potential impacts. Any appropriate offsets in respect of this clearance should be considered as a component of the Extraction Plan assessment process.

The potential consequences for terrestrial flora caused by subsidence impacts are based on the physical changes to the ground and its surface, such as surface cracking, tilting and buckling. Alteration of habitat following subsidence due to longwall mining is listed as a key threatening process under the TSC Act. The degradation of riparian vegetation along watercourses is also listed as a key threatening process under the *Fisheries Management Act 1994*.

The PAC's main concern in regards to subsidence impacts on flora relates to the uncertainty arising from potential increases in panel widths, particularly in areas where the depth of cover is approaching the predicted height of fracturing for 310 m wide longwalls (ie 385 m). However, such areas were concentrated in the southeast corner of the originally proposed mining domains, and all areas with a depth of cover < 400 m have now been removed from the area of proposed mining as a result of the PPR. Further, the Department notes that potential increases in panel width (for which conceptual approval was

sought in the EA) could not take place without detailed assessment and consideration during the Extraction Plan process, and consequent approval of an Extraction Plan. If panel width increases were to result in greater environmental impacts than originally expected, adaptive management measures would be required through the Extraction Plan process. Such measures would be included in the Biodiversity Management Plan, which forms a key component of the Extraction Plan process.

There are also a wide range of other potential indirect impacts on native vegetation such as weed invasion, fire, introduced species and disease. The PAC concluded that these potential indirect impacts were adequately addressed in the EA and could be managed effectively through Biodiversity Management Plans or other management plans. The Department supports this view.

Illawarra Coal has committed in the EA to survey the site of any proposed surface infrastructure for both threatened species and EECs. If either threatened species or EECs are identified, then the site would be relocated "wherever practicable" so as to avoid any impacts.

5.5.2 Potential Impacts on Fauna

The EA states that 47 threatened fauna species are listed as possibly occurring across the site. However, the baseline surveys undertaken for the EA actually identified only 17 of these (3 amphibians, 2 reptiles, 5 birds and 7 mammals). As a result of the reduced extent of longwall mining, Illawarra Coal reports that there are now 44 threatened fauna species potentially occurring in the site. Nine of these are classified as endangered under the TSC Act, but only 2 of these 9 were located in project surveys. The baseline surveys also identified a total of 205 other (ie non-threatened) native fauna species.

Potential impacts on terrestrial fauna include those associated with mine subsidence, which may cause cracking of the ground surface and rock falls. Surface cracking has the potential to form areas capable of "trapping" some ground dwelling fauna, while rock falls may cause a direct threat to some fauna. These impacts are expected to be very minor and are unlikely to threaten the viability of the local populations of any fauna species.

A range of fauna species are likely to utilise water habitats as a source of drinking water, so any changes in stream flows or water levels could also result in potential impacts. The Department has included conditions of approval that would minimise adverse impacts in streams within the site. Furthermore, subsidence impacts on water habitats have been substantially reduced as a result of the PPR as mining operations have been removed from all areas of upland swamp and many of the areas with significant waterways. In addition, many of the terrestrial fauna species identified are known to utilise a range of habitats, which allows them to move to alternative habitat in response to any potential habitat changes. Illawarra Coal has committed to identifying management measures to minimise impacts on terrestrial fauna and their habitats associated with future surface works.

5.5.3 Conclusion

The Department proposes to include a condition of approval requiring negligible environmental consequences on threatened species, threatened populations and EECs as a result of mine subsidence.

The PAC recommended that further targeted surveys for threatened species should be undertaken in consultation with OEH for the western domains (Area 7, Area 8 and Area 9 and West Cliff Area 5). The Department accepts this recommendation. The appropriate vehicle for such surveys is in support of the Biodiversity Management Plans proposed to be required as components of Extraction Plans, and the Department has proposed conditions to this effect. These surveys should pay particular attention to surviving areas of good quality native vegetation, particularly the Nepean River Gorge, which is the one area of the western longwall domains where depth of cover reduces to around 400 m.

The Department is also satisfied that Biodiversity Management Plans (and plans required to manage the construction of proposed gas drainage and service boreholes) are the appropriate mechanism to manage and minimise disturbance to other native vegetation.

5.6 AQUATIC ECOLOGY

The EA includes an Aquatic Ecology Assessment conducted by Bio-Analysis and peer reviewed by Dr David Goldney of Cenwest Environmental Services. Targeted surveys were conducted for threatened aquatic biota listed under the TSC Act, EPBC Act and the *Fisheries Management Act 1994* (FM Act) which were considered to possibly occur in the project area.

Baseline aquatic ecology surveys for the EA were conducted during Autumn and Spring of 2008. A total of 6,399 individuals from 82 macroinvertebrate taxa were collected. Thirteen species of fish were recorded including 11 native and two introduced species. The number of in-stream macrophytes ranged from 1 to 4 at the locations sampled.

5.6.1 Potential Impacts on Aquatic Ecology

The EA considered potential impacts on aquatic ecology in terms of habitat alteration, mine subsidence impacts and other potential direct, indirect and cumulative impacts. Some of the key potential impacts include diversion of flow, decrease in water quality and impacts on ephemeral and intermittent streams. In relation to all potential impacts, the EA concludes that the likely environmental consequences are low.

The diversion of surface water flows to sub-surface fractures has potential to reduce available habitat for fish and impede fish passage. The EA recognises subsidence impacts as a potential source of changes in flow regimes, but the potential for negative consequences is considered low overall. In addition, the likelihood of subsidence impacts is decreased considerably by the reduced scale of the project as a result of the PPR, especially given the removal of longwalls from beneath the eastern and southern streams.

The EA also discusses the impact of a decrease in water quality as a consequence of subsidence, which may be a risk to aquatic systems. The EA states that potential water quality changes would likely be localised and transient.

Four threatened species were identified as potentially occurring in the project area (the Macquarie Perch and three species of dragonfly). Of these four, only one was actually recorded in project surveys – the Macquarie Perch – in the upper reaches of the Cataract River. Both this site, and the remainder of the Cataract River, is now excluded from the area of proposed longwall mining operations under the PPR. However, the species is also known from the Nepean River system, downstream of the Pheasants Nest Weir (upstream from the project area). EA studies surveyed the Nepean River for fish at 6 sites, but at only 3 locations, on just one day, in Autumn 2008. OEH and the PAC considered this survey effort to be inadequate to confirm whether or not the Macquarie Perch is present in the Nepean River within the project site (which is quite possible, if not likely) or elsewhere in rivers and streams in the site. The Department agrees with this conclusion, notwithstanding that the EA states that the impacts to the Nepean River are anticipated to be negligible and transient.

Of the 3 dragonfly species considered to "potentially occur", only one is known to have ever existed in the project area. The Sydney Hawk Dragonfly is listed as endangered under the FM Act and is only known from three locations in a small area south of Sydney, including a 1997 record from the Nepean River near Maldon Bridge, just west of the site). Whilst it was not found in the current survey, it may exist in areas of suitable habitat within the site. The Adams Emerald Dragonfly is only known from 4 records, north and northwest of Sydney. The species has not been identified south of areas close to Berowra and Hornsby. The Giant Dragonfly is a swamp specialist species with a very long life-cycle. It is widely distributed along the east coast of NSW, but is both rare and cryptic. The largest and most viable population is believed to exist at Wingecarribee Swamp, in the Southern Highlands. Since all uplands swamps have been removed from the area of proposed longwall mining, potential impacts on this species would appear to be no longer relevant.

Both OEH and the PAC criticised the aquatic ecology surveys' scope and intensity as being inadequate for the purpose of assessing potential threats to aquatic ecosystems. The surveys were considered particularly inadequate for the four threatened species identified as potentially occurring in the project area. The PAC was of the view that no attempt was made to locate the Giant Dragonfly within swamp

habitats and that the surveys for the Adams Emerald Dragonfly and the Sydney Hawk Dragonfly covered only small sections of possible habitat.

The PAC also noted that the impacts on ephemeral and intermittent streams received little coverage in the EA. The impacts on water quality in such streams are likely to be longer-lasting given that the flows are either small or infrequent and that any streambed cracking is likely to further diminish both flows and pool-holding capacity, with no anticipation of remediation. The EA states that recent studies have found that the diversity and abundance of fish within the upper reaches of the smaller, ephemeral tributaries is generally very low. Furthermore, the Department notes that many of these streams exist in the eastern and southern domains that have been removed from the mine plan under the PPR.

5.6.2 Conclusion

The Department has taken the PAC's criticisms of the EA's aquatic ecology assessment into consideration. The PAC's principal concerns relate to inadequate survey effort overall and for threatened species in particular. However, it also expressed the view that the survey deficiencies are less significant if its recommendations in relation to stream protection are adopted. The Department has generally adopted all PAC recommendations relating to streams, with some minor changes.

The Department proposes a condition of approval requiring negligible environmental consequences on threatened species, threatened populations and EECs. It also proposes conditions requiring further targeted surveys for threatened species (including aquatic species) in Area 7, Area 8 and Area 9. These surveys should address the Macquarie Perch and the Sydney Hawk Dragonfly in particular. Illawarra Coal has also made a commitment that its Flora and Fauna Management Plan would include measures to minimise impacts on aquatic ecology and a substantial aquatic ecology monitoring program.

The Department considers that its proposed approval conditions, particularly relating to Biodiversity Management Plans, Extraction Plans and surface water management, provide a sufficient level of protection from subsidence impacts for aquatic flora and fauna, and threatened species in particular. Conditions would also require that the aquatic ecology component of Biodiversity Management Plans be developed in consultation with NSW Fisheries. The Department is also satisfied that proposed performance measure relating to the Nepean River would minimise potential water quality impacts and that Water Management Plans (required a component of Extraction Plans) would minimise water quality and habitat impacts in this and all other rivers and streams within the site.

5.7 SWAMPS

The Woronora Plateau contains the largest concentration of upland swamps on the Australian mainland, with 226 individual swamps identified in the EA as lying within the original BSO project area. Upland swamps are identified by distinct wetland vegetation composition, compared with the surrounding dry sclerophyll forest which occurs on the better-drained ridge-tops and hill slopes. A number of upland swamps in the Southern Coalfield are known to have been impacted by subsidence-induced changes to their rocky substrate and consequential changes to their hydrology and species composition.

Upland swamps were raised as a significant issue in the EA, in government agency submissions, in public submissions and by the PAC. The vast majority of the 226 swamps in the original project area are located in the North Cliff and Area 2 Extended mining domains, with the remaining few located in the eastern part of Area 3 Extended. That is, under the PPR, there are now *no* upland swamps proposed to be subject to longwall mining or potential subsidence impacts. Figure 16, below shows that the location of all swamps is within longwall domains that have been removed from the proposed project.

The PAC Report proposed 3 options to protect upland swamps. The first and simplest option was for mining to be removed from any areas located beneath upland swamps. Illawarra Coal has adopted this option by removing proposed longwall mining operations from the entirety of the North Cliff and Appin Area 2 Extended domains and from the great majority of Appin Area 3 Extended domain. This means that all 226 upland swamps identified by the PAC now fall outside the site. The Department is satisfied that there would not be any subsidence impacts or environmental consequences for any upland swamp.

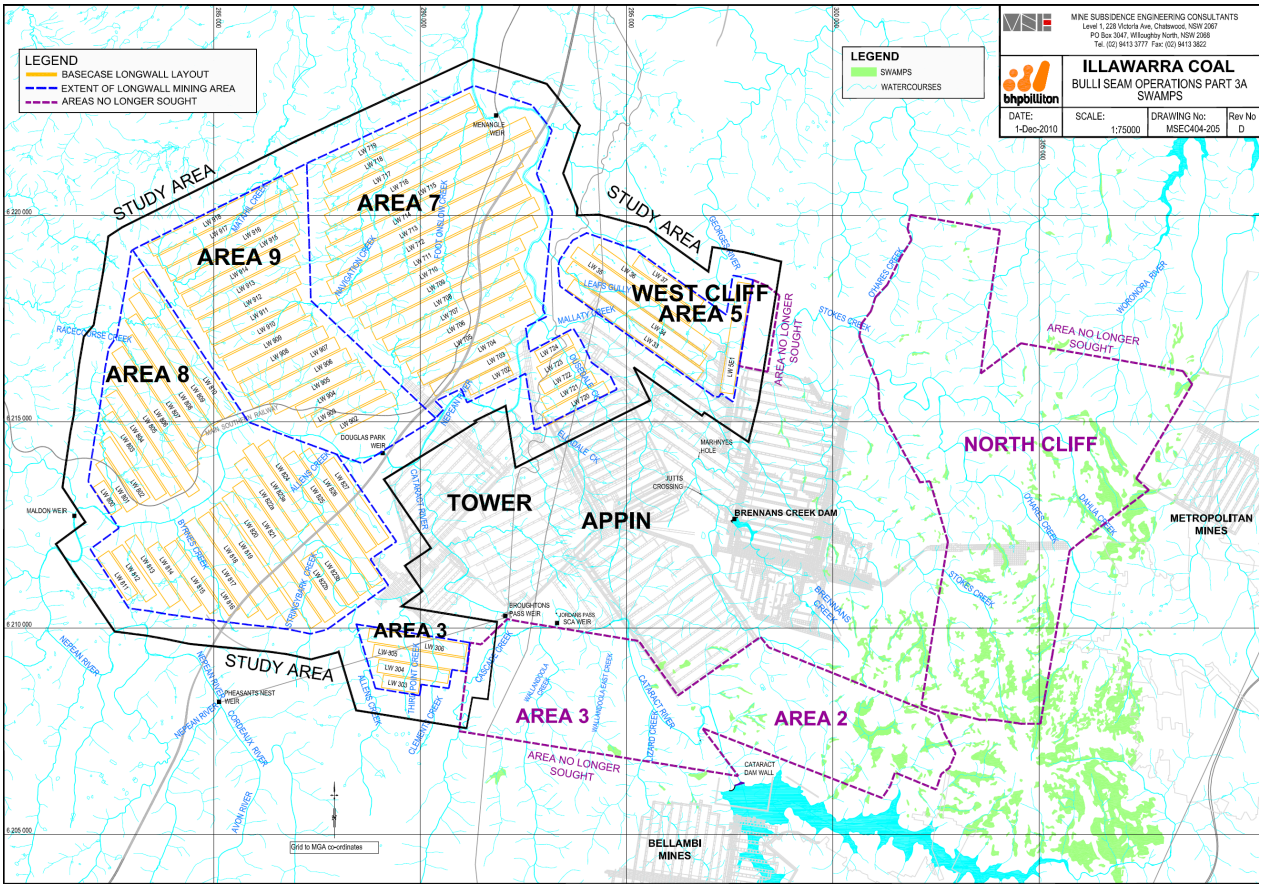

Figure 16 – *Swamp locations*

5.8 DHARAWAL STATE CONSERVATION AREA

Protection of the Dharawal SCA was one of the major concerns raised by special interest groups, government agencies and individuals in submissions. The PAC Report recommended that any mining under Dharawal SCA should be "conditional upon negligible subsidence-related impacts on streams, swamps and significant Aboriginal sites within the SCA."

State conservation areas are a category of reserve established in 2001 under the *National Parks and Wildlife Act 1974* (NPW Act) by the NSW Government with a principal purpose of permitting exploration and mining to proceed in tandem with management for conservation purposes. The Dharawal SCA was first reserved as a State Recreation Area (SRA) under the NPW Act in 1996, a reserve category that also permitted exploration and mining to proceed in tandem with management for conservation and recreation purposes. Prior to that, the area was reserved under the *Crown Lands Act 1989*. In January 2011, the then NSW Opposition announced that it would, if elected, change the reservation status of Dharawal State Conservation Area to a national park under the NPW Act. The Government has since announced the fulfilment of this policy.

Illawarra Coal holds Consolidated Coal Lease 724 (CCL 724) which affects the greater part of Dharawal SCA. It was the boundary of this lease which comprised the northeast boundary of Illawarra Coal's original project application area. However, the September 2010 PPR removed the great majority of the project's originally proposed longwall mining from within the Dharawal SCA. The October 2011 PPR Addendum confirmed this position and made clear Illawarra Coal's intended extent of continuing impacts on the SCA. The project's impacts on the reserve would now be limited to an area of 76 ha, of a total area of the reserve of 6,580 ha (see Figure 17).

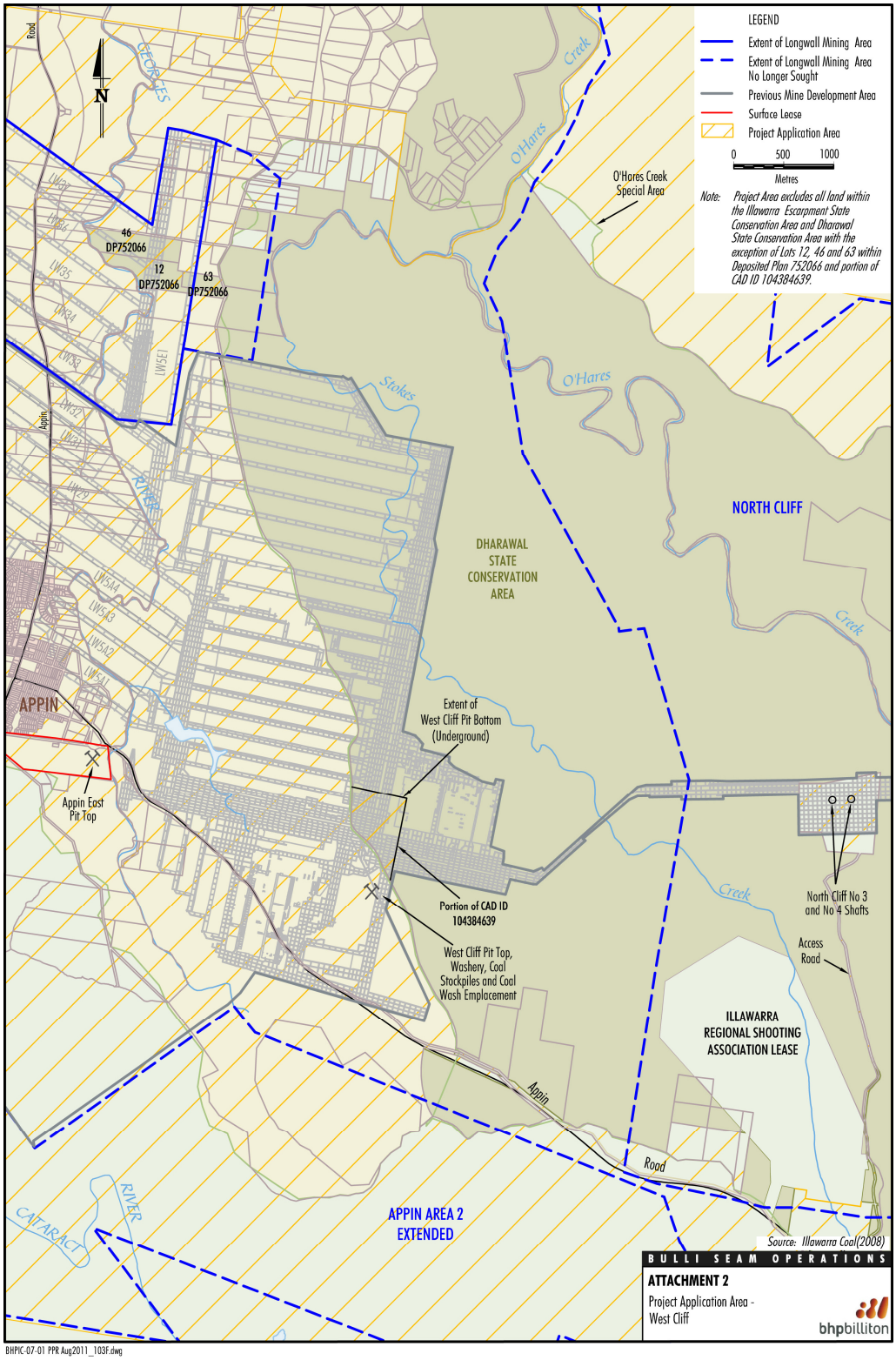

Figure 17 – *Dharawal SCA, proposed West Cliff Area 5 workings and West Cliff Pit Bottom*

There are two areas principally affected. The first is that part of the existing West Cliff Pit Bottom (ie the underground workings immediately adjacent to the shaft from the West Cliff Pit Top) which is currently within the SCA. The second is a small area of longwall mining and associated first workings in the far west of the SCA, adjacent to the Georges River. This would involve direct undermining of about 6 ha of the reserve by proposed longwall 5E1, as well as first workings (ie establishment of mains and longwall gateroads) associated with both this longwall and also the nearby proposed longwalls 36 and 37, all in West Cliff Area 5 (see Figure 17).

The Department notes that there are no identified swamps, clifflines, Aboriginal sites, EECs or areas of habitat containing viable populations of threatened species within the 76 ha of the SCA proposed to be impacted. The bed of the Georges River is also outside of this area, since the western boundary of the affected lots extends only to the river bank.

As indicated in section 3.3, the Minister for the Environment's consent is required for the lodgement of any project application affecting an SCA, prior to the grant of project approval. Illawarra Coal sought that consent on 17 December 2010. Following consideration of a significant amount of additional information provided by Illawarra Coal, OEH requested that Illawarra Coal withdraw the great majority of the Dharawal SCA (and a small area of the Illawarra Escarpment SCA also affected by an existing coal lease) from its project application. On the basis that very limited surface access had been sought to these areas (under the terms of the project as amended by the PPR), Illawarra Coal agreed to this request.

OEH also requested that the Department seek further advice from the PAC as to whether there were "environmental or other impediments to the Minister for the Environment granting land owner's consent for that part of the BSO proposal in the Dharawal SCA, having regard to the [Department's] proposed safeguards and other information". The Department duly made this request, and Dr Neil Shepherd, the Chair of the PAC's BSO Panel, was appointed by the PAC to undertake the review.

Dr Shepherd reported on 22 February 2011 (see Appendix D). His report found that:

> *the Commission is of the view that the proposed mining activities under the Dharawal SCA in the form of Development Works and Longwall 5E1 are consistent with the recommendations and intent of those parts of the PAC BSO Project Report of July 2010 that were directed to potential impacts on Dharawal SCA. The Commission can therefore see no reason to withhold land owner's consent on the basis of potential subsidence-related impacts of the proposal on the conservation values of the 20 ha of Dharawal SCA remaining within the Project Application Area.*

Dr Shepherd's report also addressed management of potential subsidence impacts on the Georges River (see section 5.2.3). The report was provided to OEH and to the then Minister for the Environment. The current Minister for the Environment granted her consent to the lodgement of the project application (as amended by the PPR and the PPR Addendum) on 15 November 2011.

5.9 BUILT FEATURES

5.9.1 Overview

Table 4 below provides a summary of major and other infrastructure within 600 m of the extent of longwall mining area.

Table 4: *Summary of Major and Other Infrastructure*

Mining Domain	Area 3 Extended	West Cliff Area 5	Area 7	Area 8	Area 9
Railways	-	-	1 (Main Southern)	1 (Main Southern)	1 (Main Southern)
Highways	-	-	1 (Hume)	1 (Hume)	1 (Hume)
Major Local Roads	2	1	4	4	4

Mining Domain	Area 3 Extended	West Cliff Area 5	Area 7	Area 8	Area 9
SCA Infrastructure	Upper Canal (including Nepean Tunnel)	Upper Canal	Upper Canal Menangle Weir		Douglas Park Weir
Other Water Infrastructure	Sydney Water Infrastructure Macarthur Water Supply System	Sydney Water Infrastructure Macarthur Water Supply System	Sydney Water Infrastructure Macarthur Water Supply System	Sydney Water Infrastructure	Sydney Water Infrastructure
Tele-communications	Copper Optical	Copper Optical	Copper Optical	Copper Optical	Copper Optical
Power Lines	 66 kV 11 kV Low Voltage	330 kV 66 kV 11 kV Low Voltage	330 kV 66 kV 11 kV Low Voltage	 66 kV 11 kV Low Voltage	 66 kV 11 kV Low Voltage
High Pressure Gas Pipelines	3	3	3	1	
Buildings	Many, including Wilton Township	Some	Many, including Menangle Township	Many, including Maldon Township and Wilton Park/Bingarra Gorge Development	Many, including Douglas Park Township
Farm Dams and Tanks	Some	Some	Many	Many	Many
Bores	2	1	36	9	9
Survey Control Marks	✓	✓	✓	✓	✓

The PAC adopted an approach of testing whether longwall mining could occur beneath the various types of built features while ensuring that they remain safe, serviceable and repairable, in line with the general policy of the Mine Subsidence Board (MSB). The PAC notes that there are precedents in NSW (and the Southern Coalfield in particular) for undermining each category of infrastructure proposed to be undermined by the BSO Project, whilst still maintaining the affected structures in a safe and serviceable condition. In fact, there exists a history of experience in undermining built environment in NSW over a period of more than 150 years. The PAC based its assessment on the use of the Base Case mine layout, rather than any amended mine plan (eg the use of a wider longwall configuration).

The Department is satisfied that the "safe, serviceable and repairable" test is generally appropriate. However, it notes that these 3 performance measures may not always be capable of being met at the same time. The Department accepts that all built features must always be kept safe for users (although safety may be maintained in certain situations by temporarily restricting use). Key infrastructure (such as a road or a railway) must also always be "serviceable", that is capable of being used for its intended purpose (even with some restriction, such as a temporary speed limit). Other built features (such as a farm dam, track, house or swimming pool) may have to be repaired, because serviceability has been compromised or even lost. In certain cases, damage may be such that repairability is an uneconomic option, and the feature must be replaced or else compensated for. The MSB regularly provides for replacement or other compensation for such buildings or structures.

The Department has therefore proposed performance measures regarding safety, serviceability, repairability and compensation. The performance measures vary according to whether the built feature is an item of key infrastructure, or an item of minor infrastructure or other built feature. The Department's proposed performance measures for items of **key infrastructure** are that they:

- always remain safe and serviceable; and
- any damage that does not affect safety or serviceability must be fully repairable, and must be full repaired.

The Department's proposed performance measures for **other built features**, including other public infrastructure, are that they:

- always remain safe;
- serviceability should be maintained wherever practicable
- any loss of serviceability must be fully compensated; and
- any damage must be fully repaired or replaced or else fully compensated.

These criteria have been used in other recent underground mining project approvals.

5.9.2 Key Infrastructure

Main Southern Railway

The Main Southern Railway is a key national transport route that carries significant freight and passenger services between Sydney and Melbourne. An 18.2 km stretch of the Main Southern Railway overlies Area 7, Area 8 and Area 9. Illawarra Coal is currently undermining the railway with Longwall 703 (part of Area 7). Illawarra Coal established a Rail Technical Committee (RTC) involving the Australian Rail Track Corporation (ARTC) and other key agencies to coordinate risk management for this undermining. Technical solutions (such as a combination of rail expansion switches and zero toe load clips which permit sections of rails to slide past one another so as to dissipate stress, complemented by real-time monitoring) have been applied. Mining has proceeded without significant incident. The RTC would continue to operate in respect of future longwalls beneath the railway and associated structures.

Table 5 shows maximum predicted subsidence movements for the Main Southern Railway. These values are not in respect of the Base Case mine layout, but rather the maxima predicted under any longwall orientation.

Table 5: *Maximum predicted subsidence-related impacts on the Main Southern Railway*

Subsidence Parameter	Prediction	Mining Domain
Total vertical displacement	1600 mm	Area 7
Total tilt	8.0 mm/m	Area 7
Total systematic tensile strain	1.4 mm/m	Area 7
Total systematic compressive strain	2.3 mm/m	Area 7
Valley Closure	300 mm	Area 9
Upsidence	430 mm	Area 9

The EA concludes that systematic subsidence is unlikely to cause any exceedance of applicable ARTC standards for track geometry. However, there is a risk of these standards being exceeded due to either substantial non-systematic movements (such as a step in the ground surface associated with faulting) or the track becoming unstable as a result of rail stress or loss of ballast or other support. The PAC concluded that it "appeared to be technically feasible" to undermine the Main Southern Railway without adversely affecting public safety and the serviceability of the rail system.

The Department is also satisfied that potential impacts to track geometry can be managed for any orientation of longwalls within the extents of longwall mining, even if actual subsidence movements are greater than the predictions or substantial non-systematic movements occur. The Department is satisfied that strict performance measures, together with an appropriate built features management plan (as a component of a robust Extraction Plan) incorporating the PAC's recommendations, would appropriately manage subsidence impacts on the Main Southern Railway.

Hume Highway

The Hume Highway (or the South Western Freeway F5) is a very important national road corridor, linking Sydney with Canberra and Melbourne. Mining in Area 7, Area 8 and Area 9 has the potential to affect 13.4 km of the Highway. There are a number of key highway structures comprising bridges, a subway, an interchange and a rest area. There are also a number of smaller structures including culverts, cuttings, embankments, emergency phone systems and road signage. The most significant and sensitive of the highway structures are a series of key bridges, including the three pairs of twin bridges over the Nepean River at Menangle, Douglas Park and Pheasants Nest and the Moolgun Bridges over Allens Creek. None of these will be directly undermined by longwalls. The twin bridges at Douglas Park and Pheasants Nest are 1000 m from the nearest longwall. The bridges at Menangle and Moolgun Creek are at the 35^{O} angle of draw from the nearest longwall, which equates to lateral distances of 370 m and 300 m respectively.

Illawarra Coal is currently undermining the Highway with Longwall 703. It has established standing steering and technical committees with the RMS and other key agencies to coordinate development of detailed risk management strategies.

The PAC notes that there is a lack of precedent for mining in the vicinity of so many major bridge structures that are sensitive to valley closure and upsidence. Both the large number of structures and the severe consequences associated with a critical structure becoming unserviceable elevates the risk associated with mining in the vicinity of these structures. Some of the bridges in the area span deep gorges and have not been designed to tolerate significant levels of tilts or strains, or the predicted levels of valley closure or upsidence. The Twin Bridges at Douglas Park were successfully re-aligned after Tower Colliery's Longwalls 16 and 17 caused differential horizontal far field movements in the bridge spans some 10 years ago. The EA foresees the possibility that similar works may need to be undertaken at some of the key bridges within the site, particularly the Moolgun Bridges over Allens Creek and the Menangle Bridges.

Apart from the risk to sensitive structures such as the bridges, there are also risks to the road pavement itself, particularly stepping failures associated with the surface expression of small faults, which may present significant safety risks, since they are likely to occur semi-instantaneously.

Having considered these risks, the PAC concluded it is feasible from a technical perspective to undermine the Hume Highway in the manner proposed without adversely affecting public safety and the serviceability of the highway. The Department is satisfied that strict performance measures, together with a robust built features management plan, incorporating the PAC's recommendations, would appropriately manage subsidence impacts on the Hume Highway and its key structures.

Key SCA Infrastructure

The SCA owns a number of weirs and other items of key water supply infrastructure within or immediately adjacent to the project area. These include the Upper Canal System of tunnels, open canals and aqueducts, the Broughtons Pass Weir on the Cataract River and a number of weirs on the Nepean River. The Cataract Tunnel, Nepean Tunnel and the Upper Canal form part of a gravity water supply system for Sydney completed in 1888. The Nepean Tunnel, the Upper Canal (including its associated aqueducts and tunnels) and Broughtons Pass Weir are listed on the State Heritage Register.

Cataract Tunnel is between about 15 m and 72 m below the surface and has been previously undermined by Longwalls 401 to 408 at Appin Colliery. This tunnel would not be directly undermined. SCA has advised the PAC that it is generally satisfied that the project's likely impacts on Cataract Tunnel would be negligible and it would remain safe and serviceable.

The Nepean Tunnel supplies water from the Nepean River, at Pheasants Nest, to Broughtons Pass Weir. A short section of the tunnel would be undermined by the proposed longwalls 305 and 306. The EA states that the predicted vertical displacement profile could result in parts of the tunnel becoming a siphon which could affect serviceability of the structure. The SCA has advised that the tunnel is relatively fragile and that effects of mining on the tunnel could result in outages associated with monitoring, testing,

maintenance and repairs. The PAC concluded that the risks associated with undermining the Nepean Tunnel could be appropriately managed.

The Upper Canal consists of open canal sections linked by Ousedale Creek Aqueduct, Elladale Creek Aqueduct, Mallaty Creek Aqueduct, Devines Tunnel 1 and Devines Tunnel 2. The open sections of the Upper Canal cross the Area 7 domain, and supply water from the Cataract Tunnel to the Prospect Reservoir. The width of the canal is approximately 3.8 m and, when running full, the depth of water is approximately 2.44 m.

The SCA advised that it is not satisfied that the BSO Project's likely overall impacts on the open section of the Upper Canal above and adjacent to longwalls 720 to 724 would be negligible and that it would remain safe and serviceable. However, the PAC accepted that these risks were manageable, partly because of the successful recent undermining of the Upper Canal and Simpsons Creek Aqueduct by longwall 409. Notwithstanding the SCA's concerns regarding the Nepean Tunnel and the Upper Canal, the Department notes the expertise of PAC Member Prof Jim Galvin in these matters and accepts the PAC's conclusion that the risks are able to be controlled by a similar management process to that adopted for previous undermining of the Upper Canal.

Broughtons Pass Weir was previously subject to small fractures sufficient to cause water leakage by closure and upsidence resulting from mining Longwalls 401 and 402 some 11 years ago, even though these longwalls were more than 400 m from the weir. Under the PPR, with the withdrawal of the proposal to mine the majority of Appin Area 3 Extended, Broughtons Pass Weir is around 1100 m from the nearest longwall (LW 306). Illawarra Coal has provided updated subsidence predictions for Broughtons Pass Weir as shown in Table 6 below, which indicate negligible subsidence-related impacts.

Table 6: *Maximum Subsidence Predictions for Broughtons Pass Weir (under PPR)*

Maximum Predicted Total Subsidence (mm)	Maximum Predicted Total Tilt (mm/m)	Maximum Predicted Total Hogging Curvature (1/km)	Maximum Predicted Total Sagging Curvature (1/km)	Maximum Predicted Total Upsidence (mm)	Maximum Predicted Total Closure (mm)
< 20	< 0.2	< 0.01	< 0.01	25	20

The Department is satisfied that strict performance measures, together with a robust built features management plan, incorporating the PAC's recommendations, would appropriately manage subsidence impacts on key SCA infrastructure. Proposed conditions require that Illawarra Coal consult with SCA (and the owners of other affected public infrastructure) during preparation of Built Features Management Plans.

5.9.3 Other Public Infrastructure and Other Built Features

Service infrastructure

There is a variety of service infrastructure located within the project area, including water, gas, electrical and telecommunications services. A summary of the key service infrastructure is as follows:

- Sydney Water owns and maintains a number of water pipelines which supply the townships of Wilton (near Area 3 Extended), Menangle (in Area 7), Maldon (in Area 8) and Douglas Park (in Area 9);
- part of the Macarthur Water Supply System, owned by United Utilities Australia, lies within Area 3 Extended and West Cliff Area 5;
- three high pressure gas pipelines (the Eastern Gas Pipeline, the AGN Pipeline and an Ethane Pipeline), together with a gas distribution network, traverse the project area in Area 3, Area 5 and Area 7;
- TransGrid owns and maintains a 330 kV transmission line which crosses Area 3 Extended, Area 5 and Area 7; and
- Integral Energy owns and maintains a number of 66 kV, 11 kV and low voltage power lines, which are expected to experience the full range of predicted systematic subsidence movements.

The PAC noted that there is extensive international experience in undermining water, gas, electrical and telecommunications services infrastructure without jeopardising public safety or the supply of important services. For example, high pressure gas pipelines have been undermined at both Appin Areas 2 and 4 and West Cliff Area 5. These pipelines have been subject to very significant subsidence effects. In one case in Appin Area 4, the pipelines were subject to 1000 mm of subsidence, 195 mm of valley closure and 135 mm of upsidence. The potential risks were well-managed through appropriate minimisation and mitigation strategies.

The likelihood of unacceptable impacts is also low due to the considerable depth of mining. Despite the relatively low risk of adverse impacts, the PAC recommended various conditions to ensure both public safety and the supply of services. The Department accepts these recommendations and is satisfied that these conditions would provide the appropriate level of management for service infrastructure. The Department is satisfied that appropriate performance measures, together with a robust built features management plan, incorporating the PAC's recommendations, would appropriately manage subsidence impacts on service infrastructure.

Roads, trails and associated structures

Under the PPR, over 40 km of major roads and 2 bridges are located directly above proposed longwall panels, in addition to tracks and fire trails. The EA provides profiles of subsidence and tilt along the major roads in each domain from which it is concluded that the predicted maximum systematic vertical displacements range between 700 mm and 1600 mm and tilts range between 4 mm/m and 7 mm/m.

The EA presents a range of initiatives for managing subsidence of local roads, bridges, culverts, cuttings and embankments. A number of local roads have been undermined by previous longwalls and the impacts on these roads did not present a public safety risk.

Many fire trails and four wheel drive tracks are located directly above the proposed longwalls and are therefore expected to be subject to the full range of subsidence movements. In particular, trails and tracks located near the top of slopes would be susceptible to cracking, which has previously been observed over mined longwalls at Metropolitan Colliery. On the basis of past experience, the Department is satisfied that subsidence impacts on roads, trails and associated structures can be controlled in a manner that maintains them in a safe and serviceable state. The Department is satisfied that appropriate performance measures, together with a built features management plan, would appropriately manage subsidence impacts on roads, trails and associated structures.

Houses and Other Built Features

A total of 1290 houses have been identified within the PPR site, of which some 900 odd are within the proposed longwall mining footprint. The great majority of these are located within Areas 7, 8 and 9. Structures associated with residences include farm dams, swimming pools, outbuildings and fences. The Department is satisfied that there is a well-established mechanism supported by legislation and administered by the MSB, which manages the impacts of mining on residential structures and associated improvements. This mechanism is effective in protecting residents from personal harm arising from mine subsidence and in maintaining and restoring structures to a condition equal to or better than their pre-mining state at no financial cost to owners.

The EA also identifies three industrial land uses within the project area including Maldon Cement Works, Allied Mills Flour Mill and the Douglas Park Petrol Station. The EA outlines a management strategy for each of these industrial land uses; however the PAC was not satisfied that this provided adequate protection from subsidence impacts. In particular, there is a limited history of undermining petrol stations. The PAC has recommended that before any mining occurs within 600 m of the footprint of these land uses, the structures must be assessed and avoidance or mitigation measures put in place. The Department agrees with this approach.

5.9.4 Conclusion

The Department has carefully considered potential impacts on items of key infrastructure (particularly the Main Southern railway and the Hume Highway and its bridges), minor infrastructure and other built features. In this respect, it has had close regard to the considerations and conclusions of the PAC, which included an eminent subsidence expert, Prof Jim Galvin, who has wide experience in assessing and managing risks associated with subsidence impacts on built features. The Department supports the analysis, conclusions and recommendations by the PAC regarding built features.

The Department has proposed performance measures addressing safety, serviceability, repairability and compensation. The performance measures vary according to whether the built feature is an item of key infrastructure, or an item of minor infrastructure or other built feature (see section 5.8.1). The Department is satisfied that strict performance measures, together with an appropriate built features management plan (as a component of a robust Extraction Plan) would appropriately manage subsidence impacts on items of key infrastructure, minor infrastructure and other built features. The PAC recommended that the risk management system for all items of key public infrastructure and other public infrastructure (except roads, trails and associated structures) be externally audited for compliance with ISO 31000 prior to submission of the Extraction Plan. The PAC also recommended that these systems are audited annually for compliance and effectiveness during extraction of longwalls which may impact the infrastructure. The Department supports these recommendations.

5.10 ABORIGINAL HERITAGE

The EA includes an Aboriginal Cultural Heritage Assessment (ACHA) prepared by Biosis Research and peer reviewed by RG Gunn, who concluded that it was "adequate and reasonable". The assessment was also developed in consultation with OEH and the relevant Aboriginal communities. The ACHA identified over 600 Aboriginal cultural heritage sites within the original project area. Under the PPR, 160 identified Aboriginal cultural heritage sites are now potentially affected by the project. Table 7 contains a breakdown of the number of Aboriginal heritage sites according to site type. Table 8 shows the assessed archaeological significance of these sites, according to the ACHA.

Table 7: *Known Aboriginal Archaeological and Cultural Heritage Sites*

Archaeological Significance	Number of sites	% of Total sites
Potential Archaeological Deposit	11	6.9
Sandstone Platform with Grinding Groove / Engraving	9	5.6
Sandstone Shelter with Art / Grinding Groove / Engraving	52	32.5
Sandstone Shelter with Deposit only	15	9.4
Scarred Tree	6	3.8
Stone Artefact/s	67	41.8
TOTAL	**160**	**100**

Table 8: *Archaeological 'Significance of Known Aboriginal Heritage Sites'*

Archaeological Significance	Number	Percentage
Low	114	71.25
Moderate	23	14.375
High	2	1.25
PAD	11	6.875
N/A*	10	6.25
Total	**160**	**100**

The PAC found that two Aboriginal heritage sites, 52-2-0854 and 52-2-3505, warranted classification as being of special significance. The first of these is located in the previously proposed North Cliff mining domain, and is therefore not affected by subsidence under the PPR. The second is located close to the West Cliff coal wash emplacement area, and is considered under section 5.12 below.

The PAC accepted that the ACHA had diligently identified and documented Aboriginal heritage sites. However, it also concluded that the ACHA had not sufficiently assessed the "likelihood" or "consequences" of impacts occurring (ie the two factors involved in an assessment of "risk"). The EA

divides the likelihood of potential impacts to Aboriginal heritage sites into four categories - moderate, low, very low and negligible. The PAC considered that these terms, which are used in a qualitative sense, should have been accompanied by more quantitative measures (which the EA only attempted in the case of "moderate" likelihood). The EA also did not address a ranking of the consequences of potential impacts.

The Department also considers that there are a number of issues related to the ACHA's assessment of significance (both scientific and cultural). The ACHA contains little explanation or reasoning as to how its significance criteria were applied. It is unclear whether the consultant has considered matters such as comparative value or regional variability. Without information on how significance was established by Biosis, it is not possible for the Department to evaluate the methodology and thereby determine its reliability. It is unclear why a large number of rock art sites, which are rare in the context of both identified sites in the study area and more generally, are classified as being of low scientific significance. A review of the AHIMS site cards for the area by the Department suggests that comparative analysis of rock art within this area may have further research potential. Opportunity would appear to exist to research the locations of particular figures, combinations of figures, types of motifs, techniques used, etc. The Department believes that Illawarra Coal should consider opportunities to foster such research, based on the continually expanding body of information which it and other mining companies hold relating to the Aboriginal heritage values of the Southern Coalfield.

The Department's review of the subsidence impact assessment also indicates that impacts were only assessed for sites identified as being of "moderate" significance or above, and as such the impacts for more that 79% of known sites is not available for consideration as part of the EA. This issue is exacerbated by the fact that less than 36% of known sites were visited as part of the ACHA.

Nonetheless, it is important to record that available evidence in the Southern Coalfield indicates that subsidence is much less likely to have an impact on most Aboriginal heritage sites than on many other features. Many sites can be undermined, with only a relatively small percentage showing significant cracking or other impacts. Previous studies (particularly by Carol Sefton) indicate that around 10% of overhangs might be subject to impact, with risk dependent on a number of factors, including the size and volume of overhangs and the presence of dampness.

The PAC recommended that a hierarchy of mining-induced consequences on Aboriginal heritage sites be established ranging from "nil" to "negligible" to "minor". It recommends that any sites warranting special significance status should be required to have "negligible" environmental consequences. The Department supports this position and has included proposed conditions requiring both negligible impact and environmental consequence. The PAC did not make a clear recommendation regarding other impacts to Aboriginal heritage sites, suggesting that one approach that warranted further work was that minor environmental consequences (or less) should be the required outcome at 90% of sites. The Department is concerned that this proposal may mean that some level of impact could occur at all sites and that there is no discrimination between sites of differing significance.

The Department therefore proposes a development of the hierarchical approach put forward by the PAC. For sites determined to hold "high" or "moderate" significance across the mining area as a result of studies required for Extraction Plans, less than 10% of such sites would be permitted to be affected by subsidence (other than negligible impacts or consequences). For all other sites, the recommended performance measure is that less than 10% of such sites (or 1 such site, whichever is the greater) within any longwall mining domain are affected by subsidence, other than minor impacts or consequences.

In reflection of the ACHA's weaknesses (particularly in site visitation, significance assessment and assessment of likelihood of impact), the Department proposes that each Extraction Plan should include a Heritage Management Plan, which has been prepared in consultation with OEH and relevant stakeholders, to manage the potential environmental consequences of the proposed second workings on Aboriginal heritage items, and which includes additional investigations (such as surveys and current register searches), sufficient to identify the significance (including "special significance") of all sites which

may be impacted by subsidence and to identify any actions required to ensure that the recommended performance measures are met.

The PAC and the Department have pointed to a number of weaknesses in the ACHA. Nonetheless, the Department accepts that some of these weaknesses relate to the survey design of the EA for a longwall mining proposal of this great scale, and that Illawarra Coal always intended that these weaknesses were addressed as part of the studies required for individual Extraction Plans. Aboriginal heritage studies would have to be undertaken at a far greater level of detail at that scale. The Department considers that the Extraction Plan process, including its required Heritage Management Plan, and the strict subsidence impact performance measures proposed in the project approval, provide strong protection for all significant Aboriginal heritage features which might be impacted by subsidence.

5.11 HISTORIC HERITAGE

The EA includes a Non-Aboriginal Heritage Assessment prepared by Heritage Management Consultants. The assessment was prepared in general accordance with the *NSW Heritage Manual*. There are a total of 45 structures of non-Aboriginal (ie historic) heritage within 600 m of the PPR's proposed extent of longwall mining. More than half of these sites are assessed as being of either State or regional significance, with 9 items being listed on the State Heritage Register. Historic heritage items include public infrastructure such as the Menangle Railway group and the Upper Canal, and former large estates such as the former Camden Park Estate, and the Wilton Park stables.

The PAC was not satisfied that the commitments in the EA would result in either proper assessment of the potential impacts of subsidence on the heritage values of significant items of historic heritage, or in maintenance of those heritage values. The PAC has emphasised that some of the masonry structures identified are highly vulnerable to subsidence impacts, particularly St James Anglican Church at Menangle and St Marys Tower at Douglas Park. The PAC recommended that for these two churches and Broughtons Pass Weir, a performance criterion of "nil" impact on the heritage value, where nil means "no mining induced change of any description in heritage value".

The Department notes that it is possible that a heritage item could experience low levels of subsidence impact which in themselves may impact on heritage values, but there is no residual loss of heritage value following appropriate management and repair. Further, it is difficult to manage impacts such as to ensure a "nil" impact. The Department therefore proposes that, for any item of State or National heritage significance (whether identified before or following project approval or an Extraction Plan), performance criteria of "negligible loss of heritage value" and "negligible impact on structural integrity or external fabric" should apply. Exceptions to the second of these two criteria would be available, but only if the owner of the feature agrees in writing.

The PAC also made a number of recommendations relating to the identification and management of all other historic heritage sites (ie locally significant sites or unlisted sites). The proposed Extraction Plan process generally incorporates these recommendations. For locally significant heritage items, the Department has recommended a performance criterion requiring no loss of heritage value greater than predicted under a Heritage Management Plan prepared as part of an Extraction Plan.

As part of any Extraction Plan, Illawarra Coal would be required to prepare a Heritage Management Plan in consultation with OEH and relevant stakeholders. One purpose of these plans would be to manage potential environmental consequences of the proposed second workings on historic heritage items. These plans would include additional investigations (such as current register searches) to identify the significance of all historic heritage sites which may be impacted by subsidence and to identify any actions required to ensure that the recommended performance measures are met.

The Department is satisfied that the proposed conditions of approval provide a strong and appropriate framework for the protection of historic heritage values, particularly key heritage items, whether already listed on State or National registers, or subject to listing in the future. The Extraction Plan process, with its

required Heritage Management Plan, and the strict subsidence impact performance measures proposed in the project approval, provide strong protection for all significant historic heritage features.

5.12 WEST CLIFF COAL WASH EMPLACEMENT AREA

The existing coal wash emplacement area at West Cliff Colliery has been approved in four previous stages (1975 and 1988 (together comprising Stage 1), 1999 (Stage 2) and 2007 (Stage 3)). The PAC and OEH both commented that the Stage 1 and 2 emplacements have been well managed. The Stage 3 component was approved in December 2007 and covers an area of about 66 ha, with a design capacity of 33.5 million tonnes (Mt). Stage 3 is planned to accept coal wash over the first 10 years of the BSO Project, before reaching full capacity (see Figure 18 below).

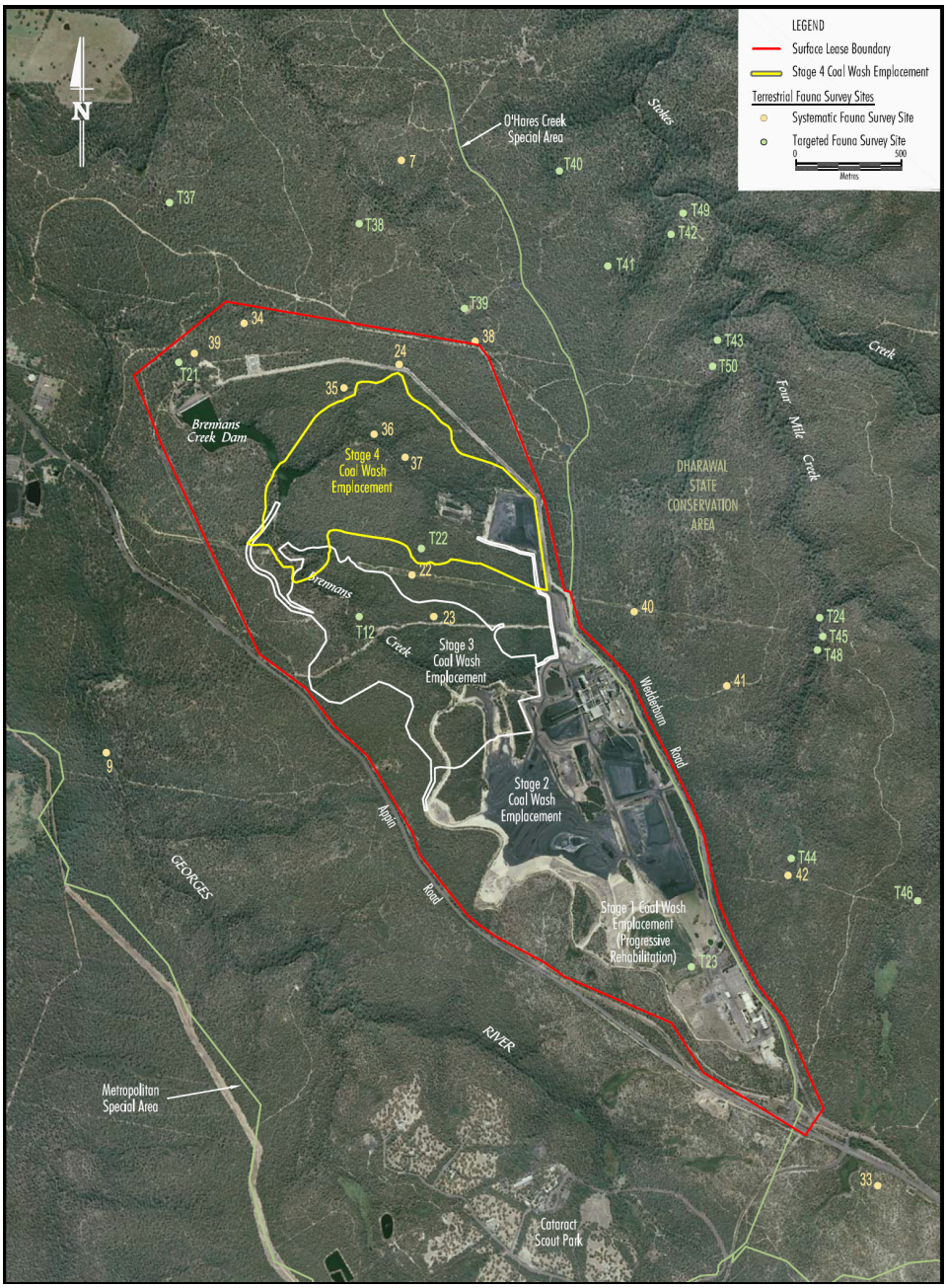

Figure 18 – *Staged development of West Cliff Coal Wash Emplacement Area*

Illawarra Coal is therefore seeking to develop Stage 4 of the West Cliff Coal Wash Emplacement as part of the BSO project. Under the original proposal, Stage 4 would have had a capacity of 40 Mt, a height of 365 m AHD and involve clearing 65 ha of native vegetation. The PPR has reduced the scope of Stage 4 so that its capacity would be only 26 Mt and its height 331 m AHD, but it would still require clearing 60 ha of vegetation. The reduction in the footprint of Stage 4 also results in the full retention of the current Brennans Creek Dam water storage capacity and also a coal stockpile area (see Figure 8 above).

5.12.1 Potential Impacts of the Stage 4 Coal Wash Emplacement

Many of the submissions received by the Department and the PAC expressed concerns over Stage 4, especially in relation to potential destruction of flora and fauna habitat. OEH highlighted the potential impacts on a number of threatened species, including the Hairy Geebung, the Southern Brown Bandicoot, and the Broad-headed Snake. Another key issue is the potential impact of runoff and seepage from the overall coal wash emplacement discharged through Brennans Creek Dam.

Hairy Geebung

The Hairy Geebung (*Persoonia hirsuta*) is classified as an endangered plant species listed under both the TSC and EPBC Acts. The emplacement area contains the core population of the known populations throughout the overall project area. Stages 3 and 4 together would result in 27 of the known 88 individuals in this core population being destroyed. As the PAC noted, an area of approximately 24 ha would be left between the Stage 3 and Stage 4 areas, which would contain the remaining 61 plants of the core population, but this proposed "refuge island" is bounded by facilities or roads on all sides.

The EA outlines the following management strategies to protect the Hairy Geebung:

- a research program with the aim of increasing the density of the Hairy Geebung in the area north of Stage 4. Seed for the program would be collected from the core area and propagated by a suitable local institution; and
- a research program (involving an institution such as the University of Wollongong) to determine the most appropriate measures to protect the Hairy Geebung population, which would be incorporated into the Biodiversity Management Plan.

The PAC believes there is a reasonable prospect that the population would survive provided these management strategies are enforced through conditions of approval. The Department agrees with the PAC and has required management strategies for the Hairy Geebung in the approval conditions as part of the West Cliff Coal Wash Emplacement Area Management Plan.

Furthermore, the Department has included a condition of approval that would require Illawarra Coal to provide a suitable biodiversity offset strategy to compensate for the clearing impacts of Stage 4. This offset strategy must be prepared in consultation with OEH and fulfil "maintain or improve" and seek to fulfil "like for like or better" conservation outcomes for the impacted vegetation associations and Hairy Geebung impacted by clearing.

Broad-headed Snake and Southern Brown Bandicoot

The Broad-headed Snake is classified as endangered under the TSC Act and vulnerable under the EPBC Act. The snake is rare, even within areas of suitable habitat, and sightings are infrequent. It has been found within the Stage 3 area previously, although not in the current surveys for Stage 4. The EA outlines an elaborate management plan, which includes the relocation of snakes prior to vegetation clearing, and progressive two-stage clearing and habitat translocation during clearing.

The PAC and OEH both believe that these management measures would not in themselves constitute a successful conservation approach (ie they are unlikely to make any difference in the local population of the Snake). Instead, the PAC recommended that a management plan for the conservation of the Snake should be developed in consultation with, and to the satisfaction of, OEH. The Department has included a requirement in the draft approval conditions that management strategies for the protection and conservation of the Broad-headed Snake be developed in consultation with OEH, as part of the West Cliff Coal Wash Emplacement Area Management Plan.

The Southern Brown Bandicoot is classified as endangered under both the TSC and EPBC Acts. It is very rare and had not been seen in the region for at least 10 years (despite previous targeted surveys) prior to discovery of a single individual on the site during surveys to support the EA. At the request of the PAC, Illawarra Coal undertook further surveys targeting the Southern Brown Bandicoot in the Stage 4 area. No further specimens were recorded, and Illawarra Coal considers that although there is suitable habitat in the area, it does not contain a "localised" population, ie it is suggested that the previous recording represented a mobile individual. The PAC concluded that the clearing of the Stage 4 area is unlikely to eliminate a viable population of Southern Brown Bandicoots. Nevertheless, the Department has included a requirement for a conservation management strategy for the Bandicoot in the approval conditions.

Aboriginal Heritage

There are 7 identified Aboriginal heritage sites close to or within the proposed footprint of the Stage 4 emplacement. Most of these sites are concentrated in and adjacent to the southwestern fringe of the proposed Stage 4 footprint (sites 52-2-2228/3617, 52-2-1373, 52-2-3533/3613, 52-2-3505 and 52-2-3506). The EA considered that one of these (52-2-3505) was of high archaeological and cultural significance. The PAC agreed with this assessment and concluded that it warranted classification as being of "special significance".

Stage 3 of the emplacement was previously redesigned to avoid burial of 3 of these sites. The proposed Stage 4 footprint would result in the burial of 2 of these 3, as well as another site. Illawarra Coal has reported that to redesign Stage 4 to avoid these 3 sites would result in a larger disturbance footprint, with additional vegetation clearance. The PAC expressed concern that all 7 sites were not included within the Aboriginal heritage impact risk assessment, but the Department's understanding is that the certainty of impact was the reason why "risk" was not assessed.

Overall, the PAC considered that the Aboriginal heritage assessment in the area of Stage 4 was inadequate as it did not define the likelihood actually attached to "likely" burial of sites beneath the emplacement and had not adequately addressed concerns raised by Aboriginal stakeholders or the fact that 3 sites had been previously protected from destruction by Stage 3. The PAC therefore recommended that Stage 4 should not proceed until an adequate Aboriginal heritage assessment had been undertaken and there had been further consultation with OEH and the relevant Aboriginal communities.

The Department accepts that the EA clearly indicates that there is an "expectation" of burial, and that this expectation makes formal consideration in the risk assessment unnecessary. However, neither the PAC nor the Department are satisfied that Illawarra Coal has done all that it can to avoid impacts on sites within the proposed southwestern extent of the Stage 4 emplacement. This is particularly the case since two of these three are classified as of "moderate" archaeological significance, which led to their protection from the Stage 3 footprint.

The Department therefore recommends that the proposed Coal Wash Emplacement Area Management Plan include detailed design plans for the Stage 4 emplacement which include options for reducing and/or avoiding impacts on Aboriginal heritage sites in and adjacent to the southwestern fringe of the proposed Stage 4 footprint (including sites 52-2-2228/3617, 52-2-1373, 52-2-3533/3613 and 52-2-3506). Additionally, impacts on the site of "special significance" (52-2-3505) would be limited to "negligible impacts", as proposed by the PAC. Illawarra Coal would have to consider staging development of Stage 4 or providing buffer areas in order to ensure this outcome.

Waste Water Discharge

The coal wash emplacement area is located within the catchment of Brennans Creek, which is a tributary of the Georges River. Site water management systems direct any surplus waste water to Brennans Creek Dam where it is stored and discharged in accordance with OEH licence conditions. There are potential impacts relating to these water discharges from Brennans Creek Dam and water quality in the upper Georges River. The Department notes that Illawarra Coal is required to comply with OEH's environment protection licence (EPL) in terms of the water quality of discharges from the Dam, and that the EPL can be

adjusted periodically to enforce improved water quality outcomes, including via the amendments to the existing pollution reduction program (PRP).

The Department has included a condition of approval that would require Illawarra Coal to prepare and implement a Surface Water Management Plan, which must include management plans for each of the mine's surface facilities. Conditions of approval would also require:

- implementation of any PRP relating to mine water discharges from Brennans Creek Dam;
- identification of 5, 7 and 10 year commitments to substantially reduce the impacts on biota of salinity and other pollutants in such discharges; and
- measures to comply with surface water discharge limits.

The PAC also raised concerns about the potential for pore pressures to build up within the coal wash emplacement, which could drive movement of coal wash water beneath Brennans Creek Dam as groundwater into downstream areas. The Department has included a requirement for a comprehensive groundwater monitoring program for the Brennans Creek Valley.

5.12.2 Other options

The PAC states that although the Stage 4 coal wash emplacement results in some undesirable outcomes, a succession of past approvals have endorsed the approach of surface emplacement of washery reject close to the West Cliff CHPP. The PAC also notes that no other regional site for surface emplacement of coal wash has been put forward as a viable alternative. The Department notes that Illawarra Coal has been examining alternative uses for or disposal of coal wash for at least the past 8 years, without identifying a viable, large scale alternative. These matters were assessed in detail in the Department's assessment and approval of the Stage 3 emplacement area in 2007. The PAC also states that any other location is likely to involve road transport of coal wash, causing additional truck traffic and associated traffic management problems. The Department agrees that the proposed location of the Stage 4 emplacement area is the only viable option for continued surface emplacement of the total output of coal washery reject from the West Cliff and Dendrobium CHPPs.

However, the PAC and OEH both recommended that emplacement of washery reject within worked-out areas of the underground mine should be actively pursued, especially since the existing capacity of Stage 3 provides a window of some 10 years to prepare such a strategy. Since approval of Stage 3, the project approval for Metropolitan Colliery has endorsed that colliery's proposal to dispose of all washery reject after 2021 using underground paste injection (a total of approximately 5 Mt). The Department agrees with both OEH and the PAC and has included a requirement in conditions for Illawarra Coal to design and implement a two year program of development of future underground coal wash disposal options. This is a much stricter requirement than proposed by Illawarra Coal, which simply proposed that within five years of approval, Illawarra Coal would "fund and commence development of a pilot-scale research and development trial for underground coal wash emplacement technology".

5.12.3 Conclusion

The Department has drafted conditions of approval that would require management strategies for the three threatened species potentially affected by Stage 4, as well as a biodiversity offset strategy. The Department has also proposed conditions to stage the development of Stage 4 to delay and avoid impacts on significant Aboriginal sites as much as possible. The Department has included a condition of approval requiring progressive rehabilitation of the emplacement area, with an emphasis on natural regeneration and retention of suitable habitat species. Conditions of approval would also require the implementation of a rapid program detailing development of underground coal wash disposal options.

5.13 NOISE

The Department notes that coal mining has been an integral part of the Appin area and the surrounding townships and was a primary reason for their original establishment and continued development. The existing noise environment surrounding the site is dominated by mine operations and road traffic noise. Existing surface operations at the various pit tops and ventilation facilities dominate the immediate noise catchment.

The EA includes a Noise Impact Assessment, including a specialist road traffic noise report, prepared by Wilkinson Murray.

5.13.1 Construction Noise

The main construction activities are proposed at the mine's surface facilities areas (as shown in yellow on Figures 4 – 7). The EA indicates that noise associated with the construction of these new facilities would be less than the current operational noise generated in the area and consequently would not be perceivable above ongoing operational activities. The Department is satisfied that construction noise impacts associated with the project can be managed within operational noise limits and has therefore not set specific construction noise criteria. The Department notes, however, that construction noise at other locations (eg for the construction of future minor surface infrastructure, such as gas boreholes or services boreholes, see section 5.15) may be managed under the management plans for such activities proposed to be required by conditions of approval.

5.13.2 Operational noise

The major sources of operational noise in the noise catchment are the Appin West, Appin East and West Cliff pit tops, and the Appin No. 1, 2 and 3 ventilation shaft and fan sites. The key components that have potential to alter the noise emissions of existing mining operations include:

- upgrades at the Appin East, Appin West and West Cliff pit tops, including the West Cliff CHPP;
- increased truck movements and operation of other mobile plant at pit tops;
- project coal wash emplacement at the West Cliff Stage 3 and Stage 4 Emplacement;
- possible upgrade of upcast ventilation shafts at West Cliff, Appin No. 2 shaft and Appin No. 3 shaft; and
- upgrades to the methane drainage plant at the Appin No.1 and No. 2 shaft site.

The proposed upgrades to surface facilities associated with the project present significant opportunities to reduce current levels of operational noise. Illawarra Coal has identified a number of potential retrofits, changes to coal handling practices and mitigation strategies that would significantly reduce noise levels in Appin and surrounding areas. These noise reductions are generally associated with proposed modifications and replacements of ventilation fans and have been incorporated in modelling of predicted noise levels presented in the EA. The EA estimates that a 1.2 dB(A) reduction in overall noise emissions can be achieved as a result of the proposal.

OEH's Industrial Noise Policy (INP) sets a noise criterion for intrusive noise, which essentially requires that the equivalent continuous noise level of a particular noise source should not be more than 5 dB above the measured background level. Table 9 below demonstrates the reduction in numbers of properties and severity of noise impacts that would be achieved by mitigation strategies proposed to be implemented as part of the project.

Table 9: *Number of Residences Exceeding Project Specific Noise Levels (Worst Case Scenario)*

Noise Level	Property Zone	No. of Existing Residences with Exceedances	No. of Residences with Exceedances After Implementation of Mitigation Measures	
			Fans	Fans + Other
1-2 dB above	Marginal	74	86	17
3-5 dB above	Management	36	20	7
More than 5 dB above		22	12	4

Table 9 illustrates the benefits that the proposed mitigation strategies would have on reducing the number of residences predicted to experience more than a 2 dB(A) exceedance of project specific noise levels (PSNLs). Importantly it is noted that no property will experience an increase of existing mine noise, after the implementation of proposed mitigation measures.

The conditions of approval include noise objectives set in accordance with the INP and OEH procedures, with strict timeframes for compliance (by the end of June 2013 and December 2014).

5.13.3 Traffic Noise

Potential traffic noise impacts from the project result from the:

- continued road transport of ROM coal from the Appin pit top to the West Cliff CHPP;
- continued road transport of product coal from the West Cliff CHPP to PKCT, Bluescope Steelworks, Corrimal and Coal Cliff Coke Works and to other customers;
- continued road transport of coal washery reject from Dendrobium CHPP at Port Kembla to the West Cliff emplacement (as backloads from delivery of product coal to PKCT and Bluescope Steelworks); and
- movement of personnel to and from work.

The road traffic noise assessment in the EA concluded that the maximum predicted changes in traffic noise levels (relative to the existing noise levels) associated with the proposal is generally below the permissible increase criterion set under by OEH Environmental Criteria for Road Traffic Noise (ECRTN) policy. However the assessment found that the change in road traffic noise associated with the project may exceed the ECRTN's 2 dB(A) allowance for Douglas Park Drive and Macarthur Road at particular times, due to work shift movements. The Department believes that these potential exceedances of noise criteria may be best avoided through the scheduling of mine commuter traffic movements. Therefore the Department proposes conditions which would require Illawarra Coal to develop a traffic management plan that seeks to negate potential road traffic noise exceedances. In the event that it is not possible to maintain road traffic noise levels below acceptable levels, then Illawarra Coal would be required to offer architectural treatments to those residences along these roads which are impacted by increased noise emissions of more than 2 dB(A).

5.13.4 Other Conditions

Additional to the noise objectives and timeframes in the approval conditions, the Department also requires that Illawarra Coal prepare and implement a noise management plan for the project including a noise monitoring program with a protocol for determining exceedances of the relevant performance criteria. This plan must also contain provisions to ensure that the road haulage fleet and other plant and equipment is maintained to an acceptable acoustic standard. Illawarra Coal would also have to install a meteorological station that is capable of continuous real-time measurement of temperature lapse rate in accordance with the *NSW Industrial Noise Policy*.

5.13.5 Conclusion

Because the project essentially involves the continuation of two existing underground coal mining operations and an existing CHPP, with no significant changes to transport methods, the key determinants of future noise impacts are the increased rate of production and coal transport, the increased number of other traffic movements required to support this increased production, and some limited construction impacts. Illawarra Coal's proposed mitigation measures will *reduce* existing noise impacts significantly.

Residual impacts are focussed on limited possible exceedances of the traffic noise impact criterion on Douglas Park Drive and Macarthur Road possible continuing (albeit reduced) exceedances of the project's PSNLs by more than 2dB(A) at up to 11 properties. The Department's proposed conditions provide for architectural treatment (eg insulation, double glazing, air conditioning) at affected properties where these exceedances continue after the implementation of other mitigation measures.

5.14 SOCIO-ECONOMIC IMPACTS

The EA includes a Socio-Economic Assessment (including a regional economic impact assessment) prepared by Gillespie Economics. After submitting its PPR, Illawarra Coal provided a summary of the social and economic benefits of the modified project as compared to the original project (see Table 10).

It is clear that the PPR has significantly reduced the potential environmental consequences of the proposed project, while still allowing considerable economic benefits to be derived. However, the Department notes that Illawarra Coal's decision (following the PAC Report) to modify the project comes at an estimated cost of some $3.4 billion in net production benefit. It also reduces prospective royalty income to the State from $3 billion to $2 billion. The PPR estimates that there would also be a drop of some 1,100

in the number of direct and indirect jobs derived from the project across the State economy. Removal of the most environmentally sensitive areas of the original project has come at a high cost to both Illawarra Coal and the State Government; and with significant flow-on effects to the local, regional and state communities.

Table 10: *Summary of Modified Social and Economic Benefits*

Approximate Social and Economic Benefits	EA Project	Modified Project under the PPR
Net Production Benefit	$10.3 billion	$6.9 billion
Net Benefit	$8.3 billion	$5.5 billion
Contribution to the State of NSW		
Royalties	$3 billion	$2 billion
Employee and Contractor Payroll Tax	$274 million	$205 million
Contribution to the Regional Economy		
Annual Direct and Indirect Regional Output or Business Turnover	$2.074 billion	$1.581 billion
Annual Direct and Indirect Value Added	$1.197 billion	$861 million
Annual Household Income	$298 million	$236 million
Direct and Indirect Jobs	3,296	2,639
Contribution to the NSW Economy		
Annual Direct and Indirect Regional Output or Business Turnover	$2.822 billion	$2.192 billion
Annual Direct and Indirect Value Added	$1.615 billion	$1.202 billion
Annual Household Income	$516 million	$415 million
Direct and Indirect Jobs	5,791	4,676

The Department also notes that the high level of economic cost of the changed mine plan has not been subject to detailed consideration at any stage of the project. In particular, it was not considered by the PAC (accepting that the PPR arose following the PAC's report). While the PAC's report was based on a lengthy, careful and conservative assessment of all natural and built environmental values, its analysis of potential economic benefits and costs was much shorter and was essentially broad in nature. For example, economic costs and benefits were not able to be disaggregated to the level of longwall domains or panels, such that the cost of its individual recommendations could be considered in any detail. There is an absence of key data regarding the economic value of individual longwall panels (based on variable data such as seam thickness; expected coal recovery, ash percentage and washery reject; cost of panel development; geological constraints; etc) to compare against the cost of proposed avoidance and impact minimisation measures. The PAC reported that it had not been well-supported by Illawarra Coal in this regard, in that it:

> *had not had access to commercial-in-confidence information that would allow a detailed assessment of the impact of its recommendation on the financial profitability of the mining operation.*

Further, the PAC's analysis of potential opportunity costs did not take into account the costs of either temporary deferral or permanent loss of Illawarra Coal's mining opportunity in the eastern and southern domains. The PAC's approach was instead to assume that this potential economic benefit would remain accessible, subject to Illawarra Coal preparing enough baseline information and proposing a sufficiently rigorous environmental protection and management regime. The economic comparison became one of "protecting features while extracting coal", rather than "loss of access to coal extraction". The PAC Report contains only a few simple, qualitative attempts (termed by the PAC as "indicative analysis" or "illustrative exercises") to analyse the marginal benefits and costs of environmental protection. These exercises are based on use of a few figures provided by Illawarra Coal in response to PAC questions and results drawn from the EA's choice modelling exercises.

The Department accepts that no precise figures are obtainable for some of these costs (since they are in part dependent on uncertain variables such as mining conditions and would also be in many cases interdependent). However, this absence of detailed economic information limits the ability of Government to fully understand the economic consequences of its decisions, and therefore operates against the interests of coal mining proponents such as Illawarra Coal. The Department must conclude that the EA and PPR did not contain sufficiently-detailed information to enable a sound understanding of the costs of:

- individual avoidance and impact minimisation set-backs and other strategies proposed in the EA (ie Illawarra Coal's localised environmental risk avoidance costs adopted or otherwise committed to within the EA; or
- individual recommendations proposed by the PAC.

Nevertheless, the Department concludes that the potential socio-economic benefits that would accrue from the modified project have been adequately reported in the EA and PPR, and that these benefits would outweigh the social and environmental impacts that are likely to occur.

Finally, a number of submissions expressed concerns over the "choice modelling" technique used in the EA's Socio-Economic Assessment to estimate environmental and social costs. This technique is used to provide estimates of environmental values in monetary terms, which are then used in a cost benefit analysis. The PAC accepted the necessary limitations and approximations of choice modelling, and stated that it could only be used to provide "guidance" to the decision-making process. It also said that choice modelling is "useful" and allows a better understanding of the trade-offs between environmental costs and mining benefits. The PAC recommends its use in future EAs where environmental consequences are of particular importance in decision-making. However, the PAC also noted that improvements could be made in regards to the application of the technique. The PAC was critical of the application of a single aggregated choice model across a large and heterogeneous project application area and a single context statement lacking in local detail and specificity as to significance.

The PAC recommended (and the Department supports) that:

> *future economic studies of environmental values in connection with mining proposals are undertaken at a sufficient level of detail to allow robust comparisons between benefits of mining and benefits of protection of natural features. Critical to this is that the study design provides survey respondents with an adequate description of the environmental attributes in the Study Area and the potential consequences for them of subsidence-induced impacts. Obvious heterogeneity in environmental attributes across the Study Area must also be accounted for.*

5.15 OTHER IMPACTS

The other potential environmental and social impacts of the project are considered in Table 11 below.

Table 11: *Other Environmental and Social Impacts*

Impact	***Assessment***
Roads and traffic	• The EA includes a Road Transport Assessment prepared for the project by Traffix traffic and transport planners. • The potential traffic impacts of the project are associated primarily with the road haulage of 7.5 Mtpa of coal to PKCT and 4 Mtpa of coal to Bluescope Steelworks. The key issue relates to increases in delays (due to both project-related and background traffic increases) at critical intersections used by coal haulage trucks. These are the Appin Road/West Cliff pit top access road intersection, Picton Road/Almond Street intersection and the Mount Ousley Road/Southern Freeway intersection. The EA indicates that upgrades to these intersections will be required during the life of the project, but broadly suggests that these upgrades are the responsibility of RMS, with the possible exception of the Appin Road/West Cliff pit top access road intersection. • The PAC questioned the use of SIDRA (Signalised and Unsignalised Intersection and Research Aid) and noted that the RMS was still reviewing the traffic analysis at the time that the PAC Report was submitted. It concluded that there was insufficient information available to the PAC to comprehensively assess traffic impacts. Therefore, the PAC

Impact	*Assessment*
	made a number of recommendations requiring Illawarra Coal to provide additional information, and for the RMS to assess and verify the information provided in the EA. • Illawarra Coal therefore provided additional information to the RMS. The RMS has since completed a full review and assessment of the EA's traffic analysis, including the additional information provided by Illawarra Coal. The RMS did not raise any objections in relation to the SIDRA analysis, but requested further consultations with Illawarra Coal over a number of matters. These discussions have been pursued, but not to finality. The Department considers that further discussions must take place between Illawarra Coal, RMS and the three councils in order to identify an appropriate program of intersection upgrades, and also Illawarra Coal's contribution to these upgrades. • The Department has therefore included a condition of approval requiring the proponent to prepare and implement a Traffic Management Plan, to be prepared in consultation with both the RMS and the three affected councils. This plan must contain an appropriate program and schedule of works for any intersection upgrades to be undertaken or contributed to by the Proponent over the life of the project. This program must be to the satisfaction of the Director-General. • The proponent would also be required to keep accurate records of the amount of coal transported from the site each day and make this information available on its website at the end of each year.
Gas drainage & service boreholes	• Once a longwall panel has been mined out, it usually requires continued drainage of gas which builds up in the goaf. This goaf gas is commonly flammable (if it contains high concentrations of methane) and is consequently a serious mine safety risk. Increasingly, goaf gas is drained directly to the surface through bore holes installed prior to or during longwall extraction. The gas is then either flared or vented. • Illawarra Coal has obtained a separate major project approval for the West Cliff Colliery Surface Gas Drainage Project and has separately lodged a project application for the Appin Mine Area 7 Surface Gas Drainage Project. However, the BSO project application seeks that future gas drainage is covered under the BSO approval, and then constructed and implemented under the provisions of a specific Surface Gas Drainage Management Plan, outlined in the EA. • Key components of this process would include: - obtaining suitable landholder agreements over land for gas drainage sites, surface infrastructure and associated vehicular access; and, - targeted noise and air quality assessment, targeted visual impact assessment, a Vegetation Management Protocol, design of erosion and sediment control and site water management measures, and site-specific Aboriginal and non-Aboriginal heritage management. • Illawarra Coal also seeks similar approval for the construction and operation of future services boreholes (small diameter surface bore holes required for underground delivery of electricity, water, ballast or concrete) and Personal Emergency Device (PED) communications management. The Department considers that these minor surface works are amenable to effective and appropriate management under management plans, and recommends conditions of approval requiring development and implementation of such plans to the satisfaction of the Director-General.
Air quality	• An Air Quality Impact Assessment for the project was prepared by PAEHolmes. Potential air quality impacts associated with the project relate to: - dust emissions from the surface operations, including operations at the West Cliff pit top, Appin West pit top, Appin East pit top and West Cliff CHPP; - dust and odour emissions from the upcast ventilation shafts; and - nitrogen dioxide emissions from the WestVAMP mine ventilation air combustion facility at West Cliff (an existing greenhouse gas emissions reduction initiative). • The predicted levels of dust deposition, suspended particulates, nitrogen dioxide, dust and odour emissions from coal haulage are not expected to exceed relevant criteria. • Air quality management and dust monitoring measures currently implemented at the Appin Mine and West Cliff Colliery would continue to be implemented for the proposed project. In addition, Illawarra Coal would develop an Air Quality Management Plan for the project that builds on existing site management plans. This must include consideration of implementing a real-time air quality management system that employs both reactive and proactive mitigation measures.

Impact	***Assessment***
Greenhouse gas emissions	• A quantitative assessment of project-related greenhouse gas emissions (GHGEs) is provided in the Air Quality Impact Assessment. • The total direct (ie Scope 1) emissions over the life of the proposed project is estimated to be approximately 161 Mt CO_{2-e}, which is an average of approximately 5.35 Mt CO_{2-e} per year. This equates to average Scope 1 emissions over the life of the proposed project of 0.52 t ones of CO_{2-e} per tonne of ROM coal. • The total indirect emissions (ie Scope 2 and 3) associated with the on-site use of fuel and electricity over the life of the project is estimated to be 22.3 Mt CO_{2-e}, which is an average of approximately 0.74 Mt CO_{2-e} per year. • Total indirect emissions (ie Scope 3) from the transport and end use of the proposed project coal by other parties are estimated to be 703 Mt CO_{2-e}, which is an average of 23.4 Mt CO_{2-e} per year. • The Department has included conditions of approval that require Illawarra Coal to minimise the GHGEs generated on site, but notes that this general obligation is likely to be superceded by the recently approved carbon tax scheme. The Department notes that the Director-General has the discretion to waive the requirement for GHGE minimisation once the carbon tax is operational. • Illawarra Coal has made a commitment to implement a Greenhouse Gas Management Plan which would include the existing measures used at the project to minimise on-site energy use. These include the Westvamp mine ventilation air combustion facility and the continued provision of pre-mining drainage gas from Appin and West Cliff Mines to fuel the EDL gas-powered electricity production facilities located at Appin East and Appin West pit tops. • The Department notes that there is a clear need for the continued supply of coking coal to meet international iron and steel making needs. The continued production of iron and steel and other socio-economic benefits generated by the project would benefit future generations. The Department also accepts that the predicted downstream Scope 3 GHG emissions are likely to eventuate whether or not the project is approved, in that coking coal is likely to be provided by other suppliers (whether domestic or international) to the Australian steelmaking facilities at Port Kembla and Whyalla or to overseas steelworks currently importing Bulli Seam coking coal. • The Department has weighed the greenhouse gas impacts of the project against a range of matters, including its contribution to global GHGEs, the need for the project and its socio-economic benefits, and the GHG impact mitigation measures available. The Department is satisfied that the project's potential GHG impacts are acceptable.
Rehabilitation	• Rehabilitation of minor project surface disturbance areas and the now sealed Bulli Shafts site would take place progressively throughout the project. Rehabilitation of West Cliff, Appin East and Appin West pit top areas; Vent Shafts No 1, 2 and 3 and minor surface disturbance areas would take place at the completion of the project. • The Department has included an approval condition requiring that a Rehabilitation Management Plan is prepared and implemented for the project in consultation with relevant stakeholders. This Plan would be required to meet a series of agreed rehabilitation objectives. • The Stage 4 coal wash emplacement area would be progressively rehabilitated under a separate management plan. Rehabilitation activities would be consistent with current practices implemented for adjoining stages of the Coal Wash Emplacement.
Visual impacts	• The potential visual impacts of the proposed project were assessed in the EA by evaluating the level of visual modification in the context of the visual sensitivity of nearby land uses and sites from which the proposed project may be visible. • The key potential impact on the visual landscape is the proposed extension of the West Cliff coal wash emplacement. The emplacement may be partially visible from the south-eastern outskirts of Appin at George Street, however the level of visual impact is expected to be low due to the presence of mature native vegetation. Views of the emplacement are available along Appin Road, however, these would also largely be restricted by the presence of mature native vegetation along the road reserve. The Cataract Scout Park is located on a ridge at an elevation of approximately 370 m AHD south of the emplacement, and has high viewer sensitivity. However, the visual modification at this location due to Stage 4 is expected to be very low, given the

Impact	Assessment
	distance, presence of intervening vegetation and existing views of the currently-approved emplacement. • Other potential visual impacts include exploration works, installation and operation of temporary gas drainage infrastructure, and other short-term surface activities. Disturbance associated with these short-term surface activities would be rehabilitated progressively and any visual impacts would therefore be limited in extent and temporary in nature. • The Department is satisfied that the potential visual impacts are likely to be low.

6 RECOMMENDED CONDITIONS

The Department has prepared recommended conditions of approval for the project (see Attachment A). These conditions are required to:

- prevent, minimise, and/or offset adverse impacts of the project;
- set standards and performance measures for acceptable environmental performance;
- ensure regular monitoring and reporting; and
- provide for the ongoing environmental management of the project.

The Department has sought comments on the recommended conditions of approval from the key government agencies, including DRE, OEH, NOW and SCA, but had not received detailed comments as at the date of this report. Illawarra Coal has reviewed and accepts the recommended conditions.

7 CONCLUSION

The Department has assessed the project application, EA, submissions on the project, the response to submissions and PPR in accordance with the relevant requirements of the EP&A Act, including the objects of the Act and the principles of ESD. The Department has also closely considered the PAC's findings and recommendations as part of its assessment of the merits of the project.

A significant number of the PAC's 136 recommendations are no longer relevant due to the reduced scope of the proposal under the PPR. The Department has carefully considered all of the PAC's relevant recommendations and has generally endorsed them. The Department has proposed conditions of approval that give general effect to these recommendations, subject to minor amendments to increase their effectiveness.

The PPR contains a new mine plan that substantially revises and reduces the scope of the original, exhibited mine plan. The PPR removed proposed longwall mining operations from nearly all of the three southern and eastern domains, which significantly reduced potential subsidence-related impacts on natural features. For example, the potential for subsidence-related impacts on upland swamps has been completely removed. Potential subsidence-related impacts on other key natural features, including cliffs, streams and biodiversity, have also been greatly diminished. Impacts on the Metropolitan Special Area are very limited, and could be considered as peripheral.

The assessment has found that the project (as amended by the PPR) would result in some adverse residual environmental impacts including minor subsidence-related impacts on limited sections of the Georges River. The Department has recommended conditions to monitor and manage these impacts, and to remediate them where reasonable and feasible. The development of Stage 4 of the coal wash emplacement at West Cliff Colliery may also result in some adverse impacts on flora and fauna, including the Hairy Geebung (a threatened flora species), as well as impacts from waste water on the upper Georges River. However, the PAC and the Department agree that the proposed location of the Stage 4

Emplacement Area is the only viable option at this time to support continued mining. The Department is satisfied that the impacts can be minimised, mitigated or managed through the imposition of a comprehensive range of conditions of approval.

The Department acknowledges that the project represents a logical extension of the existing Appin and West Cliff mines, and that it would make use of existing infrastructure and facilities. The Department also recognises that the project would provide major economic and social benefits for the Illawarra region and to NSW, including:

- a direct capital investment in the mine complex of 1.4 billion dollars;
- generating a net production benefit of 6.9 billion dollars; and
- generating 4,676 direct and indirect jobs across NSW.

On balance, the Department believes that the project represents a logical progression of existing mining operations, is satisfied that its benefits sufficiently outweigh its costs and is able to be conducted in a manner that is consistent with the objects of the EP&A Act. Consequently, it believes the project is in the public interest and should be approved subject to conditions.

8 RECOMMENDATION

It is RECOMMENDED that the PAC, as delegate of the Minister:

- consider the findings and recommendations of this report;
- approve the project application, subject to conditions; and
- sign the attached instrument of approval (Attachment A).

Howard Reed 1·12·11

Howard Reed
Manager Mining Projects

DKitto 5/12/11

David Kitto
Director Mining and Industry Projects

6.12.11

Chris Wilson
Executive Director
Major Projects Assessment

6/12/11

Richard Pearson
Deputy Director-General
Development Assessment and Systems Performance

ATTACHMENT A – CONDITIONS OF APPROVAL

See the attached Instrument of Approval.

APPENDIX A – ILLAWARRA COAL'S ENVIRONMENTAL ASSESSMENT

See enclosed box containing 5 folders (Volumes 1-5).

APPENDIX B – COPY OF SUBMISSIONS

See attached:

- Agency submissions
- General public submissions
- Special interest group submissions.

APPENDIX C – ILLAWARRA COAL'S RESPONSE TO SUBMISSIONS

See attached:

- Responses to agency submissions
- Responses to public submissions.

APPENDIX D – PLANNING ASSESSMENT COMMISSION REPORT

See enclosed box containing PAC Report dated 23 July 2010 (in white folder).

Also see attached additional report by Dr Neil Shepherd dated 22 February 2011.

APPENDIX E – ILLAWARRA COAL'S RESPONSE TO PAC REPORT

See attached:

- Response to PAC Report – Part 1 (dated 27 September 2010)
- Response to PAC Report – Part 2 (dated 19 October 2010).

APPENDIX F – ILLAWARRA COAL'S PREFERRED PROJECT REPORT

See attached:

- PPR Part 1 (dated 24 September 2010)
- PPR Part 2 (dated 19 October 2010)
- PPR Part 3 (dated 4 October 2011).

APPENDIX G – LANDOWNER'S CONSENT

See attached letter from the Minister for the Environment dated 15 November 2011.