Planning Assessment Commission

NSW GOVERNMENT

Cobbora Coal Mine Project

Review Report

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April 2013

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The Cobbora Coal Mine Project PAC Review Report©
State of New South Wales through the NSW Planning Assessment Commission, 2013.

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Executive Summary

Cobbora Holding Company (the Proponent) proposes to develop an open cut coal mine near Dunedoo, mainly within the Warrumbungle Local Government Area. The proposal is known as the Cobbora Coal Project and would involve extracting 20 million tonnes of Run of Mine Coal a year, from the concurrent operations of three open cut pits. Due to the relatively high ash content of the coal, the processing of the 20 million tonnes of run of mine coal would on average, produce only 12 million tonnes of product coal, along with relatively high volumes of waste and tailings.

The Minister for Planning and Infrastructure requested the Planning Assessment Commission carry out a review of the merits of the Cobbora Coal Project and conduct public hearings during the review.

The Commission's approach to the review
The Commission was constituted by Ms Gabrielle Kibble AO, Mr Paul Forward and Mr Brian Gilligan. Emeritus Professor Jim Galvin, Dr Steve Perrens and Dr Mark Burns were engaged by the Commission to provide expert advice on the mine plan, the water issues and the rehabilitation issues associated with the project.

The Commission examined the Proponent's Environmental Assessment, response to submissions and Preferred Project Report, was briefed by the Department and the Proponent, inspected the site, held a public hearing, and examined the submissions made on both the Environmental Assessment and the Preferred Project Report. The Commission met individually with representatives for the four surrounding Councils, as well as representatives for NSW Office of Water and NSW Treasury. The Commission also requested and subsequently met with the NSW Treasurer to advise him of the urgent need for active management of the mine's landholdings, both prior to and during any mining in the area.

The Environmental Assessment was publicly exhibited by the Department of Planning and Infrastructure from 5 October 2012 to 16 November 2012. The submissions received as part of this process were forwarded to the Commission. The Commission held a public hearing on Tuesday 11 December 2012 at the Jubilee Hall in Dunedoo and received 24 verbal submissions and five written submissions. A preferred project report was submitted by the Proponent in February 2013 and was publicly exhibited by the Department of Planning and Infrastructure from 13 February to 8 March 2013. Submissions made on the Preferred Project Report were also considered by the Commission.

Major issues
In considering the project and the issues raised in submissions, and at the public hearing, the Commission noted that an issue of particular concern locally is the social and economic impacts of the project. Although generally supportive, locals indicated that much of the project site and surrounds had already been purchased by the mine and that this had displaced a significant number of families from the area. The Commission heard that, as a consequence of this, negative impacts on the local community and the economy of the Dunedoo township were being felt. Given these impacts are already occurring, the local community indicated it is relying on the mine to replace the displaced population and associated social and economic contributions that have been lost through the acquisition process. Delays and uncertainty over the time period for the mine development are contributing to a negative investment environment in the area.

Another major concern at a local and regional level is the potential impact on water resources, both locally and on the Cudgegong River (and associated impacts on town water supplies). Some concerns were also raised about the health and amenity impacts of the project.

Members of the Gulgong community raised particular objection to the impacts of the projects coal trains which would travel along the rail line, which runs along the outskirts of Gulgong. Residents of Mudgee were also concerned that trains may be diverted through Mudgee in the future, to supply coal to power stations around Lithgow. However, this latter issue is not part of this assessment.

Notwithstanding these local and regional concerns, the majority of the objections to the project came from further afield. Many submissions from the broader region and across the state raised concerns about the impacts on flora and fauna, biodiversity and threatened species. Submissions also objected to the mining of thermal coal for the purposes of power generation in NSW and the associated greenhouse gas emissions from this process.

Some submissions objected to the notion that NSW tax payers might subsidise the mine, or coal generated power more generally with suggestions that any Government funding should be focused on delivering renewable energy. The Commission understands this concern stems from the fact that the mine is currently owned by the State Government, and the possibility that the Government may subsequently develop the mine. The Commission is aware that the NSW Government has obligations to supply coal to certain power stations in NSW under existing coal supply agreements and understands that a range of complex factors and historical decisions have lead to the current situation. The Commission considers that Treasury is best placed to examine the project's costs and benefits at the state level, in tandem with its consideration of any alternatives available.

Nonetheless the Commission is of the strong view that in order for the mine's business case to be properly considered against alternative options the proposal must be designed to best practice standards, as expected of any new mine in NSW. The Commission has assessed the project on this basis.

Land management

In considering the proposal the Commission has given particular attention to the issues arising from the land acquisition process, which has seen a significant number of families leave the area and has left a large area of land in the hands of the Proponent. The Commission also recognises that there is a strong possibility the mine may not commence immediately, or even in the near future. Social, economic and land management impacts stemming from the uncertainty around the future use of the land have already occurred and have the real potential to burden the community for some time.

An integrated land management plan is urgently needed for the Proponent's consolidated land holdings. The Commission found that careful development and implementation of this plan could address some of the issues that have arisen from the current uncertainty. The consolidated land holdings represent an opportunity for the land to be considered strategically and for historical land management practices to be reconsidered, with the potential for improved outcomes, both in terms of agricultural productivity and biodiversity conservation values. This in turn should provide a sustainable contribution to the local community, particularly if local training and skills development are incorporated into the program.

The Commission has recommended that work to strategically manage this consolidated land holding should commence immediately, in order to properly establish the rehabilitation areas required for biodiversity offset areas, and to minimise any further loss of agricultural productivity on the remaining areas of the site.

In regard to the mine itself, the Commission found that the mine plan put forward by the Proponent includes a significant margin for adaptation. This has led the Commission to recommend a number of refinements to the mine's design to minimise the predicted impacts of the project, particularly those on threatened species.

Water

Both the Commission and Mid Western Council engaged water experts in light of local concerns regarding the potential impacts on water, particularly the impact of the proposed extraction of water from the Cudgegong River. Both experts are now satisfied with the NSW Office of Water's assessment to grant the water licence transfer. Nonetheless the expert advice to the Commission highlights that there are still some uncertainties regarding some of the localised water impacts of the project.

While the NSW Office of Water and the Commission's water expert have both indicated that water impacts can generally be managed to an acceptable level, some further work will be necessary. Conditions of any approval will need to establish a strong framework for the detailed water management and monitoring plan to ensure the mine's water consumption and impacts are adaptively minimised, managed and appropriately monitored. In this regard it is noted that considerable water savings can be achieved with the mechanical treatment of tailings.

Amenity impacts

Some health and amenity impacts could occur as a result of mining. The Commission notes that while many of the surrounding land holdings have already been purchased by the Proponent, some privately owned properties are predicted to be impacted by levels of dust and/or noise that exceed the relevant guidelines. The Commission has sought to maximise the options and protections for private landholders in these circumstance. The Commission has recommended land acquisition rights are provided. It has also recommended provisions for mitigation measures (such as double glazing) to be provided in the event the landowner chooses to stay.

Siding Springs Observatory

The mine also has the potential to impact on the observing conditions at the Siding Springs Observatory which relies on the region's particularly dark skies to retain its international standing. The Commission notes that there is a significant scientific community working at Siding Springs, as well as an associated tourism component. Measures to minimise dust and to control night lighting will be essential to minimising impacts on the local astronomical conditions.

Threatened Species and Endangered Ecological Communities

The mine would impact on a number of threatened species and endangered ecological communities and offsets for some of these impacts are yet to be identified. The Commission found that some of these impacts can and should be avoided through refinements to the mine plan. With these refinements in place the Commission is satisfied the biodiversity impacts can be appropriately minimised and offset to an acceptable level. The Commission concluded that the avoidance of certain areas of the site to minimise impacts on biodiversity, combined with the immediate implementation of an integrated land management plan should ensure an overall improvement in the regional biodiversity conservation values of the area, in the long term.

Management of bushfire risks

Management of bushfire risks and support for the local rural fire service brigade will also be important. Contributions to local infrastructure projects should also be considered as a means to

minimise the social and economic impacts of the ongoing uncertainties surrounding the site and the likely commencement of mining.

Commission's conclusion

In conclusion, after careful consideration, the Commission has found that the project has merit and is able to be approved, but that uncertainties around the timing of the project have already had, and may continue to have social, economic and land management impacts locally. Consequently, the Commission has recommended that work to prepare and implement an Integrated Land Management Plan, for the Proponent's landholdings, should commence immediately. With appropriate funding and resources it should be possible to reinstate productive agricultural management of much of the land, along with rehabilitation works for areas of strategic biodiversity value. Both have the potential to provide a sustainable social and economic return to the local community.

The Commission has also made a number of recommendations to ensure the mine is appropriately designed and managed, and finds that the project could be approved, subject to conditions.

Recommendations

1. Integrated Land Management Plan

An integrated land management plan for the Proponent's full suite of landholdings (including mining and offset areas) is a matter of some urgency and should be prepared and implemented immediately rather than being tied to the commencement of mining operations. The plan should include:

a) Mapping of the agricultural capability and biodiversity regeneration potential of the landholdings and a strategic land use study to identify the best land use for each area, aiming to:
    - regenerate biodiversity offset areas to the maximum extent possible prior to commencement of mining;
    - maximise sustainable agricultural production on the remainder of the land, including through the rehabilitation and repair of eroding areas of the site;

b) A land tenure and management program, considering the existing land tenure arrangements, and suitable arrangements at each stage, (including prior to the commencement of mining, during mining operations and post mining) detailing the mechanisms and timetable for transitioning to active land management in accordance with the strategic land uses identified in a);

c) An employment, training and skills development program aimed at improving local land management techniques, resources and knowledge. This should include adaptive land management, informed by a system of trials of various agricultural and biodiversity rehabilitation and endemic vegetation reestablishment techniques, supported by a local seed bank of endemic species;

d) An integrated bushfire management plan;

e) A program to fast track work to regenerate biodiversity offset areas, this work should commence immediately and be managed adaptively, with the aim of delivering the projected biodiversity outcomes, and demonstrating success by year eight of the mine plan (see recommendation 17 c) and d)).

2. Funding for Land Management

The creation of a fund to provide for the preparation and implementation of the Integrated Land Management Plan will have multiple benefits and in particular, should be used to rehabilitate parts of the site not impacted by future mine activities and to trial future rehabilitation techniques. In

delivering these functions, creation of local training opportunities and provision of local economic stimulus should also be prioritised.

3. Appointment of an Experienced Land Manager

Any approval granted should include a condition requiring the Proponent to engage a land manager with expertise and experience in the adaptive implementation of a comprehensive land management and rehabilitation plan for both mine areas and other landholdings.

4. Mine Plan Refinements

The mine plan should be revised and optimised considering the following objectives:

- Reducing the impacts on threatened species and endangered ecological communities, particularly by: relocating the B-OOP E overburden dump and tailings emplacement areas, and avoiding or minimising intrusion of mining into the main remnant vegetation corridor (on the north eastern portion of the site);
- Minimising dust, particularly by reducing the land area that would be exposed at each stage of mining;
- Maximising the land capability and productivity of the rehabilitated final landform; and
- Minimising the extent of any final void.

The Proponent must demonstrate how exposed areas would be minimised and managed, including the effective use of interim cover and the effective and timely establishment of permanent cover.

5. Best Practice Standards

The Project should be required to meet best practice standards in all areas, during both construction and operational stages.

6. Air Quality Control Measures

All measures for control of air pollution should deliver air quality outcomes that are equal to or better than the air quality outcomes identified in the Environmental Assessment and that correspond to best practice and the application of best available technology. This must include:

- best practice coal loading and profiling, to minimise dust emissions from coal transportation; and
- a real time predictive and reactive air quality management system informed by a state of the art air quality monitoring network.

7. Air Emission Limits

Air emission limits should be applied to the project to ensure the air emissions are equal to or better than the predictions in the Environmental Assessment.

8. Provisions for landholders affected by air emissions

Where air quality criteria are predicted to be exceeded the Proponent should be required to give the landholder the option of:

- acquisition of the residence and associated property; or
- mitigation measures including air conditioners and first flush separation devices on rainwater tanks; or
- an agreement negotiated between the two parties.

9. Mine owned residences where air quality criteria are exceeded

The Proponent's commitment not to lease residences affected by air quality exceeding the criteria should be formalised in the conditions of any consent issued.

10. Minimise Blasting

The Proponent should be required to reduce the number of blasts to minimise amenity impacts on the surrounding community.

11. New roads constructed outside blast buffer zones

The Proponent should be required to ensure that the realigned Spring Ridge Road is adequately buffered from mining activities and built to an adequate Austroads standard. The buffer should be sufficient, so that the road is not affected by blasting activities on site (ideally the road should be able to remain open during periods of blasting on the mine site).

12. Noise Control Measures

The Proponent should be required to apply best practice noise control and management measures, including best available technology (including locomotives), engineering controls and predictive and reactive real time management practices.

13. Provisions for landholders affected by noise emissions

Any residence that is predicted to be impacted by a noise level of more than 35 dB(A) should be given the option of either:

- acquisition of the residence and associated property; or
- mitigation measures including double glazing, air-conditioning, insulation and acoustic barriers; or
- a negotiated agreement.

14. Noise Limits

Noise limits should be applied to ensure the project's noise emissions are equal to, or better than, the predictions in the Environmental Assessment and Preferred Project Report and Response to Submissions.

15. Heavy vehicle movement restrictions

Heavy vehicle movements on public roads must be restricted to the hours of 7 am to 6 pm Monday to Friday, 8 am to 1 pm Saturday and at no time on Sundays or public holidays, except as directed by the Police, or Roads and Maritime Services, or other emergency services for safety or emergency reasons.

16. Lighting

When detailed design is available and prior to the commencement of any mining, a comprehensive lighting assessment should be undertaken, in consultation with the Siding Springs Observatory, to ensure mitigation measures are developed and implemented to minimise night lighting impacts, particularly from night time train movements.

17. Biodiversity conservation

a) The Proponent must work with the OEH and DSEWPC to resolve the issues that have been raised by the agencies.
b) Additional offsets, for the impact on *Tylophora linearis*, should be identified prior to the commencement of mining in area B, or mining in this pit should be set back to avoid the population identified and provide a sufficient buffer zone.
c) Early results from adaptive management of possible offset lands should inform finalisation of the overall offset strategy in order to protect or enhance biodiversity values while minimising impacts on the agricultural and pastoral activities which are so significant for the local community and economy.
d) The biodiversity conservation value of regenerated areas proposed as offsets must be demonstrated to the satisfaction of the Director-General prior to clearing and mining operations proceeding beyond year 8 of the mine plan.

18. Rehabilitation of Mining Areas

In formulating and implementing the Integrated Land Management Plan, the Commission recommends that detailed consideration be given to the specialist advice received by the Commission, relating to the rehabilitation of the areas disturbed by mining.

19. Water Management

A water management plan, that satisfactorily addresses the issues raised in Dr Perrens' review report (and the submission by the NSW Office of Water), will need to be provided prior to the commencement of any works on site, applying the following principles:

a) Tailings should be treated mechanically in order to minimise water requirements for the project unless the Proponent can demonstrate that an alternative would satisfy best practice standards;
b) Mine water management facilities must be designed and managed to retain runoff from pits and all active mine areas;
c) Facilities must be in place to transfer water from sediment dams to the mine water dams, in the event that the water does not comply with the discharge criteria.

20. Employment and Training

Opportunities and provision for training and employment for Aboriginal people in the region should be developed in consultation with Warrumbungle and Wellington Shire Councils and the local TAFE colleges.

21. Voluntary Planning Agreements and Economic Stimulus through Local Infrastructure Projects

a) Warrumbungle and Wellington Shire Council's lists of infrastructure projects should be considered by the Proponent in its negotiations for the Voluntary Planning Agreements and contributions should be reasonable and equitable, reflecting the actual impact on Councils' infrastructure.
b) These infrastructure projects should also be considered by Government, to provide economic stimulus to the local economies while the future timing of the project is being considered.

22. Program of infrastructure works

A program of road and other infrastructure works and the timing for these works should be included in any final approval of the project.

23. Traffic Management Plan

The traffic management plan should include a work place travel plan for the project.

24. Requirements of the Rural Fire Service and support to the local brigade

In addition to standard bushfire management conditions and the requirements prescribed by the NSW Rural Fire Service in its submissions dated 8 November 2012 and 12 December 2012, the Proponent should be required to relocate the Dapper Brigades Shed in consultation with the NSW Rural Fire Service and provide sufficient personnel and resources to maintain the Dapper Rural Fire Service Brigade, for the life of the mine.

25. Consultation on Aboriginal Heritage Management Plan

In addition to standard conditions for the protection and management of Aboriginal cultural heritage items, registered Aboriginal parties should be consulted before the Aboriginal Heritage Management Plan is finalised.

26. Minimise, monitor and report on Greenhouse Gas Emissions

a) Appropriate conditions should be imposed to ensure best management practices for minimising greenhouse gas emissions are adopted, and mine buildings and equipment are energy efficient.
b) A greenhouse gas monitoring and reporting regime should be included in the mine management plan to review and assess mitigation measures and to identify and implement improvements, where they can be made.

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Glossary

Commission: The Commission constituted to carry of the Review, Ms Gabrielle Kibble AO, Mr Paul Forward and Mr Brian Gilligan

Director-General's Requirements: Requirements provided by the Director-General of the Department of Planning for an environmental assessment or environmental impact statement.

Department: Department of Planning and Infrastructure

EA: Environmental Assessment.

EPA: Environment Protection Authority

EP&A: Environmental Planning and Assessment.

LGA: Local Government Area.

NGO: Non-Government Organisation.

NOW: NSW Office of Water.

OEH: Office of Environment and Heritage.

PAC: Planning Assessment Commission.

PM_{10}: Particulate matter with an aerodynamic diameter smaller than 10 micrometres.

PPR: Preferred Project Report

The Proponent: The applicant under Part 3A of the EP&A Act 1979, in this report being Cobbora Holding Company Pty Ltd (CHC). 'Proponent' includes the Proponent's consultants EMGA Mitchell McLennan (EMM).

The proposal: The subject of the application under Part 3A of the EP&A Act 1979, in this report being the Cobbora Coal Mine proposed by the Cobbora Holding Company.

Riparian Zone: The area of land adjacent to a river or stream. It includes the riverbanks and land immediately adjacent to riverbanks.

TSC: Threatened Species Conservation.

TSP: Total suspended particulate matter

VPA: Voluntary Planning Agreement

1. Introduction and Terms of Reference

On 23 October 2012 the Minister for Planning and Infrastructure, the Honourable Brad Hazzard MP issued the following direction to the Chairman of the Planning Assessment Commission (PAC):

The Minister for Planning and Infrastructure requests the Planning Assessment Commission to:

1. Carry out a review of the Cobbora Coal Project; and
    a) consider the Environmental Assessment of the project, all issues raised in submissions on the project, and any further information provided during the course of the review;
    b) assess the merits of the project as a whole, paying particular attention to the:
        - proposed mine plan and final landform, and in particular the proposal to operate three open cut pits concurrently, the management of tailings and waste rock and the design of the final voids;
        - health and amenity impacts (noise, blasting, air quality and visual) of the project on the surrounding population;
        - biodiversity impacts of the project;
        - water impacts of the project; and
        - social and economic impacts of the project;
    c) recommend appropriate measures to avoid, minimize and/or offset these impacts.
2. Conduct public hearings during the review.

A copy of the Minister's direction to the PAC is provided in Appendix 1 of this report.

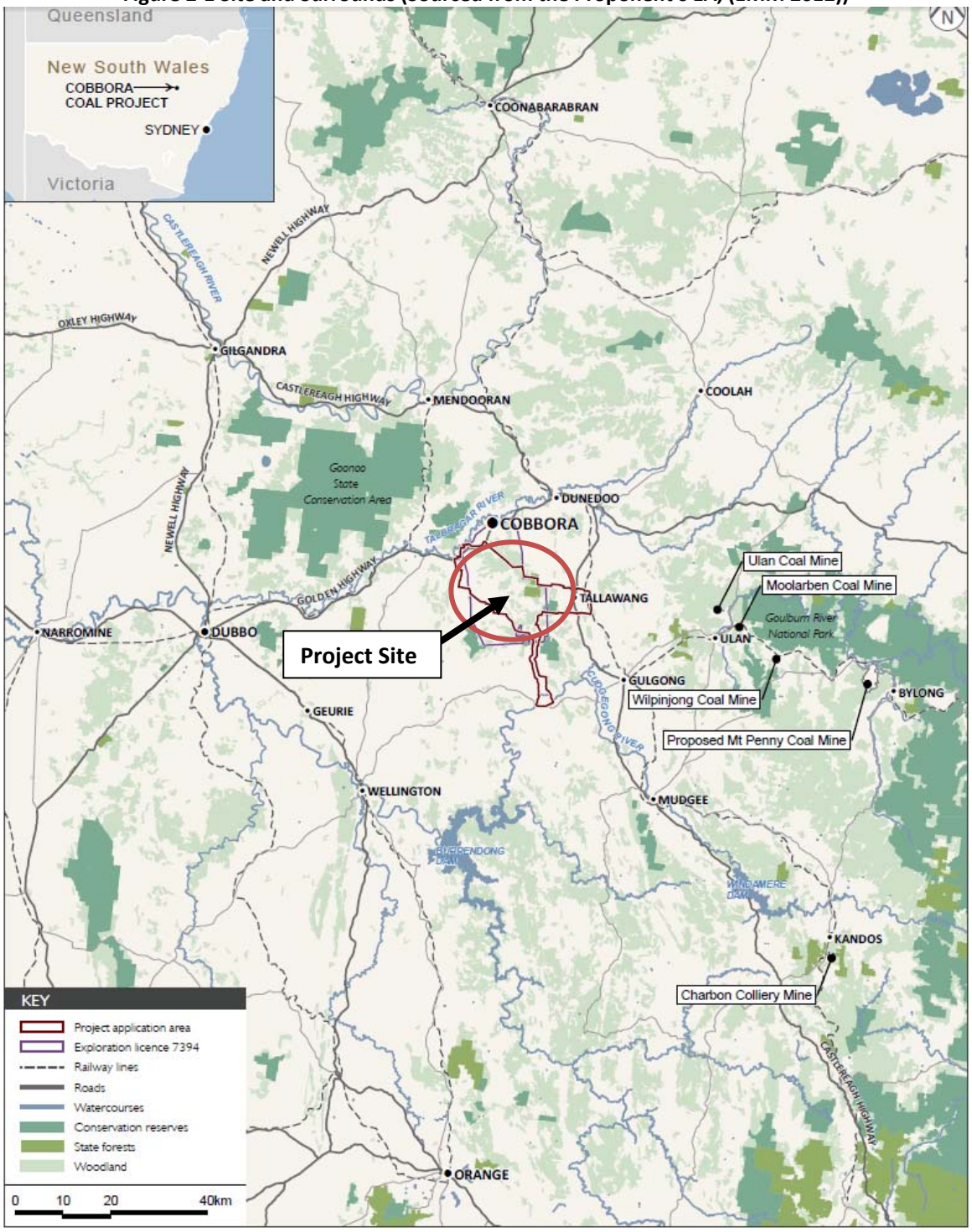
Ms Gabrielle Kibble AO, Chairman of the PAC appointed Mr Paul Forward and Mr Brian Gilligan to the Commission for the project. Ms Kibble chaired the Commission for the project.

Emeritus Professor Jim Galvin, Dr Steve Perrens and Dr Mark Burns were engaged as consultants to provide advice on the merits of the mine plan, the water issues and the rehabilitation options respectively.

2. Project Description

Cobbora Holding Company (the Proponent) proposes to develop an open cut coal mine near Dunedoo. The proposal covers a 274 km^2 area south of Cobbora, northwest of Gulgong and 60 km east of Dubbo. It is mainly within the Warrumbungle local government area, with supporting infrastructure such as pipelines, rail spurs and road diversions extending into the local government areas of Mid-Western Region and Wellington.

Figure 2-1 Site and Surrounds (Sourced from the Proponent's EA, (EMM 2012))



The mine would extract coal from the Flyblowers Creek Seam, the Ulan Upper Seam and the Ulan Lower Seam to supply coal to power stations located on the east coast of New South Wales. It is expected to extract up to 20 million tonnes of Run of Mine (ROM) coal a year over 21 years (391 Mt in total). Current measures indicate that the resource available is over 700 million tonnes of coal. Consequently it may be possible to continue mining after the 21 year life of this proposal. The Proponent has indicated it is only seeking a 21 year project approval. If an extension was deemed viable in the future, it would have to be the subject of a future application. The Commission has considered the project based on the current plan to cease mining, and rehabilitate the site, in year 21.

A coal handling and preparation plant would receive the ROM Coal for crushing and washing, to produce up to 12 million tonnes of product coal a year (and up to 8 tonnes of reject material). Course reject material is expected to account for approximately 70% of the reject while tailings would account for the remaining 30% (by dry weight) (EMM 2012). Course reject would be buried with the other waste rock (overburden and interburden). Tailings would be thickened and then pumped to one of the three tailings emplacement areas for dewatering and consolidation through seepage and evaporation.

The Proponent proposes to mine three pits simultaneously, in order to blend coal of different ash levels to meet the specifications of the power stations. Consequently three pits and three waste rock emplacement areas would be active throughout the 20 years of active mining. Progressive rehabilitation is proposed as mining proceeds. The site would be rehabilitated in year 21 leaving one final void at the south western end of pit B, including an 82 m highwall (EMM 2012), although the pit void lake would form at the bottom of this wall. The final surface water level in the void would be approximately 48 m from the top of the highwall(EMM 2012). Highwalls would also be left at the completion of mining both pit A and C, leaving a 28 m highwall along the northern edge of pit A and 30 m around the north eastern corner of pit C (EMM 2012).

Supporting Infrastructure

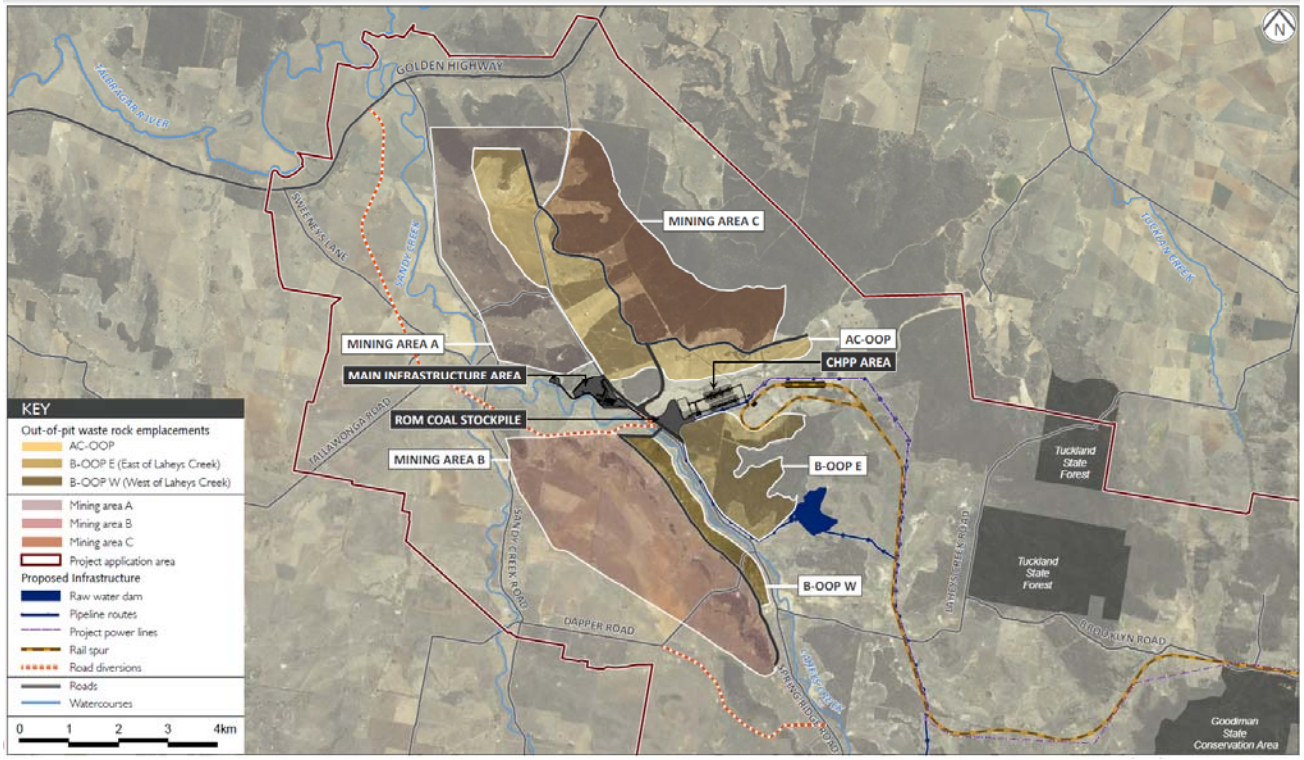
The project also includes a 28 km rail spur and loop, connecting to the main rail line at Tallawang. A locomotive provisioning facility would also be constructed with the rail spur.

A 26 km long pipeline to the Cudgegong River would be constructed to supply up to 3,310 ML of water a year, under the projects high security water access license.

Spring Ridge Road would be diverted around the site and would be used for most vehicle traffic.

A raw water dam, sediment dams, two infrastructure areas, a ROM coal, bypass coal and product coal stockpile and a topsoil stockpile would also be constructed on the site.

Figure 2-2 Project Layout, as originally proposed (Sourced from the Proponent's EA, (EMM 2012))



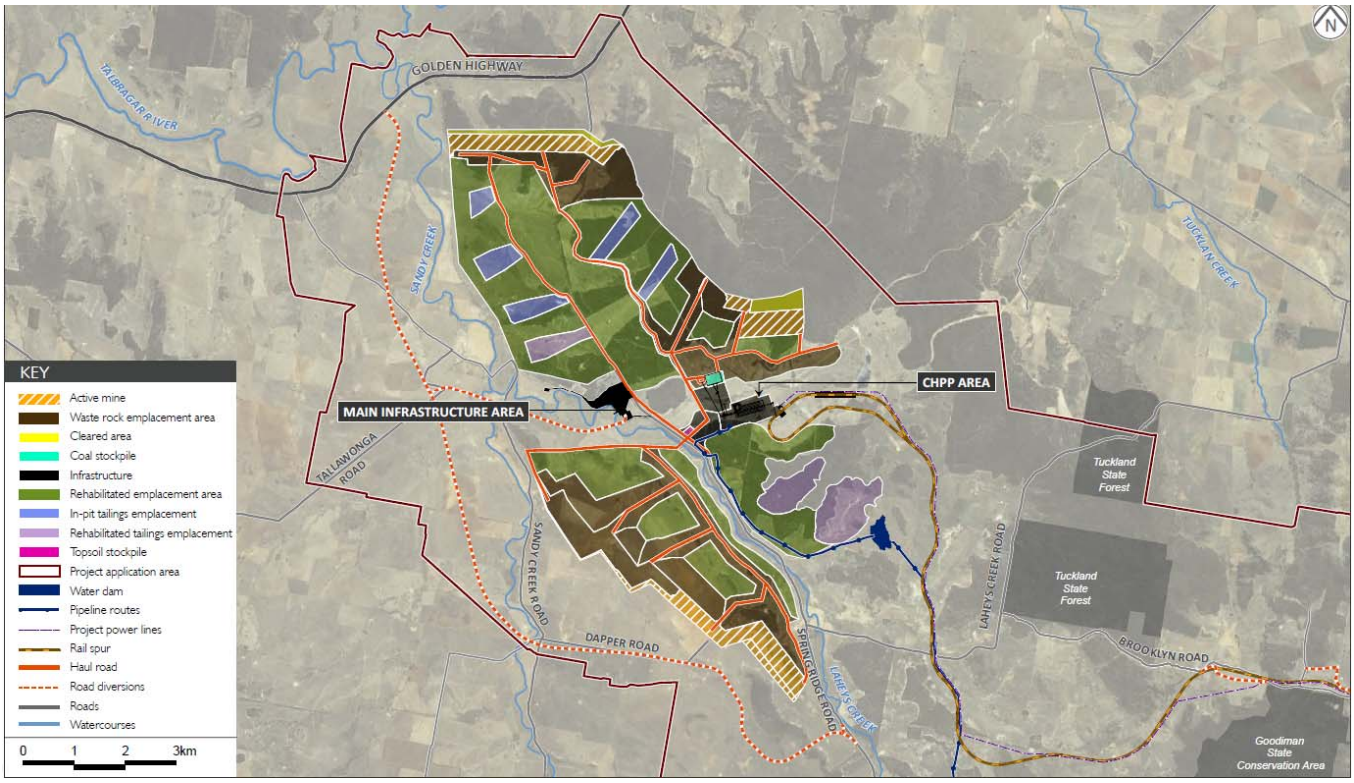
Project Modifications

In response to submissions made to the Environmental Assessment, the Preferred Project Report proposes to modify the project to address the issues raised in public submissions. The modifications include:

- Project disturbance area will increase from 4,300 ha to 4,540 ha with the mining areas increased from 3,950 ha to 4,130 ha. The increase is to allow for variations to the final alignment and siting of mine buildings and infrastructures.
- Only two out-of-pit tailings emplacements about 3 km south-east of the mining area and six smaller in-pit emplacements in mining areas A and C instead of the original proposal of one out-of-pit in , 2 km north of the main infrastructure area and two in-pit emplacement areas in the base of mining area A. The design of the emplacements remains unchanged (valley-type for the out-of-pit and impoundment-type for the in-pit emplacements).
- The mine footprint has expanded by about 180ha largely as a result of the out-of-pit east tailings employment and the rearranged mining area B.
- The final landform has been changed in terms of the proportion of land for different types of land use. For example, grazing land has been increased from 15% to about 40%, cropping land has been reduced from 25% to 10%. Similarly woodland has been reduced from 56% to 46%.
- The mine water balance has been refined. The raw water dam will be relocated to the east of the B-OOP E waste rock emplacement to allow for the construction of the out-of-pit tailings emplacement east. The dam capacity will be reduced from 1.5 GL to 1.0 GL with a corresponding reduction in water surface area from 30 ha to 17 ha. This will reduce evaporation loss.
- The Woolandra West Dam will be retained as a construction water supply. When construction is complete, it will be drained and a bypass installed to drain water from Blackheath Creek upstream to Laheys Creek.

- Water pipeline route has been refined to provide a greater buffer of 40 to 400 m to the western boundary of Yarrobil National Park and to avoid further fragmentation of vegetation.
- The B-OOP E waste rock emplacement footprint and height have been modified for the development of the out-of-pit tailings emplacement. The maximum height of the waste rock emplacement will increase from 430 m to 450 m (AHD) and an additional area of 18 ha to the south east of the emplacement.
- The rail spur alignment has been refined to reduce cuttings depth and embankment heights, and the construction of a new bridge over Brooklyn Road.
- The CHPP layout has been modified to provide a more efficient working arrangement and include additional buildings, such as workshop, maintenance yard, offices, laboratory and stores.
- A permanent realignment of the Castlereagh Highway at the location of the rail spur underpass near Tallawang will be constructed instead of a temporary roadwork speed restrictions for six months during construction of the rail spur.
- A permanent relocation of the Spring Ridge Road further to the west of the mine site instead of diversions of Spring Ridge Road and Dapper Road.
- Mine access road will be 400 m further north at the intersection of Tallawonga Road from the relocated Spring Ridge Road.

Figure 2-3 Amended Layout (mine year 20) (Sourced from the Preferred Project Report (EMM, 2013)



3. Commission Activities

3.1. Public Hearing and Submissions

In accordance with the Commission's terms of reference, a public hearing was held on the 11 December 2012 at the Jubilee Hall in Dunedoo. A total of 24 verbal submissions were made at the hearing, comprising the four local councils (Warrumbungle Shire Council, Mid-Western Regional Council, Wellington Shire Council and Dubbo City Council), eight special interest groups and 12 individuals. All persons seeking to be heard were heard. A list of speakers and a summary of the issues raised at the Hearing are at Appendices 2 and 3. Five written submissions were also made to the Commission.

Two hundred and thirty two submissions were made to the Department of Planning and were made available to the Commission, on the Department's website.

In response to public submissions, the Proponent lodged its Response to Submissions and Preferred Project Report (PPR) in early February 2013. The Preferred Project Report was made publicly available on the Department's website for submissions between 13 February and 8 March 2013. The submissions made to the Department where forwarded to the Commission for consideration. A summary of these submissions is at Appendix 4.

3.2. Documents, Meetings & Site Inspections

Through the course of the review the Commission accessed a range of documents including:

- The Proponent's Environmental Assessment;
- Submissions from councils, government agencies and the public;
- The Proponent's Preferred Project Report and Response to Submissions; and
- The further submissions from councils, government agencies and the public on the Preferred Project Report and Response to Submissions.

During the review, the Commission received a briefing from the Department of Planning and Infrastructure (20 November 2012) and a briefing from the Proponent during the site visit (10 December 2012). The Commission also met separately with representatives of Warrumbungle Shire Council on 27 February 2013, and Mid-Western Regional Council, Wellington Shire Council and Dubbo City Council (1 March 2013). The Commission also held meetings with NSW Treasury representatives on 19 December 2012, and also on 7 March 2013.

The Commission visited the site on 10 December 2012. The site inspection included a viewing of the proposed mine site, rail spur and water pipeline routes by helicopter, accompanied by the Proponent. Members of the Commission are also familiar with, and/or visited Gulgong to observe the location of the rail line during the course of the review.

3.2.1. Meeting with Warrumbungle Council

In its meeting with the Commission Warrumbungle Shire Council noted that locally the proposed mine had generally been seen in a positive light. Nonetheless the Council noted that the Proponent has purchased a large portion of the land around the mine site and that this was having a number of detrimental effects. In particular the Council indicated that 60 families have now left the area as they have sold their properties to the Proponent. This displacement of families is having an impact on local businesses in Dunedoo and also social impacts on the community.

Council also indicated that the Proponent's piecemeal approach to leasing the land was having negative impacts on the agricultural productivity of the land. The short term leasing back of properties at rents below market value provided no incentives for responsible land management practices or investment in the area. Council indicated there is already evidence of degradation of assets on properties around the mine, even suggesting that some houses may no longer be habitable. Council also expressed a preference for maintaining people on the land, except were health and safety might be compromised due to the impacts of mining. During the site visit the Commission observed extensive soil erosion on the site, further degrading the agricultural potential use of the land.

The Council noted that the Treasurer had told it that the mine was unlikely to proceed immediately and that commencement would likely be delayed for around five years. The issue of managing the land and the impacts on Dunedoo in this interim period is a key concern for Warrumbungle Shire Council. Council requested that it be consulted in the preparation of land management plans for the area.

Council also indicated that the local community was concerned about the mine's potential impacts on local water resources, particularly in the event the proposed extraction from the Cudgegong River does not eventuate. Council noted that the proposal to use excess water from the Ulan West Mine was preferable.

Other concerns raised by Warrumbungle Shire Council included rail impacts in the event that empty trains were diverted via Werris Creek, which would potentially be sought to avoid congestion around Ulan. Dust monitoring was also requested and concern was raised that while the Environmental Assessment suggested that the prevailing winds are predominantly easterlies; dust storms come from the south west.

Council also expressed concern about the Proponent's proposed Voluntary Planning Agreement. Council indicated that providing equal contributions to each of the four councils in the region was not fair as Warrumbungle would sustain, and already has sustained the majority of the impacts from the mine. Warrumbungle also noted that a per capita amount also left it at a disadvantage, as the cost of accommodating extra housing and people in larger towns would be less than those in small towns such as Dunedoo. Council also noted that the project would have impacts on Dunedoo regardless of whether the staff resided in Dunedoo. As well as socio-economic impacts, it would include impacts on health services (with increased pressure on the limited number of doctors and paramedics in town) and amenity.

Council indicated that it wants to ensure the benefits of the mine and the associated employment for the region do not come at a cost to the local community and that it is seeking to ensure that overall there is long term net benefit for the local community, if the project was to proceed.

3.2.2. Meetings with Dubbo City Council, Mid-Western Regional Council and Wellington Council

The Commission met the Councils separately on 1 March 2013 at the Dubbo City Council conference room. All three Councils advised the Commission that they are supportive of the proposed mine in terms of the economic benefits that the mine will bring to the region. At the meeting, each Council focused on only a few issues for discussion. They referred the Commission to their submissions to the Department which provided a more comprehensive explanation of the issues that are of concern to the individual Councils.

Mid Western Regional Council

Council raised a number of issues of concern in its submission to the Environmental Assessment. Discussion at the meeting focused on the issue of water. Council advised that it has engaged an independent consultant to review the water assessment and expected the review would be available as part of its submission on the Preferred Project Report.

Council's concern in relation to water includes:

- Uncertainty in the water balance modelling resulting in uncertainty about the level of impacts and potential underestimation of level of risk during extreme weather events;
- Threat to water supply to Mudgee;
- Uncertainty about the amount of water to be extracted and the cumulative impact of other mines in the region;
- Inconsistent information provided in the Environmental Assessment, Preferred Project Report and media releases;
- The acquisition of high security water licences from other areas for use in this mine area with implications for local water supply and other water users in the area.

Council's other concerns as detailed in its submission to the Department include:

- the cumulative impacts on the local economy, particularly after the mine closure in 20 years time where there will be no agricultural industry left to support the local economy.
- Council requires all roads affected by the project to be upgraded to Austroads standards. All road works should be undertaken by Council as the roads will become part of Council's infrastructure network.
- Council still questioned aspects of the car pooling scheme, estimate of traffic routes and volumes, contribution towards road maintenance, and road improvement and upgrading works.
- Council continues its negotiation with the Proponent with a view to reach agreement for a VPA to address Council's concerns.
- clear noise and vibration criteria and requirements should be imposed to make it easier for properties affected by unacceptable noise and vibration to be acquired.
- TheEA was considered to have failed to truly identify the potential impacts on the Mid-Western Region and therefore Council would be disadvantaged in VPA negotiations. Council considers the PPR approach based on actual population growth and distribution is more reasonable. Council considers in addition to contribution per head, a contribution to the on-going maintenance of Spring Ridge Road should also be included in the VPA.

Dubbo City Council

Council expressed its support of the proposed mine and considers the City is open to benefit from the construction and operation of the mine. The key issue for Council is the unplanned impacts of the mine on the City in terms of demand on housing, social services and other infrastructure, particularly health, education and training services. Council questioned the accuracy of the Social Impact Study (SIS) as the report appeared to be based on out-of-date data, arguing that the SIS should be updated to reflect more recent census information. Council questioned the reasonableness of the VPA offer as it is based on the questionable SIS. Council also believes the VPA should not dictate where any contribution to Council should be spent.

Council also advised that the City depends on a strong and healthy region, hence the impact on Dunedoo is a concern to the City. The City needs a decision and commitment on the mine to enable the local economy to move ahead.

If the mine is not to proceed immediately following approval, a short-medium term land management plan should be prepared and implemented. A reference group with appropriate expert assistance should be established to prepare the plan and oversee its implementation. This will assist in generating some interim economic activities in Dunedoo and the region.

Other issues raised in Council's submission on the EA include:

- Questions on the estimated daily traffic volumes on the highway and impacts of traffic on major intersections as well as methodology for the car-pooling estimate;
- Dubbo City Council should be nominated as the "alternate water supplier" in the potable water supply licence.
- If a Dubbo-based waste services contractor is to be used, it is likely that waste will be disposed of at the Whylandra Waste Depot, which will not accept any hazardous, liquid or toxic wastes that are generated from the mine site.
- The Proponent should engage with the Local Emergency Management Committees of the respective local government areas in managing the risks arising from its activities.
- The adequacy of the bushfire assessment was questioned as there is insufficient information to ascertain how each APZ has been calculated, and how combustible and hazardous materials have been taken into consideration to minimise bushfire threat. Council recommends that the RFS be consulted to ensure best practice procedures are in place and the site is adequately prepared for a potential bushfire.

Council also provided comment on issues in relation to the preliminary hazard assessment, workforce accommodation study, temporary workers camp, access to health and community services and environmental assessment commitments.

<u>Wellington Council</u>

There are 3 key issues of concern to Council, namely, employment and training opportunity, infrastructure and the draft voluntary planning agreement.

Council has sought assurance that its community will not be disadvantaged in the provision of appropriate infrastructure and facilities and there will be adequate compensation for the impacts from the mine. Employment is a big issue in the area. Council is generally very supportive of employment generating industries. However, it is a concern to Council that without adequate and proper training, employment opportunity for local people will be very limited.

Although only a small part of the mine is located within the Wellington local government area, the project will generate a significant increase in traffic volume on Cobbora Road. Council considers that all the local roads impacted by the mine should be upgraded. The Proponent should be required to meet the cost of upgrade, repair and on-going maintenance and argues that the terms and conditions of any road infrastructure works should be agreed between the Council and the Proponent before any approval is issued.

The preliminary draft VPA received by Council is considered by Council to be unsatisfactory. Council asserts it sought a fair and equitable financial contribution from the Proponent that reflects the impacts of the proposal on the local infrastructure and services and the community. It is also Council's view that the VPA should be tied to the land and signed-off before any approval is issued.

Council also believes that the proposed 10 weeks short course training program is tokenistic, unsatisfactory and will provide no guarantee of employment after training. The area has a high unemployment rate and every effort should be made to provide long term employment

opportunities to benefit local people. The Proponent should provide a better training program with real employment potential for the local individual candidates.

Other issues raised in Council's submission to the EA include:

- housing;
- environmental impacts on family farms and homes adjacent to the mine; and
- water impacts include adequacy of the mine water modelling, groundwater impacts, surface water impacts and impacts on downstream users.

4. Consideration of issues

The Ministerial terms of reference require the Commission to assess the merits of the project as a whole, paying particular attention to the following issues:

- Mine plan and final landform;
- Health and amenity impacts including noise, blasting, air quality and visual;
- Biodiversity impacts;
- Water impacts;
- Social and economic impacts; and
- Issues raised in submissions.

These issues are considered in the following sections of this report.

Section 5 deals with mine plan and final landform. Section 6 considers health and amenity impacts including air quality, blasting, noise, visual impact and night lighting. Section 7 focuses on biodiversity impacts. Section 8 discusses issues relating to water. Section 9 canvasses the potential social and economic impacts. Section 10 considers the key issues raised in submissions, including traffic and transport, bushfire, Aboriginal cultural heritage and greenhouse gas emissions.

5. Mine Plan and Final Landform

The Terms of Reference for this review require the Commission to pay particular attention to the proposed mine plan and final landform resulting from the project. The Commission engaged Emeritus Professor Jim Galvin to provide expert advice on this issue.

Expert advice

E/Prof Galvin requested additional information from the Proponent, on the background studies that had informed the mine plan. These were subsequently provided by the Proponent and have informed E/Prof Galvin's advice on the project, which is attached in Appendix 5.

The advice identifies areas where some flexibility may exist and this has helped inform the Commission's findings on several aspects of the project. It is also noted that the Proponent has sought approval to produce 12 million tonnes of coal a year, but that the existing coal supply agreements only require 9.5 million tonnes of coal a year, for domestic power station consumption.

E/Galvin noted the relatively poor quality of the coal resource and the associated requirements for washing, with the generation of up to 8 million tonnes of reject material per year.

Generally E/Prof Galvin found that "*The overall mine plan, including tailings disposal and establishment of a final void, is consistent with established open cut mining operations in these circumstances.*"

In considering the additional information provided by the Proponent, E/Prof Galvin noted that:

- there are considerable coal resources and reserves outside of the areas submitted for approval; and
- a risk assessment of the estimates of resources and reserves has identified a risk that the mining areas sought, may not be approved, or may be truncated. The mitigation and control

for this risk included options to justify the areas at a later date, or seek approval extensions elsewhere to offset the areas lost.

E/Prof Galvin also noted that the documents claim to have applied a degree of conservatism, to cover any future changes to the mining operations, without needing to modify consent conditions.

These points all suggest to the Commission that a significant level of flexibility has been factored in to the mine plan.

The Minister for Planning and Infrastructure also requested the Commission to particularly consider "*the proposal to operate three open cut pits concurrently, the management of tailings and waste rock and the design of the final voids"*.

E/Prof Galvin has provided some general advice on these issues from a mine engineering perspective and gave particular consideration to the number of pits proposed. In this regard the advice cautions against restricting mining to one pit, noting the need for blending, as well as business risks. A two pit operation was not ruled out by E/Prof Galvin, although he noted that this may be uneconomic.

In concluding, E/Prof Galvin noted that the advantages and disadvantages of two pits versus three would need to be considered from a range of perspectives in order to come to a final decision on this issue. E/Prof Galvin also noted that the level of disturbance under each scenario may be a relevant consideration, as well as consideration of whether there are advantages in having a less concentrated impact.

E/Prof Galvin did not make any definitive recommendation regarding the number of pits that should be allowed, nor of the suitability of the tailings and waste rock emplacement areas proposed. Nonetheless, the Commission found E/Prof Galvin's advice particularly useful as it suggests that some flexibility has been factored in to the mine planning to date and that the Commission may be able to recommend some adjustments to the mine plan, as a result of its consideration of other issues.

As a result, detailed consideration of the proposal to operate three open cut pits concurrently and the management of tailings and waste rock have been factored into the Commission's consideration of each of the other issues associated with the mine. Recommendations regarding the locations of mining areas, and tailings and waste rock emplacement areas, are made in section 7, in response to consideration of the biodiversity impacts of the project. The final landform was also considered in relation to the rehabilitation of the mine site in that section.

In considering the final landform and the design of the final voids in particular, the Commission notes that in some cases it is possible to design the mine plan to avoid the creation of a final pit void lake, and that this option should be pursued wherever possible. Nonetheless the Commission acknowledges that the location of the coal resource in relation to site's topography can significantly influence the mine's ability to avoid the creation of a final void. While the Commission has not explored these options in detail, the Commission recommends that any final void should be minimised and be addressed in the revised mine plan.

Management of tailings and the water impacts of the final void are considered in the Commission's consideration of the water impacts of the projects (see section 8).
The mine plan may need to be reviewed and revised to address the recommendations in following sections of this report.

6. Health and Amenity Impacts

6.1. Air Quality

6.1.1. Dust

Open cut mining by its nature involves numerous dust generating activities and has the potential to generate considerable particulate air pollution. The impact of dust on the environment is generally assessed by two broad parameters:

- suspended particle concentrations, expressed as total suspended particulates (TSP) or particulate matter smaller than 10 micrometres (PM_{10}) or smaller than 2.5 micrometres ($PM_{2.5}$); and
- deposited particulate matter or 'dust fall', expressed as a deposition rate in terms of grams per square metre per month (g/m^2/month).

Current Goals and Standards

The particulate matter standards that apply in NSW are set out in Table 6-1.

Table 6-1 Particulate Matter Emissions Criteria

Pollutant	Standard or Goal	
	24 hour period	Annual mean
Total suspended particulate matter (TSP)		90 $\mu g/m^3$ [b]
PM_{10}	50 $\mu g/m^3$ [a b]	30 $\mu g/m^3$ [b]
$PM_{2.5}$	25 $\mu g/m^3$ [c]	8 $\mu g/m^3$ [c]

Notes:
a National Environmental Protection Council (NEPC) standard (exceedences allowable - 5 days a year)
b NSW EPA impact assessment criteria
c National Environmental Protection Council (NEPC) advisory reporting standard

These standards are derived from two sources:

- the National Environment Protection Council (NEPC), which sets national air quality standards for environmental pollutants; and
- the NSW Environment Protection Authority which also specifies other relevant air quality assessment criteria.

The Commission notes that the annual average PM_{10} level prescribed in these documents (30 $\mu g/m^3$) is higher than the World Health Organisation goal - of 20 $\mu g/m^3$ (World Health Organisation 2005). In adopting the guidelines in 2005 the World Health Organisation indicated that the 20 $\mu g/m^3$ level reduced the mortality risk by 3% relative to the 30 $\mu g/m^3$ criteria adopted in Australia.

At the time of writing, regulation of $PM_{2.5}$ levels only exist as an advisory reporting standard, yet to be formally adopted at either a state or national level. Nonetheless, the 24 hour advisory level of 25 $\mu g/m^3$ is consistent with World Health Organisation guidelines (World Health Organisation, 2005) and the Commission considers that the project should be considered and monitored against this $PM_{2.5}$ goal.

Dust deposition rates must also be assessed under the EPA air quality assessment criteria and are specified in Table 6-2, below.

Table 6-2 Deposited dust criteria

Pollutant	Maximum increase in deposited dust levels	Maximum total deposited dust level
Deposited dust	2 g/m^2/month	4 g/m^2/month

Predicted impacts

Estimated dust emissions have been calculated by the Proponent's consultants (EMM 2012) at seven different stages of the mine's operations. These estimates are for years, 1, 2, 4, 8, 12, 16 and 20.

The modelling found that various air quality criteria would be exceeded at a number of residential receivers, as a result of the proposed mining. While the mine has already purchased a number of the surrounding properties, dust emissions from the mine are also predicted to extend beyond the mine owned properties. The mine would cause the air quality criteria to be exceeded at a number of privately owned residences, mainly to the west of the mine site.

These privately owned properties predicted (EMM 2012) to be impacted by dust levels above the applicable criteria are identified as:

- Residence 1222 – yr 4, 8, 12, 16, 20
- Residence 1223 – year 2, 8, 12, 16, 20
- Residence 1230 – year 20
- Residence 1232 – year 20
- Residence 3224 – year 2, 4, 8, 12, 16, 20
- Residence 5025 – year 8, 20.

No exceedances of the criteria were predicted for year one. As shown in Table 6-3 exceedances were predicted for all other years at residences 1223 and 3224, and from year 4 onwards for residence 1222 (EMM, 2012). Dust levels at residences to the north west of the mine, would be exceeded later in the mines life – as mining in the north western pit progresses northward.

All exceedances were as a result of background levels combined with dust emissions from the project.

Table 6-3 Maximum predicted particulate matter levels

Criteria / Residence	1222*	1223*	1230	1232*	3224	5024	5025*
Year 2							
Maximum PM_{10} 24 hour - 50 µg/m^3	49.5	**50.6**	40.7	40.9	**52.2**	45.8	47
Number of days exceeded	~1	1	0	0	1	0	0
Year 4							
Maximum PM_{10} 24 hour - 50 µg/m^3	**50.2**	49.6	41.3	43	**53.3**	45.6	48.3
Number of days exceeded	1	~1	0	0	1	0	0
Year 8							
Maximum PM_{10} 24 hour - 50 µg/m^3	**55**	**55.1**	41.7	42.2	**57.6**	48.3	**52.4**
Number of days exceeded	1	1	0	0	1	0	1
$PM_{2.5}$ Annual average - 8 µg/m^3 (*guideline*)	**8.1**	**8.1**	6.5	6.4	**8.4**	6.9	7.2
Year 12							
Maximum PM_{10} 24 hour - 50 µg/m^3	**51.5**	**50.2**	44.3	44.8	**52.8**	47.2	49
Number of days exceeded	1	1	0	0	2	0	~1
$PM_{2.5}$ Annual average - 8 µg/m^3 (*guideline*)	**8.4**	**8.4**	7.2	7.1	**8.5**	7.2	7.3
Year 16							
Maximum PM_{10} 24 hour - 50 µg/m^3	**51.1**	**50.9**	49.8	48.8	**52.9**	44.1	47.5

Criteria Residence	1222*	1223*	1230	1232*	3224	5024	5025*
Number of days exceeded	1	1	~1	0	1	0	0
$PM_{2.5}$ Annual average - 8 µg/m^3 (*guideline*)	**8.7**	**8.6**	7.2	7	**8.7**	7.3	7.5
Year 20							
Maximum PM_{10} 24 hour - 50 µg/m^3	**58.7**	**59.1**	**53.1**	**56.9**	**62.2**	47.9	**53.5**
Number of days exceeded	1	1	1	1	1	0	1
Maximum $PM_{2.5}$ 24 hour - 25 µg/m^3 (*guideline*)	**25.6**	**26.2**	23	**25**	**28.4**	21.1	24
$PM_{2.5}$ Annual average - 8 µg/m^3 (*guideline*)	**8.3**	**8.3**	7.9	7.7	**8.8**	7.1	7.5

*Proponent has indicated it has an agreement with the property owner (EMM 2013) Source: EMM 2012

Six of the properties in Table 6-3 are predicted to be impacted by air quality impacts in exceedance of the criteria. The landholders of these properties will need to be provided with acquisition rights, as well as the option to have mitigation such as air conditioning and first flush devices installed. The Commission recommends providing both options as decisions about whether to sell a home are not always straight forward and in some cases the landholder chooses not to take the acquisition option. In these cases the landholders should be provided with mitigation, to minimise the impacts as far as possible.

Property 5024 is also listed in Table 6-3 because it is predicted to receive dust levels only marginally below the 24 hour PM_{10} criteria. It could be argued that this property should also be acquired by the mine, as it would seem possible the criteria could also be exceeded at this property. However, the Proponent has indicated that the modelling is conservative because it has not accounted for the implementation of a reactive/predictive air quality control system (EMM, 2012). The Commission agrees that a carefully managed predictive and reactive real time air quality management system will be required. The Commission is satisfied that with the implementation of this air quality control system it should be possible to prevent dust levels from exceeding the air quality criteria at property 5024 under the current mine plan. Nonetheless, real time monitoring at this location will be essential to the mine's predictive and reactive management system.

No exceedance of the annual average PM_{10} criteria (30 µg/m^3) was predicted at any privately owned residence and exceedance of the equivalent WHO goal (20 µg/m^3 (WHO 2005)) is only predicted in combination with other exceedances at privately owned properties (EMM 2012).

The Proponent has already purchased a number of properties in and around the mine site. Exceedances were predicted at 28 of these properties owned by the Proponent (EMM, 2012). Some of the houses owned by the mine would be demolished as they fall within the boundaries of the mining pits, however at least 20 of the mine owned houses, outside the pit boundaries, have been predicted to receive dust levels in excess of the criteria. The Proponent has committed that these properties will not be leased as residences if health based criteria are likely to be exceeded (EMM, 2012). Given the dust levels that have been predicted, the Commission agrees that occupation of these mine owned houses will have to be restricted. Given that the Proponent has already committed to this (EMM, 2012) the Commission recommends this is included as a condition of any consent which might be given for the project.

Assessment of air quality impacts and dust in particular is usually limited to consideration of the air quality criteria in relation to the surrounding residential receivers. The Minister's direction to the Commission also lists air quality under the health and amenity impact heading. Nonetheless, the direction also asks the Commission to consider the issues raised in submissions. In this instance a number of submissions raised concerns about the dust impacts to the Siding Springs Observatory. Submissions noted the Observatory's significance and highlighted that maintenance of clear skies is

essential to the ongoing operations of the existing telescopes and to the precinct's ability to continue to attract investment for ongoing upgrades and new infrastructure required to support Australia's leading contribution in the field of astronomy.

The Australian Astronomical Observatory raised two concerns regarding dust. The most obvious is that some of the additional dust generated by the mine will fall on the instruments at the Observatory adding to the cleaning requirements it must already undertake. The Observatory is some distance from the proposed mine site. While there may be some cost to the Observatory as a result of additional dust, the more significant concern, as raised at the public hearing, is that dust in the air scatters light, increasing the night time lighting impacts on the Observatory's skyline (also see Section 6.5 regarding night lighting).

Figure 6-1 Extract from the Australian Astronomical Observatory Submission (AAO 2012)

Figure 3. A 5-minute digital exposure from Siding Spring Observatory, showing the horizon illumination from Coonabarabran (far left), Newcastle (centre) and Sydney (right). (Bob Shobbrook)

The Commission acknowledges the Observatory's significance, both to the local community and to the national and international scientific community. The long term future of the Observatory will be significant both for the local economy and for Australia's scientific community. The Commission considers that every effort must be made to minimise and manage any impacts of the mine on the Observatory. Consequently it is essential that this mine employs world's best practice in regard to minimising dust emissions and night lighting. This includes day to day operations of the mine, but also extends to the design of the mine plan itself.

Sources of particulate emissions are discussed in the Proponent's Air Quality and Greenhouse Gas Assessment (EMM 2012). Sources of particulate emissions include mining and material handling activities (e.g. blasting, digging, the use of unsealed roads as well as dumping and crushing) but also include wind erosion from exposed areas – including overburden/waste dumps (EMM 2012).

The Proponent indicated that the most significant sources of particulate matter are:

- vehicle movements on unpaved roads;
- operating bulldozers on coal;

- loading run of mine coal; and
- wind erosion of unrehabilitated waste rock and topsoil emplacements (EMM 2013).

The Proponent nominated three management measures to control particulate matter:

- water application;
- limiting vehicle speeds to 40 km/h; and
- routine maintenance to ensure low silt content in road surface material (EMM 2013).

The Commission acknowledges these management measures will assist in reducing emission from unpaved roads. Nonetheless, the current mine plan involves operating three open cut pits concurrently as well as having three out of pit overburden waste dumps. This design leaves significant portions of the site exposed to wind erosion during mining, and during the time taken for vegetation to establish on rehabilitation areas. The Commission is concerned by the large areas that would be exposed during each stage of the project and considers that the mine plan should be revised to minimise, where practicable, the total area of dust sources exposed. The Commission has not sought to quantify the dust contribution that would arise from the area to be exposed, but expects this should be used to help to inform the refinements to the mine plan. The Mine Plan is discussed further in section 5.

In addition to optimising the design of the mine plan, operational measures will also need to be implemented to minimise the dust generated. These measures should include the establishment of early and where necessary interim cover of exposed areas, as well as best practice operational controls and dust suppression and minimisation measures, not just for roads, but for stockpiles as well. It should be expected that mining activities and truck movements will need to be restricted during periods of adverse weather conditions.

The Commission notes that it will not be possible to completely eliminate the mine's impact on the Observatory's skyline, but considers that every effort should be made to reduce the impact by best practice to be required on the mine.

Coal trains

Submissions on the project also raised concerns about dust emissions generated from the uncovered coal trains travelling between the site and the power stations.

The Proponent undertook some modelling of coal dust dispersion which showed it was unlikely to cause significant impacts beyond the rail corridor (EMM 2012). The Proponent also cites a more recent study undertaken for Australian Rail Track Corporation measuring dust generated from the rail transport of coal in the Newcastle area. The study (Environ 2012) found that loaded trains increase the concentrations of particulate matter in the rail corridor, but also that there was no statistical difference between the levels produced by loaded coal trains, when compared to other (unloaded) coal trains.

The Commission acknowledges these studies, but notes that more work will be required in order to make any conclusive findings on this issue. Any future decision by Government requiring the covering of coal wagons could presumably only be justified if the further studies demonstrated that the cost was justified by the return on investment in terms of improvement in regional or subregional air quality relative to other investments which might be made towards this objective.

In the interim, Connell Hatch (2008) found that a combination of coal surface veneering, load profiling and improved train loading and unloading techniques provided a practical and cost effective way to reduce coal dust emissions from open rail wagons. The Commission considers

requirements to implement measures to minimise rail coal dust should be included in any approval conditions.

6.1.2. Other air quality impacts

The air quality impacts of blasting are discussed in the following section (6.2). Greenhouse gas emissions would also be produced and these are discussed separately (see section 10.3). Other air emissions would be produced from diesel combustion in mobile plant on site, as well as rail locomotives. The use of best available technology will be necessary to minimise emissions from combustion engines. Optimising the mine plan may also reduce the distance vehicles would travel and thus vehicle emissions as well.

6.1.3. Conclusions and Recommendations

The project is predicted to impact on air quality on a number of properties around the mine site – particularly to the west. The project's dust emissions also have the potential to impact on the night sky, which is of critical importance to the Australian Astronomical Observatory at Siding Springs. The Commission has concluded that further work is required to optimise the mine plan and demonstrate that the exposed areas would be minimised during each stage of mining. Nonetheless the Commission is generally satisfied that with this optimisation, and the application of best practice and real time predictive and reactive management, air quality impacts can be adequately managed.

Recommendations

The Proponent should reconsider and optimise the mine plan to minimise the land area that would be exposed at each stage of mining and demonstrate how exposed areas would be minimised and managed, including the effective use of interim cover and effective and timely establishment of permanent cover.

All measures for control of air pollution should deliver air quality outcomes that are equal to or better than the air quality outcomes identified in the Environmental Assessment and that correspond to best practice and the application of best available technology. This must include:

- best practice coal loading and profiling, to minimise dust emissions from coal transportation; and
- a real time predictive and reactive air quality management system informed by a state of the art air quality monitoring network.

Where air quality criteria are predicted to be exceeded the landholder should be given the option of either:

- acquisition of the residence and associated property; or
- mitigation measures including air conditioners and first flush separation devices on rainwater tanks; or
- an agreement negotiated between the two parties.

The Proponent's commitment not to lease residences affected by air quality exceeding the criteria should be formalised in the conditions of any consent issued.

Air emission limits should be applied to the project to ensure the air emissions are equal to or better than the predictions in the Environmental Assessment.

6.2. Blasting

Regular explosive blasting would occur throughout the mining operations. The Proponent has indicated that up to 600 blast events would be carried out each year (EMM, 2012). It also states that: "*Blasting will occur during day light hours, generally between 8.00 am and 6.00 pm Monday to Saturday."* (EMM 2012, volume 1 p39). The Proponent has not identified a maximum weekly, or

daily blasting rate. Nonetheless, the Commission has calculated that if blasting were to occur Monday to Saturday throughout the year an average of 1.9 blasts a day would be needed to achieve 600 blasts. Consequently 12 blasts per week would likely be required. Blasting is generally assessed in relation to amenity and structural impacts from ground vibration and airblast overpressure. Blasting also has the potential to generate safety risks for people or infrastructure in the vicinity of the blast. Blasting can also sometimes produce emissions of nitrogen dioxide (NO_2), nitric oxide (NO) and carbon monoxide (CO) (QLD DEEDI, 2011).

6.2.1. Ground Vibration and Airblast Overpressure

Ground vibration and airblast produced by blasting falls into two categories—

a) those causing human discomfort; and
b) those with the potential for causing damage to structures, architectural elements and services. (AS 2187.2-2006)

Blast criteria for amenity and structural impacts are prescribed in the Australian Standards (AS 2187.2-2006) and in the ANZEC "Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration" (ANZEC, 1990). The relevant criteria are presented in Table 6-4 below.

Table 6-4 Blast Criteria

Blast Impact	*Amenity Criteria*	*Structural Damage Criteria*
Airblast Overpressure	115 dB for 95% of blasts in any year 120 dB for 100% of blasts	133 dB
Ground Vibration	5 mm/second for 95% of blasts in any year 10 mm/second for 100% of blasts	10 mm/sec

Sourced from:
ANZEC Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration
Australian Standard AS 2187.2-2006 Explosives – Storage and Use, Part 2: Use of Explosives.

The Australian Standard (AS 2187.2-2006) for the use of explosives specifies that:

> *The area surrounding the blast site should be inspected and assessed to determine appropriate means of minimizing environmental impacts. Regulatory limits may apply. In conducting the risk management, foreseeable factors should be considered, including, but not limited to the following:*
>
> *a) Distances to buildings, structures, and other environmental effects.*
> *NOTE: See Appendix J for guidance.*
> *b) Identification of monitoring requirements and the requirement for monitoring locations, systems and instruments.*
> *c) Ground vibration and airblast overpressure.*
> *NOTE: See Appendix J for information and guidance on the environmental effects of ground vibration and airblast overpressure.*
> *d) Effects of various weather patterns and wind directions.*
> *e) Effects of dust, fume, sediment run-off, noise.*

The ANZEC guideline also specifies that "*Blasting should generally only be permitted during the hours of 9.00 am – 5.00 pm Monday to Saturday. Blasting should not take place on Sundays or Public Holidays.*"(ANZEC, 1990 p 3). The guideline also states that "*Blasting should generally take place no more than once a day.*" (ANZEC, 1990 p 3).

The Proponent's consultants have calculated the minimum distance to a private residence at which blasting can occur, to meet the overpressure and vibration criteria, based on two maximum

instantaneous charge scenarios. At the lower charge scenario (1,500 MIC (kg)) blasting is predicted to remain within the criteria. The higher charge scenario (3,500 MIC (kg)) would cause an exceedence of the overpressure criteria at one privately owned residence (3177). The Proponent has not calculated the level of exceedence, instead indicating that the lower charge would be used when blasting occurs within 1,650 meters of a privately owned residence (EMM, 2012).

The Commission expects that with careful management, selection of blasting methods and reduction of the Maximum Instantaneous Charge, where necessary, blasting could be managed to ensure airblast overpressure levels remained below the amenity criteria of 115 dB.

In regard to the number of blasts sought, up to 600 a year (EMM, 2012), the Commission is concerned that this would exceed the guideline level of one per day (ANZEC, 1990). No justification for this number of blasts has been provided. The Commission considers that the number of blasts should be minimised and is not convinced there is justification for carrying out more than one blast a day. The Commission also had concerns with the proposed blasting times 8 am to 6 pm (EMM, 2012).The Commission considers that blasting should be restricted to the hours specified in the guideline(ANZEC, 1990), that is 9 am to 5 pm and should not be allowed on Sundays or public holidays.

6.2.2. Surface Blasting Gas Emissions and other Safety Risks

Under ideal conditions explosive reactions do not produce NO_x emissions, however conditions encountered during mine blasting are rarely ideal (QLD DEEDI, 2011). Blasting produces a sudden localised release of gases with potentially high concentrations of oxides of nitrogen (AEISG Inc, 2011). These gas emissions generally dissipate quickly resulting in air quality impacts being short lived and limited to the immediate area of the mine site. While mining is one of the top ten sources of NO_x emissions in Australia (National Pollution Inventory, 2011), the total predicted emissions from blasting are small in comparison to those from mobile plant associated with the project (EMM 2012). Nonetheless, in some circumstances blast gas emissions can take some time to disperse and, at high concentrations, have the potential to impact on human health (AEISG Inc, 2011).

There are a number of mitigation or control measures that can be implemented to minimize NO_x emissions. Both the Australian Explosives Industry and Safety Group Inc *Code of Practice – Prevention and Management of Blast Generated NO_x Gases in Surface Blasting*, as well as the *Queensland Guidance Note QGN 20 – Management of oxides of nitrogen in open cut blasting* include guidance on blast management practices. These guidelines cover a range of management areas, including blast preparation practices; exclusion and management zones; and monitoring, reporting and investigation procedures.

Blasting can also generate other more obvious safety risks for people and infrastructure that might be in close proximity to the blast area, such as flying debris.

Spring Ridge Road would be diverted around the site and would remain publicly accessible. The Proponent indicates that temporary road closures are necessary where blasts are within 500 m of a road (EMM, 2012). It appears that a section of the realigned Spring Ridge Road would be within this zone (east of Dapper Road) (EMM, 2013 Figure 3.1 page 14). In response to public submission, the Preferred Project Report proposes to relocate the Spring Ridge Road further to the west of the mine site to replace the original proposal to detour from Spring Ridge Road, Dapper Road and Brooklyn Road-Corish Lane. The Commission considers that the realignment of Spring Ridge Road should be designed to prevent the need for road closures during blasting.

6.2.3. Conclusions and Recommendations

The Commission is satisfied that with appropriate management plans and practices in place, blasting on the site can be managed within the amenity criteria for both ground vibration and airblast overpressure. The Commission is also satisfied that gas emissions and other safety risks can be minimised and managed through the adoption of appropriate operating procedures and a Blast Management Plan.

Recommendations

The Proponent should be required to reduce the number of blasts to minimise amenity impacts on the surrounding community.

The Proponent should be required to ensure that the realigned Spring Ridge Road is adequately buffered from mining activities and built to an Austroads standard. The buffer should be sufficient, so that the road is not affected by blasting activities on site (so that it is ideally able to remain open during periods of blasting on the mine site).

6.3. Noise

Open cut mining and its associated activities use many different types of moving machinery and equipment with the potential to generate significant environmental noise.

For most noise sources encountered in open cut mining, proven techniques have been developed for mitigation of noise impacts. In general noise from fixed-position machinery can be mitigated by measures, such as noise barriers, sound attenuators and silencers. The noise generation capacity of equipment used is well characterized for application in noise modelling. For moving equipment some mitigation of noise can be achieved by design of the engine exhaust systems and alarms. However, most mitigation for moving equipment relies on providing sound-absorbing barriers and optimizing vehicle movement. In the case of rail movement and loading, the design of track and rolling stock is important, as well as ensuring locomotives have low noise ratings and are appropriately operated.

Noise impacts are readily monitored by noise measurement instruments used according to established protocols and as defined in regulations and industry standards (such as the Industrial Noise Policy and Australian Standards).

Regulatory requirements

The NSW regulatory authority for environmental noise, the EPA, has established guidelines for noise assessment, the Industrial Noise Policy and the NSW Road Noise Policy. There are two objectives in environmental noise control:

- Protection of amenity noise levels suitable to specific land uses, and
- Protection against intrusive noise.

In any situation the more stringent of the requirements or goals must be met.

An assessment in accordance with the guidelines involves identification of nearby residential dwellings (and any other sensitive receptors), assessing the existing ambient noise levels, setting noise goals from the EPA guidelines, establishing noise emission levels for all equipment and operations of the project and modelling the predicted noise levels to assess compliance with the noise goals at the receptors under all weather conditions. Where compliance proves difficult, appropriate ameliorative measures must be designed to reduce the noise levels to meet the goals.

Modelling must take account of local meteorology and topography. Noise predictions are made for daytime, evening and night (including night time sleep disturbance).

6.3.1. Noise Goals

The Proponent did not provide any background noise monitoring results in its Environmental Assessment, instead adopting the lowest noise goals for all sensitive receivers, as shown in Table 6-5. The Commission would prefer that the background monitoring had been undertaken to determine the background noise levels, but acknowledges that this approach is accepted in the Industrial Noise Policy (EPA 2000). Nonetheless, in responding to the submissions made during the public exhibition the Proponent indicated that some background noise monitoring had been undertaken in 2009, and indicated that this recorded rating background levels of 32 dB(A) during the day and 28 dB(A) during the evening and night (EMM, 2013).

Table 6-5 Operational Noise Goals

	Day 7 am – 6 pm	Evening 6 pm – 10 pm	Night 10 pm – 7 am	Sleep Disturbance 10 pm – 7 am
Adopted Noise Criteria	35 L_{Aeq} 15 min	35 L_{Aeq} 15 min	35 L_{Aeq} 15 min	45 L_{A1}, 1 min

The standard road and rail traffic noise goals are shown in Table 6-6 below.

Table 6-6 Road and Rail Traffic Noise Goals

	Road Traffic Noise Goals (DECCW 2011)		Rail Noise Assessment Trigger Levels*	
	Day 7 am – 10 pm	Night 10 pm – 7 am	All times	
Adopted Noise Criteria	55 L_{Aeq} 1 hour	50 L_{Aeq} 1 hour	60 L_{Aeq} 24hour	85 L_{Amax}

Note: Rail Noise Assessment Trigger Levels are not currently covered by any published guideline or policy, but are sourced from the EPA website http://www.environment.nsw.gov.au/noise/railnoise.htm Accessed 20 February 2013.

6.3.2. Predicted Impacts

A number of nearby properties, including residences, would experience noise impacts from the mine during both construction and operations and also from traffic and rail movements.

Operations

The Proponent's modelling, provided in both the environmental assessment (EMM 2012) and partly revised in the preferred project report (EMM 2013) indicates that, over the life of the mine, up to 11 residential receivers are predicted to be impacted by noise levels over the 35 dB(A) noise goal (see Table 6-7). Four residential properties near the proposed rail spur would be heavily affected, with noise levels in excess of 40 dBA during the evening or night and the Proponent has nominated these residences as likely to be within the acquisition zone (EMM 2012 and EMM 2013).

Table 6-7 Highest average predicted noise impact at nearby residences

House #	Maximum Predicted Noise Level (dBA) $LA_{eq(15\ min)}$	Years exceedences (levels above 35 dB(A)) are predicted	Revised prediction based on realigned rail spur $LA_{eq(15\ min)}$
	Sourced from Environmental Assessment		*Sourced from Preferred Project Report*
1178	**36**	Year 20	Not provided
1198	<35	Year 20	**35.3**
1199	<35	Year 20	**35.1**
3021	**39**	All years modelled	**39**
3022	**39**	All years modelled	**39**
3024	**38**	All years modelled	**38**
3035	**37**	All years modelled	**37**
3041*	**36**	All years modelled	30
3043*	**39**	All years modelled	35
3057*	**44**	All years modelled	Not provided
3062	<35	All years modelled	**45**
3108	**48**	All years modelled	**53**
5001	**44**	All years modelled	**45**
5023*	**38**	All years modelled	Not provided

* Proponent has indicated it has an agreement with property owner Source: EMM, 2012 and EMM, 2013

Possible sleep disturbance impacts could occur at up to ten residential properties (see Table 6-8).

Table 6-8 Maximum predicted noise level (sleep disturbance), criterion = 45 dB(A)

House #	Maximum Predicted Noise Level (dBA) $LA_{(MAX)}$ Sourced from EA	Revised prediction based on realigned rail spur $LA_{eq(15\ min)}$ Sourced from PPR
1178	Not provided	Not provided
1198	Not provided	Not provided
1199	Not provided	Not provided
3021	**48**	**50**
3022	**48**	**50**
3024	**47**	**49**
3035	**46**	**48**
3041*	**48**	36
3043*	**50**	38
3057*	Not provided	Not provided
3062	**54**	**56**
3108	**48**	**65**
5001	**51** (sourced from PPR)	**54**
5023*	**49**	**48**

* Proponent has indicated it has an agreement with property owner Source: EMM, 2012 and EMM, 2013

In its response to submissions the Proponent indicated it expects acquisition rights would be available to those residential properties where maximum (sleep disturbance) noise levels would exceed 50 dB(A) $L_{(max)}$, ie #3062, 3108 and 5001 (EMM 2013).

The Proponent has indicated that the majority of the exceedances are due to trains running on the rail spur, as predicted levels fall below 30 dB(A) at most residences when the rail spur contribution is

removed from the model (EMM, 2012). Consistent with this, modelled noise levels were found to be relatively evenly spread across the mining years modelled.

The Proponent has argued (EMM 2013) that noise from the rail spur should be considered against the amenity criteria in the Industrial Noise Policy (EPA 2000), rather than the intrusive criteria – which are much lower in this area. Somewhat confusingly the Preferred Project Report (EMM 2013) also refers to the "Rail Infrastructure Noise Guidelines – Draft for Consultation" (OEH 2012a) when considering impacts from the rail spur. The Commission does not agree with either of the approaches advocated by the Proponent.

The Rail Infrastructure Noise Guidelines – Draft for Consultation, clearly states that rail lines on an industrial site servicing an industry (e.g. mining) are excluded and "should be assessed in accordance with the Industrial noise policy" (OEH 2012a, page 5). Consequently the Commission has not considered the predictions against the "Rail Infrastructure Noise Guidelines – Draft for Consultation" (OEH 2012a).

The Commission also does not support the Proponent's adoption of the amenity criteria as the appropriate control in this instance.

The EPA, in its submission (EPA 2012) considered the predicted noise levels against the intrusive criteria (i.e. a limit of 35 dB(A) in this area).

Where noise limits are predicted to be exceeded the EPA has recommended noise limits up to 5 dB(A) above of the intrusive noise criteria (EPA 2012). Where noise levels are predicted to exceed the criteria by more than 5 dB(A) the EPA has indicated that this is above the limit it would usually licence to and that it expects acquisition rights would be assigned to those properties (EPA 2012). The Commission acknowledges that this has been standard practice for mining projects in NSW for many years.

The Commission generally supports the EPA's approach of establishing noise limits based on the intrusive criteria in the Industrial Noise Policy (EPA 2000). Nonetheless the Commission considers some additional options and protection should also be provided. There are two reasons for this.

1. The Proponent has not provided detailed background noise monitoring data to characterise the existing noise levels, but has indicated noise levels drop to 28 dB(A) during the evening and night. Given the rural characteristics of the area the Commission considers it is possible background noise levels may in fact be even lower than this at certain times. If background noise levels are in fact lower than the 30 dB(A) level adopted, the noise impact from the project will be more obvious to existing residents.
2. The Commission also notes that mining is a new industry in the region. Long term residents would not have expected that a coal mine would be constructed nearby when they made the decision to live in the area. Consequently, the Commission considers that affected residents should be afforded the maximum number of options in relation dealing with the impacts on the mine.

In addition to applying the noise limits proposed by the EPA, the Commission recommends that the conditions should also provide acquisition rights to all residents of properties where noise levels are predicted to exceed 35 dB(A).

The Commission recommends that all affected residents (those whose residence is predicted to be impacted by a noise level of more than 35 dB(A)) should be given the option of either:

- acquisition of the residence and associated property; or

- mitigation measures such as double glazing, air-conditioning, insulation and acoustic barriers; or
- a negotiated agreement.

The Commission understands that the Proponent has agreements with the owners of some of the properties predicted to be impacted and that other negotiations are also progressing (EMM 2013).

Where residents choose to stay and accept the mitigation options, the Commission considers that the predicted noise levels should be adopted as the noise limit at the property. This means that noise limits at some properties would be as high as 53 dB(A) – well above the level the EPA has indicated (EPA 2012) it would be willing to licence to. The Commission acknowledges a noise impact at this level would be unacceptable to most people, but recognises that the decision to sell a home is often complicated by a range of factors including social and historical connections to a place, which ultimately outweigh the impact of the mine, for some people. The Commission considers that by providing this range of options each affected individual will be able to select the most appropriate option for their specific circumstances.

Much of the noise impact is attributed to trains on the rail spur. The Proponent has committed to sourcing rail locomotives to satisfy ARTC's Environment Protection Licence (EPL) (EMM 2012) and using rail design and construction techniques (such as continuous welded rail). The Proponent also considered the use of noise bunds and acoustic insulation, in combination with air conditioning or some other mechanical ventilation. For the three most heavily affected residences the Proponent found that construction of a barrier, about 20 m from the house and running parallel to the rail tracks would reduce noise levels by between 4.5 and 12.5 dB(A) $L_{eq(period)}$ (EMM 2013). The indicative cost of this option was also found to be acceptable (EMM 2013). Consequently the Commission recommends that this mitigation option should be included in the suite of measures to be provided to residents who choose to stay on their properties.

Other noise control options, such as the use of engineering controls and the use of predictive real time management and monitoring do not appear to have been included in the noise modelling. The Commission considers that best practice noise management measures should be applied to the project and consequently the predicted noise levels should be conservative.

Vacant Land

The project would also impact on vacant land, producing noise levels in excess of 40 dB(A) over more than 25% of 43 vacant land parcels within seven different land holdings. The Proponent has indicated it has reached agreements with most of the affected landholders (EMM, 2012). The Department of Planning and Infrastructure usually applies standard conditions for acquisition of noise affected vacant land, were agreements have not been reached, the Commission is satisfied with this approach.

Offsite Rail Noise

A number of speakers at the public hearing raised concerns about noise impacts from the project's coal trains on the rail network. The Proponent has predicted its trains would likely cause exceedance of the rail traffic noise goals at six structures (mainly houses) along the rail line around Gulgong (EMM 2012). The Proponent also predicted (EMM 2013) that further down the line, noise from the project's trains would increase noise levels by up to 1.5 dB(A). This highest impact would occur between Bylong and Mangoola in year 21 (EMM 2013).

The EPA has recommended that the Proponent must only use locomotives that have received an approval to operate on the NSW rail network (EPA 2012). The Proponent has argued that it cannot

commit to this as rail haulers have not been selected (EMM 2013). The Commission considers that as the rail haulers have not been selected the Proponent will be able to select haulers who are able to provide approved locomotives. Consequently the Commission recommends that the EPA's proposed condition relating to rail noise (EPA 2012) should be applied.

Road traffic noise

The Proponent has only assessed the impacts of heavy vehicle traffic during the day time period (7 am to 6 pm) and the EPA has recommended limiting heavy vehicle movements to this timeframe (EPA 2012). The Proponent has not raised any concerns with this approach, so the Commission has recommended that the EPA's proposed conditions should be applied.

6.3.3. Conclusions and Recommendations

The project is predicted to impact on a number of residential dwellings, both locally around the mine site and further afield due to noise from coal trains. The Commission has concluded that the Proponent should be required to apply best practice techniques to minimise and manage noise from the project, both on and off site. A suite of noise management and control conditions should be applied to the project to give affected residents the widest range of options for dealing with the noise impacts of the mine.

With the recommended measures in place, the Commission is satisfied that the noise impacts of the project would be appropriately managed.

Recommendations:

The Proponent should be required to apply best practice noise control and management measures, including best available technology (including locomotives), engineering controls and predictive and reactive real time management practices.

Any residence that is predicted to be impacted by a noise level of more than 35 dB(A) should be given the option of either:

- acquisition of the residence and associated property; or
- mitigation measures including double glazing, air-conditioning, insulation and acoustic barriers; or
- a negotiated agreement.

Noise limits should be applied to ensure the project's noise emissions are equal to, or better than, the predictions in the Environmental Assessment and Preferred Project Report and Response to Submissions.

Heavy vehicle movements on public roads must be restricted to the hours of 7 am to 6 pm Monday to Friday, 8 am to 1 pm Saturday and at no time on Sundays or public holidays, except as directed by the Police, or Roads and Maritime Services, or other emergency services for safety or emergency reasons.

6.4. Visual

Visual impact is considered in Appendix O of the Environmental Assessment. The Visual Assessment Report (VAR) provides a qualitative analysis of the potential visual impacts of the project on public and private receptors, where appropriate, it also recommends mitigation measures to minimise such impacts.

The existing landscape is characterised by undulating terrain, with broad valleys and low hills. About half of the site has been cleared and modified for agricultural uses including pastures and cropping. The remainder of the site is covered by remnant woodland vegetation.

The project will change the landscape. The changes will be noticeable and generally perceived as intrusive to the rural landscape, especially in the early stages of operation with the exposed overburden faces. The VAR considers the magnitude of such impacts will be localised because the project area is rather isolated from townships and the Proponent has already acquired many affected neighbouring properties. The site is also away from major transport routes. Traffic volumes on roads adjacent to the site are low. Therefore impact on motorists is considered low.

The key mitigation measures recommended include:

- Early screen planting and earth mounding at strategic locations and affected neighbouring properties to reduce direct viewpoints to mine operation and infrastructure;
- Early and progressive rehabilitation of disturbed areas, particularly the exposed overburden faces;
- A commitment to acquire remaining impacted properties or enter visual amenity agreements with landowners; and
- The preparation of a landscape management plan and lighting management plan.

The VAR concluded that the mitigation measures have been developed to address impacts both generally and from specific viewpoints surrounding the project area. If the recommended mitigation measures are implemented, the project is not considered by the Proponent to have a significant impact on the visual amenity of the area.

The Proponent's Preferred Project Report, in response to submissions to the Environmental Assessment, proposes to relocate the Spring Ridge Road and Dapper Road further to the west of the mine. The Commission agrees that the relocation of the road with appropriate roadside landscaping may remove the visual impact on the passing motorists. However, any roadside planting should aim at providing visual relief to the travelling public that complements the existing landform and landscape in the area, rather than the often adopted massive roadside plantings that completely block-off any distant view from the road.

Impact from night lighting is discussed in the next section of this report.

The Commission is satisfied that given the location of the proposed mine, the relocation of Spring Ridge Road further to the west of the mine site and appropriate landscape and lighting treatments, the mine will not have a significant visual impact on the surrounding areas or travelling motorists.

6.5. Night Lighting

The mine is proposed to be operated 24 hours a day. Potential impacts from night lighting require consideration not only for the amenity of neighbouring properties and travelling motorists, but also the operation of the Siding Springs Observatory (the Observatory), an important optical astronomical observatory, which is located about 100km to the north of the proposed mine. The assessment of night lighting is considered in the Visual Assessment Report (VAR) (Appendix O of the Environmental Assessment).

Night operation of the mine will produce sky glow as a result of illumination for in-pit activities and mine infrastructure area. Other sources of night lighting include mobile lighting structures and equipments and train movements during the night period.

The VAR only provides a qualitative assessment of lighting impacts as there is insufficient engineering information to undertake a quantitative assessment. Initial assessment concludes that potential impact on the Observatory is small as the proposed mine is about the same distance from the Observatory as Dubbo, but will have substantially less lighting. A more detailed assessment is planned to be carried out when engineering details are available. The VAR also indicated that future assessment will be carried out by a suitably qualified lighting consultant who is familiar with the Observatory and its operational requirements to ensure minimal impact on the Observatory.

The key proposed mitigation measures include:

- The preparation of a Landscape Management Plan that will include bunding and vegetation buffers to screen night lighting;
- workings on out-of-pit emplacements benches will be staged, wherever possible, so that the outer embankments will provide a visual screen for in-pit-workings;
- a Lighting Management Plan will be prepared to meet the requirements of Warrumbungle DCP No 1, AS 4282 and AS/NZS 1158. In the event that compliance is not possible, special measures will be implemented in consultation with affected parties.

The Environment Protection Authority (EPA) in its submission on the Environmental Assessment considered further assessment/information is required regarding the potential impacts from lighting on local and regional amenity. In its submission on the Preferred Project Report, the EPA advised that given the Proponent's commitment to engage a suitably qualified expert to prepare a detailed lighting management plan for the project, it is satisfied that a relevant condition of approval is appropriate to address its concern.

The Commission broadly agrees with the proposed management approach and mitigation measures to address the issue of night lighting in terms of the mine's potential impacts on nearby residents and the travelling public. The key concern to the Commission is the potential impact on the Observatory, which is a nationally significant scientific facility.

Siding Spring Observatory

The Australian Astronomical Observatory (AAO) made a submission on the Environmental Assessment outlining its concerns about potential night lighting and blasting impacts on the operation of the Siding Springs Observatory. Major contributors to night lighting impacts are upward light spill and increased levels of atmospheric dust. Blasting activities may also generate seismic activity.

The AAO advised that its key concern is damaging light pollution from upward sky glow from the mine operation. It notes the Warrumbungle Shire Council formally refers development applications that require lighting assessment to the Observatory as provided in the DCP No 1. The Orana REP is the principal legislative instrument covering lighting developments within 100km of the Anglo-Australian Telescope. The AAO also understands that a new State Environmental Planning Policy (SEPP) is being prepared to extend the REP zone to the boundaries of the affected local government areas and mandating full cut-off fittings on light sources. The requirement for fully-shielded lights is now a standard condition of approval for mines within 200km of the Observatory.

The AAO recommends the following mitigation measures to minimise potential impacts:

- Use of full cut-off lighting fixtures,
- Use low colour-temperature lamps;
- Consideration be given to the upward scattering of light from the surfaces being illuminated;
- Design the layout of access roads so that they are aligned away from the direction of the Observatory; and

- Implementation of effective dust-minimisation procedures to be adopted.

The AAO also recommends the following conditions to be included:

- A formal consultation process to be established with the ANU and AAO to develop a mitigation program to minimise potential impacts on the Observatory;
- A requirement to implement the approved mitigation program;
- Ongoing engagement with the ANU and AAO to monitor the efficacy of the proposed mitigation measures;
- Suitable equipment to be provided for the monitoring of light and dust levels at both the mine site and at the Observatory; and
- Lighting facilities to be consistent with the draft new SEPP governing lighting developments and conditions of consent for mines within 200km of the Observatory.

Commission's comments and recommendation

The Commission agrees that the Lighting Management Plan should be prepared in consultation with the Observatory and Warrumbungle Shire Council to ensure it is consistent with Council's Development Control Plan and other relevant Australian Standards and requirements to minimise its impact on the Siding Springs Observatory. The plan should be prepared by an appropriately qualified expert, include a management and monitoring regime for all aspects of the project and be approved by the Director General before mine construction commences.

The Commission notes rail spur layout and line design (in terms of relative levels) are yet to be finalised. According to the Environmental Assessment, when fully operating, the mine is expected to generate 10 train movements per day. Depending on the train schedule, some of the movements may be during the night period. Trains will be climbing up an embankment near Laheys Creek Road. Hence, train light will be directed upward resulting in sky glow in the area. The Commission recommends that when detailed design is available, a comprehensive lighting assessment should be undertaken to ensure mitigation measures will be developed and implemented to minimise night lighting impacts from train movements before operations commence. However, such measures should be balanced with the potential risk on safety.

Air quality impacts including dust are discussed in Section 6.1 of this report. The Commission agrees that effective dust management is important to minimise the night lighting impact on the operation of the Observatory as well as impacts on the health and amenity of the community. It notes that there are standard dust control requirements for coal mining projects. However, in this project, the suppression of dust over exposed surfaces including overburden, extraction face and roads is of critical importance to ensure there is minimum light-flux from the mine that will impact on the operation of the Observatory. As recommended in Section 6.1.1, the Commission considers that this mine should adopt the world's best practice to minimise dust emissions and this requirement should be included in any approval conditions.

7. Biodiversity Impacts

7.1. Current situation and impacts identified

The project has a 4,700 ha footprint (EMM, 2012). The site is currently comprised of farmland, with some native forest remnants, particularly on the northern portion of the site. Some of the farmland areas are highly degraded.

Vegetation Communities

A total area of 2,113 ha of native woodland (including regrowth) and 1,048 ha of native pasture is proposed to be cleared (EMM, 2013).

The Proponent's Preferred Project Report and Response to Submissions indicates that the native pasture is in low condition, while 1,960 ha is woodland (or woodland regrowth) in moderate to good condition (EMM, 2013). Of the woodland, an area of 1,043 ha is identified as Blue-leaved Ironbark Woodland, along with an additional 450 ha of Blue-leaved Ironbark Woodland regrowth vegetation (EMM, 2013). Other vegetation communities identified within the project footprint include Cypress Pine Woodland (188 ha), Slaty Gum Woodland (101 ha) and Dwyer's Red Gum Woodland (67 ha) (EMM, 2013).

The ecological surveys commissioned by the Proponent also identified three endangered ecological communities in the area (EMM, 2012). These communities are:

1. The Box gum Grassy Woodland, listed critically endangered as *White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland* under the *Environment Protection and Biodiversity Conservation Act 1999* and listed an endangered ecological community, as White Box Yellow Box Blakely's Red Gum Woodland under the NSW *Threatened Species Conservation Act 1995*;
2. Inland Grey Box Woodland listed as an endangered ecological community under both the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the NSW *Threatened Species Conservation Act 1995* and named: *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia*; and *Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions*, respectively; and
3. Fuzzy Box Woodland listed as an endangered ecological community under the NSW *Threatened Species Conservation Act 1995*, named: *Fuzzy Box Woodland on alluvial soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions*.

The project would impact on each of these communities, with the clearing of:

- 123 ha of Box Gum Woodland (including 105 ha of derived native grasslands);
- 83 ha of Inland Grey Box Woodland (including 34 ha of derived native grasslands); and
- 28 ha of Fuzzy Box Woodland (including 14 ha of derived native grasslands) (EMM, 2013).

Flora

Four threatened plants were identified. These are:

1. *Zieria ingramii*, listed as endangered at both the state and national level under the *Threatened Species Conservation Act* and the *Environment Protection and Biodiversity Conservation Act*;
2. *Tylophora linearis*, listed as endangered at the national level and vulnerable at the state level, under the *Environment Protection and Biodiversity Conservation Act* and *Threatened Species Conservation Act*, respectively;

3. *Homoranthus darwinioides*, listed as vulnerable at the state and national level under the *Threatened Species Conservation Act* and the *Environment Protection and Biodiversity Conservation Act*; and
4. *Acacia ausfeldii*, listed as vulnerable at the state level, under the *Threatened Species Conservation Act* (EMM, 2012).

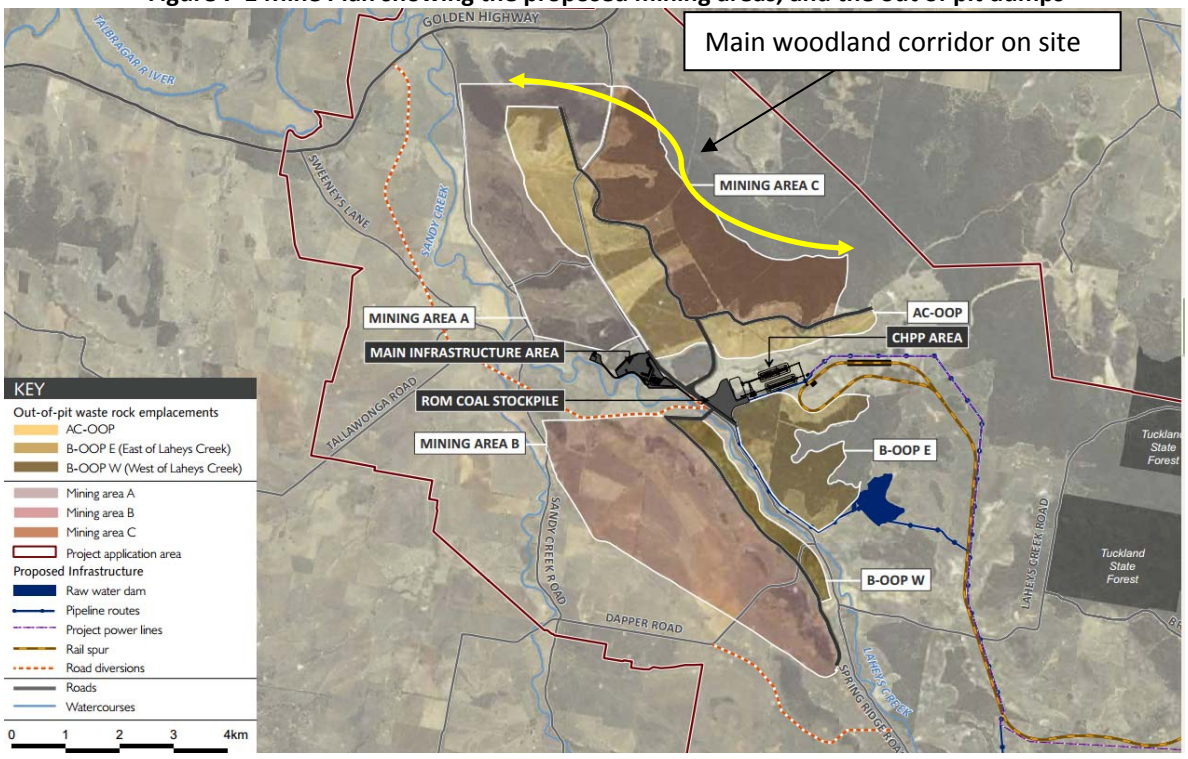
The Proponent's assessment found the project would have a significant impact on three of these threatened species, *Zieria ingramii*, *Tylophora linearis* and *Homoranthus darwinioides* (EMM, 2013).

Fauna

As listed in Appendix 8 seventeen threatened or migratory bird species were recorded in the area, along with five threatened bat species. A further 21 threatened or migratory fauna species were assessed as having a moderate or high potential to occur in the area, by the Proponent's consultants (EMM, 2012 and EMM, 2013).

There is an existing vegetation corridor running along the north eastern part of the site, providing some level of connection to the Tuckland State Forest to the east. As shown in Figure 7-1 Mining Area C and the later stages of Mining Area A would intrude into this corridor, significantly narrowing its width. This more consolidated forest area of the site was also found to support many of the threatened species identified on the site, as well a number of populations of the endangered *Zieria ingramii* plant.

Figure 7-1 Mine Plan showing the proposed mining areas, and the out of pit dumps



Source: EMM 2012

7.2. Consideration

The NSW Office of Environment and Heritage (2012b) raised concerns about the survey effort undertaken and considered that other cryptic flora species may occur on site, such as *Rulingia procumbens* and *Philotheca ericifolia*, which are likely to be influenced by fire. OEH (2012b) indicated a targeted search for *Philotheca queenslandica* should also have been undertaken. The Proponent

acknowledges that it would remove habitat for *Philotheca ericifolia*, *Diuris tricolor*, *Rulingia procumbens* and *Pomaderris queenslandica*, but argues that the outcome would not be significant (EMM 2013).

The NSW Office of Environment and Heritage (2012b) also originally raised concerns that there may be additional areas of Box Gum Grassy Woodland Endangered Ecological Community (additional to that identified in the EA), in the form of Derived Native Grassland. The Proponent has since provided its response to submissions, which includes updated figures and quantifies the areas of derived native grasslands. The figures considered by the Commission and discussed in this report are from the Proponent's preferred project report (EMM 2013) which identified 105 ha of derived native grassland (consistent with the description of Box Gum Grassy Woodland) in response to the Office of Environment and Heritage's concern.

Submissions from special interest groups and member of the public also raised concerns about the impacts on biodiversity and the survey effort to date.

The Office of Environment and Heritage (OEH), by letter dated 13 March 2013 advised that a number of matters that it raised in its early submission have been addressed in the Preferred Project Report. However, there are still a number of issues remain to be addressed. These include:

- Assessment and mitigation of potential indirect impacts on habitat;
- Calculations and justification of offset requirements;
- The adequacy of the proposed offset strategy; and
- The need to continue to consult with OEH on a range of biodiversity-related matters.

The Commonwealth Department of Sustainability, Environment, Water, Population and Communities (DSEWPC) also made a submission to the Department in response to the Preferred Project Report. Similar to the OEH, the DSEWPC advised that although a number of the issues that it raised earlier have been addressed, there are still outstanding concerns about the quality of information and analysis provided to determine the likely impacts to Matters of National Environmental Significance (MNES). These concerns include:

- Adequacy of assessment of impacts on all MNES, such as (but not limited to) the Spotted-tailed Quoll and woodland birds;
- Adequacy of information about proposed measures to mitigate impacts on MNES; and
- The Updated Biodiversity Offset Strategy does not meet the requirements of the EPBC Act Offsets Policy. Particularly, the strategy does not address all relevant MNES and does not provide adequate detail about the offset proposal.

From its inspection of the site, on 10 December 2012, the Commission noted the poor condition of much of the site – including significant erosion, the presence of weeds and the poor quality of the soils in many areas. The Commission was initially concerned that, given the relatively poor soils, it may not be possible to effectively achieve rehabilitation objectives post mining. As a result of these concerns, the Commission engaged Dr Mark Burns to provide specialist advice on this issue.

7.2.1. Advice on rehabilitation

Dr Burns visited the site on 5 February 2013, provided a presentation to the Commission on 7 February 2013 and provided a report to the Commission on 19 February 2013. Dr Burns' advice is attached in Appendix 6.

Dr Burns acknowledged the concerns raised by the Commission, noting the signs of a long history of poor land management in the area, exacerbated by poor soil structure, drought and overgrazing. In this regard Dr Burns suggested the proposed mine may represent an opportunity to enhance the

regional environment with a combination of intensive land management, encouragement of natural regeneration in strategic areas and improved management of remnant forest areas.

Dr Burns noted that the area had mainly been used for grazing, rather than cropping. He advised areas with a history of grazing are more likely to have retained a seed bank and lignotubers and consequently there is widespread potential for natural regeneration of grazing land and areas surrounding natural bush land. Dr Burns indicated that stock exclusion can result in dense natural regeneration and suggested this would be an effective way of establishing vegetation on offset land and corridors, enhancing biodiversity values in these areas.

Dr Burns acknowledged the Commission's concerns about rehabilitating the mine site, noting a shortfall in soil organic matter and raising concerns about the proposed surface application of sodic subsoils. Nonetheless Dr Burns advised that with careful planning and implementation, rehabilitation should be possible. Dr Burns recommended a two stage strategy for enhancing organic matter in the soil. The first stage would involve the dense sowing of a sterile cover crop, which would be allowed to mature over a four to six month period. Once mature the sterile cover crop would be incorporated into the topsoil layer and the final crop of woodland or pasture seed would be sown.

Dr Burns also recommended that sodic subsoils are only reapplied to the areas proposed to be rehabilitated to class three agricultural land.

The advice from Dr Burns gives the Commission confidence on several fronts:

- it confirms that much of the currently cleared agricultural and pastoral land in the project area is substantially degraded as a result of historical overgrazing. Ironically, the consolidation of land ownership by the Proponent and the potential for a new, strategic, land management regime during and post mining provides an opportunity to enhance land condition and capability around the mine site;
- the detailed proposals from Dr Burns for enhancement of the rehabilitation strategy through a two-step heavy seeding process is also likely to assist with dust suppression and should reduce the potential air quality impacts from the extensive mine footprint;
- the proposals for mulching of vulnerable areas using the timber cleared for mining coupled with the grazing exclusion and understorey enhancement actions proposed suggest there can be significant improvements made to the biodiversity values of the uncleared forested areas and proposed offset areas; and
- any potential for increased bushfire fuel can be managed by cross referencing the rehabilitation plan and the fire management plan. Both would be routinely required in any approval.

The Commission generally accepts the approach recommended by Dr Burns and has broadly adopted his recommendations (see section 7.3.1). Of particular note is the imperative for an active and adaptive land management plan, to minimise impacts associated with the mine's large footprint and deliver long term enhancement of biodiversity values across the regional landscape.

<u>Stock Exclusion Zone</u>

Dr Burns recommended that stock should be permanently excluded from all offset and rehabilitation areas. The Commission agrees that this will be essential while the vegetation is establishing on the site. Nonetheless the Commission considers there may be some scope for limited and highly controlled grazing of rehabilitation areas in the future, to adaptively manage for biodiversity outcomes and limit the build-up of bushfire fuel loads. This option would not be available for many years, as the vegetation would need time to establish. Nonetheless the Commission has not adopted Dr Burns' stronger recommendation on this issue. The Commission instead opted to provide some

flexibility for this to be reconsidered in line with adaptive management experience on site as the rehabilitation and land management plan is implemented.

7.2.2. Offsets

The Proponent has proposed to provide 5,667 ha of land for biodiversity offsets. Of this, 3,909 ha is existing woodland and 1,758 ha would be revegetated as part of the project. Simplistically, there are two different policy perspectives regarding the provision of offsets. Offsets are either provided by:

- Securing existing high quality vegetation that is equivalent to the areas to be removed; or
- Providing for the replacement of the areas to be removed by regeneration of suitable areas nearby.

There are advantages and disadvantages to both approaches. By securing existing vegetation it is possible to ensure like for like communities, including habitat and occurrence of specific threatened species in the area to be secured. Notwithstanding this, the areas secured are existing woodlands and while additional protection may be provided through an offset, the areas are often not at risk of clearance and this approach can still result in an overall loss of vegetation at a regional landscape level.

On the other hand attempting to rehabilitate unforested areas can be fraught with difficulty and are not always successful. Even when successful, it takes many years for trees to provide suitable cover for foraging birds and mammals and decades to produce tree hollows suitable for breeding purposes. Consequently regeneration areas often require many years of forward planning to provide any meaningful habitat replacement value.

For these reasons offsets should only be considered as a last resort, after all alternative options have been exhausted. Nonetheless, offsets can sometimes provide opportunities to make strategic additions to regional biodiversity assets, including through the consolidation of existing assets, the addition of new unprotected priority areas into a reserve system and the connection of otherwise fragmented remnants. Consequently, when developed strategically at the landscape level, and with suitable expert restoration work offsets are sometimes the best option, providing a long term net benefit for a region.

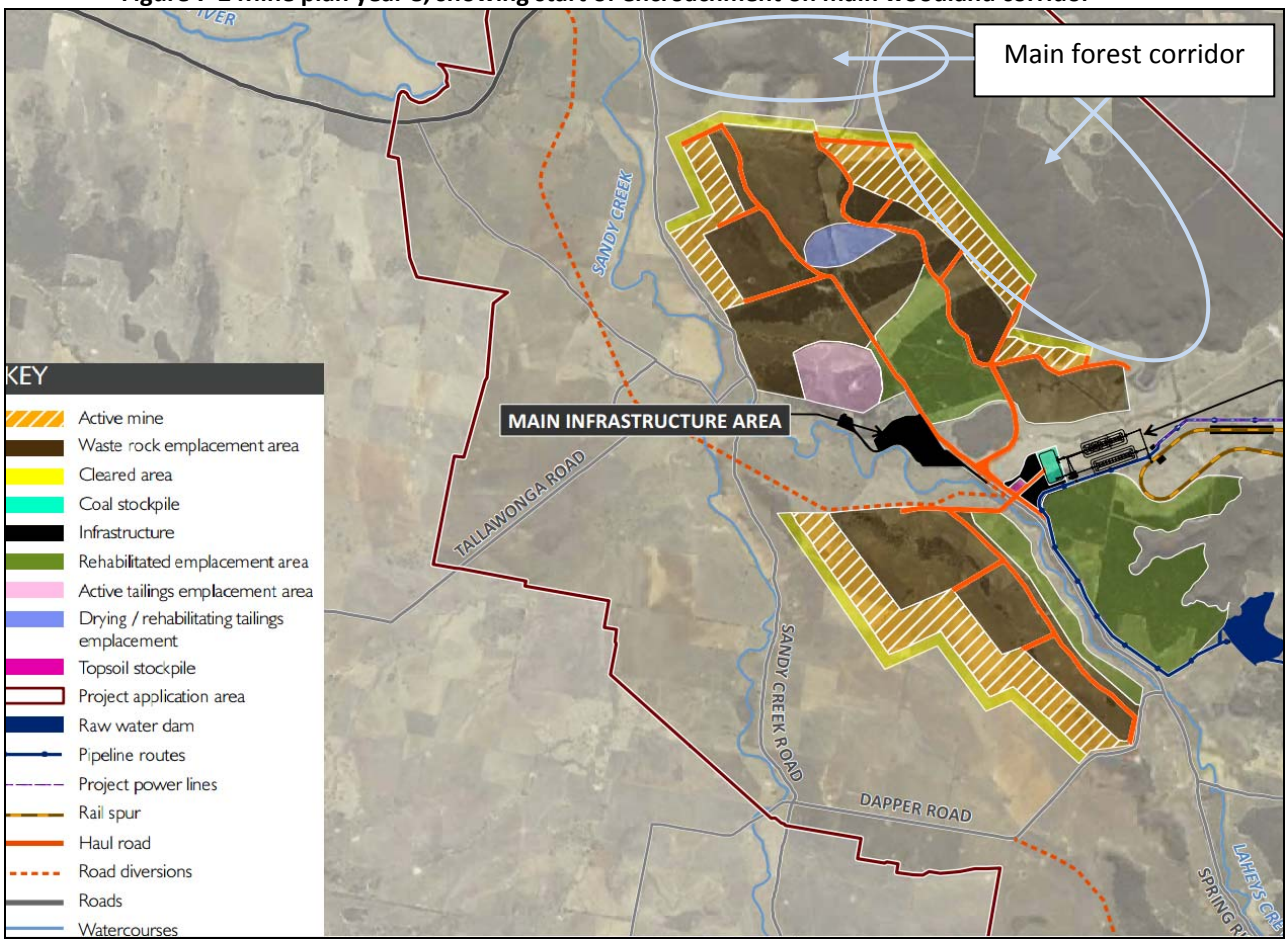
7.3. Findings and Recommendations

In this instance the Commission considers there is room for some adjustments to the mine plan, to avoid some of the predicted impacts. In particular the Commission recommends two key changes. These relate to mining area C, also referred to here as pit C and to the out of pit waste rock emplacement area B-OOP E (East of Laheys Creek).

<u>Pit C</u>

Much of the coal proposed to be mined in pit C is covered by established woodland communities and include hollow bearing trees and other valuable habitat features. Mining of pit C is proposed to start in year two and would generally progress in a north easterly direction. Consequently the Commission estimates it would take between 4 and 8 years for mining to reach the main northern woodland area (see Figure 7-2).

Figure 7-2 Mine plan year 8, showing start of encroachment on main woodland corridor



Source: EMM, 2012

In the first instance the Commission considers that the mine plan should be reconsidered with the goal of avoiding or minimising intrusion into the main woodland corridor.

In the event that some of this area cannot be avoided the Commission recommends that the Proponent should be required to demonstrate that its rehabilitation and adaptive land management plan is delivering results. Any revegetated area proposed for biodiversity conservation purposes must have the real prospect of providing appropriate habitat for the threatened species identified on the affected area. This should be demonstrated to the satisfaction of the Director General prior to the project progressing beyond year eight of the mine plan for pit C.

In order to achieve this, the Proponent would need to commence work to establish replacement vegetation on offset properties immediately. Where habitat features are unable to be produced in the available time, artificial solutions such as nest boxes would need to be installed and maintained. The success of the revegetation and habitat replacement efforts would then need to be demonstrated in the scheduled report to the satisfaction of the Director General prior to any clearing within the main vegetation corridor on the north eastern part of the site from Year 8.

The Commission also notes that for similar reasons in reconsidering the mine plan, efforts should be made to limit the northern extent of pit A.

Out of Pit Emplacement B – east of Laheys Creek

The Commission does not support the proposal to clear vegetation to the east of the site for the purpose of providing an out of pit waste dump (and tailings emplacement) for pit B. The Commission notes that this waste dump is only required in the first years of mining and is planned to be rehabilitated by year 4.

The area contains populations of the endangered *Zieria ingramii* and the vulnerable *Homoranthus darwinioides*. Nine different threatened fauna species were also identified in this area (EMM 2012). The Commission does not believe this overburden waste dump represents best practice in terms of mine planning. The Commission notes that the Preferred Project Report actually proposes to increase the height of the waste rock emplacement by 20m and add an extra 18 ha to the footprint and recommends that the Proponent should be required to do further work to find an alternative location for this overburden waste dump (and out of pit tailings emplacement area), away from threatened species or demonstrate that all reasonable measures have been taken to minimise the footprint, the surface area of exposed material and impacts on threatened species.

The Commission acknowledges this recommendation will present some redesign challenges but is confident a superior alternative can be devised. For example when combined with the Commission's recommendation to reduce the size of pit C, it may be possible for the overburden and tailings from pit B to be relocated to the main out of pit emplacement area (between pits A and C). This option should be explored and relative impacts compared with any other alternatives available.

Implications of these recommendations

The Commission acknowledges that the recommended changes would have flow on effects on other aspects of the assessment including the air and noise modelling results. Nonetheless associated redesign and remodelling should have minimal impact on the timeframes for the commencement of the project.

Reasons for the recommended changes

In formulating this recommendation the Commission has adopted a strategic landscape approach, aiming to minimise intrusion of impacts into large woodland remnants. This is also where the majority of the threatened fauna species were identified (EMM 2012). Nonetheless, the Commission acknowledges that this approach would mainly protect the existing Blue-leaved Ironbark Woodland, while the endangered ecological communities, particularly the derived native grasslands, would be cleared to make way for the mine.

The Commission has adopted this approach for a number of reasons, particularly:

- the existing woodland (in proposed pit C and overburden dump BOOP- E, east of Laheys Creek) supports more threatened species, and has a higher habitat value in relation to hollow bearing trees and cover, than the grasslands of pit A;
- a number of offset credits are yet to be identified for impacts associated with Pit C and the overburden dump BOOP- E, east of Laheys Creek (particularly for threatened plants growing in these areas);
- the derived native grasslands are likely to regenerate to a treed woodland if appropriately managed, however, it would take many years to establish viable foraging habitat, and decades for breeding habitat such as hollows to form; and
- other larger areas of derived native grasslands have been identified in the region, and would be restored instead, through the offset strategy proposed.

The Proponent's surveys of the proposed offset areas have identified areas of existing Box Gum Grassy Woodland (347 ha) and Inland Grey Box Woodland (111 ha), that could be secured as offsets

(EMM 2012). The Proponent has also identified native grassland which could be restored to woodland habitat, including:

- 270 ha of grassland capable of supporting Box Gum Grassy Woodland;
- 37 ha of grassland capable of supporting Fuzzy Box Woodland; and
- 684 ha of grassland capable of supporting Inland Grey Box Woodland (EMM 2012).

The Proponent and the Office of Environment and Heritage have not yet agreed on the offset credit calculations. Nonetheless, even adopting the Proponent's calculations, some shortfalls exist.

In its calculations of the credits accumulated from the proposed offsets, the Proponent has secured more than enough credits for the impact on Box Gum Grassy Woodland and Inland Grey Box Woodland, however there is a shortfall in credits for Fuzzy Box Woodland at this stage (EMM 2012).

Credits for the proposed impacts on significantly impacted threatened flora and fauna are more difficult to source. The Proponent is yet to find any of the credits required for impacts on *Homoranthus darwinioides* and *Tylophora linearis*. By the Proponent's measure (EMM 2012), the proposed offset strategy also has shortfalls of:

- 9,037 credits for *Zieria ingramii*; and
- 124 credits for Long-eared Pied Bat breeding habitat.

The Commission's recommended adjustments to the mine plan will help to reduce the project's impacts and the resulting number of credits required. Nonetheless as credits for the impact on *Tylophora linearis* have not been identified to date, it may be cost effective to modify pit B to avoid this impact.

The Commission also notes that a number of the issues raised by the Office of Environment and Heritage (OEH) and DSEWPC have not yet been resolved. With the recommended modifications to the mine plan, some of these issues may be resolved, however the Proponent will need to work through these with OEH and DSEWPC to determine how to resolve the outstanding issues.

The Commission has concluded that some adjustments to the mine plan would reduce the biodiversity impacts of the project and minimise the need for additional land to be acquired for biodiversity offsets. The Commission is satisfied that these adjustments are achievable and warranted to minimise the size of the footprint of the mine, the potential for dust generation and the scale of the land management challenges that the mine's large land holdings are already imposing in the local area. With these adjustments in place the Commission is satisfied the impacts on biodiversity would be appropriately minimised and that the residual impacts can be adequately managed through a strong commitment to improved land management practices and restoration of offset lands.

Land management (*This section should be read in conjunction with Section 9 of this report*)

The scale of the land acquisitions already concluded, the pressure for more biodiversity offsets to be identified and the large exposed area with potential for dust generation warrant a focused attention on integrated land management.

In view of the disruption that has already occurred within the Dunedoo community and local economy as a result of Cobbora mine related land purchases and land use changes, along with the potential for delay in the commencement of any mining operations, it is important that a comprehensive approach to the management of Proponent owned land be developed and implemented immediately rather than waiting until mining commences.

An integrated land management plan is urgently required with the following objectives:

- to minimise the total area of land taken out of productive agricultural and pastoral activities;
- to minimise the further rural property acquisitions needed for biodiversity offsets;
- to provide early demonstration of effective rehabilitation of degraded woodlands and derived grasslands;
- to minimise the impact on the local community and economy; and
- to achieve best practice dust suppression.

The scope of the land management plan should include the lease terms and conditions applying to any land owned by the Proponent. The plan should be formulated with local input as well as specialist advice and must include provisions for:

- immediate, medium term and long term targets and strategies;
- integrated management of properties to achieve, optimum agricultural, pastoral or biodiversity outputs;
- monitoring and adaptive management strategies to ensure that practical lessons from on-site experience are recognised and applied.

In view of the impacts already being experienced on the Dunedoo community and local economy, urgent and initially intensive action is needed to map and fence land to be managed for the range of specific purposes so that as much land as possible is being managed to contribute sustainably to the local economy.

While there are some obvious opportunities for land to be added to adjacent or nearby reserves, wherever possible, opportunities for suitably covenanting parts of properties should be explored, so that they can be managed for biodiversity conservation while the rest of the property is managed for agricultural or pastoral production in accordance with land capability.

Early work to demonstrate the feasibility of rehabilitation of degraded woodlands and related habitats should be undertaken and the results considered in deliberations on the extent of any further biodiversity offsets required.

7.3.1. Recommendations

The mine plan should be revised to:

- relocate out of pit emplacement area B-OOP E, to avoid or minimise impacts on native vegetation and threatened species in particular; and
- avoid or minimise intrusion of mining into the main vegetation corridor (on the north eastern portion of the site).

An integrated land management plan should be prepared as a matter of urgency for immediate implementation as a condition of any approval granted rather than being tied to the commencement of mining operations. The plan should include:

a) Mapping of the agricultural capability and biodiversity regeneration potential of the landholdings and a strategic land use study to identify the best land use for each area, aiming to:
    - regenerate biodiversity offset areas to the maximum extent possible prior to commencement of mining;
    - maximise sustainable agricultural production on the remainder of the land, including through the rehabilitation and repair of eroding areas of the site;
b) A land tenure and management program, considering the existing land tenure arrangements, and suitable arrangements at each stage, (including prior to the commencement of mining, during mining operations and post mining) detailing the

mechanisms and timetable for transitioning to active land management in accordance with the strategic land uses identified in a);

c) An employment, training and skills development program aimed at improving local land management techniques, resources and knowledge. This should include adaptive land management, informed by a system of trials of various agricultural and biodiversity rehabilitation and endemic vegetation reestablishment techniques, supported by a local seed bank of endemic species;
d) An integrated bushfire management plan;
e) A program to fast track work to regenerate biodiversity offset areas, this work should commence immediately and be managed adaptively, with the aim of delivering the projected biodiversity outcomes, and demonstrating success by year eight of the mine plan (see recommendation 17 c) and d)).

Early results from adaptive management of possible offset lands should inform finalisation of the overall offset strategy in order to protect or enhance biodiversity values while minimising impacts on the local community and economy.

Additional offsets, for the impact on *Tylophora linearis*, should be identified prior to the commencement of mining in area B, or mining in this pit should be set back to avoid the population identified and provide a sufficient buffer zone.

Work to revegetate grasslands proposed as offsets should start immediately and be managed adaptively to give confidence that projected outcomes can be delivered. This should be demonstrated to the satisfaction of the Director General prior to clearing and mining operations proceeding beyond Year 8 of the mine plan.

The Proponent must work with the OEH and DSEWPC to resolve the issues that have been raised by the agencies.

Any approval granted should include a condition requiring the Proponent to engage a land manager with expertise and experience in the adaptive implementation of a comprehensive land management and rehabilitation plan for both mine areas and other landholdings.

In formulating and implementing the Integrated Land Management Plan, the Commission recommends that detailed consideration be given to the advice received from Dr Burns, relating to the rehabilitation of the areas disturbed by mining, particularly:

a) The two stage organic soil enhancement strategy proposed by Dr Burns should be adopted in the rehabilitation of the mine site.
b) Limiting the application and reuse of sodic sub-soil to areas which are to be reinstated as Class III agricultural land.
c) Excluding stock from areas undergoing rehabilitation and/or revegetation.
d) adopting a strategic approach to the clearing and onsite reuse of timber and bush rock, demonstrating the best use of the product.

8. Water Impacts

The Commission engaged Dr Steve Perrens to provide expert advice on the projects impacts on water resources. Dr Perrens' report is attached in Appendix 7. Dr Perrens' executive summary is copied here, followed by the Commissions recommendations based on Dr Perrens' advice.

Background

The proposed Cobbora Coal Project comprises a new open-cut coal mine that is intended to extract 20 million tonnes per year of run of mine coal (ROM) from which 12 million tonnes of product coal will be supplied by rail, mostly to the state's power generators (primarily Bayswater and Liddell power stations). Some coal (up to about 20%) is proposed to be sold into the export market or to power stations on the Central Coast.

The proposed mine would comprise three active open-cut mine pits within an overall disturbance area of 4,130 ha located within an area of 32,538 ha owned by the Cobbora Holding Company (CHC). The mine would be serviced by a 28 km rail spur from the Dunedoo-Gulgong rail line and a 26 km pipeline from the Cudgegong River. The proposed disturbance area associated with the rail line and pipeline, including buffers, is 410 ha.

Figure S-1 shows the location of the Project Application Area (including the corridors for the rail spur and pipeline) in relation to the main river systems. The mine itself would be located in the lower reaches of Sandy Creek and its major tributary Laheys Creek which drain to the Talbragar River about 2 km north of the Project Application Area. The Talbragar River is a tributary of the Macquarie River which it joins approximately 6 km north of Dubbo. In addition to surface and groundwater from within the mine area, water for the project will be supplied from the Cudgegong River by means of releases from Windamere Dam for transfer to the mine via the pipeline. As shown on **Figure S-1**, the Cudgegong River drains into Burrendong Dam. Burrendong Dam is operated in conjunction with Windamere Dam to provide regulated flow in the Cudgegong and Macquarie River systems.

Figure S-2 shows the immediate area of the mine (comprising Mining Areas A, B and C) and associated infrastructure such as the Main Infrastructure Area, Coal Handling and Preparation Area (CHPP), water storage dams and tailings emplacements. (References to '(Amended)' on **Figure S-2** refer to amendments to the mine layout presented in the Preferred Project Report (PPR, February 2013) compared to the original Environmental Assessment (EA, September 2012)). As shown on **Figure S-2**, Sandy Creek runs from south to north along the western side of the mine footprint. Laheys Creek runs approximately south-east to north-west between mine areas and joins Sandy Creek approximately 1.5 km north-west of the north-west corner of Mining Area B. Blackheath Creek (not shown on **Figure S-2**), is a tributary of Laheys Creek which runs in an east-west direction immediately north of the CHPP and joins Laheys creek immediately south of the Main Infrastructure Area.

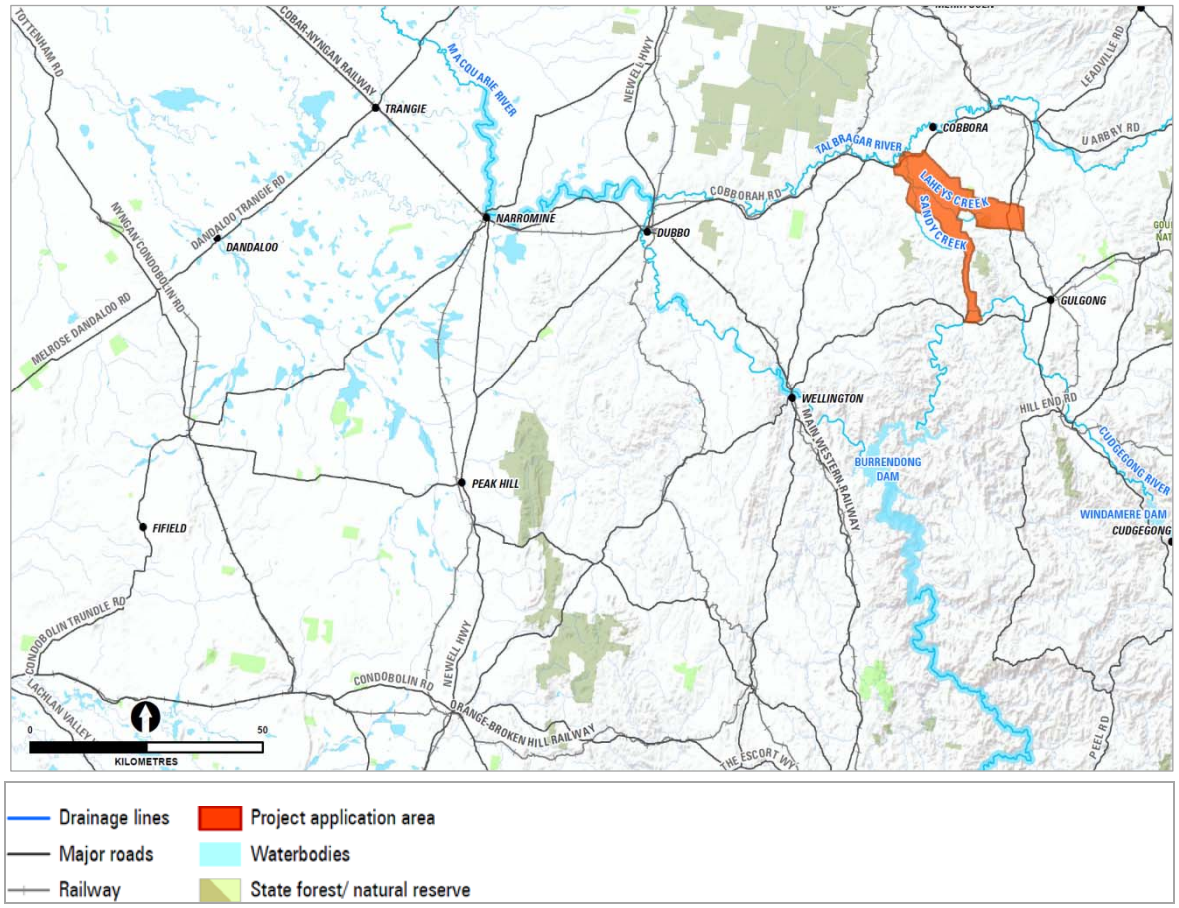


Figure S-1: Location of Cobbora Project Application Area in Relation to Rivers, Roads and Towns

Source: *Surface Water Assessment*, (Appendix F to the *Preferred Project Report*), Figure 3-1

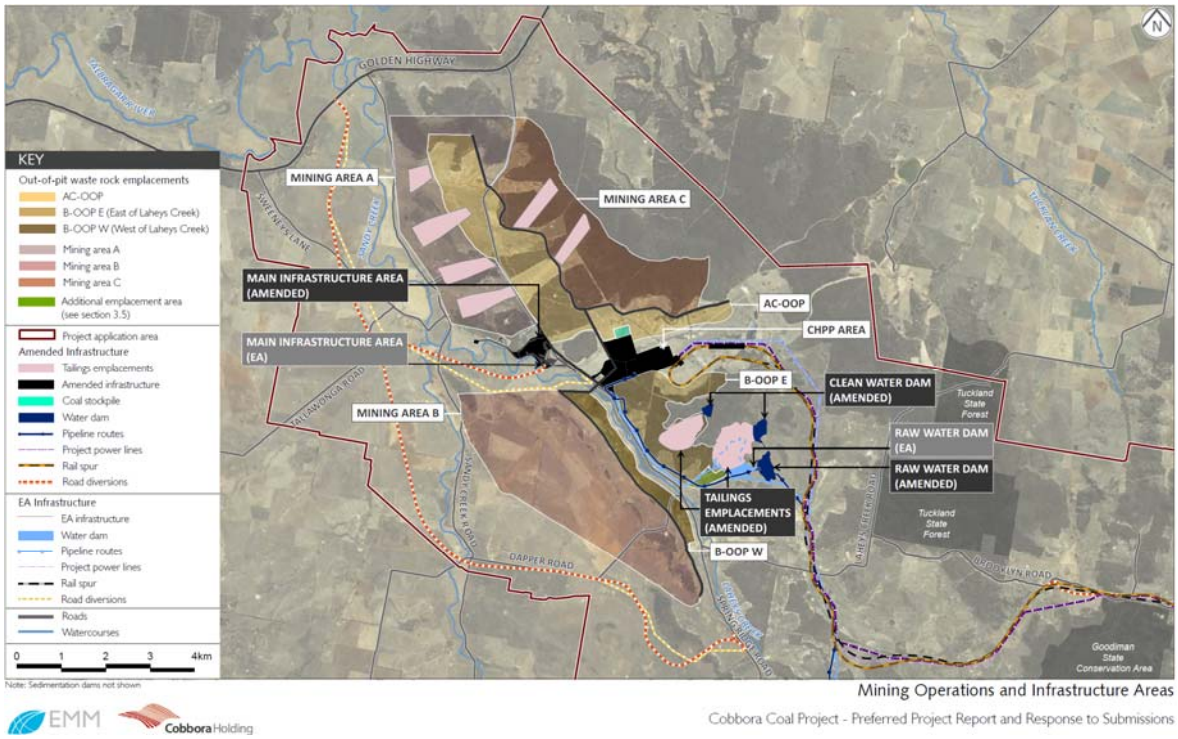


Figure S-2: Cobbora Mine Operations and Infrastructure Areas

Source: *Preferred Project Report*), Figure 3.1

This report is concerned with the water issues that are integral to other aspects of the mine operations including tailings disposal, dust suppression and pollution control. Accordingly, the report starts with a review of the water requirements for mine operations, the variation in water requirements as the mine progressively develops and the uncertainties caused by climate variability. The important features of the various water sources available to meet the mine water requirements are then reviewed along with the associated licencing requirements. Subsequently the mine water balance provides the framework for reviewing the risks of water shortage or excess and the available options to deal with such contingencies. Finally, the impacts of the mine on flow, flooding, groundwater and water quality are reviewed.

Water Demands

Water requirements for tailings disposal and dust suppression account for about 90% of the water required for the mine. There is some uncertainty associated with both of these demands:

- Tailings disposal is proposed to be by means of slurry (35% solids) deposited into two out-of-pit tailings dams for the first six years and then into six in-pit emplacements. The sizing of the tailings emplacements and the coal handling facilities is based on a 'worst case' assumption that tailings will comprise 10% of the ROM coal. However, the water demands and water balance analysis are based on an average of 5.5% tailings over the life of the mine and do not account for a period of up to a year when the ROM coal may have a higher proportion of tailings.
- The option of tailings disposal by means of a slurry is justified on least cost grounds as assessed by NPV. The Dewatering Options Report assesses the technical features and capital and operating costs associated with five alternative options including four mechanical dewatering options which would provide water savings of up to 70% (about 1,100 ML/year at peak production assuming 5.5% tailings). All of the mechanical dewatering options include provision of an out-of-pit tailings dam for use in the event of breakdown. However the costs for these options include provision for raising the out-of pit dam in Mine Years 9 and 13, by which time disposal into a section of the pit void would be an option. If these costs are taken out of the analysis of the NPV for two of the mechanical options, the costs are in line with the costs for the preferred option.
- The water balance analysis for the project examines the effect of dry, median and wet years on the mine operation but fails to account for possible increases in water requirements for dust suppression in drier years (up to 250 ML). In response to a question about this issue the consultants have indicated that chemical dust suppressants could be used to supplement water in the event of a shortage.
- A number of other losses such as seepage from dams, water loss in coarse rejects and produce coal do not appear to have been accounted for.

Water Sources

The Surface Water Assessment shows that main sources of water for mine operation would be groundwater inflow to the pits and water imported from the Cudgegong River via a 26 km pipeline.

- The Groundwater Assessment predicts that inflow to the mine pits will progressively increase as the mine develops to a rate of in excess of 2,000 ML/year between Mine Years 7 and 18 with a peak of about 2,800 ML in Mine Year 14. These predictions are all based on the

assessed loss from the groundwater system which are then included as gains to the surface water system after allowing for minor evaporative losses from sumps. However, this analysis fails to account for the fact that most groundwater would appear as small seepages around the face of the pit rather than as a distinct flow that can be captured. These seepages would be subject to significant loss by evaporation. CHC's surface water consultants disagree with this view and contend that, in the event of a requirement to capture more groundwater, dewatering bores or other direct access methods could be employed.

- Water would be imported from the Cudgegong River, on an 'as needs' basis, using CHC's high security access entitlements for up to 3,311 ML/year. The terms under which 2,311 ML of these water entitlements were transferred from downstream to upstream of Burrendong Dam has been the subject of some concern by the community and local government that it may detract from the reliability of supply. This issue is canvassed further below. It is worth noting, however, that the water balance analysis indicates that less than half of the entitlements would be required to meet mine water demands in a median rainfall year.
- Runoff from the mine pits and work areas that drain to the mine water dams is predicted to contribute about 20% of the mine water demands in a median rainfall year.

Water Balance Assessment

Figure S-3 is a schematic diagram which illustrates the flow regime at key points within the Macquarie River valley and those related to the Cobbora Mine for a median year based on data from the following sources:

- Median annual flows in the Talbragar, Cudgegong and Macquarie Rivers derived from an analysis of the annual flow data for the period 1984-2012 taken from the NOW web site (http://realtimedata.water.nsw.gov.au/). The period after 1984 was chosen because Windamere Dam was completed that year.
- Water uses, losses and sources for a median rainfall year in Year 16 of mine operation. This data was summarised from the *Addendum* to the *Surface Water Assessment* (March 2013).

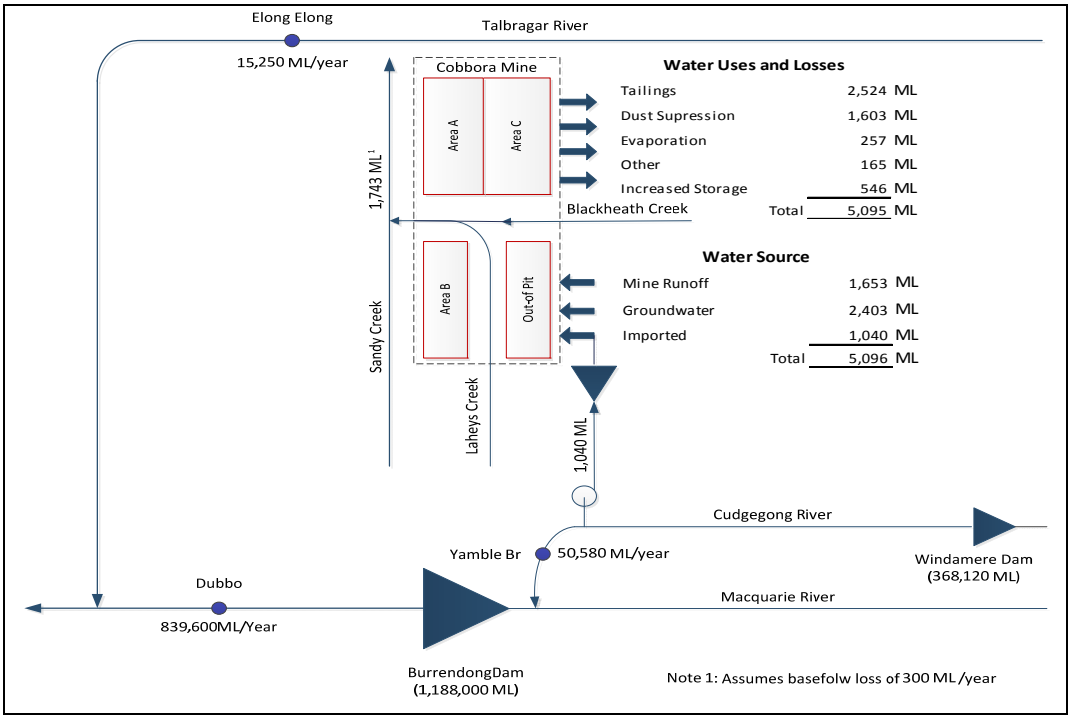


Figure S-3: River Flows and Mine Water Sources/Losses in a Median Year

While **Figure S-3** relates to flows in a specific year (a median climate/flow year during Year 16 of the mine operation), the table below provides a summary of the mine water balance assessment for the five representative mine years selected for detailed water balance analysis using 111 years of historic rainfall data. For simplicity the table omits some of the minor contributions to the overall water demand including evaporation losses and the contribution of runoff within the mine. The apparent anomalies in the volume of water imported occur because of carry-over of water in the mine storages which is depleted during the year in question. As shown in the table (Column 3), from Year 4 onwards, the mine would have about 3,200 ML of storage capacity, including 1,000 ML in the Raw Water Dam. This capacity provides significant opportunity to balance any variation of water supply and demand from year to year.

Mine Year	Product Coal (Mt/a)	Water Storage Capacity (ML)	CHPP Make-up (ML/a)	Dust Suppression (ML/a)	Total Site Demand (ML/a)	Groundwater Seepage (ML/a)	Imported Water (ML/year)		
							Dry Year (1967)	Median Year (1906)	Wet Year (1990)
1	0.7	2,696	134	376	524	131	120	120	0
4	11.2	3,199	2,092	968	3,210	1,069	1,840	1,300	360
12	12.0	3,166	2,524	1,651	4,340	2,446	580[1]	960[1]	400
16	12.0	3,166	2,524	1,603	4,292	2,403	1,220	1,040	380
20	12.0	3,216	2,524	1,371	4,055	1,163	2,400	1,660	400

The data in the last three columns of the table suggests that in a dry year (10% probability) the maximum requirement for imported water would be 2,400 ML, compared to entitlements of 3,311 ML. However, for various reasons outlined above, the picture painted in the table is considered optimistic, in particular:

- The analysis assumes that tailings will comprise 5.5% of ROM coal on average. If, however, poorer quality coal with 10% tailings was mined an additional 1,900 ML/year could be required.
- Water requirements for dust suppression could vary by up to 250 ML in a 10th percentile dry year unless chemical dust suppressants were also used.
- Seepage losses from dams have been ignored.
- The questionable assumption that a large proportion of the groundwater inflow will actually be available to make a significant contribution (up to 50%) to the overall water balance.

These issues indicate that the full entitlement of the high security licence for 3,311 ML from the Cudgegong River may be called on more frequently than the water balance analysis suggests. On the other hand, by only assessing the water balance for selected mine years, the analysis does not necessarily provide a full picture of the risk of having to retain water in the mine pits for an extended period. Analysis undertaken by consultants for Mid-Western Regional Council assessed the 'life-of-mine' water balance by applying the climatic data and mine layout details on a continually evolving basis, rather than the climatic and mine layout `snapshot' approach adopted for the Surface Water Assessment. Their analysis indicated that under some climate sequences there may be excess mine water stored in a pit for several years (e.g. more than 10 years with greater than 1,500 ML, and more than 5 years requiring management of 3,000 ML or more).

The uncertainties in the modelling ultimately revolve around the question of how the mine would operate under extreme conditions of too little or too much water:

- In a situation of excess water, the mine could:
  - Reduce the import of water to the absolute minimum required to provide potable supply and maintain the required water quality for the CHPP (about 18%);
  - Identify opportunities for disposal of additional water onto bare overburden;
  - Relocate any remaining excess water to one of the mine pits to allow operations to continue in the other two;
  - Commission a reverse osmosis plant to provide water of a suitable quality for substitution for imported raw water for the CHPP, for irrigation or for discharge to the environment (subject to obtaining a discharge licence and meeting water quality criteria).
- In a situation of water shortage, the mine could implement a range of actions:
  - Install dewatering bores or other in-ground measures to directly access groundwater;
  - Reduce water usage for dust suppression by the use of chemical suppressants;
  - Purchase additional water from the Cudgegong River on the 'temporary trade' market at the prevailing market price.

Based on the assumptions that underpin the water balance analysis, it appears that water shortage is more likely than excess. Rather than investing in dewatering methods such as dewatering bores, a more cost effective solution could be to significantly reduce the overall water demand for the project by using mechanical dewatering which has the potential to significantly reduce make-up water requirements.

Impacts on Flow and Groundwater

From the analysis in the Surface Water Assessment and the Groundwater Assessment it is difficult to determine:

- The expected magnitude of the combined losses of baseflow and surface runoff on flows in Laheys Creek, Sandy Creek and the Talbragar River over the course of mining and the period of groundwater recovery;
- The magnitude of losses from different reaches of creeks and/or river that would be affected by baseflow loss attributable to groundwater drawdown;
- The progressive increase in baseflow loss over time as the mine develops and the subsequent groundwater recovery.

The Surface Water Assessment (page 33) notes that the total combined induced loss of flows in the Lower Talbragar River Water Source peaks at 799 ML/year. The Groundwater Assessment (page 115) states that induced baseflow loss of up to 480 ML/year would occur in 2036 (Mine Year 23), but the source of the remaining 319 ML/year is not apparent and is not accounted for by the relatively minor changes on surface flow described in Appendix C to the Surface Water Assessment (maximum 37 ML/year in Mine Year 12 in a 10th percentile dry year).

Groundwater drawdown is identified as having the potential to reduce the groundwater contribution to some of the semi-permanent pools in Laheys Creek and Sandy Creek. The assessment in Appendix C to the Surface Water Assessment concludes that the predicted

changes in the flow regime as a result of release of water from sediment dams could positively affect the semi-permanent pools. However, it is unclear how much of the predicted loss of baseflow (up to 480 ML/year) would occur within the reaches of the creeks in which the pools are located. In a 'worst case' scenario the combined impact of reduced surface runoff and baseflow loss could lead to significantly greater impact on continuity of water supply to the semi-permanent pools than has been assessed to date.

The issues relating to baseflow and surface runoff losses in the surface water systems require further clarification as to their magnitude, location and progression over time. The proposed mechanisms for offsetting the losses also require clarification.

The proposed final landform involves backfilling of two of the pits (Mine Areas A and C) to a level that is at least 3 m above the predicted final groundwater level; and one remnant void (Void B) in the south-west corner of Mine Area B. Void B would have a total catchment area of 242 ha, including the lake that would form in the base of the void. A water balance analysis that took account of groundwater inflow and used multiple 1,000 year rainfall sequences indicated that the lake level would initially rise rapidly from a base level of about 340 m AHD to a level of about 374 m AHD within 100 years and thereafter vary within a range of about 370 to 378 m AHD depending on the climate. The salinity is predicted to progressively increase in a linear manner to a median estimate of about 8,900 mg/L after 100 years and continue to increase at that rate thereafter. Key findings of the water balance analysis are that:

- The maximum equilibrium water level from 100 climate replicates of 1,000 years is 29 m below the top-of-void level of 407 m AHD. The void is therefore not expected to overtop.
- The maximum equilibrium water level is 2 m below the adjacent creek level of 380 m AHD. The void is therefore expected to be a net groundwater sink and no groundwater outflow would occur from the void lake towards the creek.

Although the water balance analysis does not appear to have taken account of possible climate change effects, these would tend to reduce rainfall and runoff and increase evaporation leading to a lower equilibrium lake level.

Flooding

Flood impact assessment for the creeks within the immediate vicinity of the mine and along the rail line has been undertaken using accepted methods. On the whole, the analysis indicates that the mine facilities would have minimal impact on the flood regime except in a few locations which require further assessment/detail particularly in relation to flow velocities and sour protection in the immediate vicinity of some crossings where sharp drops in flood levels imply high velocities and the potential for scour. In addition, details are required of the protection of the toe of the overburden dump on the western side of Laheys Creek which will be a permanent feature of the landscape after mining ceases.

Much of the proposed rail line will be located on a 6 m high embankment which has the potential to cause flooding upstream unless adequate hydraulic capacity is provided at locations where the rail line crosses watercourses and creeks. Localised hydraulic models were prepared for each of the 21 identified watercourse crossings. The preliminary designs developed for the major crossings of Fords Creek and Tallawang Creek have been estimated to lead to flood level increases 200 m upstream of the rail line of 0.14 m and 0.01 m respectively.

Up to 86 ha of the lower Sandy Creek catchment on its eastern side would be diverted north into the eastern arm of Flyblowers Creek. A dry detention basin (70 ML capacity) would be required to restore peak flows at the Golden Highway culvert to the existing levels.

Water Quality Impacts

The Surface Water Assessment includes details of routine monthly water quality monitoring that has been undertaken at three sites on Laheys Creek and Sandy Creek and two sites on the Talbragar River. The water quality data indicates that Laheys Creek and Sandy Creek have significant naturally occurring sources of salinity and are strongly influenced by agricultural activities on the catchment. The water quality data indicates that the Talbragar River is far from a pristine system and could be described as representing a 'moderately to highly disturbed' system.

These data have been used as a basis for modelling water quality over a 30 year period in order to determine water quality objectives that reflect local conditions. This analysis was based on the procedure set out in the ANZECC Guidelines. The resulting water quality objectives are very little different from the values that could have been derived from direct statistical analysis of the monitoring data. Modelling has also been used to assess water quality impacts downstream of the mine. The analysis shows that, while adhering to the proposed discharge water quality criteria, runoff from the overburden dumps can nevertheless be expected to have a significant influence on total dissolved solids in Sandy Creek. In view of the relatively small catchment area attributable to overburden dumps (maximum 1,633 ha), compared to the overall size of the Sandy Creek catchment (28,000 ha), these results appear counter intuitive.

It should be noted that the sediment dams would not reduce total dissolved solids and salinity. The only way that some control could be exercised over saline discharge from the sediment dams (or any other dissolved characteristic such as metals, nitrogen, or pH) would be for all water that exceeded the adopted discharge criteria to be transferred to a mine water dam. This would involve a change in the operating strategy from that adopted for purposes of the water balance analysis.

Provided the following facilities are in place and the required management practices are followed, there is no reason why the mine would significantly impact on water quality in Sandy Creek or the Talbragar River:

1. Mine water management facilities are designed and managed so as to retain runoff from pits and all active mine areas;

2. Facilities are provided to allow the transfer of water from sediment dams to the mine water dams in the event that the water does not comply with the discharge criteria.

Water Extraction from the Cudgegong River

Prior to approving the transfer of a high security entitlement from downstream to upstream of Burrendong Dam, the NSW Office of Water (NOW) undertook a detailed assessment of the impact the transfer would have on the resource availability and reliability for other water users. The key factor that underlies NOW's assessment that there would be no significant impact is

that, for operational purposes, Windamere Dam (on the Cudgegong River) and Burrendong Dam are operated as a single source. The operation of the dams as a single source includes rules for the bulk transfer of water from Windamere Dam to supplement the water in Burrendong Dam (subject to a minimum reserve storage below which no transfers occur). Accordingly, a volume of high security water ordered from Windamere Dam for extraction from the Cudgegong River would be the same as the same volume ordered from Burrendong Dam for extraction on the Macquarie River, and would have no significant impact on the available resource or its reliability. Independent analysis by consultants on behalf of Mid-Western Regional Council confirms NOW's assessment.

Conclusions

The review identifies a range of uncertainties associated with the estimated water requirements for the operation of the Cobbora Mine and the relative contributions from different sources of supply. Notwithstanding these uncertainties, none of them individually or collectively would be 'show stoppers'. A range of options are available that would allow the mine to adapt its water use and manage the various sources to allow the mine to operate within the constraints of the available water resources. The mine proposes to construct mine water dams and a raw water dam with a combined capacity of approximately 3,000 ML which would provide opportunities to balance water uses and losses in the short term (6 – 12 months). In the longer term, water use could be reduced by using mechanical de-watering. Alternatively, additional certainty of groundwater supply could be achieved by the installation of de-watering bores.

There is also some uncertainty associated with the extent and magnitude of groundwater drawdown that could affect privately owned bores as well semi-permanent pools in Laheys Creek and Sandy Creek. The impact of the project on baseflow and runoff to Laheys Creek, Sandy Creek and the Talbragar River is also unclear. While the project has sufficient water licence entitlements in the Lower Talbragar Water Source to cover the projected loses, the mechanism for any offset requires clarification.

Cobbora Mine proposes to draw an average of approximately 1,270 ML/year (approximately 30% of average water requirements) from the Cudgegong River using its high security water access entitlements for up to 3,311 ML/year. These entitlements include 2,211 ML which were acquired from downstream of Burrendong Dam and, following analysis by NOW, transferred to the Cudgegong River upstream of the dam. Windamere Dam (which regulates flow in the Cudgegong River) and Burrendong Dam are operated as a single source for purposes of meeting the licenced water entitlements on the Cudgegong River and the Macquarie River. The analysis undertaken by NOW (and verified by independent analysis undertaken by consultants commissioned by Mid-Western Regional Council) shows that the transfer by CHC of a high security licence from downstream to upstream of Burrendong Dam would not significantly impact the water availability or reliability of supply to other users on the Cudgegong River.

The concerns raised by the Mid-Western Regional Council relating to changes in the reserve storage in Windamere Dam in order to maintain security of supply arise from a re-assessment of the 'drought of record' following experience in the decade up to 2010. This reassessment has been commenced by NOW and State Water.

Dr Perrens' report is provided in full at Appendix 7

8.1.1. Findings and Recommendations

The Commission has carefully considered Dr Perrens advice and also noted the submissions made by the NSW Office of Water. While Dr Perrens has highlighted some of the uncertainty associated with various aspects of the water modelling provided by the Proponent to date, the Commission understands that these uncertainties can be managed and that it should be possible to deal with both the scenarios for periods of particularly wet conditions as well as those for dry periods of water shortages or droughts. Nonetheless the Commission considers that the management of water resources is of the upmost importance in this region and that every effort should be made to minimise the project's impacts on water. In order to achieve this, further work will need to be provided to address the issues raised by Dr Perrens, in the project's water management plan.

Dr Perrens made a compelling case for requiring the use of mechanical tailings treatment, with the potential to achieve water savings of some 2,550 ML a year. The Commission considers that a mechanical tailings treatment technology should be required to be employed. Based on the analysis provided by the Proponent (EMM 2013) solid bowl centrifuge technology appears to be a promising option worthy of detailed consideration. Mechanical dewatering of tailings should also assist in minimising the out of pit tailings emplacement requirements of the project.

A water management plan, that satisfactorily addresses the issues raised in Dr Perrens' review report (and the submission by the NSW Office of Water), will need to be provided prior to the commencement of any works on site, applying the following principles:

a) tailings should be treated mechanically in order to minimise water requirements for the project unless the Proponent can demonstrate that an alternative would satisfy best practice standards;
b) mine water management facilities must be designed and managed to retain runoff from pits and all active mine areas;
c) facilities must be in place to transfer water from sediment dams to the mine water dams, in the event that the water does not comply with the discharge criteria.

9. Social and Economic Impacts

At a local and regional level the project would have a range of benefits and costs including increased employment opportunities and diversification of the local economy. However, based on experience of other coal mine developments in regional New South Wales, the project would also generate housing, infrastructure and servicing pressures, as well as competition for labour, some displacement of agricultural enterprises and possibly some losses to local specialty businesses servicing the agricultural sector.

As noted previously, the project is located mostly within the Shire of Warrumbungle close to the small regional town of Dunedoo, which has a population of 1254 (at the 2011 census). Warrumbungle Shire Council advised the Commission that the Proponent "has bought up 33,000 ha of land formerly owned by 68 families (overall 90 farms involved), most of whom have left the district. That represents a very significant loss of agricultural production worth many millions of dollars".

The Commission observed that even though some of the land acquired by the Proponent has been leased, little productive agricultural activity is occurring on the site, and activities associated with the development phase of the project have not replaced agriculture and passed through to benefit the local economy. Moreover, future uncertainty regarding the timing of the construction and operational phases of the project may have a negative impact on future investment in the local town of Dunedoo. While it may be difficult for Government to address this uncertainty in the short to medium term, the creation of a fund to rehabilitate parts of the site not impacted by future mine activities could provide a small stimulus to the local economy, and be a partial replacement for lost agricultural activities. The fund could also be used to trial future rehabilitation techniques for the site and train local workers.

In its briefing to the Commission, the Proponent indicated that it has established a number of training opportunities in the region, with funding for apprenticeships. The Commission notes this proactive approach, but considers that far more could be done, particularly with the provision of training opportunities for local Aboriginal people.

Opportunities and provision for training and employment opportunities for Aboriginal people in the region should be explored in consultation with Warrumbungle and Wellington Shire Councils and the local TAFE colleges

In their submissions to the Preferred Project Report, Warrumbungle and Wellington Shire Councils listed a number of infrastructure projects that would benefit local communities and be required if the mine was to proceed to construction and operational stages. The list of infrastructure projects should be considered by Government to provide further economic stimulus to the local economies while the future timing of the project is being considered.

The list of infrastructure projects should also be considered by the Proponent in its negotiations for the Voluntary Planning Agreements.

At the state level the mine would have significant financial benefits in terms of royalties and taxes but, as the State Government is effectively the Proponent, this mine also involves a number of additional costs and risks to the state.

The terms of reference are not explicit about the scope or scale of economic impacts the Commission should examine. Some of the submissions made to the Commission raised concerns with the economics of the proposal at the state level. These concerns included that the mine (and coal powered electricity generation, by association) would effectively be subsidised by the State and NSW tax payers - and consequently that it should not proceed.

The Commission understands the NSW Government has obligations to supply coal to certain power stations in NSW under existing coal supply agreements. The Commission has not examined these agreements or the background to them, but understands there are a range of complex factors, including historical decisions, which have led to the current situation. Notwithstanding the existence of these agreements, during the early stages of this review the NSW Treasurer indicated publicly that the Cobbora coal mine may not proceed immediately.

In light of these comments the Commission met with NSW Treasury (on 19 December 2012) in order to clarify its understanding of the status of the project. Treasury confirmed it was still seeking approval for the project and the Commission was advised that the development of the Cobbora coal mine will remain a priority for the NSW Government, unless and until a superior alternative is established.

The Commission considers that Treasury is best placed to examine the project's costs and benefits at the state level and its economic justification, in tandem with its consideration of any alternatives available, as part of the business case development process. Consequently the Commission has not undertaken a detailed assessment of the economic impacts of the project at a state level.

Nonetheless, the Commission is of the strong view that in order for the mine's business case to be properly considered against alternative options the Government may seek to pursue, the proposal must be designed and operated to the same best practice standards as are expected of any new mine in NSW. The Commission has assessed the project on this basis and recommends that the project must be required to meet best practice standards in all areas.

9.1.1. Findings and Recommendations

The creation of a fund to rehabilitate parts of the site not impacted by future mine activities could provide a small stimulus to the local economy, and be a partial replacement for lost agricultural activities. The fund could also be used to trial future rehabilitation techniques for the site and train local workers.

In its briefing to the Commission, the Proponent indicated that it has established a number of training opportunities in the region, with funding for apprenticeships. The Commission notes this proactive approach, but considers that far more could be done, particularly with the provision of training opportunities for local Aboriginal people.
Opportunities and provision for training and employment opportunities for Aboriginal people in the region should be explored in consultation with Warrumbungle and Wellington Shire Councils and the local TAFE colleges.

Warrumbungle and Wellington Shire Councils have identified a number of infrastructure projects that would benefit local communities and in the Councils' opinion, should be required if the mine was to proceed to construction and operational stages. The list of infrastructure projects should be considered by Government to provide further economic stimulus to the local economies while the future timing of the project is being considered. The list of infrastructure projects should also be considered during negotiations for the Voluntary Planning Agreement's with Proponent.
The project should be required to meet best practice standards in all areas during construction and operational stages.

10. Other Key Issues

10.1. Traffic and Transport

The proposed coal mine, if approved, will generate a significant number of car and truck movements on the regional road network during the construction phase and operation of the mine. As product coal will be transported via rail to the various power stations in the Hunter and Central Coast as well as other domestic or export markets, impact on the rail network and associated amenity issues are also matters that need to be addressed.

10.1.1. Road Transport

Road transport is assessed in Appendix K of the Environmental Assessment. The assessment concluded that road traffic impacts would be experienced during both construction and operation, with greater impacts experienced during construction. For both phases the majority of traffic would come to and from the west (Dubbo) along the Golden Highway.

The key issues identified in the Environmental Assessment include:

Construction

- In order for the project to proceed parts of the existing road network will need to be upgraded, modified, closed and/or realigned;
- The project would include a construction workforce of approximately 550 persons. Approximately 340 workers would reside at the temporary accommodation village located on Spring Ridge Road and would commute by bus to the project area;

Operation

- The operation workforce is expected to reach its peak between 2027 and 2030 with approximately 590 people;
- The realigned Spring Ridge Road would experience the greatest increase in daily traffic flows during operation with an increase of 538% (from 78 to 498 movements) for cars and 1,171% (from 7 to 89 movements) for heavy vehicles per day. The existing daily traffic on this road is considered low and therefore these percentages are predicted off a low base.
- The Golden Highway would experience increases of approximately 32% (from 990 to 1,308 movements) for cars and 16% (from 267 to 309 movements) for heavy vehicles per day;
- A number of impacts were identified that would need to be mitigated and managed, which include new road alignments, sealed shoulder widening, additional routine pavement maintenance, intersection upgrades and additional turning lanes; and
- Potential increase in road safety risks that need to be managed and mitigated through driver safety training and road safety audits (including a safety audit of all school bus stops on affected roads).

Submissions to the Environmental Assessment raised a number of concerns in relation to road transport. The key concerns included:

- Lack of information provided on oversized vehicles, the use of Cobbora Road and access along local roads;
- Adequacy and reliability of the information provided on workforce modelling, car sharing estimates and traffic volumes;
- Design requirements of intersection upgrades;
- the need to remove and/or restore the section of Spring Ridge Road outside the mine footprint;
- Appropriate financial contributions to Councils relating to road upgrades and maintenance;
- The loss of road infrastructure within the mine area; and

- the additional travel time required due to the new road diversions.

In response to submissions to the Environmental Assessment the Proponent modified the project in its Preferred Project Report (PPR). The modifications included:

- A permanent realignment of the Castlereagh Highway (with a design speed of 100km/hr) at the location of the rail spur underpass near Tallawang instead of a temporary detour during construction;
- The relocation of the Spring Ridge Road further to the west of the mine site to replace the EA proposed detour from Spring Ridge Road, Dapper Road and Brooklyn Road-Corish Lane. This new section of the Spring Ridge Road will be open to the public before the commencement of mining operation;
- The mine access road has been moved to the new intersection of Tallawonga Road and the new relocated Spring Ridge Road; and
- The temporary construction village has been relocated 500m to the south which will be located on a straight section of the existing Spring Ridge Road.

The Commission notes that no changes were made between the Environmental Assessment and Preferred Project Report to car or heavy vehicle traffic volumes or distributions. The Proponent maintains a car driver ratio of 50% for the mine shift workforce and 75% for the mine management and site visitors is achievable. To support its position, the Preferred Project Report outlines the car pooling scheme adopted by the Cadia Valley Mine. About 70% of its operational workforce have signed up and registered for the scheme. Cadia's workforce commuting car driver ratio has been reduced to about 54% since the introduction of the scheme.

Some submissions to the Preferred Project Report raised issues similar to the submissions to the Environmental Assessment. Other issues include:

- Inadequate workforce modelling;
- the impacts (such as accommodation/housing, roads and traffic) on Cobbora due to cumulative impacts of other major projects in the area;
- Councils' seek a Voluntary Planning Agreement (VPA) that delivers equitable distribution of funds based on the infrastructure, environmental and social impacts. As the proposed mine is within the Warrumbungle local government area, Warrumbungle Shire Council considers it should receive a bigger proportion of the VPA funding to mitigate the impacts on the community; and
- Councils disagree with the predicted daily traffic volumes and car sharing estimates proposed and consider traffic impacts to be underestimated.

The Commission notes that the Preferred Project Report has broadly addressed the key issues of concern raised in submissions from the public, agencies and Councils, particularly in relation to road safety, and road upgrades. It is also noted that RMS has entered into an agreement with the Proponent regarding a number of existing intersection upgrades which will be treated separately to the project approval.

The Commission considers that to ensure product coal is transported via rail, a condition prohibiting the road transportation of product coal is appropriate.

The Commission acknowledges that the mine will generate additional traffic on the surrounding road network in particular on the new relocated Spring Ridge Road and the Golden Highway. The Commission accepts that the project's impact on the road network can be managed by the implementation of the identified road upgrading and improvement works. It is noted that negotiation between the Proponent and Councils and the RMS is continuing and some agreements

have been reached. The Commission supports the parties' efforts to negotiate an acceptable outcome to all parties. To ensure transparency and a clear indication of the timing of implementation, the Commission recommends a program of works to be included in the final approval.

The Commission notes that a Traffic Management Plan (TMP) is a standard requirement for mining proposals. To address the car pooling issue, the Commission recommends that a workplace travel plan should be an integral part of the TMP. According to the Preferred Project Report, the Proponent has committed resources to set up and support the plan with a target of 50% to 60% car driver ratio for the shift and mine management workforce respectively. The TMP should also include contingency measures and requirements to undertake a safety audit on all school bus stops on affected roads and a road dilapidation survey prior to construction commencing.

The Commission also notes that the Councils have varying positions seeking funding contributions to the upgrade and maintenance of roads. The Commission considers contributions should be reasonable and equitable and reflect the actual impact on the infrastructure.

10.1.2. Rail Transport

Rail transport is considered in Appendix L of the Environmental Assessment. The proposed mine will be developed to supply 9.5 million tonnes per annum (Mtpa) of coal to five power stations and 2.5 Mtpa of coal may also be produced for other domestic customers or exported. At full production, the mine will require 10 train movements per day for 300 days per year. Of the 10 movements, 8 will be to the various power stations (including Bayswater, Liddell and the central coast), and two to the Upper Hunter Valley or Newcastle area for other domestic or export markets.

The Environmental Assessment Report reviewed the existing rail network and its utilisation and found the capacity for coal transport increases progressively east of Ulan. A range of rail network capacity improvement works have been identified to cater for the growing demand for coal and other freight transport. The Environmental Assessment concluded that with the additional timetable capacity and network improvements, there will be sufficient capacity to meet the cumulative demand from the project and other identified coal projects on all sections of the rail route from Cobbora to Vales Point.

In reviewing the level crossing safety issue, the Environmental Assessment found the 2 crossings in the Newcastle urban area, namely, at Clyde Street, Islington and St James Road, Adamstown, have been recently upgraded to the highest level of safety protection. The potential increase in daily train traffic from the Cobbora project will have no measureable effect on the existing accident collision risk levels but will result in some additional delays for road traffic at the level crossings.

Various crossings on major traffic routes on the Mangoola to Ulan section of the coal transport route were examined. The findings and recommendations for these crossings are:

- Golden Highway near Denman - an additional half boom barrier control to be installed to reduce the estimated collision risk rate from about 0.08 per year to 0.05 per year;
- Station Street crossing and two Ulan area level crossings which have active control with flashing lights and bells but no half boom barriers. The small increase in daily train traffic will not change the collision risk at these crossings. The collision risk rate remains at about 0.02 per year.
- Six identified level crossings on public roads within the Ulan-Gulgong-Tallawang areas, which currently have passive (stop sign) control. These will require further safety assessment by ARTC to confirm the most appropriate further safety treatment at each location.

The level crossing waiting times assessment concluded that the project will result in minor increase in the crossing closure time. However, the assessment argues that the minor increase will not be noticeable in the Newcastle crossings. In other crossings, the increase in closure time may be noticeable, but the assessment concludes this is considered generally acceptable to most road users.

Submissions on the Environmental Assessment raised a number of concerns in relation to rail transport. The key concerns included:

- impacts on different sections of the train paths;
- cumulative rail traffic;
- funding mechanism for network enhancement and infrastructure improvements;
- rail spur connection;
- timing of upgrading at Eraring and Vales Point power stations; and
- the issue of safety and need to upgrade existing level crossings.

In response to these concerns, further investigation of the level crossing delays and a review of safety-risk assessment were carried out. As a result of the investigation and review, additional environmental management measures are proposed to address the issues of crossing safety and road traffic delay impact. The measures include:

- additional railway level crossing safety improvement measures at six existing railway level crossings in the Gulgong area; and
- additional traffic delay mitigation measures for road traffic at the two crossings in the Newcastle urban area.

The Preferred Project Report also proposes a number of refinements to the route alignment of the 28km rail spur to improve operational efficiency and to minimise fuel usage. There are now two road underpasses in the vicinity of Brooklyn Road and Suzanne Road. Daily train numbers and train sizes are the same and there are no proposed changes to project rail operations. No new level crossings are required for the rail spur. Therefore, the project changes will have no increased rail traffic impacts compared to the impacts beyond those presented in the Environmental Assessment.

According to the Preferred Project Report the Proponent has reached agreement with ARTC to carry out the design work (Phase 1) to upgrade the Gulgong level crossing. Further work will be depend on the funding agreement between the Proponent and ARTC. Mid-western Regional Council has indicated its support for the proposed upgrade.

The Commission notes that the Preferred Project Report has broadly addressed the key issues of concern raised in submissions from the public, agencies and Councils, particularly in relation to level crossing safety and traffic delay issues. As to the need to upgrade the passing loops for Awaba North and Vales Point Power Station, the Preferred Project Report indicated that discussions are continuing between Origin Energy and Transport for NSW to determine the timing and funding for these works. The frequency and configuration of trains servicing the power stations remain unchanged until the upgrading is completed. The Commission agrees. However, if an alternative rail route is considered, the Commission recommends it should be subject to further assessment as part of this application or a future modification application.

The Commission also supports Mid-western Regional Council's request that public consultation, particularly with adjoining owners should be carried out prior to any road closure as a result of rail improvement/upgrading works.

10.2. **Bushfire**

Machinery and equipment and motor vehicle exhaust systems are listed as some of the main sources of bush fire ignition for the region (Orana Bushfire Management Committee, 2011 and Cudgegong Bush Fire Management Committee, 2012). If not appropriately managed, mine machinery and vehicles could also become a source of ignition during bushfire danger periods.

The NSW *Rural Fires Act 1997* requires an occupier of land to take practicable steps to prevent the occurrence of bushfires (and minimise the danger of the spread of a bush fire) on (or from) land under its control or management. The occupiers must also all take all possible steps to extinguish a fire on its land during a bushfire danger period (*Rural Fires Act 1997*).

The Proponent's bushfire assessment describes some of the operational measures the mine could undertake to reduce the risk of igniting a bushfire, these include specifying locations for refuelling and only blasting in cleared areas. As stated above, machinery and exhaust systems are a known ignition source in rural areas, management of this risk is not discussed in the Proponent's Environmental Assessment (EMM, 2012).

Notwithstanding the broad level of consideration provided in the Proponent's bushfire assessment (EMM, 2012), the Commission is satisfied the law (*Rural Fires Act, 1997*) requires the Proponent to undertake whatever measures necessary to prevent and extinguish any bushfire on the site.

The Commission supports the NSW Rural Fire Service's recommendations, including for additional protection of the dangerous goods depot. The Commission also considers that additional preventative measures and actions will need to be implemented during adverse conditions. For example it may be necessary to postpone vegetation clearing and restrict activities to cleared areas of the site in response to the prediction or occurrence of adverse conditions.

In purchasing the mine site and surrounding areas of affected land, the Proponent has now consolidated the ownership of a large area of land which will require active management effective rehabilitation and recovery of vegetation cover to suppress dust and enhance biodiversity values. This has the potential to lead to a significant increase in ground cover and understorey bushfire fuel loads, which will need to be monitored and managed; a potentially labour intensive task.

The Commission notes however that the acquisition of the project site and surrounding land has already had an impact on the region's ability to manage bush fires outside of the project site. The Proponent's bushfire assessment indicates that the local Rural Fire Service Brigade, the Dapper RFS has limited membership, training and equipment. The Proponent's social assessment (EMM, 2012) nominates the ageing demographic as the primary reason for the area's declining RFS, SES and other rescue squad membership. Nonetheless it also concedes that in buying up the project area and surrounds the project may have displaced some members of the brigade (EMM 2012).

In its submission to the Commission (dated 12 December 2012) the NSW Rural Fire Service goes further, raising serious concerns about the impacts which the proposal has already had on the membership of the Dapper Brigade. The submission notes that the Proponent now owns more than 90 percent of the Dapper Brigade area and that 35 families left the area when the mine purchased their properties. This has left the Brigade without enough members to crew a tanker or respond to an incident (RFS, 2012).

The Commission considers that the potential loss of a Brigade is a serious issue which must be resolved. The Proponent indicated that it has provided some contributions to fire services with the purchase of two water carts/cannons and a contribution to the training of fire-fighters in the local

area (EMM, 2012). The Commission considers that in addition to this, the Proponent should be required to provide sufficient personnel and support to ensure the Dapper Rural Fire Service is appropriately resourced at all times. The Commission considers that this is justified for a number of reasons. Firstly, while the Commission acknowledges that the Proponent is legally obliged to take steps to prevent and control bushfires on site, the operations of the mine would introduce additional bushfire ignition sources and risks to the area. Secondly, in purchasing the project site and surrounds the Proponent has already unintentionally displaced existing or potential members of the brigade. The project will also increase the density of people in the area, not just on site but on the local roads, adding to the workload for emergency services in the event a bushfire did ignite.

The NSW Rural Fire Service also noted that the Dapper Brigade's shed would be isolated by the proposed mine (RFS 2012). The Commission considers that the mine should be required to relocate the shed to a central location to ensure the Brigade can respond promptly to any incident that might arise in the Brigade's area.

Recommendation:
In addition to standard bushfire management conditions and the requirements prescribed by the NSW Rural Fire Service in its submissions dated 8 November 2012 and 12 December 2012, ***the Proponent should be required to relocate the Dapper Brigades Shed in consultation with the NSW Rural Fire Service and provide sufficient personnel and resources to maintain the Dapper Rural Fire Service Brigade, for the life of the mine.***

A Bushfire Management Plan will be required, covering the entire area of the Proponent's land holdings. Its implementation will require both dedicated staffing for proactive fire management as part of an overall Land Management Plan and responsive arrangements, for mine staff to be quickly diverted to address a local fire emergency.

10.3. Aboriginal Cultural Heritage

Aboriginal cultural heritage (ACH) is considered in Appendix P of the Environmental Assessment. The ACH report details the assessment process including consultation, desktop studies and field surveys. It identified 229 Aboriginal sites within the project area, of which 150 (66%) will remain undisturbed. Of the 79 sites that will be impacted by the project, only 4 are considered to be of high significance.

The mine footprint has been modified to avoid Aboriginal sites of high significance, including removing the requirement to divert Sandy and Laheys Creeks. Mitigation measures include salvage, collection, and permanent storage and safe keeping of salvaged items.

The ACH report recommends the preparation of an Aboriginal Heritage Management Plan (AHMP) which will include a regular monitoring and evaluation program to ensure the effectiveness and reliability of the proposed management/mitigation measures. The AHMP should be reviewed on a regular base and the Registered Aboriginal parties (RAP) and OEH should be consulted when the review is undertaken.

The Murong Gialinga Aboriginal and Torres Strait Islander Corporation submitted that the impact of the project on Aboriginal cultural heritage has not been adequately addressed due to insufficient survey of the mine area for significant sites. It is argued the consultation process has lacked diligence and respect for the input of the key Aboriginal Stakeholders. It believes all Aboriginal artefacts should be collected and placed in a keeping place on a country agreed by all RAPs. The time for salvaging should remain 12 months as originally recommended to ensure the job is done

properly. Drill sites should be monitored by an Aboriginal representative from the RAPs on a roster base.

Although they support a keeping place to store all salvaged items, it is a concern to the Aboriginal community that the significance of the artefacts lies in the landscape. The salvage process and storage in a keeping house does not provide the context to illustrate the significance of the items. They believe that the artefacts should be returned to the country when mining is completed.

The OEH submission on the Environmental Assessment advised that the ACH assessment has adequately presented the information, identified sites and assessed the potential impacts. It made two specific recommendations. First, adequate protection and stabilisation of creeks are required to protect Aboriginal sites within the mine area. The AHMP should include measures to manage and protect sensitive areas that are exposed to traffic. Secondly, a contribution should be made to research and examine the cultural heritage values in biodiversity offset areas to improve Aboriginal landscape knowledge for intergeneration opportunities, and future planning decisions.

The OEH also recommends adequate resources be allocated to cultural heritage management and an opportunity be provided to improve the research skills of RAPs as part of the AHMP process.

The OEH, in response to the Preferred Project Report, advised that the concerns raised in its submission on the Environmental Assessment have been adequately addressed. It also advised that the Proponent has agreed to expand on the research design to include survey for heritage items in selected biodiversity offset areas to improve interpretation of the landscape context within the Cobbora precinct.

The OEH has also reviewed the draft AHMP provided by the Proponent. It considers the plan is clear and adequate in relation to the salvage methods, research design, management and mitigation actions, dispute resolution procedures as well as Aboriginal involvement and communication protocols.

Although the Commission supports the proposed management of impacts on Aboriginal cultural heritage, it acknowledges the concerns raised by the Aboriginal community. The Commission notes that standard conditions of approval for mining projects cover the general requirements for the protection, monitoring and/or management of Aboriginal cultural heritage items. The Commission recommends these conditions to be included in any approval for this project and the RAPs are to be consulted before the AHMP is finalised.

10.4. Greenhouse Gas Emissions

Chapter 15 of the Proponent's Environmental Assessment provides a Greenhouse Gas assessment for the project. The assessment includes a qualitative assessment of the potential Scope 1, 2 and 3 greenhouse gas emissions of the project, a qualitative assessment of the potential impacts of these emissions on the environment; and an assessment of all reasonable and feasible measures that could be implemented on site to minimise the greenhouse gas emissions of the project and ensure it is energy efficient as required by the Director-General's Requirements for the assessment.

A number of submissions raised concern that the project will generate a significant increase in GHG emissions and associated climate change impacts if it were to be approved. Associated with this is the concern that by supplying coal for power generation the project will delay and discourage the development and use of renewable energies. Other issues raised include:

- the assessment did not include carbon footprint from progressive clearing; and

- the proposal is inconsistent with the precautionary principle.

The Commission notes the *NSW State Plan* includes a target to increase renewable energy by 20% by 2020. Nevertheless coal will continue to be required to supply these coal-fired power stations. It is also noted that the Environmental Assessment indicated that using coal from this mine to produce electricity by the NSW power stations will produce less greenhouse gas emissions than if the same amount of electricity was imported from Victoria. The Proponent also noted the low waste to coal stripping ratio reduced diesel use on site compared to many other coal mines in NSW and that the coal seams have a low methane and CO_2 content, so fugitive emissions would also be relatively low.

The Commission acknowledges that the mining operation and downstream use of the coal would generate greenhouse gas emissions that will contribute to climate change. Therefore, direct emissions from the operation of the mine and indirect emissions produced to support the operation of the mine should be minimised. The current carbon pricing mechanism provides some incentive to minimise emissions. The Proponent has also committed to minimising scope 2 and 3 emissions through use of energy efficient technologies and also that "alternative energy sources such as solar power and green power will be used wherever practical" (EMM, 2012 Volume 1 p357). Appropriate conditions should also be imposed, reinforcing these commitments, to ensure best management practices are adopted and mine buildings and equipment are energy efficient to minimise emissions. A monitoring and reporting regime should be included in the mine management plan to review and assess mitigation measures and to identify and implement improvements, where they can be made.

Policy on Greenhouse Gas Emissions is still evolving on a number of fronts and the Commission acknowledges that conditions may need to be drafted in response to policy at the time the assessment is finalised.

11. Findings and Recommendations

The Commission has carefully considered the proposal, and the submissions made, including the issues raised at the public hearing and the submissions made on both the Environmental Assessment and the Preferred Project Report, from individuals, groups, organisations and government authorities. The Commission also sought specific expert advice on:

- the mine plan;
- the potential impacts on water resources; and
- the rehabilitation options for the site.

The Commission found that the project would have a number of impacts, but that these can be managed to an acceptable level through some adjustments to the mine plan, use of best available technologies (e.g. for tailings processing and dust and noise attenuation) and through careful management of operations on site. The Commission has made a number of recommendations in this regard, particularly relating to the need for best practice management of dust, noise, blasting operations, lighting and water.

Water impacts of the project were considered in detail, with the engagement of Dr Steve Perrens to provide expert advice on this issue. Dr Perrens indicated that while there are still a number of uncertainties in the modelling provided and the assumptions used, the water requirements of the project can largely be met by the Proponent's existing water licence holdings. Nonetheless, Dr Perrens suggested that savings could be made with the use of better tailings treatment technologies and the Commission has recommended that this should be required in any approval. Water monitoring will also be essential, including for the establishment of baseline levels, as well as monitoring during and post mining.

The long term management of the site and surrounds was of particular concern to the Commission, and to the local community. The Commission noted that in purchasing the mine site the Proponent has displaced a significant number of families and heard that this is having negative social and economic impacts on the local community. The Commission heard and saw evidence that the land was not being managed sustainably. The Commission understands that the current short term leases do not encourage tenants to manage the land to its highest and best use. With this in mind the Commission also notes that there is no certainty regarding the likely commencement of the mine, consequently there is a risk that the Proponent's now considerable land holdings could be left without effective management for some time.

The Commission raised this issue with NSW Treasury representatives and subsequently with the NSW Treasurer, such was the significance of the issue for the Commission. The Commission found that this issue and the existing social and economic impact on the local community could be addressed with the development and immediate implementation of an integrated land management plan for the Proponent's consolidated land holdings. By considering the consolidated holdings strategically it should be possible to identify and establish areas of productive agricultural land and to rehabilitate certain areas for biodiversity conservation purposes. Such an approach would create employment and training opportunities which if carefully developed, could provide real improvements to the land and sustainable contributions to the surrounding communities.

In considering the mine plan and associated impacts the Commission found there was some room for improvement and has recommended that certain overburden waste dump and out of pit tailings emplacement areas should be relocated to minimise impacts on threatened species and reduce the need for additional land to be secured for biodiversity offset purposes. The Commission also believes

that consideration should be given to reducing the size of Pit C to avoid significant encroachment into the main biodiversity corridor on the northern part of the site.

With these measures, and requirements for best practice management, in place the Commission is satisfied that the project should be approved, subject to conditions.

11.1. Recommendations

In considering the project and its potential impacts the Commission has identified a number of areas where the mine plan could be improved. The Commission has consolidated these and other recommendations from the various sections of the report into this final consolidated list of recommendations on the project.

1. Integrated Land Management Plan

An integrated land management plan for the Proponent's full suite of landholdings (including mining and offset areas) is a matter of some urgency and should be prepared and implemented immediately rather than being tied to the commencement of mining operations. The plan should include:

a) Mapping of the agricultural capability and biodiversity regeneration potential of the landholdings and a strategic land use study to identify the best land use for each area, aiming to:
    - regenerate biodiversity offset areas to the maximum extent possible prior to commencement of mining;
    - maximise sustainable agricultural production on the remainder of the land, including through the rehabilitation and repair of eroding areas of the site;
b) A land tenure and management program, considering the existing land tenure arrangements, and suitable arrangements at each stage, (including prior to the commencement of mining, during mining operations and post mining) detailing the mechanisms and timetable for transitioning to active land management in accordance with the strategic land uses identified in a);
c) An employment, training and skills development program aimed at improving local land management techniques, resources and knowledge. This should include adaptive land management, informed by a system of trials of various agricultural and biodiversity rehabilitation and endemic vegetation reestablishment techniques, supported by a local seed bank of endemic species;
d) An integrated bushfire management plan;
e) A program to fast track work to regenerate biodiversity offset areas, this work should commence immediately and be managed adaptively, with the aim of delivering the projected biodiversity outcomes, and demonstrating success by year eight of the mine plan (see recommendation 17 c) and d))

2. Funding for Land Management

The creation of a fund to provide for the preparation and implementation of the Integrated Land Management Plan will have multiple benefits and in particular, should be used to rehabilitate parts of the site not impacted by future mine activities and to trial future rehabilitation techniques. In delivering these functions, creation of local training opportunities and provision of local economic stimulus should also be prioritised.

3. Appointment of an Experienced Land Manager

Any approval granted should include a condition requiring the Proponent to engage a land manager with expertise and experience in the adaptive implementation of a comprehensive land management and rehabilitation plan for both mine areas and other landholdings.

4. Mine Plan Refinements

The mine plan should be revised and optimised considering the following objectives:

- Reducing the impacts on threatened species and endangered ecological communities, particularly by: relocating the B-OOP E overburden dump and tailings emplacement areas, and avoiding or minimising intrusion of mining into the main remnant vegetation corridor (on the north eastern portion of the site);
- Minimising dust, particularly by reducing the land area that would be exposed at each stage of mining;
- Maximising the land capability and productivity of the rehabilitated final landform; and
- Minimising the extent of any final void.

The Proponent must demonstrate how exposed areas would be minimised and managed, including the effective use of interim cover and the effective and timely establishment of permanent cover.

5. Best Practice Standards

The Project should be required to meet best practice standards in all areas, during both construction and operational stages.

6. Air Quality Control Measures

All measures for control of air pollution should deliver air quality outcomes that are equal to or better than the air quality outcomes identified in the Environmental Assessment and that correspond to best practice and the application of best available technology. This must include:

- best practice coal loading and profiling, to minimise dust emissions from coal transportation; and
- a real time predictive and reactive air quality management system informed by a state of the art air quality monitoring network.

7. Air Emission Limits

Air emission limits should be applied to the project to ensure the air emissions are equal to or better than the predictions in the Environmental Assessment.

8. Provisions for landholders affected by air emissions

Where air quality criteria are predicted to be exceeded the Proponent should be required to give the landholder the option of:

- acquisition of the residence and associated property; or
- mitigation measures including air conditioners and first flush separation devices on rainwater tanks; or
- an agreement negotiated between the two parties.

9. Mine owned residences where air quality criteria are exceeded

The Proponent's commitment not to lease residences affected by air quality exceeding the criteria should be formalised in the conditions of any consent issued.

10. Minimise Blasting

The Proponent should be required to reduce the number of blasts to minimise amenity impacts on the surrounding community.

11. New roads constructed outside blast buffer zones

The Proponent should be required to ensure that the realigned Spring Ridge Road is adequately buffered from mining activities and built to an adequate Austroads standard. The buffer should be sufficient, so that the road is not affected by blasting activities on site (ideally the road should be able to remain open during periods of blasting on the mine site).

12. Noise Control Measures

The Proponent should be required to apply best practice noise control and management measures, including best available technology (including locomotives), engineering controls and predictive and reactive real time management practices.

13. Provisions for landholders affected by noise emissions

Any residence that is predicted to be impacted by a noise level of more than 35 dB(A) should be given the option of either:

- acquisition of the residence and associated property; or
- mitigation measures including double glazing, air-conditioning, insulation and acoustic barriers; or
- a negotiated agreement.

14. Noise Limits

Noise limits should be applied to ensure the project's noise emissions are equal to, or better than, the predictions in the Environmental Assessment and Preferred Project Report and Response to Submissions.

15. Heavy vehicle movement restrictions

Heavy vehicle movements on public roads must be restricted to the hours of 7 am to 6 pm Monday to Friday, 8 am to 1 pm Saturday and at no time on Sundays or public holidays, except as directed by the Police, or Roads and Maritime Services, or other emergency services for safety or emergency reasons.

16. Lighting

When detailed design is available and prior to the commencement of any mining, a comprehensive lighting assessment should be undertaken, in consultation with the Siding Springs Observatory, to ensure mitigation measures are developed and implemented to minimise night lighting impacts, particularly from night time train movements.

17. Biodiversity conservation

a) The Proponent must work with the OEH and DSEWPC to resolve the issues that have been raised by the agencies.
b) Additional offsets, for the impact on *Tylophora linearis*, should be identified prior to the commencement of mining in area B, or mining in this pit should be set back to avoid the population identified and provide a sufficient buffer zone.
c) Early results from adaptive management of possible offset lands should inform finalisation of the overall offset strategy in order to protect or enhance biodiversity values while minimising impacts on the agricultural and pastoral activities which are so significant for the local community and economy.
d) The biodiversity conservation value of regenerated areas proposed as offsets must be demonstrated to the satisfaction of the Director-General prior to clearing and mining operations proceeding beyond year 8 of the mine plan.

18. Rehabilitation of Mining Areas

In formulating and implementing the Integrated Land Management Plan, the Commission recommends that detailed consideration be given to the specialist advice received by the Commission, relating to the rehabilitation of the areas disturbed by mining.

19. Water Management

A water management plan, that satisfactorily addresses the issues raised in Dr Perrens' review report (and the submission by the NSW Office of Water), will need to be provided prior to the commencement of any works on site, applying the following principles:

a) Tailings should be treated mechanically in order to minimise water requirements for the project unless the Proponent can demonstrate that an alternative would satisfy best practice standards;
b) Mine water management facilities must be designed and managed to retain runoff from pits and all active mine areas;
c) Facilities must be in place to transfer water from sediment dams to the mine water dams, in the event that the water does not comply with the discharge criteria.

20. Employment and Training

Opportunities and provision for training and employment for Aboriginal people in the region should be developed in consultation with Warrumbungle and Wellington Shire Councils and the local TAFE colleges.

21. Voluntary Planning Agreements and Economic Stimulus through Local Infrastructure Projects

a) Warrumbungle and Wellington Shire Council's lists of infrastructure projects should be considered by the Proponent in its negotiations for the Voluntary Planning Agreements and contributions should be reasonable and equitable, reflecting the actual impact on Councils' infrastructure.
b) These infrastructure projects should also be considered by Government, to provide economic stimulus to the local economies while the future timing of the project is being considered.

22. Program of infrastructure works

A program of road and other infrastructure works and the timing for these works should be included in any final approval of the project.

23. Traffic Management Plan

The traffic management plan should include a work place travel plan for the project.

24. Requirements of the Rural Fire Service and support to the local brigade

In addition to standard bushfire management conditions and the requirements prescribed by the NSW Rural Fire Service in its submissions dated 8 November 2012 and 12 December 2012, the Proponent should be required to relocate the Dapper Brigades Shed in consultation with the NSW Rural Fire Service and provide sufficient personnel and resources to maintain the Dapper Rural Fire Service Brigade, for the life of the mine.

25. Consultation on Aboriginal Heritage Management Plan

In addition to standard conditions for the protection and management of Aboriginal cultural heritage items, registered Aboriginal parties should be consulted before the Aboriginal Heritage Management Plan is finalised.

26. Minimise, monitor and report on Greenhouse Gas Emissions

a) Appropriate conditions should be imposed to ensure best management practices for minimising greenhouse gas emissions are adopted, and mine buildings and equipment are energy efficient.
b) A greenhouse gas monitoring and reporting regime should be included in the mine management plan to review and assess mitigation measures and to identify and implement improvements, where they can be made.

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List of Appendices

Request to the Planning Assessment Commission

Cobbora Coal Project

Section 23D(1)(b)(ii) of the *Environmental Planning and Assessment Act 1979.*
Clauses 268R(1)(a) and 268V of the *Environmental Planning & Assessment Regulation 2000.*

I, the Minister for Planning and Infrastructure request the Planning Assessment Commission to:

1. Carry out a review of the Cobbora Coal Project, and:
   a) consider the Environmental Assessment of the project, all issues raised in submissions on the project, and any further information provided during the course of the review;
   b) assess the merits of the project as a whole, paying particular attention to the:
      - the proposed mine plan and final landform, and in particular the proposal to operate three open cut pits concurrently, the management of tailings and waste rock, and the design of the final voids;
      - health and amenity impacts (noise, blasting, air quality and visual) of the project on the surrounding population;
      - biodiversity impacts of the project;
      - water impacts of the project; and
      - social and economic impacts of the project;
   c) recommend appropriate measures to avoid, minimise and/or offset these impacts.

2. Conduct public hearings during the review.

3. Submit its final report on the review to the Department by the end of February 2012, unless the Director-General of the Department of Planning and Infrastructure agrees otherwise.

The Hon Brad Hazzard MP
Minister for Planning & Infrastructure

Sydney 23 October 2012

APPENDIX 2

LIST OF SPEAKERS AT THE PUBLIC HEARING

Hearing Date:
Venue:

1. Warrumbungle Shire Council
   Mayor Cr Murray Coe and Steve Loane
2. Mid-Western Regional Council
   Warwick Bennett
3. Wellington Shire Council
   Mayor Cr Rod Buhr and Michael Tolhurst
4. Dubbo City Council
   Mayor Cr Matthew Dickerson and Vince Berkhaut
5. Dr Sara Ferguson
6. Hunter Environment Lobby
   Jan Davis
7. Australian Astronomical Observatory
   Professor Fred Watson and Peter Verwayen
8. Sally Dent
9. Richard Tanner
10. Nature Conservation Council
    James Tremain
11. Peter Portelli
12. Cudgegong Valley Water Users Committee
    Trevor Crosby and Russell Holden
13. Phil Jones
14. Kerry-Anne Burke
15. Wendy Moyle
16. Kay Binns
17. Phyllis Setchell
18. Mudgee District Environment Group
    Bev Smiles and Rod Campbell(Economists at Large)
19. Diane O'Mara
20. Inland Rivers Network
    Bev Smiles
21. Dunedoo Mendooran Health Advisory Council
    Colin Dorman
22. Friends of the Pilliga
    Jane and Milton Judd
23. Brett Yeo
24. Sandy Cox

APPENDIX 3

SUMMARY OF SUBMISSIONS PRESENTED AT THE PUBLIC HEARING

Issues	Submissions presented at the public hearing
Social and Economic	• Need for employment in the region; • Local economic impacts including the loss of approximately 35 local families already, due to the purchase of farms within the proposed mine site and associated loss of income to local businesses; • Workforce arrangements, opposition to fly in fly out style workforce, concerns about assumptions used in workforce calculations; • Housing, no housing strategy for the mine workers, a housing policy could be developed with Landcom, particularly as there is sufficient government owned land in the region to accommodate the housing needs of the mine locally; • Uncertainty regarding where workers will live and the associated impacts and benefits of the additional population and the commuter trips; • Changing demographics of the centres where mine workers will live, or stay; • Impacts on Dunedoo will be higher than those on larger towns which can absorb the additional people and the changing demographic more readily • Current apprenticeships and future employment schemes need to include specific places/schemes for the Aboriginal Community; • The ongoing viability of the Siding Springs Observatory must not be compromised; • Voluntary Planning Agreements, details yet to be negotiated, concern regarding uncertainties, need for contributions to be based on a clear nexus with properly collected data; • Councils seeking assistance with infrastructure upgrades for both hard and soft infrastructure; • Cost to Councils in considering the project and associated documents such as the Voluntary Planning Agreement is already considerable; • Divide and conquer impacts on the community; • Cost to NSW taxpayers • Uncertainty about mine is having a big impact on local community and also dividing the community • Concerns about limits to growth, the need for a steady state economy, mining not considered to be economically sustainable • Impacts on the demographics, • Loss of local community loyalty and cohesion • Impacts on character of Gulgong township • Impacts on services across the region, including childcare, access to doctors and other medical services, emergency services - including volunteer services • Inflated property values, rental costs and rates • Long term cost out weigh benefits • Cost benefit Analysis – adequacy of the information provided, method used, costs considered, assumptions made and the reliability of the conclusions
Flora and Fauna	• Impacts on Threatened species and Endangered Ecological Communities; • Loss of native vegetation; • Level of offsets proposed – considered inadequate; • Flora and fauna survey effort – considered inadequate; • Impacts on regional vegetation corridors • Detail of final offset strategy not available; • Concerns about the security of the Biodiversity offsets • Impacts on aquatic ecosystems, and threatened species including catfish • Rehabilitation concerns, including long timeframes for reconstruction of ecosystems
Water	• Adequacy of the information provided • Surface Water • Ground Water

	• Water allocations • Catchment areas • Water contamination • Competition for water during drought • Opposition to creation of a final void and associated hypersaline lake • Licensing concerns, including the process • Concerns other industries cannot compete for licences • Concerns about the suitability of the data used and assumptions made • Impacts on quality of water collected from rooves • Acid mine drainage – adequacy of the information provided • Alternative water sources, such as excess water from Ulan mine should be used to supply the mine
Air Quality	• Dust and particulate matter • Associated health impacts • Need for baseline monitoring in both Cobbora, Dunedoo and Tuckland • Adequacy of the information provided and modelling undertaken • Need for $PM_{2.5}$ emissions to be considered • Emissions form combustion engines • Request for coal wagons to be covered • Cumulative impacts, particularly from coal trains
Noise	• Impacts on local residents; • Modelling inputs – adequacy of the information • From the trains, both locally and on the main rail line, particularly for residents around Gulgong, sleep disturbance and impacts on schools • Cumulative train noise impacts
Traffic	• Need for road upgrades and maintenance • Road safety • Need for wide load/ heavy vehicle bypass for Dunedoo • Need for rail crossings in Gulgong to be upgraded • Concerns about increased traffic causing vibration impacts on heritage sites in Gulgong • Impact of road diversions on travel times and fuel costs for locals, particularly as the diversions will be permanent and remain post mining • Rail traffic, safety at level crossings ,and road closure impacts from cumulative train traffic
Road Diversions	• Concerns about the additional travel time necessary to take the new road diversions • Loss of infrastructure to Warrumbungle Shire Council; • Additional infrastructure maintenance costs associated with the extra road in Wellington LGA
Greenhouse gas emissions	• including concerns that alternative energy sources and options are available and have not been considered.
Health Impacts	• from Dust and Noise, but also from social impacts to the community; • requests for a baseline health assessment of the surrounding community.
Lighting	• impacts on the Siding Springs Observatory, from both uncontrolled lighting and from light dispersion from dust particles the preservation of the region's dark skies is essential to the operation of the facility and its ability to maintain investment for ongoing upgrades.
Bushfire	• need for comprehensive fire management plan
Other issues	• Need for baseline monitoring to be undertaken now, before mining commences, in both Cobbora and Dunedoo • Adequacy of the Environmental Assessment • Inconsistencies regarding the prevailing winds and concerns about weather data used in the modelling • Detailed conditions of approval will be essential and Warrumbungle Shire Council needs to have input into the post approval plans • Concerns regarding the process and the level of information available at the time of the

	public hearing • Mine needs to meet best practice standards • Level of information supplied, concerns about the validity of the process and the inability of various parties to reach a position on the project based on the information provided • Potential impacts on the Siding Springs Observatory, which is Australia's largest optical telescope and a significant piece of scientific infrastructure with significant capital investment value, and also an important industry for the local community both in terms of economic investment and employment, as well as the associated tourism industry. • Cumulative impacts of coal trains on the rail corridor, particularly for Gulgong • Concern about the process for selecting the mine and the agreements in place for the supply of coal. • Concerns about breaches of conditions and limits • Speed of the process, project should be delayed while other alternatives are explored • Poor quality of the coal resource and associated impacts on consumption, cost and power station infrastructure • Concerns about the mine plan and the final landform proposed • Concerns coal trains will be sent through Mudgee, due to congestion on rail in the Hunter or to supply power stations near Lithgow • Sustainability

APPENDIX 4

SUMMARY OF SUBMISSIONS TO THE PREFERRED PROJECT REPORT

Many issues raised in the submissions to the PPR are similar to those raised in the submissions to the Environmental Assessment and the presentation made at the public hearing. Below is a brief summary of the key issues raised in the submissions to the Preferred Project Report.

Issues	Submissions to Preferred Project Report
Social and Economic impacts	• The loss of 68 local families has already caused significant social and economic impacts on Dunedoo and the surrounding communities; • Inadequate information provided on potential impact on the local and regional economies, the community and agricultural industry and the proposed land rehabilitation; • Need assurance that appropriate environmental safeguards will be implemented; • Question on the adequacy and capacity of the region's housing and social infrastructure to accommodate the expected workforce; • Adequacy of the proposed training program and employment opportunity for Aboriginal community and unemployed locals; • Significant loss of agricultural land; • Impact on renewable energy sector; • Draft Voluntary Planning Agreements unsatisfactory and should be based on equitable distribution of funds based on impacts; • Require contribution to support upgrades for both hard and soft infrastructure; • Cost to NSW taxpayers and on the State's budget and expose the State to financial risk; • Inadequate assessment of the Ulan rail line capacity; • Cumulative social and economic impacts in the region; and • Inadequate cost benefit analysis with long term costs outweighing benefits.
Flora and Fauna	• Impacts on Threatened species and Endangered Ecological Communities; • Loss of native vegetation; • Offset strategy lacks details and inadequate, should be secured before determination of project; • Impacts on aquatic ecosystems due to increase flows from the mine water release; • Impacts of light spill and dust on adjacent offsets or the OEH estate; • Matters of national environmental significance not adequately assessed and mitigated; • Appropriate biodiversity mitigation measures not achievable; and • Rehabilitation concerns, including long timeframes for reconstruction of ecosystems.
Water	• Adequacy of the information provided: o Availability of surface and ground waters, o permanent and semi permanent pools in Sandy's and Lahey's Creek, o Acid mine drainage, and o Downstream flow impacts on Talbragar River; • Impacts on surface water, groundwater, water allocations, and catchment areas; • Water contamination and protection of surface and ground waters from contamination; • Issues in relation to water licence o Inability for a Scheduled Development of Scheduled Activity Licence to be issued until the relevant plans are prepared, o Increased volume of water licences required for the mine, o Licensing process, and o other industries cannot compete for licences; • Uncertainty in relation to water discharge limits and the interim discharge limits should be reviewed;

	• Competition for water during drought; • Concern that the project will alter the hydrological regime of the area; • Low ecotoxicity of flocculants should be used.
Air quality	• Impact on health; and • Inadequate air quality modelling and no further modelling following changes made in the PPR.
Noise	• Inadequate information on modelling inputs and background noise level predictions/assumptions; • The additional noise assessments undertaken for the Goodman SCA should be made available; and • Impacts from the trains, both locally and on the main rail line.
Traffic	• Need for road upgrades and maintenance and road works to meet Ausroad standards; • Inadequate information on traffic volumes predicted and car pooling predictions; • Support for car pooling scheme; • Relevant road authority should be consulted in the development of the Traffic Management Plan.
Road Diversions	• Loss of infrastructure to Warrumbungle Shire Council.
Aboriginal Heritage	• Concern about the whole or partial disturbance of 70 sites of Aboriginal Cultural Heritage; • Views of Aboriginal stakeholders not adequately considered; and • Appropriate measures to manage Aboriginal impacts needs to be developed.
Waste and Contaminated Land Management	• Further information/clarification is required for the followings: o the assessment of potentially acid forming material, o proposed measures to manage waste rock and protect surface water and ground water from pollution o the construction of the clay liners (or alternate geosynthetic liners) for all contaminated water storage structures, o how all contaminated water storages will be lined including the Tailing Storage Facilities, and o the expected quality of tailings and seepage generated from stored tailings; and • Contaminated site assessment must be undertaken for both Yallambie and Danbar.
Greenhouse Gas Emissions	• alternative energy sources and options have not been considered; and • Conflict with the State and Federal government's commitments to reduce carbon emissions.
Health impacts	• From dust emissions, noise and social impacts to the community.
Bushfire	• need a comprehensive fire management plan
Other issues	• Cumulative impact of additional train movements has not been adequately assessed; • The quality of coal to be produced and saleability of the product • Adequacy of the Environmental Assessment; • Inconsistencies regarding the prevailing winds and concerns about weather data used in the modelling; • Poor quality of the coal resource and associated impacts on consumption, cost and power station infrastructure; and • Sustainability.

Appendix 5

ADVICE FROM EMERITUS PROFESSOR JIM GALVIN

Galvin and Associates Pty Ltd

ABN 27 086 258 871

17 February 2013

Ms G Kibble AO
Chair
Planning Assessment Commission
GPO Box 3415
Sydney NSW 2001

Dear Gabrielle

Subject: Review of the Cobbora Coal Project Mine Plan

I refer to your request in December 2012 to review aspects of the Environmental Assessment (EA) for the Cobbora Coal Project, specifically in respect of the Minister's terms of reference to:

b) assess the merits of the project as a whole, paying particular attention to:

- *the proposed mine plan and final landform, and in particular the proposal to operate three open cut pits concurrently, the management of tailings and waste rock, and the design of the final voids.*

My advice is based on the following select material provided by Ms Megan Webb and on a discussion with Mr Steve Bullman, Project Manager Mining, facilitated through Ms Webb:

- Executive Summary, Cobbora Coal Project EA.
- Table of Contents for the EA.
- Pages 50 to 60 and select Figures from Chapter 3 of EA.
- PowerPoint slides of a presentation to Planning Assessment Commission by Cobbora Holding Company Pty Limited (CHC) on 10 December 2012.
- Cobbora Coal Project Scoping Study. Mine Planning and Scheduling Report. Doc No. C001-900-MIN-RP-001 Rev B. Cobbora Holding Pty Limited. Undated.
- Cobbora JORC Resource and Reserve Statement 2012, Doc. No. COB1301-02, prepared by Palaris. September 2012.

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Project Context

CHC has submitted an EA to secure Project Approval for a new mine to produce up to 12 million tonnes per annum (Mtpa) of saleable product from up to five coal seams, of which Coal Supply Agreements are in place to supply up to 9.5 Mtpa to Macquarie Generation for domestic power station consumption. The remaining 25% of production is available for sale to either domestic or export markets. These saleable production levels require run-of-mine (ROM) production of some 20 Mtpa, thus generating 8 Mtpa of reject material.

Cobbora is distinguished from other large Australian open cut coal mines because:

- It is a low quality coal deposit, with the target coal seams containing many stone bands, Figure 1.
- It is tied (captive) to a domestic market with a fixed delivery schedule over the life of mine.
- This market only requires one coal product of fixed specification.
- The selling price is low.
- The selling price is fixed, being indexed annually.

The Cobbora geological model indicates that the coal quality is highly variable in key parameters such as raw ash. The ROM ash levels of the coal plies range from 18 to 67%, with the weighted average ash content being approximately 40%. To produce a consistent market product of 26% (max) ash at 12% (max) moisture, the coal needs to be washed. Selective mining of some coal plies may be possible on an opportunistic basis. The benefits of this approach have to be weighed against the cost of acquiring different mining equipment and making adjustments to the coal washery.

Where ash content of ROM coal meets the customer's product coal specifications, or where beneficiation will not substantially improve the ash content, it is proposed that the coal will be mined, crushed and placed directly in a so-called 'bypass' coal stockpile for direct shipment. Otherwise, all coal is to be washed to reduce ash content to specification.

Generic Mine Plan

The generic mine layout is shown in Figure 2. A suite of state-of-the-art computer based mine planning and scheduling tools have been utilised to generate it.

It is proposed to simultaneously extract coal from multiple mining faces distributed across three areas, or pits. Initially, overburden will be placed in out-of-pit dumps until the areas from which coal has been extracted become available for overburden placement. Coarse rejects will be emplaced with this overburden, with fine reject from the washing process being placed in tailings dams.

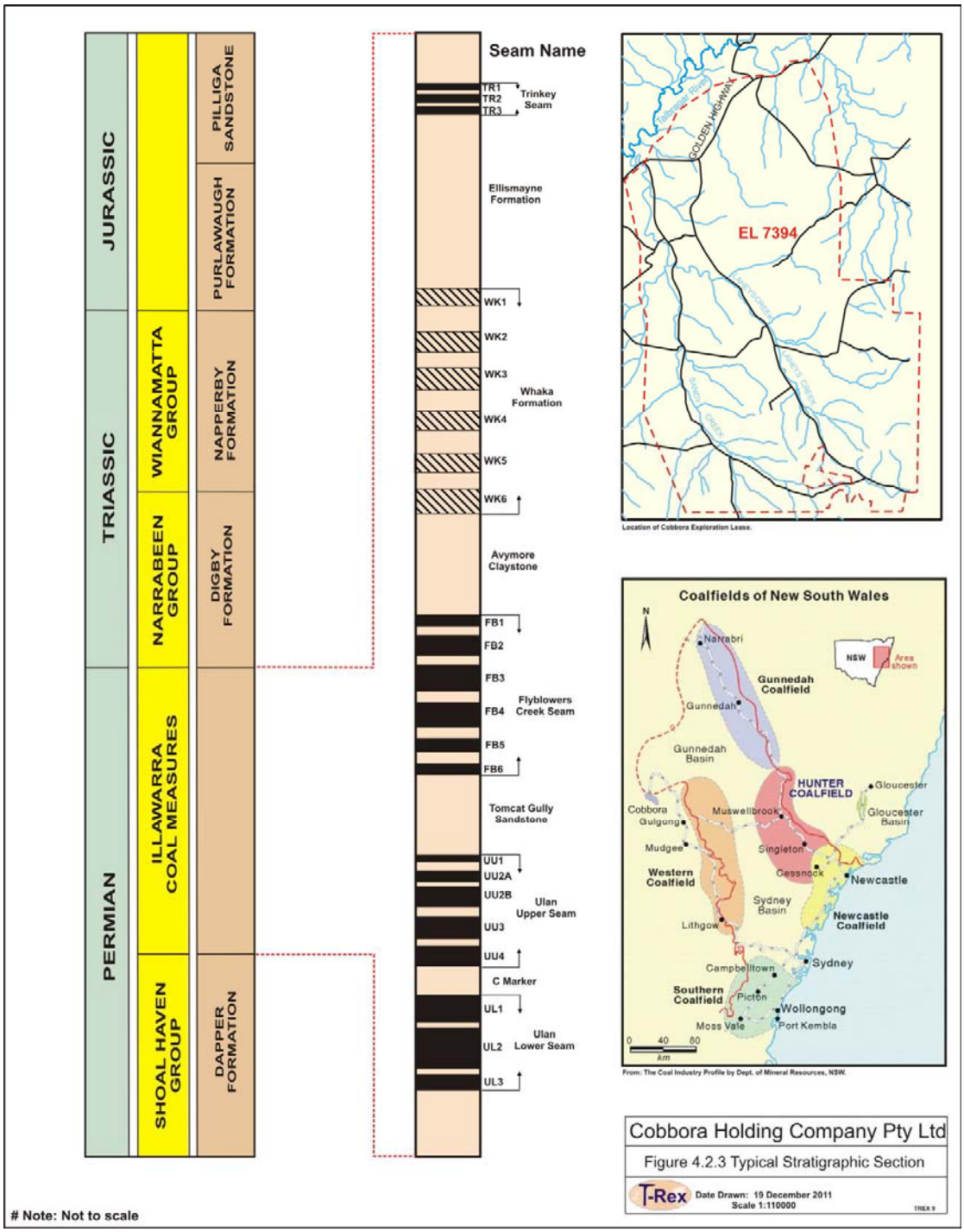

Figure 1: Locality and regional stratigraphy plan showing the distribution of stone bands within each seam.

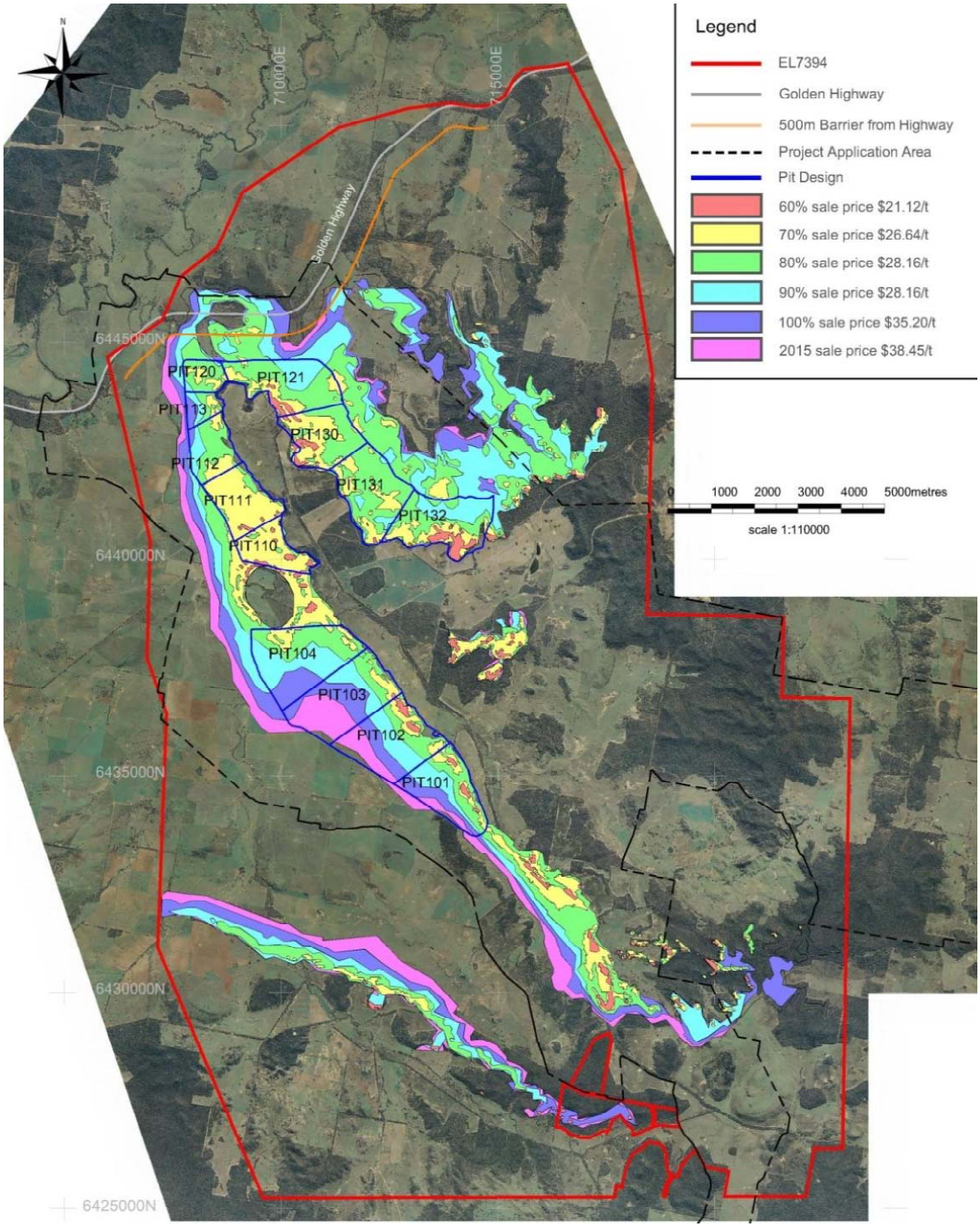

Figure 2: Generic mine layout showing limits of mining areas applied for in the EA and sensitivity of mining areas to selling price.

The mine closure plan is based on backfilling two of the three final voids to above the final water table. The third void is planned to be partially backfilled to above the final water table, with a lake proposed at the southern end of the final void. The EA acknowledges that lake may become hypersaline over time.

The overall mine plan, including tailings disposal and establishment of a final void, is consistent with established open cut mining operations in these circumstances. This is not to say that all the mining practices are consistent with contemporary environmental standards.

Resources and Reserves

The *Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves (*the *'JORC Code')* sets out the minimum standards, recommendation and guidelines for Public Reporting in Australasia of Explorations Results, Mineral Resources and Ore Reserves. Estimates of resources (what is present) and reserves (what is likely to be recoverable) are required to be undertaken by persons with nominated qualifications.

Palaris is a consulting company that has recognised capabilities in preparing JORC resources and reserve statements. Palaris has prepared such a statement for the Cobbora Project and I have placed considerable reliance on it. The assessment by Palaris has been based on the information contained in the EA, including the proposed mine plan. Its principal findings and conclusions are:

- The geological structural models and coal quality models prepared for the project by Tampin Resources Pty Ltd are acceptable. Palaris has based its assessment on these models.
- There are five coal seams within the Cobbora lease, of which three qualify for inclusion in calculating JORC resources and reserves. These are:
    - Flyblowers Creek Seam - thickness range 3.4 to 6.0 m.
    - Ulan Upper Seam - thickness range 2.3 to 4.4 m.
    - Ulan Lower Seam - thickness range 3.1 to 3.3 m.
- The Trinkey seam plies were not able to be classified as better than an inferred resource at this stage and so were excluded from the assessment.
- The Whaka seam group was also not considered due to the limited quality information available at the time of the assessment.
- There are a number of stone plies within each of the three principal seams. Estimates of reserves are based on these being mined with the coal when they are less than 0.3 m thick (in a process referred to as 'bulk mining').
- A risk assessment of the estimates of resources and reserves has identified one risk as being the mining areas sought under the Part 3A submission are not approved or are truncated. The risk mitigation and controls measures proposed if this were to occur are reserve downgrade, with the potential to

justify the areas at a later date or seek approval extensions elsewhere to offset the areas lost.

- There are considerable resources and reserves outside the areas submitted for environment approval.
- Open pit limits delineated by CHC are validated.
- Pit wall designs used in the assessment are considered conservative.
- The proposed mine design criteria used in estimating reserves is based on sound mine planning design principles.
- Mining related costs are particularly sensitive to the degree of selective mining that will occur within the target seam groups.

Mine Planning Implications

The principal requirement for the mine schedule is to deliver a consistent coal quality to the washery to be assembled into train cargos. The mine schedule has to ensure that a number of coals are available at any point in time to enable blending in order to achieve the required coal quality. This required flexibility is proposed to be achieved by having three simultaneous coal mining areas.

The Mine Planning and Scheduling Report states that:

> *The Cobbora geological model exhibits an unusual amount of variability in the coal quality and washability results. This variability influences the mine plan heavily as the schedule has to be structured such that multiple coal sources can be mined simultaneously to produce the single quality product.*
>
> *The Cobbora Mine is different to other projects in this manner in there is only a single product specification namely the CSA coal at 24% ash as received (ar). The mine cannot be scheduled with periods of high ash or low ash as an average ash must be created at all times. The variability of the Product Ash is shown in Figure 1.3* [reproduced as Figure 3 in this report to PAC] *and it highlights the need to have blending options to achieve the single coal specification.*
>
> *The mine must be sequenced to simultaneously produce High, Medium and Low Ash coals for blending. If mining progressed from one larger pit rather than three smaller working areas then there would be periods where the mine could not meet the 24% ash requirement.*

The same report states that a pit optimisation study was undertaken (using a well known software package) to assess the economic limits of mining at Cobbora and to help delineate areas of higher value in terms of coal quality and revenue. The mining costs are principally influenced by the strip ratio and the revenue by coal yield and product qualities. However, the report goes on to state that the practicalities of strip mining rarely allow such sequencing to be implemented and that the analysis is limited by not taking into account coal blending and other coal quality considerations. The process also does not distinguish between areas that have surface constraints and, hence, is only used as a guide to the mining sequence that would allow the highest profit margin coal to be mined first and less viable coal to be mined later in the project, or not at all. This analysis generated Figure 2.

For the option studied, it has been assumed that coal extraction will occur in a bulk mining scenario using 400 t hydraulic excavators taking aggregated seam sections. Mining of overburden would occur with 600 t hydraulic excavators. Consequently, the mining costs used in the pit optimisation exercise have been premised on the bulk mining of seam working sections; that is, without regard to selective mining of sections. Pit designs and ROM mining reserves have been generated on this basis.

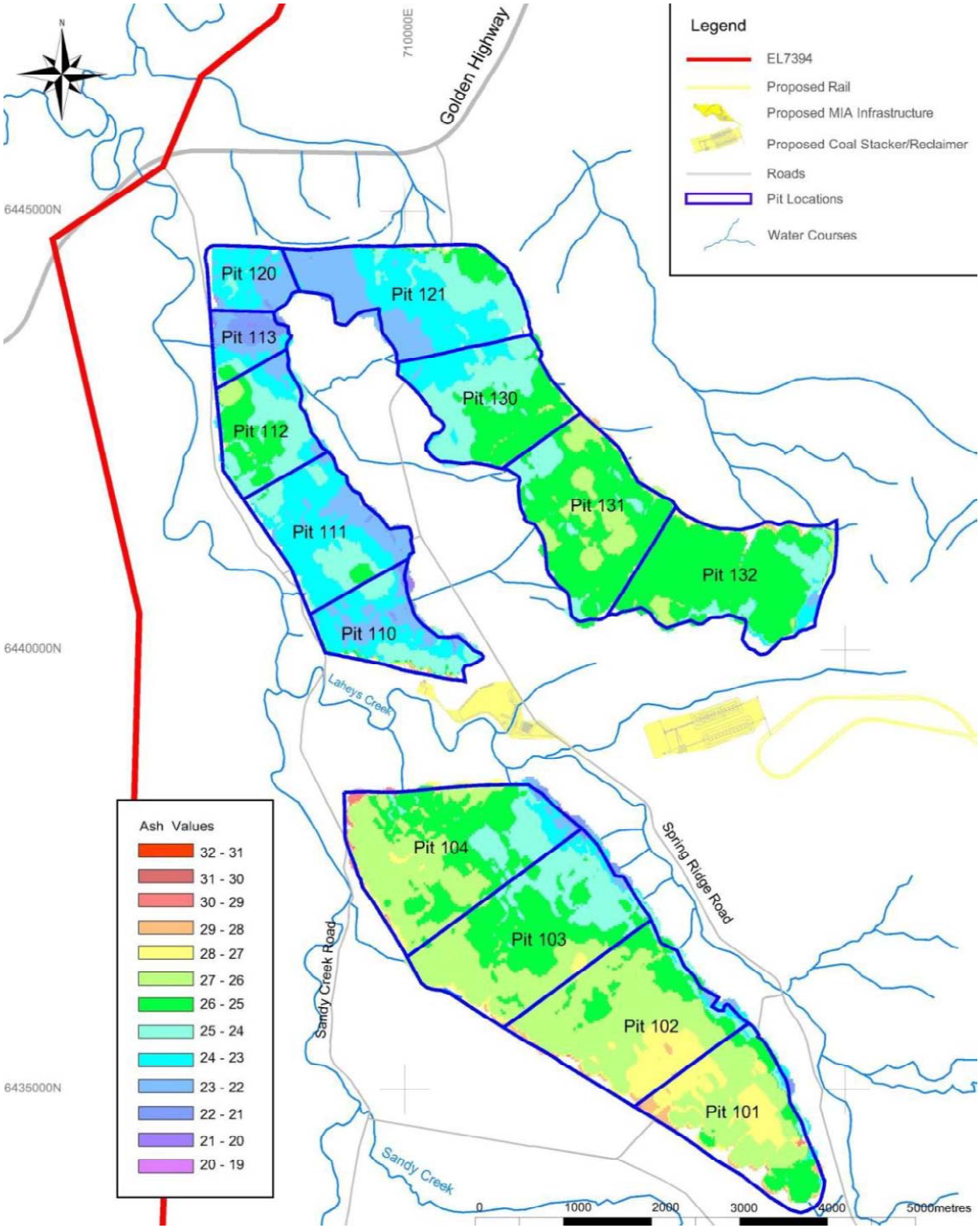

Figure 3: Variation in product ash across proposal area.

The mine design is claimed to be conservative, with a focus on achievable outcomes and using well proven mining techniques typical to Hunter Valley open cut coal operations. Apparently, it transpires that there is very little coal suitable for bypassing the washery.

The mine design is based on developing a mining sequence that achieves the required production and quality targets. It is claimed that a degree of conservatism has been applied to this process to cover any possible future changes to the mining operations without needing to modify the consent conditions.

Discussion

Mine planning in open cut mining is a live and ongoing process, with changes having to made in responses to factors such as unexpected geological conditions, changes in mining technology, increases in operating cost, and changing market scenarios. The level of mine planning undertaken to date for Cobbora is consistent for a project at this stage of development. It is based on an number of assumptions and approximations which will be verified and clarified as experience is gained in mining the deposit.

There is a range of variables that impact on the mine layout at Cobbora. Two of more important are the opportunity to produce an additional 2.5 Mtpa over and above the current CSA and the manner in which coal quality is be achieved. A number of options are associated with the latter including bulk mining versus selective mining, washing versus bypass product, and number of production pits. The amount of time, effort and expenses in fully evaluating the various permutations is not commensurate with the current stage of the project.

Based on my general mining engineering knowledge and my operational experience specific to designing and managing underground coal mines that were captive to NSW power stations, including one mine that relied on mining three seams simultaneously in order to blend to achieve specification, this project is unlikely to be an economic and reliable coal supplier if operations are confined to one pit. Business risk considerations quite apart from coal quality considerations would caution against this ‘all eggs in the one basket’ approach.

In theory, a two pit operation may suffice for achieving consistent coal quality and quantity, but at a cost that might be prohibitive. Mr Bullman advised that it would be relatively straight forward and quick to rerun the mine schedule to achieve market specification from just two pits; perhaps, one week of work. However, he cautioned regarding all the potential downstream implications of this type of operation. These relate to matters such as blast design, blast size, and frequency of blasting; size and duration of out-of-pit dumping; noise, dust and lighting impacts; equipment selection; and washery design, operation and economics. Some of these have the potential to require a revise EA. I am in general agreement with Mr Bullman.

A question which cannot be answered without running a suite of mine planning options is: What are the comparative advantages and disadvantages of two pits versus three pits? Other questions that arise include: Does three pits result in more disturbance to the environment at any point in time, or is the disturbance much the same but less concentrated? Are there advantages in having less concentrated

disturbance? What are the positive and negative consequences of confining production to 9.5 Mtpa rather than 12 Mtpa?

I cannot answer these questions. If the project proceeds, they may be able to addressed by approval conditions that specify performance outcomes and hold the operator responsible for how these are achieved.

Plans for tailings disposal and final void configuration are consistent with standard industry practices. Aspects of the environment impact and consequences of these plans may require input from others with expertise in groundwater, surface water and/or fauna and flora.

Should you have any queries arising from this review, please do not hesitate to contact me.

Yours sincerely

Emeritus Professor JM Galvin

Appendix 6

ADVICE FROM DR MARK BURNS

COBBORA COAL PROJECT

ADVICE ON REHABILITATION

Photograph supplied by NSW Planning Assessment Commission

Prepared for: NSW Planning Assessment Commission

Prepared by:
Global Soil Systems

February 2013

COBBORA COAL PROJECT
ADVICE ON REHABILITATION

Prepared for:

NSW Planning Assessment Commission

Prepared By:

_____
Dr M. Burns
Principal,
Global Soil Systems

February 2013

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1.0 BACKGROUND

Global Soil Systems (GSS) have been engaged by the NSW Planning Assessment Commission (PAC) to review the rehabilitation strategy for the proposed Cobbora Mine. In this context the revised *Mine Rehabilitation Strategy*: *Cobbora Coal Project* (GSSE, February 2013) was the main document reviewed. In addition, a general site inspection of the proposed mine was undertaken on Tuesday 5th February 2013 in conjunction with representatives from PAC, Cobbora Holding Company Pty Limited and GSSE.

Subsequent to the above site inspection a Power Point presentation, containing a summary of the main findings, was presented to the Commissioners (NSW Planning Assessment Commission) in Sydney on Thursday 7th February. This report includes the content of this presentation along with some expansion of detail. Photographs from Cobbora and other mines have been included to highlight major points of interest.

2.0 SCOPE OF WORK

The Scope of Work is as per PAC direction as follows:

1. Review the appropriate documentation provided by the Commission with regard to relevant environmental guidelines, best practice, mining industry standards and legislation.

2. Meet with the Commission, proponents/agency experts as necessary.

3. Provide the Commission with written advice on the:

   - Adequacy of the documentation, and, if necessary, identify gaps in the documentation;

   - Adequacy and/or suitability of the proposed rehabilitation (including both interim and long term cover) and/or techniques and proposed mitigation and/or management and/or protection measures and/or contingencies if required;

   - Assessment of the significance of the impacts of the proposal;

   - Suggested remedial actions for the issues identified and the alternatives/contingencies available.

4. Conduct peer reviews of other service providers work if required.

In summary, a practical approach was adopted which largely centered on:

- Has the mine received the best advice?

- Are there any deficiencies in this advice?

- If so, what actions are required to ensure the best possible outcome?

3.0 MAIN FINDINGS

3.1 Can the site be effectively and successfully rehabilitated?

After a review of all of the above factors it was concluded that, yes, the mine can be successfully rehabilitated if specific targeted strategies are implemented. Recommendations are made below in this regard. Expansion of the current Mine Rehabilitation Strategy (MRS) to include these enhanced strategies is recommended.

In general, the updated MRS report (February 2013) provides a comprehensive and practical coverage of the key issues and should result in a successful outcome if closely followed. If expanded into a slightly more detailed Mine Rehabilitation Management Plan (MRMP) it should constitute the definitive, guiding, rehabilitation document.

In this context it should be acknowledged that the traditional sequential process in the preparation of rehabilitation related documents normally involves:

- EA (section on rehabilitation) > Preparation of the MRS (guiding strategy) > Preparation of the MRMP (plan containing more detailed rehabilitation specifications – working document).

The proponent has chosen to go directly to the MRS which was included as ***Appendix F*** in the EA. This is considered a reasonable approach.

The second issue is that the level of detail in the mine's Rehabilitation Strategy is quite good and will require relatively minor expansion in detail to become a more comprehensive Management Plan

Recommendation
1. It is recommended that the existing Rehabilitation Strategy (MRS) be expanded to include the suggested improvements made in this report (and any other feedback) and thus be considered as the final guiding Mine Rehabilitation Management Plan (MRMP) for the Mine. The suggested title of this enhanced document should be 'Cobbora Holding Company Pty Limited - Mine Rehabilitation Strategy and Management Plan'. This expansion capitalizes on the existing good and comprehensive format of the current MRS, as well as keeping all rehabilitation guidance in one single document (rather than spread over two or three separate documents).

3.2 Two Pivotal Issues Require Further Attention

Two key issues need to be addressed in greater detail in order to ensure rehabilitation and land management success:

- Soils
- Land Management.

3.2.1 Soils

Relevant Soil Characteristics

Proposed re-spreading of previously stripped and stockpiled topsoil onto the new, re-contoured land form will only lead to successful revegetation if the soil is of suitable quality. The MRS (Chapter 5) states:

- There are 25 different soil types in the PAA (Project Application Area).
- The MRS notes that topsoils are universally non-sodic and non-saline and thus have generally favorable chemical characteristics.
- However, most topsoils are limited by physical characteristics and specifically by weak soil structure (generally sandy/gravelly). Organic enhancement of topsoil has been proposed in the MRS but no specific details on how this will be achieved have been given.
- Subsoils are generally sodic and hence are unsuitable for general surface re-spreading although specific placement of a heavy clay subsoil, below the topsoil layer, has been generally recommended to enhance soil water holding capacity. This is not of concern for relatively flat, limited area, Class III cropping land. However, the widespread spreading of sodic material on elevated, re-contoured areas is of some concern and needs further consideration. It is recommended that sodic subsoils only be respread on Class III land prior to topsoiling.

Required Quantities of Organic Matter

In order to enhance the physical characteristics of topsoil organic enhancement will be required. This will involve large quantities of organics.

The area of disturbance requiring topsoil is approximately 4,000 ha (3,953 ha). The total volume of available topsoil has been estimated at 9.6 MCM (million cubic meters - allowing for 5% handling loss). It is assumed that this quantity refers to available topsoil but the intention to also reuse sub-soil requires that the available topsoil volume (as distinct from sub-soil) needs clarification.

Assuming a minimum of 100 cubic metres of organics per hectare is required (a low application rate for say biosolids), and a total area requiring amelioration of 4,000 ha, the quantity of organics required is estimated at 400,000 cubic metres. Can this quantity of organics be practically sourced?

Potential Sources of Imported Organics

The main potential sources of imported organics include:

- Feedlot waste – several feedlots are in this area but volume and supply is uncertain. Also there are potential volume and weed issues with imported waste.
- Biosolids from local councils – also potential volume and weed issues.

- Council green waste – also potential volume and weed problems.

For all three sources (singularly or combined) available supply is likely to be uncertain and probably only a small percentage of the 400,000 cubic meters required. In addition to potential weed problems, there are also other OH & S, logistical and legislative requirements which will make the regular delivery of large volumes of imported organics onto an active mine site impractical.

Conclusion – The importation of required quantities of organics from the above sources is considered impractical.

A Recommended Alternative Soil Organic Enhancement Strategy

The following two stage strategy is proposed to address the short fall in soil organics. The strategy is based on growing a dense, sterile, cereal cover crop which will be plowed (incorporated) into the topsoil layer at maturity.

Stage 1 - Following bulk shaping, surface drainage construction and topsoil respreading, deep rip the site and sow a heavy cover crop of either Japanese Millet (warm season) or Oats (cool season) at 40 kg/ha + 200 kg/ha of Granulock 15.

Stage 2 - When the crop matures (4 to 6 months) (see example in ***Plate 1*** in ***Appendix 1***) deep rip (parallel to the contour) the standing sward (***Plate 2***) and incorporate it into the topsoil layer. Immediately after ripping, sow the preferred, final crop (tree or pasture seed - see example of similarly treated (older) site in ***Plate 3***).

Advantages

- The above strategy will greatly enhance topsoil organic content and hence surface stability, rainfall infiltration and retention, nutrient content, microbial activity etc. etc.

- This strategy removes the need to source and import large volumes of external organics which may have weed and potentially other problems.

- Can still selectively source smaller volumes of external organics if a specific need exists.

Disadvantages

- Two separate sowing events and hence a delay in sowing the final, preferred crop.

- Increased cost ($400 - $500/ha - considered minor).

- Potential failure of cover crop due to drought (a common problem for any revegetation strategy).

Recommendations

1. *Consider the two stage organic soil enhancement strategy proposed above.*

2. *Reconsider the wide spread reuse of sodic sub-soil. A more limited application for reinstated Class III land only is recommended.*

3.2.2 Land Management Issues

Current Condition of the Site

The current condition of the site is relevant to both soil and future land management strategies.

This area was first settled by Europeans in 1832. Since then, grazing (mainly sheep) and cropping (mainly wheat) have been the main land uses.

On many farms there has been a long history of poor land management which has been exacerbated by poor structured topsoils (see earlier comments), drought and overgrazing. As a result there are currently significant examples of both gully and sheet erosion (***Plates 4, 5 & 6***). It can be reasonably assumed that significant quantities of topsoil have been lost through erosion over time. In some locations the topsoil layer has been completely lost leading to exposure of sodic subsoils and consequent accelerated erosion (see above plates).

Erosion has been accelerated where grazing has concentrated around natural springs where greener grass is present (***Plate 4***), and along creek lines (***Plates 5 & 6***).

Problems of erosion are less evident on Class III cropping land (***Plate 7***) compared to Class IV (and higher) grazing land (***Plate 8***). In general cropping land is flatter and has been better managed for obvious reasons.

A significant factor in the erosion history of the general area is the dominance of sheep grazing which is more damaging to grass and vegetation cover compared to cattle grazing.

Grazing has not only been limited to cleared country but has also occurred in remnant bushland. This has effectively resulted in the elimination of understory and ground cover in many forest areas (***Plate 9***).

Relevance of Current Site Condition to Proposed Rehabilitation Strategy

Should the proposed Cobbora Mine proceed, mine management will have the responsibility to wisely manage both the rehabilitation of disturbed areas (approximately 4,000 ha) as well as the remainder of the lease holding (approximately 23,000 ha of undisturbed land) – a total of approximately 27,000ha. The large size of the undisturbed area highlights the impact that either good (positive impact) or poor (negative impact) management will have on the region.

Two potentially conflicting objectives need to be considered in the management of non-mined land.

The first is the need to meet ecological enhancement objectives such as creation of offset areas, wildlife corridors and the management of remnant forest areas. This has generally been well addressed in the MRS.

The second objective, for a significant component of this land, is to appropriately manage purchased farming areas and ensure land capability in relevant areas. The later will require either the setting up of an agricultural management company linked to the mine and/or leasing of land back to occupants of properties which have been purchased by the mine (and others).

Either way it is strongly suggested that current land practices need to be improved upon and that significantly eroded areas will need to be repaired. Focused and intensive land management will be needed. In one sense, the proposed mine

represents a significant opportunity to enhance the regional environment through both enhanced land management, encouragement of natural regeneration in key areas, and improved management of remnant forest areas.

The MRS indicates that a land management plan will be prepared subsequent to approval. This plan needs to acknowledge the potential for a significant proportion of currently grazed country (non-cropped areas) to naturally regenerate. While the potential for natural regeneration has been acknowledged in the MRS as being < 10% of the PAA, the site inspection suggests that this area may be much higher. If so, this higher potential has the ability to be utilized in a positive way to achieve ecological objectives.

Potential for Natural Regeneration

As mentioned above, the site inspection indicated a wide spread potential for natural regeneration on grazing and other peripheral areas surrounding remnant bush land (***Plate 10***). This potential is likely to be considerably greater than the estimated 10% but will not be fully known until stock is removed and protective fencing installed. Emerging trees are likely to originate from remnant root stock and lignotubers which most likely, have been present for many years, but have continually been grazed back by stock. The tendency on this and many other sites has been for regenerating trees to emerge during times of low grazing pressure and visually disappear (above ground shoots) during heavier grazing. Experience has shown that below ground lignotubers can stay viable for over 100 years.

Experience at many other sites has also shown that the removal of stock through exclusion fencing can result in dense natural regeneration. This strategy can be used to great effect at Cobbora to help achieve offset and vegetation corridor objectives on un-mined land. The potential for natural regeneration requires more detailed examination. The exclusion of stock from remnant woodland/forest areas will also result in the re-emergence of a denser and more diverse understory and will enhance biodiversity values in these areas.

Having said this, there is a need for balance between ecological enhancement (fencing off areas for natural regeneration) and in ensuring ongoing land capability (on a reasonable proportion of the land) through cropping and grazing.

Recommendations

1. *The first step in optimizing the potential for natural regeneration is to undertake a more detailed assessment of natural regeneration potential in key areas and overlay this result with revegetation offset (and other relevant maps) in the MRS. This may result in adjustment of proposed ecological boundaries and may help maximize the benefit of natural regeneration.*

2. *Construct stock proof fencing (with access gates) around proposed areas of natural regeneration. Stock must also be excluded from all rehabilitated and artificially revegetated areas across the lease holding. Past experience has shown that limited/controlled grazing of these areas is rarely successful and total stock exclusion over long periods of time is strongly recommended. This requirement may need balancing with other land use and fire protection objectives.*

3. *Incorporate all areas into the Fire Management Strategy.*

3.2.3 Other Issues and Recommendations

Erosion Repair
Currently eroded and degraded land will need a repair plan.

Recommendation
1. *Prepare a strategy to identify and repair currently eroding areas. This should be incorporated into the overriding Land Management Strategy for the PAA.*

Re-Use of Felled Timber
This topic has been lightly discussed in the MRS but needs further expansion along with more detailed clearing protocols.

Although Land Capability Classes before and after disturbance were listed in Table 4.2 (page 32) it was difficult to calculate from this table the exact area of remnant woodland that will be cleared during disturbance. However, in Section 4.6 (page 33) the MRS states that *CHC will reinstate the same quantity of woodland in the Mining Operations Domain to that directly impacted by the project*. Table 4.6 (page 34) indicates that this equates to 1,901 ha of woodland.

As such, felled timber represents a valuable and substantial organic and ecological enhancement resource whose use needs to be more carefully considered and maximized.

There is little detail on how felled timber will be utilized other than a general reference on page 44 to *re-spreading tree trunks and branches less than 300 mm diameter on proposed woodland areas*.

In the absence of greater detail in the MRS it is recommended that felled timber be either mulched and used as a soil amendment, or placed as coarse timber (roots, stumps, trunks, crowns) in key habitat enhancement areas. There are numerous recent precedents for both mulching and coarse timber placement at other mines (e.g. Moolarben, Donaldson, Mt Arthur, Mangoola, West Cliff, Mt. Owen etc.) (***Plates 11, 12 & 13***).

Following composting, mulched timber should be used as an additional soil amendment on steeper slopes (additional to the cover crop strategy on steeper slopes). These steeper slopes are located around the periphery of the new land form as shown in Figure 4.1 in the MRS.

Assuming a total area of 1901ha of woodland is felled, and that composting will significantly reduce volume, it is estimated that sufficient composted material should be available to treat at least 300–400 ha of steeper slopes (and possibly more). Composted mulch should be spread and incorporated (ripped in) prior to sowing of the cover crop.

Recommendations
1. *Identify timbered areas to be cleared.*

2. *Mulch approximately 70% of felled timber volume - compost and spread as additional organic amendment on steeper rehabilitated slopes (mainly peripheral slopes).*

3. *Haul and spread remaining coarse felled timber (30%) on selected rehabilitated and offset areas to enhance habitat.*

ReUse of Bush Rock

There are significant surface bush rock formations in some proposed clearing areas (***Plate 14***). This resource has the potential to be used in both erosion control structures (rock lining of drains) and in habitat enhancement areas similar to the concept proposed for felled timber.

Recommendation

1. *Consider the potential to reuse bush rock in selected habitat enhancement areas.*

Seed Collection

If the use of local provenance seed is to be maximized, seed collection should start at least two years ahead of proposed use of that seed for nursery propagation of tube stock or for direct seeding. Many species such as grey box only flower and produce seed every three to four years. Hence, significant lead time is involved in collecting local provenance seed (of sufficient quantity) for mine purposes.

Recommendation

1. Initiate a native tree and shrub seed collection program as soon as possible***.***

Weeds

Sifton weed (Biddi Bush) is a major weed in the Cobbora mine area (***Plate 15***) and is largely uncontrolled. Once topsoil is disturbed during the stripping, stockpiling and re-spreading process weeds will regenerate rapidly on stockpiled topsoil dumps and on recontoured topsoil areas (***Plate 16***).

The issue of weed management and control is generally well addressed in the MRS but needs intensive input and control during the mine's operation.

Recommendation

1. *One minor suggestion for improvement of weed control is to construct topsoil dumps with very shallow slopes so that the surface, weed infested layer can be easily scalped off and disposed of prior to recovery of the underlying, clean material.*

Expanded Revegetation Specifications

If the proposal to progress the existing Rehabilitation Strategy (MRS) to Rehabilitation Management Plan (MRMP) status is acceptable, more detailed revegetation strategies need to be developed. The MRS already contains good detail and this should be expanded upon for the different plant communities.

Recommendation

1. *Expand re-vegetation specification.*

Landform and Drainage Design Factors Which Will Enhance Rehabilitation Success

The landform and surface drainage strategies appear to be practical and well thought out. Two aspects which will enhance the chance of rehabilitation success are the flat to gentle sloping nature of the great majority of the new landform, combined with the absence of major stream diversion channels.

Flat or gentle slopes increase rainfall infiltration and hence plant survival and growth. Steeper slopes reduce these favourable characteristics while exacerbating runoff, erosion, and offsite water quality issues.

Enhancing Soil Water Availability

Many of the strategies proposed in the MRS and in this report centre on maximizing rainfall infiltration and enhancing soil water availability to plants.

The relatively low rainfall in this area (average 619 mm/annum) means that surface runoff needs to be minimized and rainfall infiltration maximized in order to achieve reasonable, long term ecological health. Soil water availability is the main factor driving plant growth and species diversity. If soil water availability drops below critical levels for extended periods the risk of rehabilitated areas becoming weed infested waste lands increases.

Design factors which will enhance soil water availability include:

- Landform design – greater infiltration on flat areas.
- Organic amendment including establishment of an initial dense cover crop and incorporation of composted felled timber mulch.
- Deep ripping along the contour.
- Rapid establishment of the final vegetation cover which will reduce runoff.
- Use of coarse timber to assist infiltration and erosion control.
- Effective surface water management design.

4.0 RECOMMENDATION SUMMARY

1. *It is recommended that the existing Rehabilitation Strategy (MRS) be expanded to include the suggested improvements made in this report (and any other feedback) and thus be considered as the final guiding Management Plan (MRMP) for the Mine. The suggested title of this enhanced document should be 'Cobbora Holding Company Pty Limited – Mine Rehabilitation Strategy and Management Plan'. This expansion capitalizes on the existing good and comprehensive format of the current MRS, as well as keeping all rehabilitation guidance in one single document (rather than spread over two or three separate documents).*

2. *Consider the two stage organic soil enhancement strategy proposed above.*

3. *Reconsider the wide spread reuse of sodic sub-soil. A more limited application for reinstated Class III land only is recommended.*

4. *The first step in optimizing the potential for natural regeneration is to undertake a more detailed assessment of natural regeneration potential in key areas and overlay this result with revegetation offset (and other relevant maps) in the MRS. This may result in adjustment of proposed ecological boundaries and may help maximize the benefit of natural regeneration.*

5. *Construct stock proof fencing (with access gates) around proposed areas of natural regeneration. Stock must also be excluded from all rehabilitated and artificially revegetated areas across the lease holding. Past experience has*

shown that limited/controlled grazing of these areas is rarely successful and total stock exclusion over long periods of time is strongly recommended.

6. *Incorporate all areas into the Fire Management Strategy.*

7. *Prepare a strategy to identify and repair currently eroding areas. This should be incorporated into the overriding Land Management Strategy for the PAA.*

8. *Identify timbered areas to be cleared.*

9. *Mulch approximately 70% of felled timber volume, compost and spread as additional organic amendment on steeper rehabilitation area slopes (mainly peripheral slopes).*

10. *Haul and spread remaining coarse felled timber (30%) on selected rehabilitated and offset areas to enhance habitat.*

11. *Consider the potential to reuse bush rock in selected habitat enhancement areas.*

12. *Initiate a native tree and shrub seed collection program as soon as possible.*

13. *One minor suggestion for improvement of weed control is to construct topsoil dumps with very shallow slopes so that the surface, weed infested layer can be easily scalped off and disposed of prior to recovery of the underlying, clean material.*

14. *Expand re-vegetation specification.*

APPENDIX 1
PLATES

Plates 1 to 16 use photographs from on and off site to highlight points made in the report. Plates 17 (a) onwards show before and after examples at other mines where similar principles have been applied.

Plate 1 - Temporary cover crops can have many advantages including rapid stabilizing of slopes and organic enhancement of soils.

Plate 2 - Ripping will be used to incorporate the cover crop when mature.

Plate 3 - The use of a cover crop has been used successfully at other mines.

P

Plate 4 - Severe gully erosion within the Cobbora Project Area. Photograph supplied by the Planning Assessment Commission.

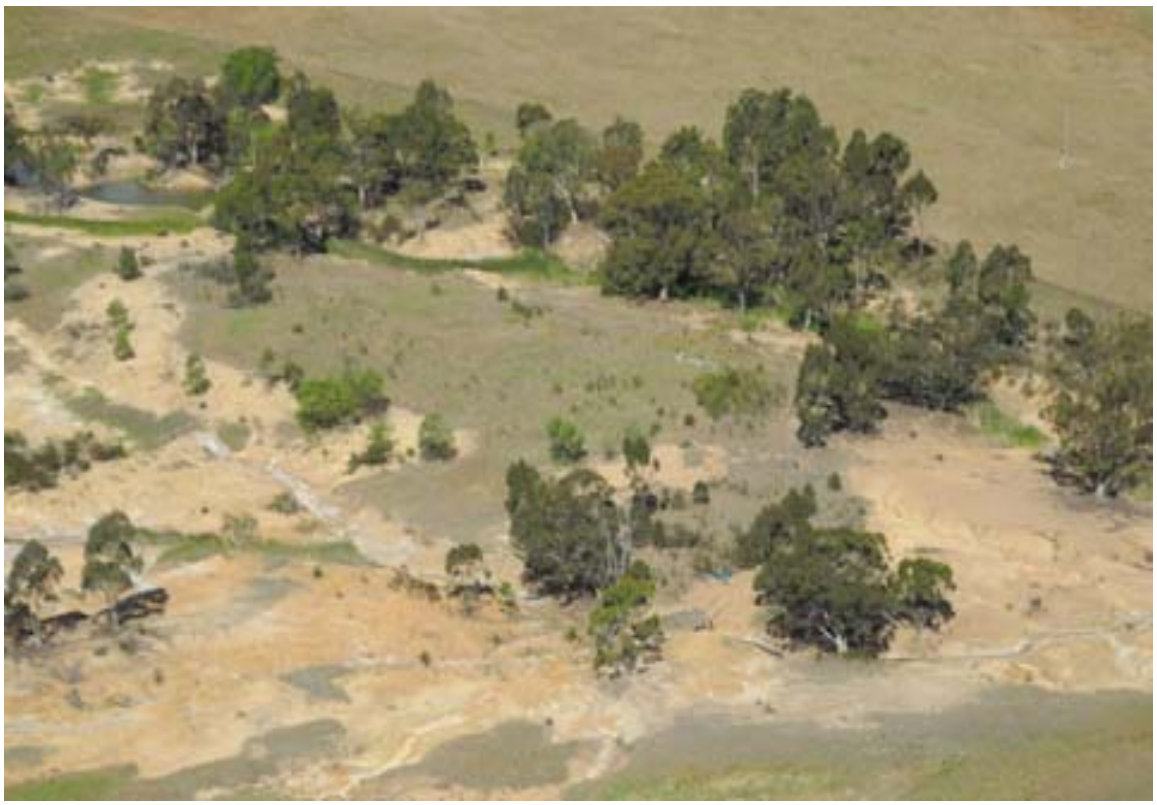

Plate 5 (a) - Severe gully and sheet erosion along a creek line within the Project area. Photograph supplied by the Planning Assessment Commission.

Plate 5 (b) - Stock concentrating around water and over grazing are the major causes of erosion.

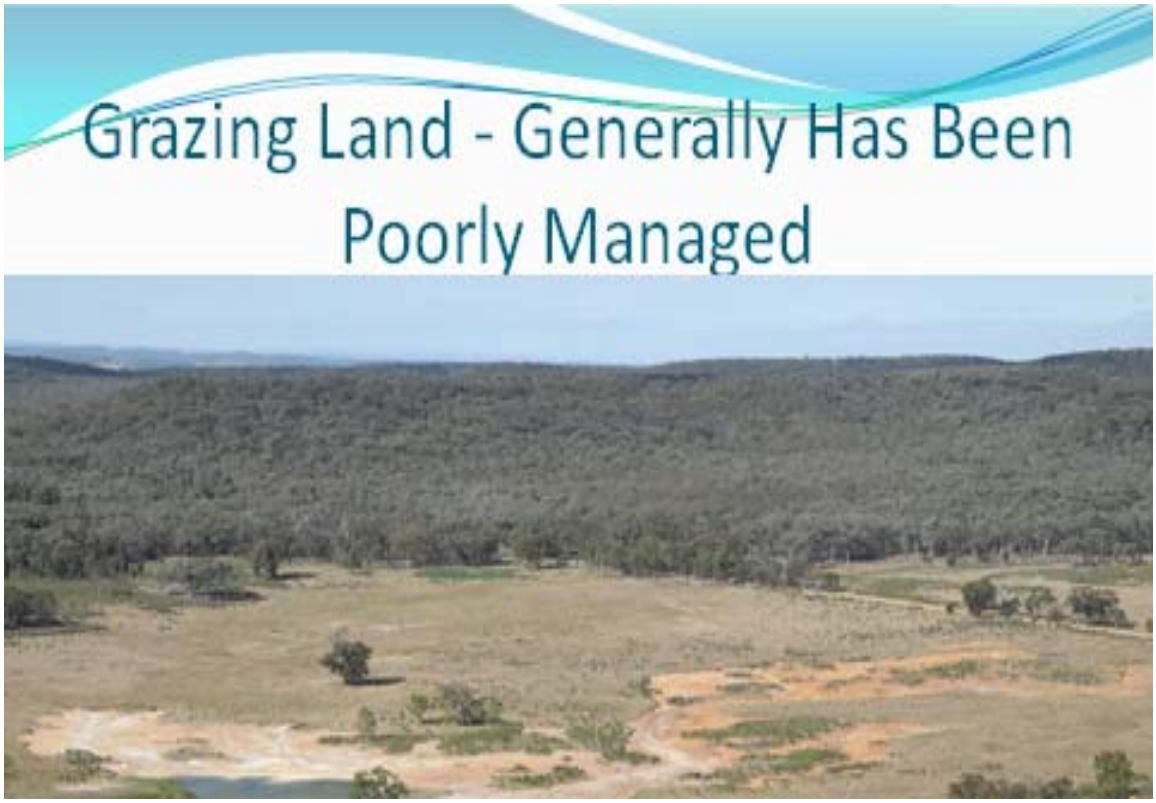

Plate 6 - Poor land management and severe creek erosion where stock concentrate. Photograph supplied by the Planning Assessment Commission.

Plate 7 - Erosion problems are less a problem on flatter and better managed Class III cropping land.

Plate 8 - Class 4 and above land covers 77% of the total project area and generally requires improved management. Photograph supplied by the Planning Assessment Commission.

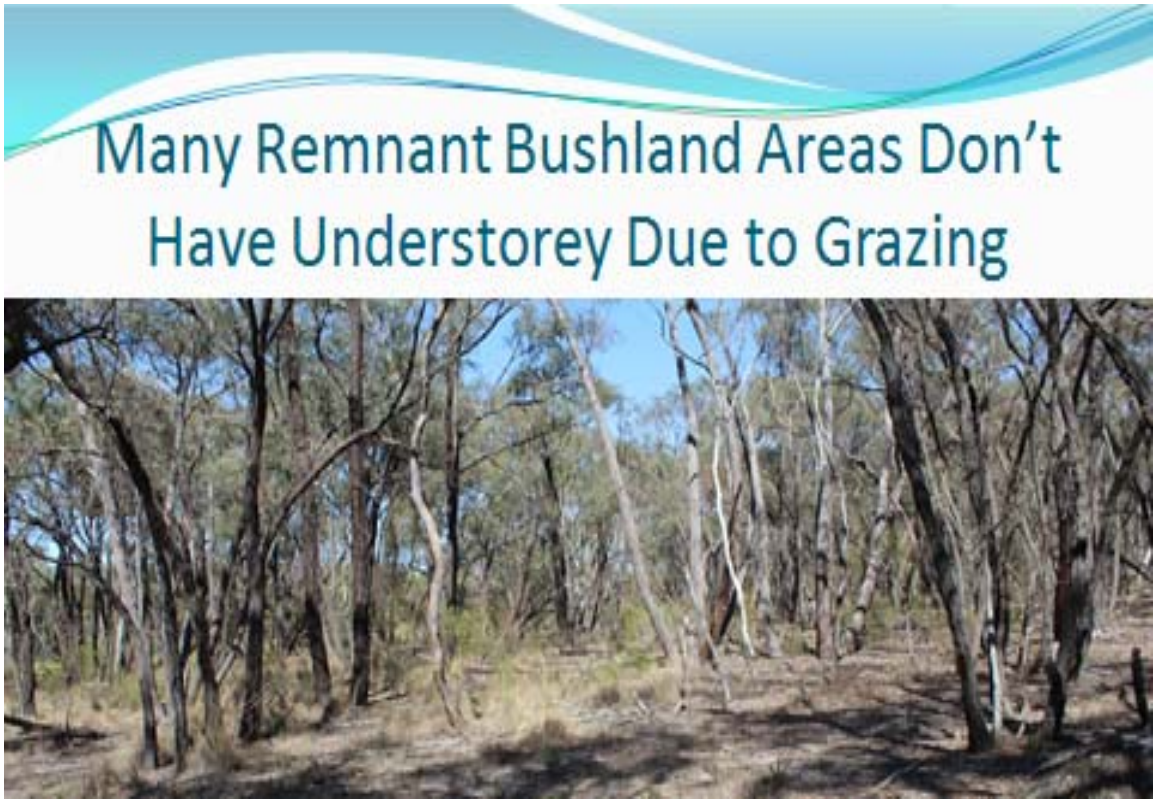

Plate 9 - Grazing of remnant forest and woodland areas has largely destroyed the understorey layer.

Plate 10 - The potential for natural regeneration of bush land is present over large areas of the project area.

Plate 11 – Example of respreading felled timber for soil and habitat enhancement at another mine.

Plate 12 – Reusing felled timber at another mine

Plate 13 – Reusing felled timber at another mine. Note revegetation in background advancing towards foreground.

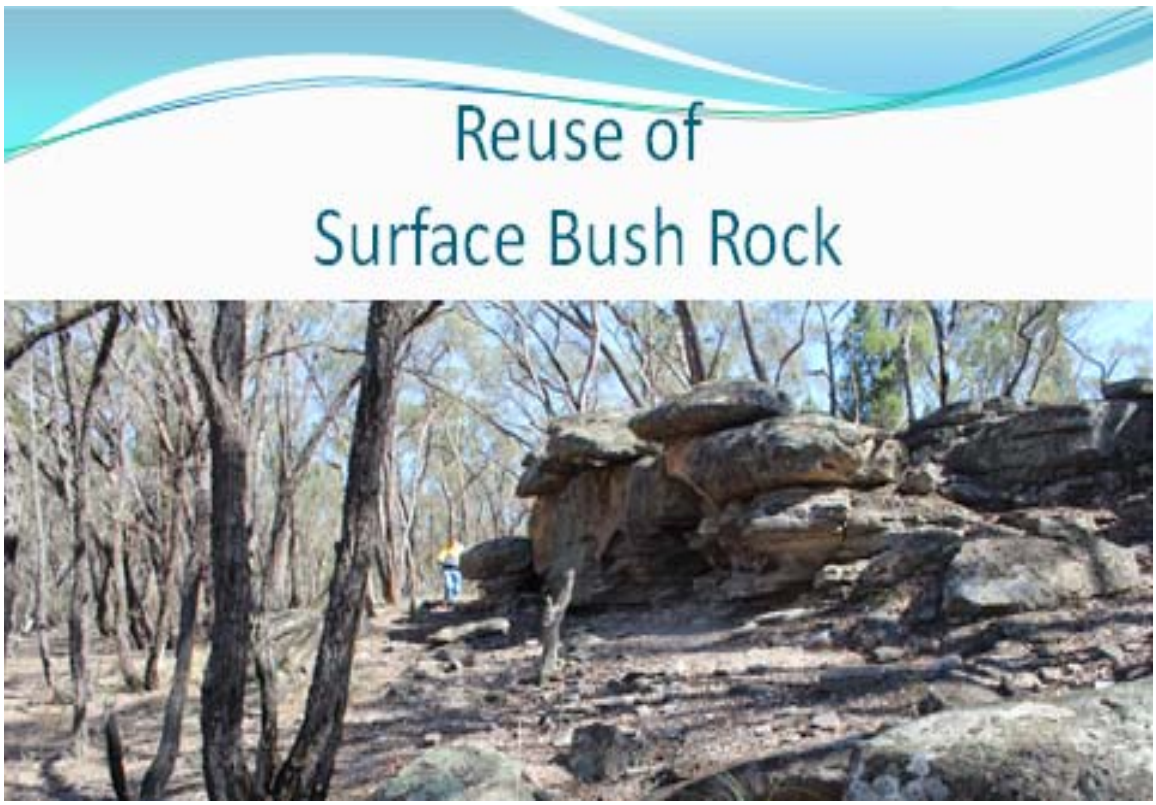

Plate 14 (a) – Reuse of disturbed surface rock for habitat enhancement is recommended.

Plate 14 (b) – Reuse of felled timber and bush rock at another mine site.

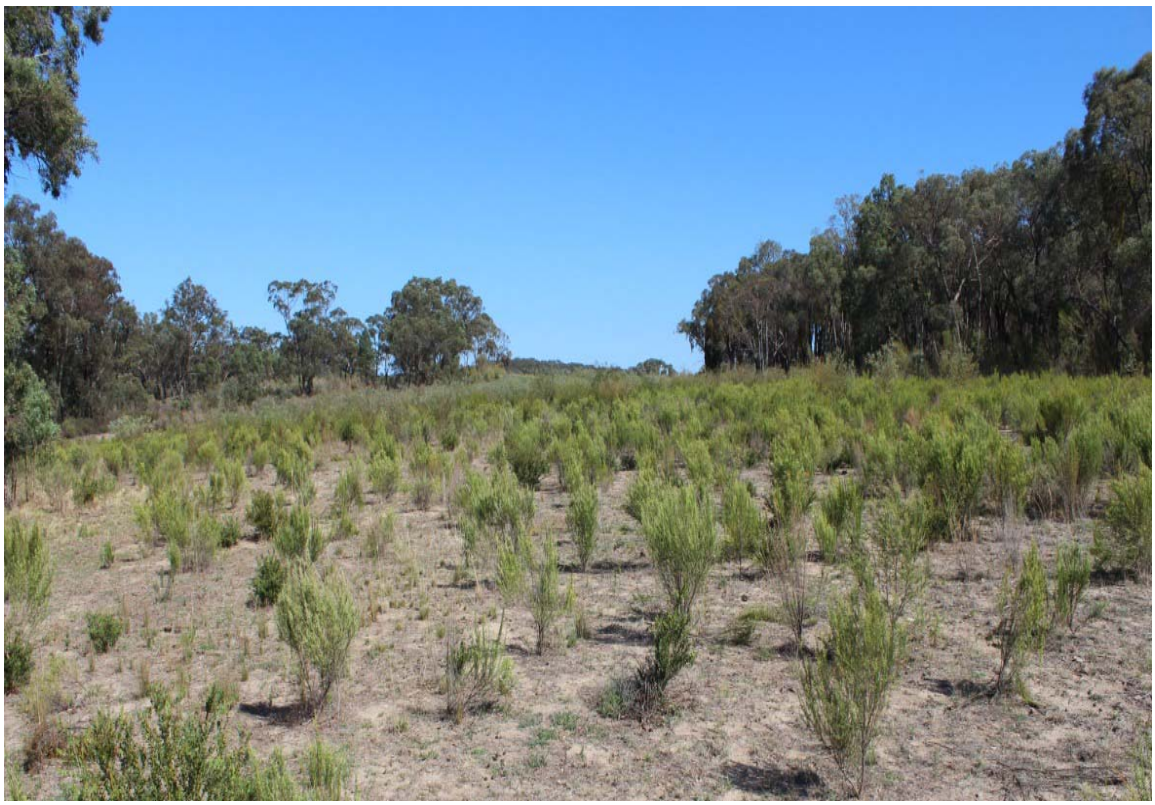

Plate 15 – Sifton bush (Biddi Bush) is a major weed on the Cobbora project area.

P

Plate 16 – Weed regeneration on a topsoil stockpile on a mine in the Hunter Valley. Weeds propagate rapidly once topsoil is disturbed.

Plate 17 to …… Examples of before and after photographs showing similar rehabilitation at other sites.

Plate 17 (a) - Before

Plate 17 (b) After -Three years

Plate 18 (a) - Before

Plate 18 (b) - Four years after

LARGE AREAS MULCHED AND TREE SEEDED

Plate 19 (a) - Before

Plate 19 (b) - Two years after

CENTRAL TABLELANDS

Plate 20 (a) - Before

Plate 20 (b) – Three years after

Plate 21 (a) - Before

Plate 21 (b) – Three years after

Plate 22 (a) – Before.

Plate 22 (b) – Progressive rehabilitation over a large area.

Plate 23 (a) - Before

Plate 23 (b) – Five years after

Plate 24 (a) - Before

Into this…….

Plate 24 (b) – Five years after

Appendix 7

ADVICE FROM DR STEVE PERRENS

EVANS & PECK
think through the future

Planning Assessment Commission

Cobbora Coal Project

Review of Potential Water Impacts

April 2013

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Summary

This report has been prepared to advise the Planning Assessment Commission in relation to the Minister's request for the Commission to:

1. *Carry out a review of the Cobbra Coal Project, and:*
   a) *Consider the Environmental Assessment of the project, all issues raised in submissions on the project, and further information provided during the course of the review;*
   b) *Assess the merits of the project paying particular attention to the:*
      - *. . . .*
      - *Water impacts of the project;*

Background

The proposed Cobbora Coal Project comprises a new open-cut coal mine that is intended to extract 20 million tonnes per year of run of mine coal (ROM) from which 12 million tonnes of product coal will be supplied by rail, mostly to the state's power generators (primarily Bayswater and Liddell power stations). Some coal (up to about 20%) is proposed to be sold into the export market or to power stations on the Central Coast.

The proposed mine would comprise three active open-cut mine pits within an overall disturbance area of 4,130 ha located within an area of 32,538 ha owned by the Cobbora Holding Company (CHC). The mine would be serviced by a 28 km rail spur from the Dunedoo-Gulgong rail line and a 26 km pipeline from the Cudgegong River. The proposed disturbance area associated with the rail line and pipeline, including buffers, is 410 ha.

Figure S-1 shows the location of the Project Application Area (including the corridors for the rail spur and pipeline) in relation to the main river systems. The mine itself would be located in the lower reaches of Sandy Creek and its major tributary Laheys Creek which drain to the Talbragar River about 2 km north of the Project Application Area. The Talbragar River is a tributary of the Macquarie River which it joins approximately 6 km north of Dubbo. In addition to surface and groundwater from within the mine area, water for the project will be supplied from the Cudgegong River by means of releases from Windamere Dam for transfer to the mine via the pipeline. As shown on **Figure S-1**, the Cudgegong River drains into Burrendong Dam. Burrendong Dam is operated in conjunction with Windamere Dam to provide regulated flow in the Cudgegong and Macquarie River systems.

Figure S-2 shows the immediate area of the mine (comprising Mining Areas A, B and C) and associated infrastructure such as the Main Infrastructure Area, Coal Handling and Preparation Area (CHPP), water storage dams and tailings emplacements. (References to '(Amended)' on **Figure S-2** refer to amendments to the mine layout presented in the *Preferred Project Report* (PPR, February 2013) compared to the original *Environmental Assessment* (EA, September 2012)). As shown on **Figure S-2**, Sandy Creek runs from south to north along the western side of the mine footprint. Laheys Creek runs approximately south-east to north-west between mine areas and joins Sandy Creek approximately 1.5 km north-west of the north-west corner of Mining Area B. Blackheath Creek (not shown on **Figure S-2**), is a tributary of Laheys Creek which runs in an east-west direction immediately north of the CHPP and joins Laheys creek immediately south of the Main Infrastructure Area.

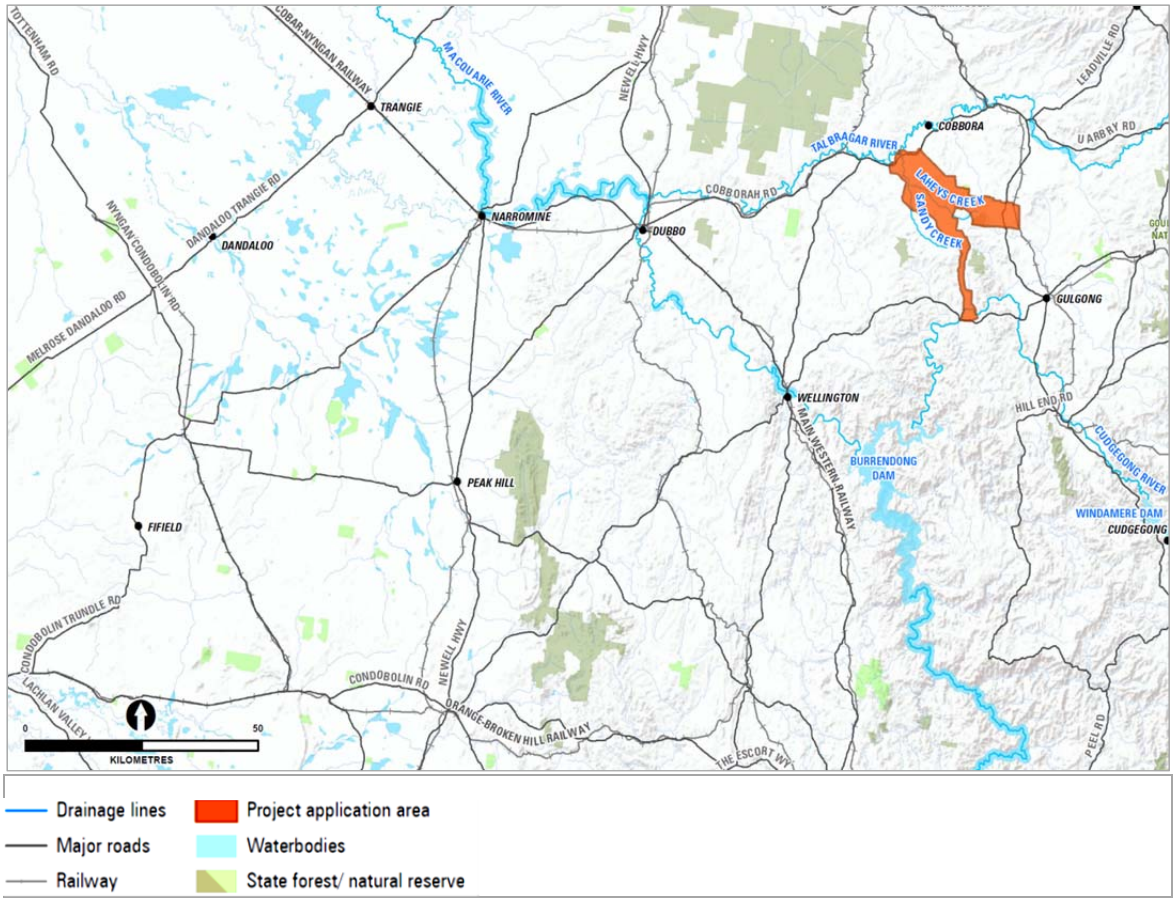

Figure S-1: Location of Cobbora Project Application Area in Relation to Rivers, Roads and Towns
Source: *Surface Water Assessment*, (Appendix F to the *Preferred Project Report*), Figure 3-1

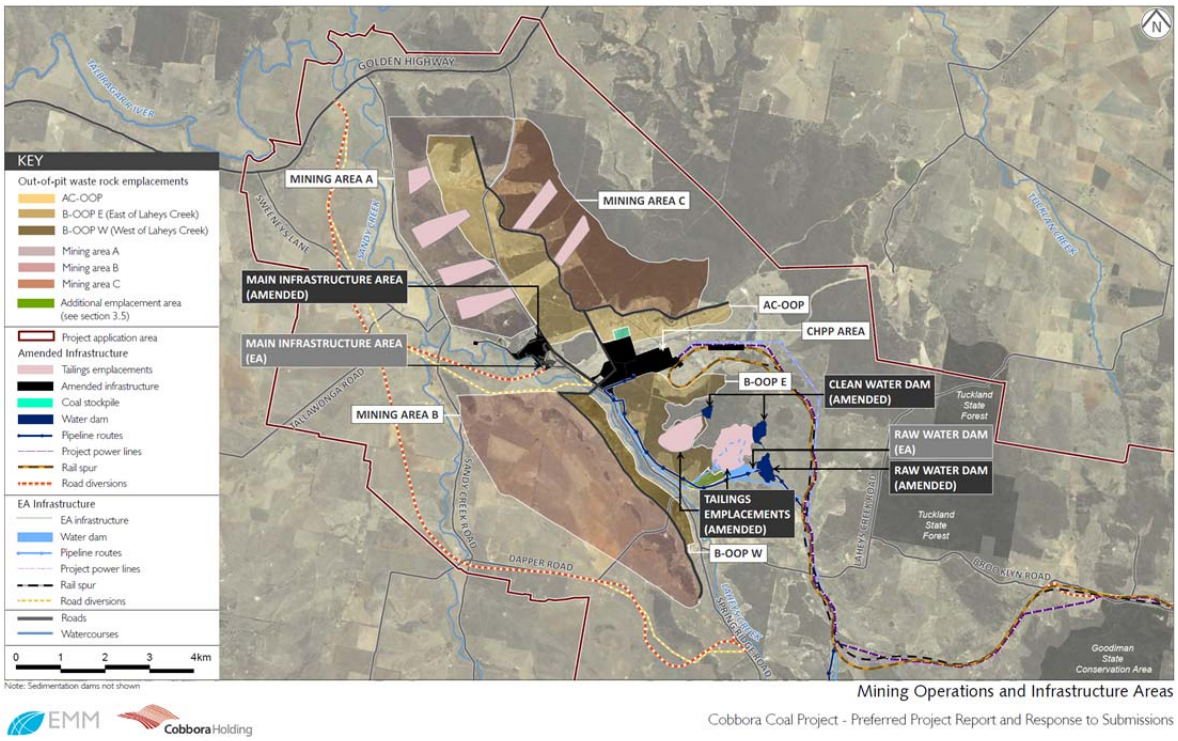

Figure S-2: Cobbora Mine Operations and Infrastructure Areas
Source: *Preferred Project Report*), Figure 3.1

This report is concerned with the water issues that are integral to other aspects of the mine operations including tailings disposal, dust suppression and pollution control. Accordingly, the report starts with a review of the water requirements for mine operations, the variation in water requirements as the mine progressively develops and the uncertainties caused by climate variability. The important features of the various water sources available to meet the mine water requirements are then reviewed along with the associated licencing requirements. Subsequently the mine water balance provides the framework for reviewing the risks of water shortage or excess and the available options to deal with such contingencies. Finally, the impacts of the mine on flow, flooding, groundwater and water quality are reviewed.

Water Demands

Water requirements for tailings disposal and dust suppression account for about 90% of the water required for the mine. There is some uncertainty associated with both of these demands:

- Tailings disposal is proposed to be by means of slurry (35% solids) deposited into two out-of-pit tailings dams for the first six years and then into six in-pit emplacements. The sizing of the tailings emplacements and the coal handling facilities is based on a 'worst case' assumption that tailings will comprise 10% of the ROM coal. However, the water demands and water balance analysis are based on an average of 5.5% tailings over the life of the mine and do not account for a period of up to a year when the ROM coal may have a higher proportion of tailings.
- The option of tailings disposal by means of a slurry is justified on least cost grounds as assessed by NPV. The *Dewatering Options Report* assesses the technical features and capital and operating costs associated with five alternative options including four mechanical dewatering options which would provide water savings of up to 70% (about 1,100 ML/year at peak production assuming 5.5% tailings). All of the mechanical dewatering options include provision of an out-of-pit tailings dam for use in the event of breakdown. However the costs for these options include provision for raising the out-of pit dam in Mine Years 9 and 13, by which time disposal into a section of the pit void would be an option. If these costs are taken out of the analysis of the NPV for two of the mechanical options, the costs are in line with the costs for the preferred option.
- The water balance analysis for the project examines the effect of dry, median and wet years on the mine operation but fails to account for possible increases in water requirements for dust suppression in drier years (up to 250 ML). In response to a question about this issue the consultants have indicated that chemical dust suppressants could be used to supplement water in the event of a shortage.
- A number of other losses such as seepage from dams, water loss in coarse rejects and produce coal do not appear to have been accounted for.

Water Sources

The *Surface Water Assessment* shows that main sources of water for mine operation would be groundwater inflow to the pits and water imported from the Cudgegong River via a 26 km pipeline.

- The *Groundwater Assessment* predicts that inflow to the mine pits will progressively increase as the mine develops to a rate of in excess of 2,000 ML/year between Mine Years 7 and 18 with a peak of about 2,800 ML in Mine Year 14. These predictions are all based on the assessed loss from the groundwater system which are then included as gains to the surface water system

after allowing for minor evaporative losses from sumps. However, this analysis fails to account for the fact that most groundwater would appear as small seepages around the face of the pit rather than as a distinct flow that can be captured. These seepages would be subject to significant loss by evaporation. CHC's surface water consultants disagree with this view and contend that, in the event of a requirement to capture more groundwater, dewatering bores or other direct access methods could be employed.

- Water would be imported from the Cudgegong River, on an 'as needs' basis, using CHC's high security access entitlements for up to 3,311 ML/year. The terms under which 2,311 ML of these water entitlements were transferred from downstream to upstream of Burrendong Dam has been the subject of some concern by the community and local government that it may detract from the reliability of supply. This issue is canvassed further below. It is worth noting, however, that the water balance analysis indicates that less than half of the entitlements would be required to meet mine water demands in a median rainfall year.
- Runoff from the mine pits and work areas that drain to the mine water dams is predicted to contribute about 20% of the mine water demands in a median rainfall year.

Water Balance Assessment

Figure S-3 is a schematic diagram which illustrates the flow regime at key points within the Macquarie River valley and those related to the Cobbora Mine for a median year based on data from the following sources:

- Median annual flows in the Talbragar, Cudgegong and Macquarie Rivers derived from an analysis of the annual flow data for the period 1984-2012 taken from the NOW web site (http://realtimedata.water.nsw.gov.au/). The period after 1984 was chosen because Windamere Dam was completed that year.
- Water uses, losses and sources for a median rainfall year in Year 16 of mine operation. This data was summarised from the *Addendum* to the *Surface Water Assessment* (March 2013).

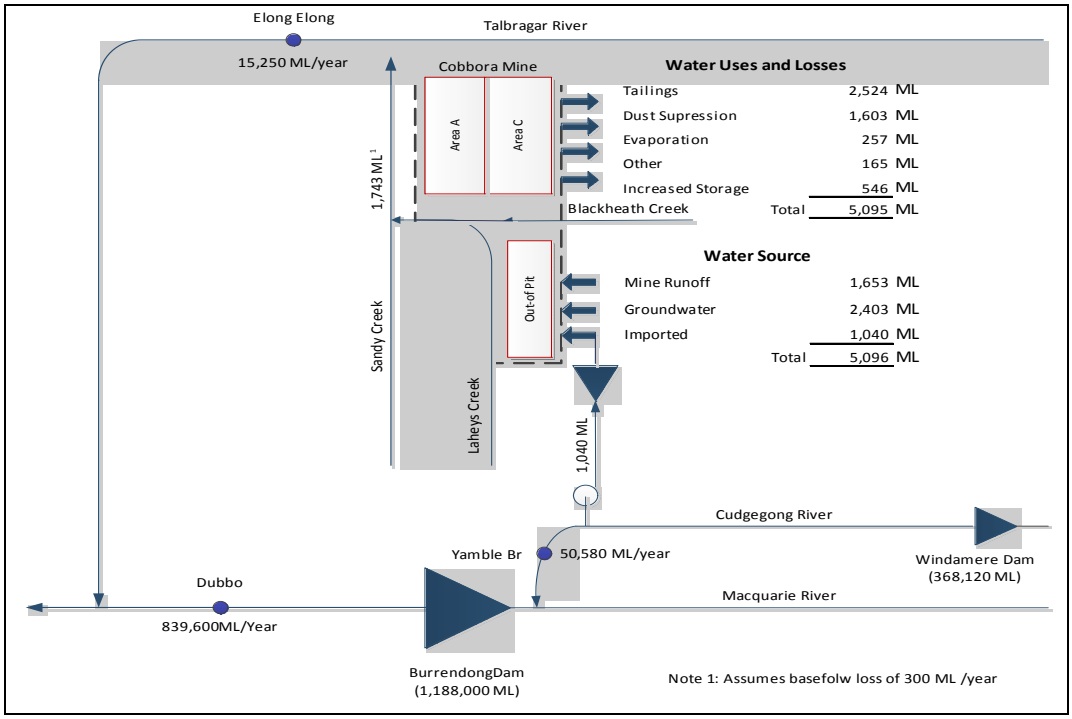

Figure S-3: River Flows and Mine Water Sources/Losses in a Median Year

While **Figure S-3** relates to flows in a specific year (a median climate/flow year during Year 16 of the mine operation), the table below provides a summary of the mine water balance assessment for the five representative mine years selected for detailed water balance analysis using 111 years of historic rainfall data. For simplicity the table omits some of the minor contributions to the overall water demand including evaporation losses and the contribution of runoff within the mine. The apparent anomalies in the volume of water imported occur because of carry-over of water in the mine storages which is depleted during the year in question. As shown in the table (Column 3), from Year 4 onwards, the mine would have about 3,200 ML of storage capacity, including 1,000 ML in the Raw Water Dam. This capacity provides significant opportunity to balance any variation of water supply and demand from year to year.

Mine Year	Product Coal (Mt/a)	Water Storage Capacity (ML)	CHPP Make-up (ML/a)	Dust Suppression (ML/a)	Total Site Demand (ML/a)	Groundwater Seepage (ML/a)	Imported Water (ML/year)		
							Dry Year (1967)	Median Year (1906)	Wet Year (1990)
1	0.7	2,696	134	376	524	131	120	120	0
4	11.2	3,199	2,092	968	3,210	1,069	1,840	1,300	360
12	12.0	3,166	2,524	1,651	4,340	2,446	580[1]	960[1]	400
16	12.0	3,166	2,524	1,603	4,292	2,403	1,220	1,040	380
20	12.0	3,216	2,524	1,371	4,055	1,163	2,400	1,660	400

The data in the last three columns of the table suggests that in a dry year (10% probability) the maximum requirement for imported water would be 2,400 ML, compared to entitlements of 3,311 ML. However, for various reasons outlined above, the picture painted in the table is considered optimistic, in particular:

- The analysis assumes that tailings will comprise 5.5% of ROM coal on average. If, however, poorer quality coal with 10% tailings was mined an additional 1,900 ML/year could be required.
- Water requirements for dust suppression could vary by up to 250 ML in a 10th percentile dry year unless chemical dust suppressants were also used.
- Seepage losses from dams have been ignored.
- The questionable assumption that a large proportion of the groundwater inflow will actually be available to make a significant contribution (up to 50%) to the overall water balance.

These issues indicate that the full entitlement of the high security licence for 3,311 ML from the Cudgegong River may be called on more frequently than the water balance analysis suggests. On the other hand, by only assessing the water balance for selected mine years, the analysis does not necessarily provide a full picture of the risk of having to retain water in the mine pits for an extended period. Analysis undertaken by consultants for Mid-Western Regional Council assessed the 'life-of-mine' water balance by applying the climatic data and mine layout details on a continually evolving basis, rather than the climatic and mine layout `snapshot' approach adopted for the *Surface Water Assessment*. Their analysis indicated that under some climate sequences there may be excess mine water stored in a pit for several years (e.g. more than 10 years with greater than 1,500 ML, and more than 5 years requiring management of 3,000 ML or more).

The uncertainties in the modelling ultimately revolve around the question of how the mine would operate under extreme conditions of too little or too much water:

- In a situation of excess water, the mine could:
  - Reduce the import of water to the absolute minimum required to provide potable supply and maintain the required water quality for the CHPP (about 18%);
  - Identify opportunities for disposal of additional water onto bare overburden;
  - Relocate any remaining excess water to one of the mine pits to allow operations to continue in the other two;
  - Commission a reverse osmosis plant to provide water of a suitable quality for substitution for imported raw water for the CHPP, for irrigation or for discharge to the environment (subject to obtaining a discharge licence and meeting water quality criteria).
- In a situation of water shortage, the mine could implement a range of actions:
  - Install dewatering bores or other in-ground measures to directly access groundwater;
  - Reduce water usage for dust suppression by the use of chemical suppressants;
  - Purchase additional water from the Cudgegong River on the 'temporary trade' market at the prevailing market price.

Based on the assumptions that underpin the water balance analysis, it appears that water shortage is more likely than excess. Rather than investing in dewatering methods such as dewatering bores, a more cost effective solution could be to significantly reduce the overall water demand for the project by using mechanical dewatering which has the potential to significantly reduce make-up water requirements.

Impacts on Flow and Groundwater

From the analysis in the *Surface Water Assessment* and the *Groundwater Assessment* it is difficult to determine:

- The expected magnitude of the combined losses of baseflow and surface runoff on flows in Laheys Creek, Sandy Creek and the Talbragar River over the course of mining and the period of groundwater recovery;
- The magnitude of losses from different reaches of creeks and/or river that would be affected by baseflow loss attributable to groundwater drawdown;
- The progressive increase in baseflow loss over time as the mine develops and the subsequent groundwater recovery.

The *Surface Water Assessment* (page 33) notes that the total combined induced loss of flows in the Lower Talbragar River Water Source peaks at 799 ML/year. The *Groundwater Assessment* (page 115) states that induced baseflow loss of up to 480 ML/year would occur in 2036 (Mine Year 23), but the source of the remaining 319 ML/year is not apparent and is not accounted for by the relatively minor changes on surface flow described in Appendix C to the *Surface Water Assessment* (maximum 37 ML/year in Mine Year 12 in a 10^{th} percentile dry year).

Groundwater drawdown is identified as having the potential to reduce the groundwater contribution to some of the semi-permanent pools in Laheys Creek and Sandy Creek. The assessment in Appendix C to the *Surface Water Assessment* concludes that the predicted changes in the flow regime as a result of release of water from sediment dams could positively affect the semi-permanent pools. However, it is unclear how much of the predicted loss of baseflow (up to 480 ML/year) would occur within the reaches of the creeks in which the pools are located. In a 'worst case' scenario the combined impact of reduced surface runoff and baseflow loss could lead

to significantly greater impact on continuity of water supply to the semi-permanent pools than has been assessed to date.

The issues relating to baseflow and surface runoff losses in the surface water systems require further clarification as to their magnitude, location and progression over time. The proposed mechanisms for offsetting the losses also require clarification.

The proposed final landform involves backfilling of two of the pits (Mine Areas A and C) to a level that is at least 3 m above the predicted final groundwater level; and one remnant void (Void B) in the south-west corner of Mine Area B. Void B would have a total catchment area of 242 ha, including the lake that would form in the base of the void. A water balance analysis that took account of groundwater inflow and used multiple 1,000 year rainfall sequences indicated that the lake level would initially rise rapidly from a base level of about 340 m AHD to a level of about 374 m AHD within 100 years and thereafter vary within a range of about 370 to 378 m AHD depending on the climate. The salinity is predicted to progressively increase in a linear manner to a median estimate of about 8,900 mg/L after 100 years and continue to increase at that rate thereafter. Key findings of the water balance analysis are that:

- The maximum equilibrium water level from 100 climate replicates of 1,000 years is 29 m below the top-of-void level of 407 m AHD. The void is therefore not expected to overtop.
- The maximum equilibrium water level is 2 m below the adjacent creek level of 380 m AHD. The void is therefore expected to be a net groundwater sink and no groundwater outflow would occur from the void lake towards the creek.

Although the water balance analysis does not appear to have taken account of possible climate change effects, these would tend to reduce rainfall and runoff and increase evaporation leading to a lower equilibrium lake level.

Flooding

Flood impact assessment for the creeks within the immediate vicinity of the mine and along the rail line has been undertaken using accepted methods. On the whole, the analysis indicates that the mine facilities would have minimal impact on the flood regime except in a few locations which require further assessment/detail particularly in relation to flow velocities and sour protection in the immediate vicinity of some crossings where sharp drops in flood levels imply high velocities and the potential for scour. In addition, details are required of the protection of the toe of the overburden dump on the western side of Laheys Creek which will be a permanent feature of the landscape after mining ceases.

Much of the proposed rail line will be located on a 6 m high embankment which has the potential to cause flooding upstream unless adequate hydraulic capacity is provided at locations where the rail line crosses watercourses and creeks. Localised hydraulic models were prepared for each of the 21 identified watercourse crossings. The preliminary designs developed for the major crossings of Fords Creek and Tallawang Creek have been estimated to lead to flood level increases 200 m upstream of the rail line of 0.14 m and 0.01 m respectively.

Up to 86 ha of the lower Sandy Creek catchment on its eastern side would be diverted north into the eastern arm of Flyblowers Creek. A dry detention basin (70 ML capacity) would be required to restore peak flows at the Golden Highway culvert to the existing levels.

Water Quality Impacts

The *Surface Water Assessment* includes details of routine monthly water quality monitoring that has been undertaken at three sites on Laheys Creek and Sandy Creek and two sites on the Talbragar River. The water quality data indicates that Laheys Creek and Sandy Creek have significant naturally occurring sources of salinity and are strongly influenced by agricultural activities on the catchment. The water quality data indicates that the Talbragar River is far from a pristine system and could be described as representing a 'moderately to highly disturbed' system.

These data have been used as a basis for modelling water quality over a 30 year period in order to determine water quality objectives that reflect local conditions. This analysis was based on the procedure set out in the ANZECC Guidelines. The resulting water quality objectives are very little different from the values that could have been derived from direct statistical analysis of the monitoring data. Modelling has also been used to assess water quality impacts downstream of the mine. The analysis shows that, while adhering to the proposed discharge water quality criteria, runoff from the overburden dumps can nevertheless be expected to have a significant influence on total dissolved solids in Sandy Creek. In view of the relatively small catchment area attributable to overburden dumps (maximum 1,633 ha), compared to the overall size of the Sandy Creek catchment (28,000 ha), these results appear counter intuitive.

It should be noted that the sediment dams would not reduce total dissolved solids and salinity. The only way that some control could be exercised over saline discharge from the sediment dams (or any other dissolved characteristic such as metals, nitrogen, or pH) would be for all water that exceeded the adopted discharge criteria to be transferred to a mine water dam. This would involve a change in the operating strategy from that adopted for purposes of the water balance analysis.

Provided the following facilities are in place and the required management practices are followed, there is no reason why the mine would significantly impact on water quality in Sandy Creek or the Talbragar River:

1. Mine water management facilities are designed and managed so as to retain runoff from pits and all active mine areas;
2. Facilities are provided to allow the transfer of water from sediment dams to the mine water dams in the event that the water does not comply with the discharge criteria.

Water Extraction from the Cudgegong River

Prior to approving the transfer of a high security entitlement from downstream to upstream of Burrendong Dam, the NSW Office of Water (NOW) undertook a detailed assessment of the impact the transfer would have on the resource availability and reliability for other water users. The key factor that underlies NOW's assessment that there would be no significant impact is that, for operational purposes, Windamere Dam (on the Cudgegong River) and Burrendong Dam are operated as a single source. The operation of the dams as a single source includes rules for the bulk transfer of water from Windamere Dam to supplement the water in Burrendong Dam (subject to a minimum reserve storage below which no transfers occur). Accordingly, a volume of high security water ordered from Windamere Dam for extraction from the Cudgegong River would be the same as the same volume ordered from Burrendong Dam for extraction on the Macquarie River, and would have no significant impact on the available resource or its reliability. Independent analysis by consultants on behalf of Mid-Western Regional Council confirms NOW's assessment.

Conclusions

The review identifies a range of uncertainties associated with the estimated water requirements for the operation of the Cobbora Mine and the relative contributions from different sources of supply. Notwithstanding these uncertainties, none of them individually or collectively would be 'show stoppers'. A range of options are available that would allow the mine to adapt its water use and manage the various sources to allow the mine to operate within the constraints of the available water resources. The mine proposes to construct mine water dams and a raw water dam with a combined capacity of approximately 3,000 ML which would provide opportunities to balance water uses and losses in the short term (6 – 12 months). In the longer term, water use could be reduced by using mechanical de-watering. Alternatively, additional certainty of groundwater supply could be achieved by the installation of de-watering bores.

There is also some uncertainty associated with the extent and magnitude of groundwater drawdown that could affect privately owned bores as well semi-permanent pools in Laheys Creek and Sandy Creek. The impact of the project on baseflow and runoff to Laheys Creek, Sandy Creek and the Talbragar River is also unclear. While the project has sufficient water licence entitlements in the Lower Talbragar Water Source to cover the projected loses, the mechanism for any offset requires clarification.

Cobbora Mine proposes to draw an average of approximately 1,270 ML/year (approximately 30% of average water requirements) from the Cudgegong River using its high security water access entitlements for up to 3,311 ML/year. These entitlements include 2,211 ML which were acquired from downstream of Burrendong Dam and, following analysis by NOW, transferred to the Cudgegong River upstream of the dam. Windamere Dam (which regulates flow in the Cudgegong River) and Burrendong Dam are operated as a single source for purposes of meeting the licenced water entitlements on the Cudgegong River and the Macquarie River. The analysis undertaken by NOW (and verified by independent analysis undertaken by consultants commissioned by Mid-Western Regional Council) shows that the transfer by CHC of a high security licence from downstream to upstream of Burrendong Dam would not significantly impact the water availability or reliability of supply to other users on the Cudgegong River.

The concerns raised by the Mid-Western Regional Council relating to changes in the reserve storage in Windamere Dam in order to maintain security of supply arise from a re-assessment of the 'drought of record' following experience in the decade up to 2010. This reassessment has been commenced by NOW and State Water.

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1 Introduction

This report has been prepared to advise the Planning Assessment Commission (PAC) in relation to the Minister's request for the Commission to:

2. *Carry out a review of the Cobbora Coal Project, and:*
   c) *Consider the Environmental Assessment of the project, all issues raised in submissions on the project, and further information provided during the course of the review;*
   d) *Assess the merits of the project paying particular attention to the:*
      - *. . . .*
      - *Water impacts of the project;*

1.1 Background

The proposed Cobbora Coal Project is intended to extract 20 million tonnes per year of run of mine coal (ROM) from which 12 million tonnes of product coal will be supplied by rail, mostly to the state's power generators (primarily Bayswater and Liddell power stations). Some coal (up to about 20%) is proposed to be sold into the export market or to power stations on the Central Coast.

The proposed mine would comprise three active open-cut mine pits within an overall disturbance area of 4,130 ha located within an area of 32,538 ha owned by the Cobbora Holding Company (CHC). The mine would be serviced by a 28 km rail spur from the Dunedoo-Gulgong rail line and a 26 km pipeline from the Cudgegong River. The proposed disturbance area associated with the rail line and pipeline, including buffers, is 410 ha.

Figure 1.1 shows the location of the Project Application Area (including the corridors for the rail spur and pipeline) in relation to the main river systems in the Macquarie Valley. The mine itself would be located in the lower reaches of Sandy Creek and its major tributary Laheys Creek. The confluence of Sandy Creek with the Talbragar River is located about 2 km north of the Project Application Area as shown in greater detail in **Figure 1.2**. The Talbragar River is a tributary of the Macquarie River which it joins approximately 6 km north of Dubbo. In addition to surface runoff and groundwater inflow to the mine pits, water for the project will be supplied from the Cudgegong River by means of releases from Windamere Dam for transfer to the mine via the pipeline. As shown on **Figure 1.1**, the Cudgegong River drains into Burrendong Dam which is operated in conjunction with Windamere Dam to provide regulated flow in the Cudgegong and Macquarie River systems.

Figure 1.2 shows the immediate area of the mine and associated infrastructure in relation to Laheys Creek and Sandy Creek. (**Note**: References to '(*Amended*)' on **Figure 1.2** refer to amendments to the mine layout presented in the *Preferred Project Report* (PPR, February 2013) compared to the original *Environmental Assessment* (EA, September 2012)). As shown on **Figure 1.2**, Sandy Creek runs from south to north along the western side of the mine area. Laheys Creek runs approximately from south-east to north-west between sections of the mine and joins Sandy Creek approximately 1.5 km north-west of Mining Area B. Blackheath Creek (not shown on **Figure 1.2**), is a tributary of Laheys Creek which runs in an east-west direction immediately to the north of the CHPP and joins Laheys creek immediately south of the Main Infrastructure Area.

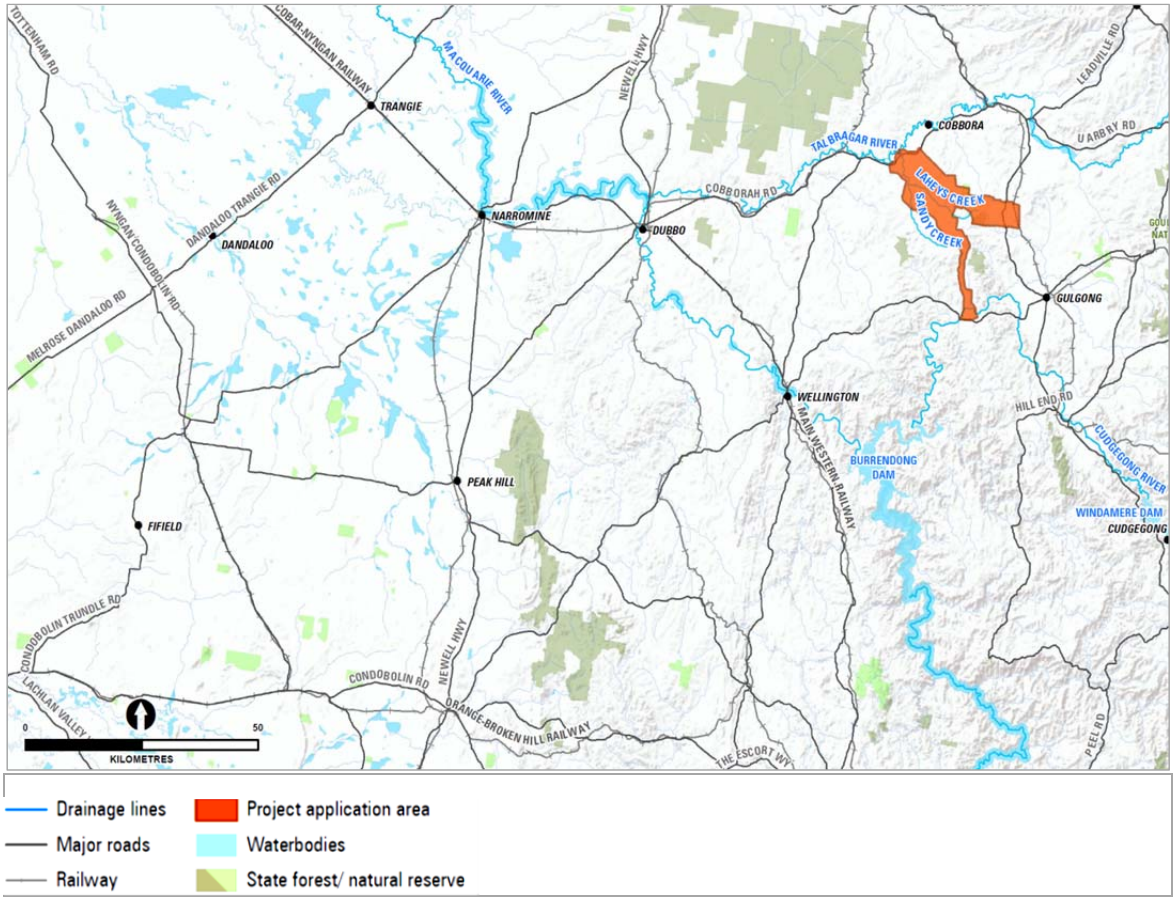

Figure 1.1: Location of Cobbora Project Application Area in Relation to Rivers, Roads and Towns

Source: *Surface Water Assessment*, (Appendix F to the *Preferred Project Report*), Figure 3-1

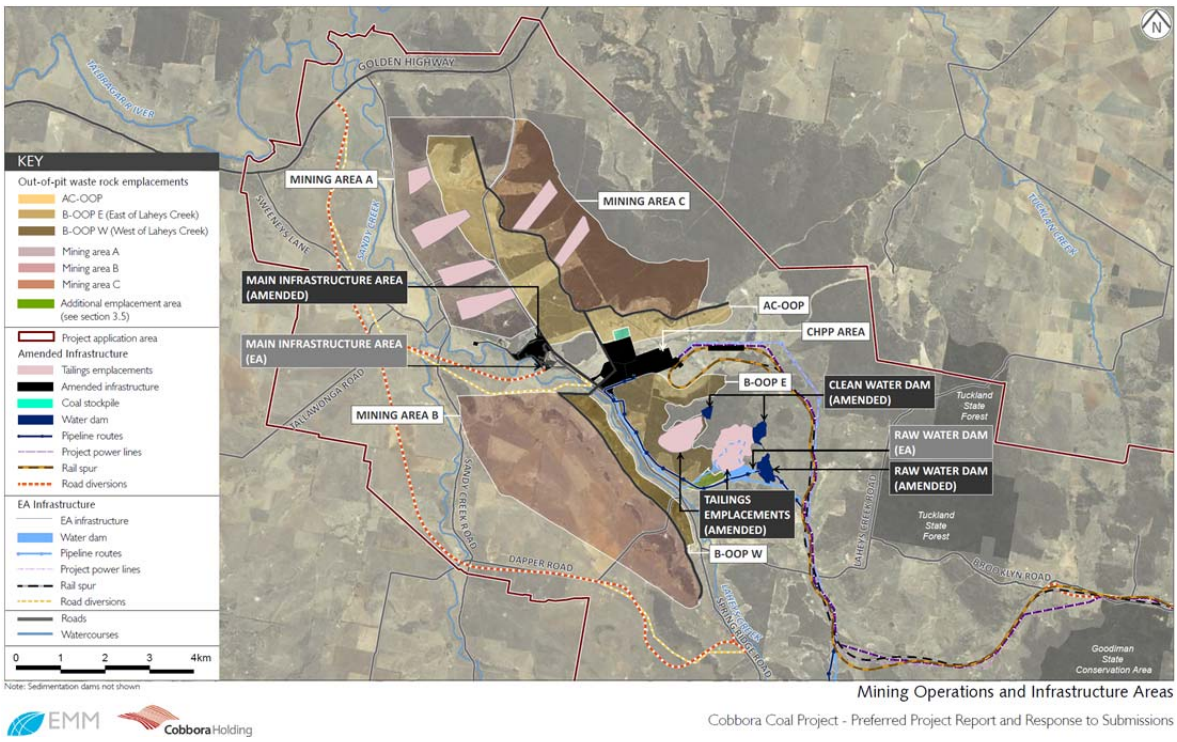

Figure 1.2: Cobbora Mine Operations and Infrastructure Areas

Source: *Preferred Project Report*), Figure 3.1

As shown in **Figure 1.2**, the mine disturbance area comprises three main zones:

1. Land located to the north of Blackheath Creek which drains in a westerly direction towards Sandy Creek. This land ranges in elevation from 360 m AHD in the north-west corner of the mine disturbance area to 480 m AHD in the south-east corner. Slopes range from less than 1.5% near Sandy Creek to 5% near the eastern boundary of the disturbance area, with small steeper areas. Land use within this landform comprises forest on the ridges and cleared areas used for grazing and cropping between the ridges and on the flatter land towards Sandy Creek. Open-cut mining from two pits (designated 'A' and 'C') is proposed in this zone.
2. Land located to south of Blackheath Creek which drains in a westerly direction towards Laheys Creek. This land has similar topography and land use to that in the zone to the north of Blackheath Creek. This zone is proposed to accommodate initial out-of-pit overburden dumps and tailings dams, water storage dams, the coal handling and preparation plant (CHPP), the coal stockpile area and the rail loop.
3. Land located between Laheys Creek and Sandy Creek. This area ranges in elevation from about 370 m AHD at the northern end to about 460 m AHD near the southern boundary of the disturbance area. Land slopes are generally of the order of 1% with a small area with steeper slopes at the southern end. The majority of this area has been cleared for grazing and cropping. A single open-cut mine pit ('B') is proposed in this zone.

The *Surface Water Assessment* estimates that mine would require up to 4,900 ML in a dry year mainly for operation of the CHPP and dust suppression on haul roads and work areas. This water will be sourced from a variety of on-site sources (groundwater inflow to the mine pits and surface runoff from operating areas and overburden dumps) supplemented by water from the Cudgegong River for which the company holds high security licences for up to 3,311 ML per year.

As mining progresses all three mine pits will be progressively backfilled including deposition of tailings from the CHPP into six emplacement areas within mining areas A and C. At completion of mining, it is proposed to backfill two of the three mine pits (A and C) to a level that would create free-draining depressions. The majority of the third pit (B) would also be backfilled, but would leave a small internally draining void in which a small lake is predicted to form. This lake is predicted to be a permanent 'sink' for groundwater with a water level below the perimeter ground level and the level in the nearest section of creek.

The proposed final landform would comprise elevated gently sloping land (0-1% slope) suitable for grazing (about 40% of the disturbance area) and cropping (about 10% of the disturbance area), with surrounding forest (46% of the disturbance area). The remaining area would comprise high-walls and the remnant void.

1.2 Review Documentation

For purposes of this review the key documentation comprises the following elements of the *Preferred Project Report* ('the PPR') which updated a range of aspects relating to water management that were initially described in the *Environmental Assessment* (prepared by EMGA Mitchell McLennan, September 2012) and various technical appendices to the PPR:

- *Preferred Project Report and Response to Submissions* (prepared by EMGA Mitchell McLennan, February 2013);

- *Tailings Storage Facilities Management Plan*, Appendix B to the PPR (prepared by Cobbora Holding Company, February 2013);
- *Dewatering Options Report – Comparison of Options for Tailings Dewatering*, Appendix C to the PPR (prepared by QCC Resources, January 2013);
- *Groundwater Assessment*, Appendix E to the PPR (prepared by Parsons Brinkerhoff, January 2013);
- *Surface Water Assessment,* Appendix F to the PPR (prepared by Parsons Brinkerhoff, January 2013);
- *Mine Rehabilitation Strategy,* Appendix G to the PPR (prepared by GSS Environmental, February, 2013);

Note that throughout this review, references to the *Groundwater Assessment* and the *Surface Water Assessment* relate to the versions that form part of the PPR as listed above.

Additional material has also been drawn from the following responses to requests for clarification:

- *Cobbora Coal Project – Surface Water Assessment – responses to initial comments from DP&I reviewer Steve Perrens*, (Memo from Parsons Brinkerhoff, 7 March 2013);
- *Cobbora Coal Project – Water Balance and Water Management System - Addendum* (prepared by Parsons Brinkerhoff, 18 March 2013);
- *Clarification of Tailings Information* (Memo from by CHC, 19 March 2013).

In addition, this review also considers some matters referred to in the following submissions from agencies and local government made in response to the PPR:

- Environment Protection Authority (8 March 2013);
- Office of Environment and Heritage (13 March 2013);
- Mid-Western Regional Council (7 March 2013);
- Department of Primary Industries (2 April 2013);
- *Water Modelling – Cudgegong River NSW (Draft)*, (letter report prepared by Gilbert and Sutherland for Mid-Western Regional Council, 14 March 2013).

1.3 Scope

A key issue for the Cobbora Project relates to the water requirements for operation of the CHPP and for dust suppression on haul roads. Accordingly, this review provides an assessment of these water requirements and then assesses the sources of water and the volumes available to meet the project needs. The review is structured as follows:

- **Section 2** reviews the proposed arrangements for disposal of tailings in a combination of out-of-pit dams (Mine Years 1-6) and in-pit storages (Mine Years 7-20).
- **Section 3** provides a review of the water requirements for operation of the mine, the variability of the water requirements over the life of the mine and the robustness of the estimated water requirements.

- **Section 4** comments on the various sources of water available to the mine to meet its operational requirements including the 'incidental' capture of groundwater and surface water needed to avoid the discharge of polluted runoff or hindrance to mine operations.
- **Section 5** reviews the overall water balance in the context of the water requirements and available sources discussed in the previous sections.
- **Section 6** reviews the potential the impacts of the project on groundwater drawdown and the flow in local creeks including the potential impact of changes in flow on semi-permanent refuge pools.
- **Section 7** provides an overview of the potential impacts of the mine on surface water quality and the proposed water quality objectives for discharge from the sediment dams.
- **Section 8** considers the potential impacts of the proposed project on the water resources of the Macquarie River basin with particular focus on the Cudgegong River and the Talbragar River.
- **Section 9** provides conclusions arising from this review.

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2 Tailings Management

2.1 Coal and Waste Production

2.1.1 Overview

In order to meet the required specifications for the product coal, the project proposes to simultaneously mine coal from three pits, with the coal washed and blended to produce a product with an ash content of about 24% which is suitable for power stations in NSW[1]. The requirement for washing and blending arises because of the variability of the coal resource which has an ash content generally varying between 25% and 45%[2]. However, where the ash content of the raw coal meets the required specifications, the coal will be mined as cleanly as possible, crushed and placed in a 'bypass' coal stockpile for directly loading onto a train[3].

The anticipated proportion of coal that would not require washing and blending is not stated in the EA and it appears that the CHPP water requirements and tailings disposal volumes are based on product coal dispatched from the mine comprising an average of 60% of the ROM coal. Of the 40% of ROM extracted as wastes during the processing, coarse reject material is expected to be in the order of 70 – 75% leading to the following allowance for wastes at full production:

- Coarse rejects 5.6 million tonnes per year (dry weight) – 28% of ROM;
- Tailings 2.4 million tonnes per year (dry weight)[4] – 12% of ROM.

In response to a request for clarification of aspects of the tailings management strategy, a memo from CHC dated 19 March 2013 (*Clarification of Tailings Information*) provides the following comment in relation to the proportion tailings:

> *Initially, it was assumed that 10% of ROM coal is fines (40% of ROM coal is rejects and 25% of rejects is fines). Further studies have found that there will be less tailings formed on average. However, this conservative assumption remains applicable as it results in conservatively large tailings emplacements and the higher costs associated with larger embankments and drainage works.*

The memo from CHC also notes that:

> *The mechanical and coal processing equipment designs are based on the need for the facilities to handle and process lower than the average grade coals, while maintaining coal production rates. Therefore, it is also applicable for the mechanical dewatering options require infrastructure to be sized to handle the maximum tailings volumes that may occur over the life of the mine (i.e. based on 10% fines).*

However, for purposes of the water balance calculations relating to the tailings, the memo notes the following assumptions:

[1] Cobbora Coal Project EA, Section 3.3
[2] Cobbora Coal Project EA, Section 3.4.1
[3] Cobbora Coal Project EA, Section 3.6.1
[4] Cobbora Coal Project EA, Section 3.6.5

- Tailings will average 5.5% of ROM coal (on a dry weight basis) over the life of the mine;
- An updated product yield of 65%.

2.1.2 Comment

The net result of the changes in assumptions relating to waste products from coal processing are summarised in **Table 2.1** which indicates that the latest water balance analysis (March 2013) is based on less than half of the tailings production stated in the original EA. The effect of this assumption is to significantly reduce the estimated volume of water that would be retained in tailings or lost by evaporation and seepage from the tailings emplacements.

This raises an apparent contradiction with the coal processing facilities designed to handle ROM that would produce tailings at a peak rate of 2 million tonnes, but the water balance analysis assumes a long term average of about half this value. This ignores the possibility that, at some stage during the life of the mine, water losses associated with tailings may be up to twice that assumed for the analysis.

Table 2.1: Estimated ROM and Waste Tonnages

	EA (Mtpa)[1]	Updated Coal Processing (Mtpa)[2]	Updated Tailings Water Balance (Mtpa)[2]
Maximum ROM Production	20.0	20.0	20.0
Total Wastes	8.0	8.0	7.0
Coarse Rejects	5.6	6.0	5.9
Tailings	2.4	2.0	1.0

Sources: 1) *Environmental Assessment*, Table 3.3
2) Attachment 1 to the *Clarification of Tailings Information* memorandum (CHC, 19 March 2013)

2.2 CHPP Operations and Water Use

Following crushing of the ROM coal, conventional coal washing technology is proposed which would treat coarse and fine fractions by separate processes, both of which require water. The outputs from these processes would be:

- Coarse rejects (nominal maximum 50 mm diameter) which would be separated from the lower density coal in a magnetite 'dense medium'. The coarse rejects would then be rinsed to remove the magnetite, drained and loaded onto trucks for disposal with the mine overburden.
- Tailings, which are mostly clays and other fine mineral particles, would be discharged from the CHPP as a slurry with a solids content of about 35% by mass.

The *Tailings Storage Facilities Management Plan* (Appendix B to the PPR) sets out details of the proposed facilities for disposal of tailings from the CHPP. In essence the proposal involves:

- Construction of two out-of-pit tailings dams (final capacity 7,000 ML or 7 million m^3 each) located about 2 km and 3 km respectively to the south-east of the CHPP and coal stockpile area (see **Figure 1.2**). The embankments for these dams would initially be constructed to provide a capacity of 1,100 ML (1.1 million m^3) each and would be raised by 15 m after about 18 months to give a total capacity of 14,000 ML (14 million m^3) which is estimated to be sufficient for the first six years of the project.

- Six in-pit tailings emplacements would be progressively built when the out-of-pit tailings dams are nearing capacity. These emplacements would be created in the voids left by redundant mine access ramps and would be constructed as part of the mining operation. The total capacity of these in-pit emplacements is estimated to be about 53,000 ML (53 million m^3).

The *Dewatering Options Report* (Appendix C of the *Preferred Project Report*) examines the technical aspects and costs associated with a variety of dewatering technologies that could be used to further process the tailings slurry to produce a tailings product with significantly lower moisture content. Section 3.6 of that report indicates that available dewatering technologies could increase water recovery by a factor of 3 to 4 with an increase in the costs compared to the preferred slurry disposal option.

Table 2.2 below summarises the comparative NPV costs extracted from Figure 6.1 of the *Dewatering Options Report* and levelised costs of tailings disposal per tonne of product coal (based on total ROM production over the life of the mine of 390[5] Mt with an assumed yield of 70%). The NPV for Options 3 – 6 includes a total about $30 million for the construction of an out of pit tailings storage for use in the event of equipment breakdown. The cash flow assumes that the first stage of the proposed out of pit storage (OOP-E – see **Section 2.3** below) would be constructed at the commencement of operations and progressively lifted in three stages (in Mine Years 3, 9 and 13).

Table 2.2: Cost Comparisons for Tailings Treatment Options

	Treatment Option	NPV ($ million)	NPV Compared to Slurry Disposal	Levelised Cost ($/t of product coal)
1	Slurry disposal (preferred option)	$180	100%	$0.66
2	Secondary flocculation at disposal	$198	110%	$0.73
3	Paste thickener	$190	106%	$0.70
4	Belt press	$216	120%	$0.79
5	Pressure filter	$233	129%	$0.85
6	Solid bowl centrifuges	$189	105%	$0.69

Source: NPV derived from Figure 6.1 in *Dewatering Options Report*.

2.3 Tailings Emplacement and Water Returns

As noted previously, two out-of-pit tailings dams (designated OOP-E and OOP-W) would receive tailings for the first six years, with tailings placed in one of six in-pit emplacements thereafter.

Decant ponds would be provided from which water draining from the surface of the tailings would be pumped back to the Mine Water Dam 4 (575 ML capacity). This water would be given priority for use in the CHPP (except for approximately 18% of raw water) or for dust suppression.

Seepage collections channels and a return pumping system would be constructed downstream of the tailings dam walls. Section 8.7 of the *Tailings Facilities Management Plan* lists the estimated recovery of water from the tailings dams as 25-30% of the water contained in the tailings delivered to the out-of-pit tailings dams.

[5] Section 3.3 of EA

The six in-pit storages would be constructed in old access ramps with low permeability rock in the base and be surrounded on by permeable mine waste. Collection sumps would be constructed down-gradient of the tailings emplacement and any collected water would be returned to Mine Water Dam 4. Section 8.7 of the *Tailings Facilities Management Plan* lists the estimated recovery of water from the in-pit tailings emplacements as 10-15% of the water contained in the tailings.

Table 2.3 summarises the annual water use and volume capable of being recycled at peak production (Mine Year 13) based on data provided in Attachment 1 to the *Clarification of Tailings Information* memorandum (CHC, 19 March 2013). The table presents data for two scenarios:

- The analysis used for sizing the CHPP facilities assuming tailings comprise 10% of ROM. This would require 4,154 ML/year for conveyance of tailings as a slurry;
- The water balance analysis assuming tailings comprise 5.5% of ROM, which would require 1,886 ML/year for conveyance of tailings as a slurry.

Table 2.3: Water Use and Recycling for Tailings Treatment Options

	Treatment	Tailings Production = 1 Mtpa		Tailings Production = 2 Mtpa	
		Water Recycled (ML/year)	Make-up Water (ML/year)	Water Recycled (ML/year)	Make-up Water (ML/year)
1	Slurry disposal (preferred option)	283	1,602	623	3,531
2	Secondary flocculation at disposal	471	1,414	1,038	3,116
3	Paste thickener	967	918	2,334	1,820
4	Belt press	1,209	676	2,821	1,333
5	Pressure filter	1,397	488	3,191	963
6	Solid bowl centrifuges	1,397	488	3,191	963

Source: Attachment 1 to the *Clarification of Tailings Information* memorandum (CHC, 19 March 2013)

2.4 Comment

The justification for adoption of the preferred option (slurry disposal) appears to be based largely on the fact that it has the lowest NPV. However, as noted above, the NPV of all the mechanical de-watering options includes about $30 million for the staged construction of an out of pit tailings dam to receive tailings in the event of breakdown of the mechanical equipment. The analysis includes lifting the dam wall in Years 9 and 13. However, by this stage of mining the preferred proposal would involve tailings placement within the mined out sections of the pit. Presumably the option of disposal of tailings in the pits would also be available as a backup to a mechanical dewatering system. Accordingly, the provision in the assessment of all the mechanical options for raising the wall of the tailings dam in Years 9 and 13 (NPV of about $10 million) is questionable.

If the estimated NPV cost of Option 3 (paste thickener) or Option 6 (solid bowl centrifuges) (see **Table 2.2**) is reduced by $10 million, the NPV of those options would be the same as, or $1 million less than, the preferred option. In addition, Option 3 has the potential to require an average of about 680 ML/year less make-up water (assuming 1 Mtpa of tailings – see **Table 2.3**) or about 1,710 ML less in a year when the ROM feed contains 2 Mt of tailings. Comparable water savings for Option 6 would be about 1,100 ML/year and 2,550 ML/year. The preferred option is therefore questionable on economic grounds and is not justified in terms of water requirements – which is a key issue for the project.

3 Operational Water Requirements and Losses

The predicted water requirements for make-up for the CHPP and dust suppression account for over 90% of the total water requirement. The reliability of the estimates for these two uses is therefore essential for determining the overall water balance of the project.

3.1 CHPP Make-Up Water

As described in **Section 2**, the preferred option for disposal of tailings would involve deposition of wet tailings (35% by mass of solids) into out-of-pit tailings dams for the first six years and thereafter into in-pit emplacements. The expected volume of make-up water at full production is summarised in **Table 3.1** for the two scenarios referenced in **Table 2.3** and values quoted in versions of the *Surface Water Assessment* (Appendix E to the original EA (September 2012) and the Appendix F to the PPR (January 2013)).

- Long term average tailings production of 1 Mtpa;
- Possible short term tailings production of 2 Mtpa;
- Tables 6-1 to 6-3 of Appendix E of the EA;
- Tables 6-1 to 6-3 of Appendix F of the PPR.

Table 3.1: Make-up Water Requirements for the CHPP for 12 Mtpa Product Coal

Disposal Location	CHPP Make-Up Water Requirement (ML/year)			
	Tailings Production 1 Mtpa	Tailings Production 2 Mtpa	Water Balance (EA Appendix E)	Water Balance (PPR Appendix F)
Out-of Pit Disposal (up to Year 6)	1,319	2,908	2,340[1]	2,092[1]
In-pit Disposal (Year 7 Onwards)	1,602	3,531	2,500[2]	2,524[2]

Note 1: Including minimum of ±430 ML of raw water.
Note 2: Including minimum of ±462 ML of raw water.

While the make-up water requirements used in in the water balance analyses lie approximately mid-way between the values taken from **Table 2.3**, the reasons why different values have been adopted for the water balance analysis are not apparent. However, based on the data from the *Clarification of Tailings Information,* it appears that, depending on the quality of the coal extracted in a particular year, the actual water demand for CHPP water supply top-up could vary by as much as ±40% from that assumed in the water balance analysis (about 1,000 ML/year when tailings disposal occurs in in-pit emplacements).

3.2 Water for Dust Suppression

Estimated water requirements for dust suppression are based on achieving 75% dust control efficiency as defined in the *National Pollutant Inventory, Emission Estimation Technique Manual for Mining, Version* (Environment Australia, 2012) assuming average annual evaporation of 1,735 mm and average annual rainfall of 625 mm with no watering required on days when rainfall exceeds 1 mm. **Table 3.2** summarises the estimated water requirements used in the water balance analysis.

Table 3.2: Estimated Water Requirements for Dust Suppression

	Mine Year				
	1	4	12	16	20
Road Area (ha)[1]	18.5	46.3	65.7	58.9	54.6
Water Requirement (ML/year)[2]	376	968	1,651	1,603	1,371
Water Requirement (ML/ha/year)	20	21	25	27	25

Sources: 1) *Surface Water Assessment – Responses* (Memo 7 March 2013)
2) Tables 2-3 to 2-5 *Water Balance and Water Management System – Addendum* (18 March 2013)

The differences in application rate (ML/ha/year) for different years of the mine life appear to be due to differences in assumed truck movements (range from 68 trucks/h in Mine Year 1 to 90 trucks/h in Mine Year 16).

The water requirements for dust suppression set out in **Table 3.2** are based on average annual evaporation, rainfall and number of rain days. An analysis of the daily rainfall data from Dunedoo and pan evaporation from Wellington indicates that the difference in water requirements could vary by ±15% of the average between 10th percentile dry and 90th percentile wet years. This variation (up to 250 ML/year) has not been taken into account in the water balance analysis which assumes a constant average value for each year of the mine life used in the water balance assessment.

3.3 Water Losses

3.3.1 Evaporation from Dams

The estimated evaporation losses from all dams, including the sumps in the mine pit, are set out in **Table 3.3**.

Table 3.3: Evaporation Loss from Mine Water Dams

Mine Year	Annual Evaporation Loss Net of Direct Rain (ML)		
	10th Percentile Dry Year	50th Percentile Median Year	90th Percentile Wet Year
1	334	81	238
4	498	217	130
12	601	272	1,178
16	543	257	984
20	496	236	440

Source: Tables 2-3 to 2-5 *Water Balance and Water Management System – Addendum* (18 March 2013)

The rainfall data for Dunedoo and pan evaporation data for Wellington for the period 1965 – 2012 (coincident daily records) indicates that the annual evaporation loss (net of direct rainfall) for 10th percentile (dry) and 90th percentile (wet) years can be expected to vary by about 45% from the median. Based on this indicative variation, it is difficult to see how the 10th percentile dry year losses can vary by a factor of between 2 and 4 as indicated in indicate **Table 3.3**. Intuitively, one would expect the net loss by evaporation in a 90th percentile (wet) year to be less than in a median rainfall year. However, the data for a 90th percentile wet year in **Table 3.3** shows greater losses in all except Year 4.

3.3.2 Seepage from Dams

The water balance modelling assumes that seepage losses from the mine water storage dams and sediment dams are negligible. This assumption has been adopted on the basis of the *Manual for Assessing Hazard Categories and Hydraulic Performance of Dams* (DERM, Qld, 2012) which is intended to add a level of conservatism to minimise the risk of overflow from mine water dams. However, the converse may apply in a situation where water is scarce.

In the case of the water balance analysis for the Cobbora Project, the average net evaporation loss from water surfaces (after accounting for incident rainfall) is of the order of 900 mm/year. Seepage of the order of 300 mm/year would be in line with observed seepage losses from farm irrigation storages. Such a seepage loss could account for an additional 100 ML loss in the water balance analysis.

3.3.3 Water in Coarse Rejects

The *Surface Water Assessment* makes no reference to the water lost from the CHPP washing circuit in the coarse rejects. Given the large mass of coarse rejects (± 6 Mtpa) even a 5% change in average moisture content could account for an additional loss of 300 ML/year.

3.3.4 Water in Product Coal

The *Surface Water Assessment* also makes no reference to the water lost from the CHPP washing circuit in the product coal which leaves the CHPP as a moist product from which water will be lost by evaporation in the stockpiles before being loaded onto rail. A net increase of 2% in the moisture content of the product coal could account for about a further 240 ML/year at peak production of 12 Mtpa.

3.4 Comment

The apparent anomalies and omissions in defining the water uses and losses from the mine water management system suggest that, overall, these losses may have been underestimated. Although the major sources of 'loss' in the tailings deposition and for dust suppression constitute about 90% of losses identified in the updated water balance tables (Tables 2-3 to 2-5 in the *Water Balance and Water Management System – Addendum,* 18 March 2013), it appears that other water losses such as in the coarse rejects and coal product have not been accounted for.

4 Water Sources and Licencing

4.1 Groundwater

The *Groundwater Assessment* (Appendix E to the PPR) documents the investigations and modelling undertaken to assess the following potential impacts of the project:

- The extent and magnitude of groundwater drawdown in an area surrounding the mine pits;
- The rate of groundwater inflow to the mine pit voids;
- The impact of groundwater drawdown on seeps, baseflow and semi-permanent pools in Laheys Creek, Sandy Creek, and on baseflow in the Talbragar River;
- Any impact on groundwater users.

Investigations for the groundwater assessment included installing 56 piezometers and five test production bores, hydraulic testing of bores, water level and water quality sampling and geophysical investigations. These investigations identified two main aquifers within the assessment area:

- Quaternary alluvium aquifer associated with the unconsolidated sediments of the Talbragar River, Sandy Creek and Laheys Creek;
- Porous rock aquifer associated with porous rocks of Permian and Triassic sandstone, coal and claystone associated with the Gunnedah Basin.

Data from the investigations was used to develop a numerical groundwater model to provide a quantitative assessment of the potential impacts, in particular the groundwater inflows to the pit voids, the extent of drawdown of the water table and depressurisation of the underlying aquifer.

4.1.1 Groundwater Inflow to Mine Pits

The predicted inflow rates to the pit voids are summarised in **Table 4.1** which also lists the net groundwater usage (required for groundwater licencing purposes) after accounting for river losses and enhanced groundwater recharge. For purposes of cross referencing with the overall site water balance assessment (see **Section 5**), the table lists the calendar years referenced in the *Groundwater Assessment* and the corresponding mine years referenced in the *Surface Water Assessment*. The *Surface Water Assessment* provides water balance analyses for the selected years which are shaded light blue in **Table 4.1**.

The predicted maximum inflow to the pit (2,802 ML/year) and net groundwater usage (2,202 ML/year) occur in 2028 (Mine Year 14). However, the years selected for water balance modelling (Mine Years 12 and 16) have inflows which are about 350 – 400 ML/year less than for Mine Year 14.

Table 4.1: Predicted Inflow to Mine Pits and Net Groundwater Usage
Rows shaded light blue used for water balance assessment

Calendar Year	Mine Year	Total Pit Inflow (ML/year)	Net Groundwater Usage (ML/year)	Calendar Year	Mine Year	Total Pit Inflow (ML/year)	Net Groundwater Usage (ML/year)
2015	1	130	95	2026	12	2,447	1,929
2016	2	544	468	2027	13	2,144	1,585
2017	3	824	698	2028	14	2,802	2,202
2018	4	1,069	897	2029	15	2,690	2,053
2019	5	1,030	820	2030	16	2,403	1,729
2020	6	1,396	1,145	2031	17	2,025	1,315
2021	7	2,107	1,808	2032	18	2,082	1,336
2022	8	2,439	2,095	2033	19	944	162
2023	9	2,336	1,946	2034	20	1,162	363
2024	10	2,455	2,019	2035	21	31	0

Source: *Groundwater Assessment* - Tables 6.3 and 64.

As with any model, the results are heavily dependent on the model assumptions and the adopted parameters. The *Groundwater Model Technical Report* (Appendix H to the *Groundwater Assessment*) provides assessment of the sensitivity of the model results to input parameters. This included the properties of the Ulan Coal Seams and the properties of the backfill material which were considered to be the most significant parameters with respect to mine inflows and drawdown. **Table 4.2** summarises the results of the analysis of the sensitivity of mine inflow and groundwater usage to changes of ±50% in the hydraulic conductivity of these parameters.

Table 4.2: Groundwater Model Sensitivity to Variation of Hydraulic Conductivity

Parameter	Mine Dewatering During Mine Life		Groundwater Usage During Mine Life	
	Average	Maximum	Average	Maximum
	Flow Rate (ML/year)			
Base Model	1,694	2,802	1,272	2,202
+50% Ulan K	1,835	3,017	1,339	2,319
-50% Ulan K	1,527	2,543	1,188	2,057
+50% Backfill K	1,820	3,068	1,391	2,457
-50% Backfill K	1,583	2,564	1,168	1,974
	Percentage Change from Base Model			
+50% Ulan K	8%	8%	5%	5%
-50% Ulan K	-10%	-9%	-7%	-7%
+50% Backfill K	7%	9%	9%	12%
-50% Backfill K	-7%	-8%	-8%	-10%

Source: *Groundwater Model Technical Report,* Table 5.5

The results in **Table 4.2** indicate that the mine inflow and groundwater usage estimates are not very sensitive to the assumed hydraulic conductivity (range of the order of ±10%). Notwithstanding, this analysis indicates that maximum mine inflow rates (Mine Year 14) could vary in the range of about +200 to -250 ML/year.

4.1.2 Groundwater Drawdown

As a result of groundwater inflows to the mine pits the maximum lowering of the water table is predicted to be up to:

- 90 m in Mining Area B;
- 60 m in Mining Area A; and
- 40 m in Mining Area C.

The 1 m drawdown contour is predicted to extend up to:

- 5.5 km to the south of the mine;
- Nearly 6 km to the west of Mining Area A; and
- Within 4 km to the north and east.

The groundwater model predicts that 13 private groundwater bores, 10 of which are owned by CHC, would experience drawdown greater than 2 m. The maximum predicted drawdowns at the other three private bores are 2.2 m, 2.4 m and 5.1 m.

The analysis of model sensitivity to assumed hydraulic conductivity (see **Section 4.1.1** above) also included an assessment of drawdown estimates in the three privately owned bores. This analysis showed that the variation was in the range of about ±1 m.

The *Surface Water Assessment* identifies 14 significant pools along Laheys Creek and Sandy Creek and their tributaries of which:

- Two are 'likely' to be groundwater dependent;
- Four are 'potentially' groundwater dependent.

Issues relating to potential impacts of groundwater drawdown on these pools are discussed in **Section 6.1**.

Discussions with Dr Frans Kalf, who is reviewing the *Groundwater Assessment* on behalf of DP&I, indicate that there are some issues relating to the way that the creeks and rivers have been modelled. The modelling reported in the *Groundwater Assessment* (January 2013) includes the use of the 'River Package' module, which assumes there is a constant source of water in all of the creeks and rivers included in the model. The effect of this assumption is that it will reduce the predicted drawdown, particularly in the area to the west of Sandy Creek. This issue has been raised with the consultants and it is understood that further groundwater modelling has been undertaken assuming that the creeks and rivers do not contribute to the alluvial groundwater system. This modelling is reported to lead to increased groundwater drawdowns of up to about 5 m at the three identified private bores.

In practice, because there is flow in Sandy Creek and Laheys Creek for about 60% of the time according to the consultants, the actual drawdown is likely to be somewhere between the results from the two different models. Notwithstanding any further refinement of the predicted groundwater drawdown during the assessment process, any 'make-good' requirements will be based on ongoing monitoring while mining progresses and the requirements for 'make-good' specified in any Project Approval.

The impact of the assumptions of dry creeks and rivers on dewatering flows to the mine, baseflow losses to the Talbragar River and on pools in Sandy Creek and Laheys Creek have not yet been assessed.

4.1.3 Baseflow in Talbragar River

The description of the interaction between groundwater and the rivers is confusing. On page 86, the *Groundwater Assessment* comments that all surface water channels cease to flow (including the Talbragar River) for periods of time when rainfall is low (there is no significant baseflow component).

> *'Baseflow recession curves for the tributary creeks are steep (typically days) while recession curves for the Talbragar are longer (weeks), but ultimately reduce to zero baseflow over time. This indicates that groundwater discharge from the main regional aquifer (Permo-Triassic units) is not a major contributor to surface water flows and the rapid recessions may instead indicate temporary storage in alluvium proximal to the channel'.*

On the other hand, in Section 7.1 (page 115) of the *Groundwater Assessment*, groundwater drawdown is predicted to impact on groundwater inflow to a number of semi-permanent pools along Laheys Creek and Sandy Creek (see **Section 6.1**) and to lead to a likely maximum reduction baseflow to the Talbragar River of approximately 480 ML/a (in 2036 following the end of mining operations). The *Groundwater Assessment* considers that the impact would small, representing only 0.9% of the average annual flow.

However, this assessment overlooks the highly skewed statistical distribution of flow in the Talbragar River which is illustrated by the flow duration curve in **Figure 4.1**. For such rivers, comparison of the predicted reduction in baseflow with flow in years of relatively low flow (see **Table 4.3**) is a better indication of the predicted impact. The table shows that in a 1 in 10 low flow year the predicted reduction in baseflow could account for 62% of the flow in the river while in a 1 in 5 low flow year the reduction would be 10%. Even in a median flow year the reduction would be 2.7%.

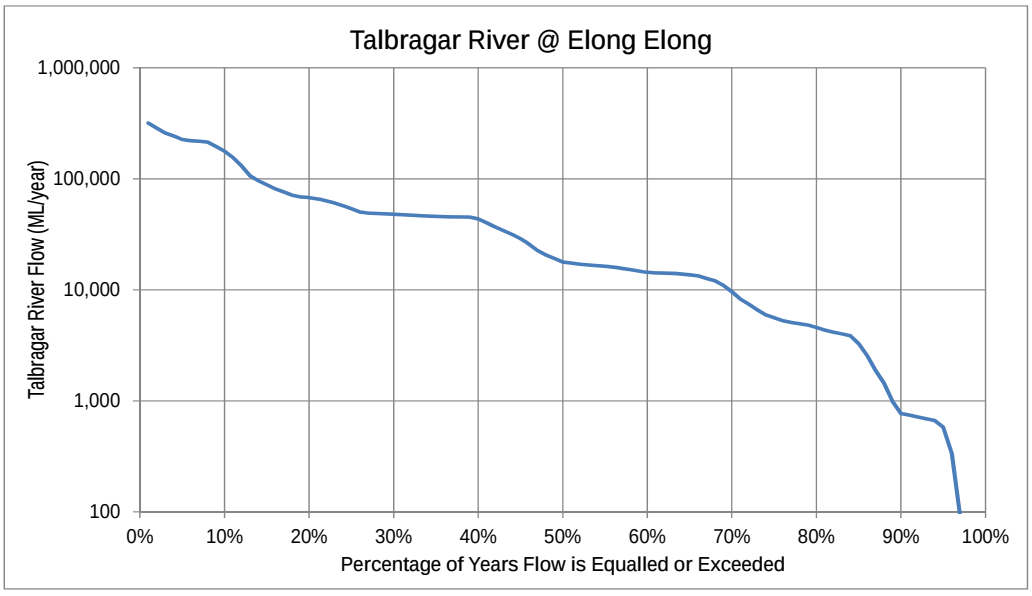

Figure 4.1: Annual Flow Duration Curve for the Talbragar River at Elong Elong (421042)
Source: Data from NOW web site http://realtimedata.water.nsw.gov.au/water.stm?ppbm=SURFACE_WATER&rs&3&rskm_url

Table 4.3: Impact of Reduction of 480 ML/year of Baseflow on Flow in Talbragar River

Probability of Occurrence	Annual Flow (ML/year)	Predicted Flow Reduction
1 in 10 low flow year	768	62%
1 in 5 low flow year	4,576	10%
Median flow year	17,802	2.7%

Source: Data from NOW web site http://realtimedata.water.nsw.gov.au/water.stm?ppbm=SURFACE_WATER&rs&3&rskm_url

The analysis of the sensitivity of the model to the assumed hydraulic conductivity (see **Section 4.1.1** above) also included an assessment of the impact on estimated baseflow impacts on the Talbragar River for the period of mining and 50 years post mining. The results of this analysis are summarised in **Table 4.4** which shows variation of the order of ±25%.

Table 4.4: Sensitivity of Talbragar River Baseflow Loss to Variation of Hydraulic Conductivity

Parameter	Talbragar River Baseflow Loss (2015 – 2085)	
	Average	Maximum
	Baseflow Loss (ML/year)	
Base Model	260	480
+50% Ulan K	308	579
-50% Ulan K	201	349
+50% Backfill K	211	494
-50% Backfill K	194	453
	Percentage Change from Base Model	
+50% Ulan K	18%	21%
-50% Ulan K	-23%	-27%
+50% Backfill K	-19%	3%
-50% Backfill K	-25%	-6%

Source: *Groundwater Model Technical Report,* Table 5.5

The results of the groundwater modelling are presented in terms of the loss of baseflow that needs to be accounted for in the Talbragar River Water Source as a whole, and provides an assessment in terms of the impact of the loss of baseflow in the river as a whole (as represented by the flow regime at Elong Elong). However the major effect is actually likely to occur in Laheys Creek and Sandy Creek and be reflected in the flow regime from Sandy Creek where it discharges into the Talbragar River. This loss of baseflow does not appear to have been taken into account in the assessment of flows in Laheys Creek and Sandy Creek (Appendix C of the *Surface Water Assessment*). This issue is considered further in **Section 6.1** below.

4.1.4 Groundwater Quality

The *Groundwater Assessment* reports the following average groundwater quality in various aquifers:

- Alluvium aquifer average electrical conductivity (EC) of 3,650 µS/cm, with salinities generally increasing with depth;

- Triassic sandstone units average EC of 4,000 µS/cm;
- Permian sandstone units average EC of 1,600 µS/cm.

The *Groundwater Assessment* concludes that there is likely to be some variation in quality of groundwater inflows to the pits depending on depth and location of mining with the shallower mining generally producing more saline water.

None of this water would be suitable for discharge to the environment without treatment. Accordingly, the mine plan envisages that all groundwater draining to the mine pits would be retained on site and recycled for use in the CHPP or for dust suppression.

4.2 Surface Runoff from Undisturbed Land

4.2.1 Harvestable Rights

As of January 2013 CHC owns 32,538 ha of land which carry an entitlement to construct water storage dams on first-order or second-order watercourses that do not permanently flow up to a total capacity of 2,115 ML without requiring a licence. The *Surface Water Assessment* has identified 811 unlicensed farm dams with an estimated capacity of 1,545 ML located on land owned by CHC.

Page 32 of the *Surface Water Assessment* indicates that the unused capacity for unlicensed dams (570 ML) would be sufficient to account for Clean Water Dams 9 and 10 (44 ML and 357 ML respectively) which would be located upstream of the two out-of-pit tailings dams. Other water storages not associated with pollution control would require licensing.

The status and capacity of Clean Water Dams 9 and 10 is unclear:

- Table 5-5 of Appendix E to the *Surface Water Assessment* lists the capacity of these dams as 5 ML and 37 ML with catchment areas of 8.3ha and 58.3 ha respectively. These dam capacities and catchment areas appear to be more consistent with the mine layout plans (Figures 4-1 to 4-5 of Appendix E) than the volumes quoted on page 32 of the *Surface Water Assessment* (44 ML and 357 ML).
- While Clean Water Dams 9 and 10 are shown on the mine layout plans in Appendix E (Figures 4-1 to 4-5) they do not appear in any of the water management schematic diagrams (Figures 4-6 to 4-10). Notwithstanding, given the small size of the catchments contributing to these dams, it would appear that they would not significantly contribute to available water supply for the project.

Assuming that the capacities of Clean Water Dams 9 and 10 quoted in Table 5-5 of Appendix E are correct, it would appear that the project has a latent capacity to construct additional water supply dams to catch natural runoff totalling about 528 ML without requiring a licence.

4.2.2 Highwall Dams and Diversions

Appendix E to the *Surface Water Assessment* describes the strategy for diverting runoff from undisturbed catchments around the mine area in order to, as far as possible, minimise the site water inventory and maintain pre-development flows to Sandy Creek and Laheys Creek:

- Clean water catch drains to divert minor catchments around the mine site, where practical.

- Clean water highwall dams and levees upslope of the pit to reduce peak flow rates and velocities from undisturbed catchments. Highwall dams would be pumped out to the creek system. Runoff from very large storm events would overtop highwall dams and flow into the mine pit.

Table 5-5 of Appendix E of the *Surface Water Assessment* lists eight highwall dams ranging in size from 10 ML to 53 ML and two dams located upstream of the tailings dams (previously discussed in **Section 4.2.1**). It is proposed that all water from the clean water dams would be pumped or drained via diversion channels to the natural drainage systems or direct to Laheys Creek or Sandy Creek. None of the water from these sources would be utilised in the mine water management system.

4.3 Surface Runoff from Mine Areas

The mine water management strategy is based around maintaining segregation of water of different quality as far as practical:

- **Overburden water** — runoff from overburden emplacements, topsoil stockpiles and other disturbed areas which will contain elevated suspended solids. This water would be held in sedimentation dams to allow settlement of sediments before release to the creek system or on-site re-use.
- **Pit water** — runoff from the open pits and groundwater seepage into the mine which can potentially contain suspended solids, salts and heavy metals etc. This water would be stored on-site and will be re-used for dust suppression or fed into the process water circuit.
- **Infrastructure water** — runoff from the areas around the CHPP, stockpiles and infrastructure area. This water would be directed to one of the mine water dams for re-use in the process water circuit or for dust suppression.
- **Process water** — utilised in the CHPP, including return water from the tailings emplacement areas. This water would be continuously recycled within the system.

4.3.1 Overburden Dumps and Sediment Basins

Runoff from overburden emplacements and soil stockpiles would be directed by contour banks and drains to a series of sediment dams strategically located throughout the mine. These dams would be designed and operated in accordance with the requirements in *Mines and Quarries* (DECC 2006). Water retained in the sediment basins would be either:

- Held for sufficient time to allow settlement to occur (with the addition of flocculent if necessary) and then discharged in accordance with licence conditions (see **Section 7.5** for further comment on this issue); or
- Pumped to one of the mine water dams for re-use within the mine.

Although one of the stated objectives of the mine water management system is to minimise the need to use raw water supplies when the mine is short of water, it is unclear how this is reflected in the water balance analysis in Tables 2-3 to 2-5 in the *Water Balance and Surface Water Management System – Addendum* (18 March 2013) from which the data in **Table 4.5** has been extracted. As shown in the table, the proposed operation of the sediment dams (as represented in

the water balance analysis) does not appear to fully utilise water collected in the sediment dams at the expense of raw water imports.

Table 4.5: Sediment Basin Runoff, Re-use and Discharge

Scenario	Runoff, Re-use and Discharge	Year 1	Year 4	Year 12	Year 16	Year 20
10th percentile dry year	Runoff to sediment dams (ML/year)	139	242	288	295	233
	Sediment dam water re-used (ML/year)	24	119	24	126	123
	Sedimentation dam overflows (ML/year)	0	0	0	0	0
	Sedimentation dam controlled releases (ML/year)	41	0	118	34	0
	Runoff re-used (%)	17%	49%	8%	43%	53%
50th percentile median year	Runoff to sediment dams (ML/year)	279	505	611	616	491
	Sediment dam water re-used (ML/year)	107	176	136	150	154
	Sedimentation dam overflows (ML/year)	0	0	0	0	0
	Sedimentation dam controlled releases (ML/year)	92	193	318	325	218
	Runoff re-used (%)	38%	35%	22%	24%	31%
90th percentile wet year	Runoff to sediment dams (ML/year)	1,114	2,220	3,013	2,912	2,313
	Sediment dam water re-used (ML/year)	102	105	104	104	104
	Sedimentation dam overflows (ML/year)	117	371	489	565	369
	Sedimentation dam controlled releases (ML/year)	870	1,706	2,377	2,208	1,806
	Runoff re-used (%)	9%	5%	3%	4%	4%

Source: *Surface Water Assessment – Addendum* (March 2013), Tables 2-3 to 2-5

4.3.2 Mine Pit Water

Mine pit water would be directed to a series of sumps within the pit from where it would be pumped to one of the mine water dams for re-use. This water will comprise a mixture of groundwater inflow, runoff from the pits themselves and runoff from any catchments that drain towards the pits (predominantly overburden). Some seepage from the tailings emplacements may also drain through the overburden to the sumps.

Although not specifically stated in the *Surface Water Assessment*, the analysis of the risk of water needing to be stored in the pits implies that water would be held in the pits if there was insufficient capacity in the mine water dams, rather than discharged.

4.3.3 Mine Infrastructure Areas and Stockpiles

All runoff from the mine infrastructure area, CHPP precinct, stockpile area and rail loop would drain to a series of Mine Water Dams that would be designed to retain all runoff. The nominated sizes of the Mine Water Dams that retain runoff from these areas are based on the greater of:

- Local catchment runoff from a 100-year ARI 72-hour storm event with an assumed runoff coefficient of 85%.
- Use of the water balance model to assess the dam size required to achieve no discharge when operated as part of the overall site water management system under 111 years of daily historical climate conditions. The quoted average runoff from the runoff model (AWBM) for

'industrial' land use is 40%[6]. However, the modelled maximum runoff under prolonged rainfall is likely to be significantly higher than this.

The *Surface Water Assessment* notes that, in most cases, water balance modelling criteria required an increase in the capacity based on the 100-year ARI 72-hour storm event to cater for extended wet periods. The adopted design approach using the water balance model is considered appropriate. However to provide a high level of certainty that the mine water dams would not overflow, additional freeboard to the spill level (say 1 m) should be considered.

4.4 Licenced Water Sources

4.4.1 Groundwater

The *Groundwater Assessment* reports that, utilising the account management provisions of the relevant Water Sharing Plan, the project requires aquifer access licence entitlements of 1,924 unit shares. As of January 2013, CHC holds three aquifer access licences with a combined volumetric entitlement of 1,024 unit shares and purchase of a further 150 unit shares is currently pending. The *Groundwater Assessment* notes that the groundwater source has an additional 15,496 unit shares spread over approximately 113 licences from which to source the remaining 750 unit shares required.

CHC has acquired two water access licences with a combined 1,780 unit shares in the Lower Talbragar River Water Source (see **Section 4.4.3**). These licences are associated with three existing licensed dams which historically stored water for irrigation and stock watering. The *Groundwater Assessment* notes that additional existing water access licences on the Lower Talbragar River would be purchased by CHC to account for the baseflow loss to the Talbragar River. However, the text in the *Surface Water Assessment* (page 33) indicates the intention to account for the baseflow loss of 480 ML by surrendering some of the existing surface water access entitlements and states that no further purchase of water access licences is proposed for the Project.

Notwithstanding any purchase or surrender of water access licence entitlements to account for the predicted loss of baseflow to the Talbragar River, further consideration may need to be given to how the incidental 'take' of baseflow is administered. The water sharing rules for the Lower Talbragar River water source prohibit pumping when there is no visible flow into and out of a pool. However, the incidental 'take' of water as a result of groundwater lowering will continue even when there is no visible flow in the river.

4.4.2 Cudgegong River

To provide the necessary level of water supply security for the Project, CHC has purchased a total of 3,311 ML of regulated river (high-security) water access licence (WAL) entitlements from the Macquarie and Cudgegong Regulated Rivers Water Source. This water would be provided to the project site by a 26 km pipeline from a pump station on the Cudgegong River about 2 km upstream from Yamble Bridge.

[6] Table 3.9 of Appendix E to the *Surface Water Assessment*

The WALs acquired by CHC included 2,311 ML of authorising extraction from downstream of Burrendong Dam. Subsequently, CHC sought approval from NOW (in accordance with the rules of *the Water Sharing Plan (WSP) for the Macquarie and Cudgegong Regulated Rivers Water Source 2003* (the WMP), and the *Water Management Act 2000* (the WMA)) to change the extraction zone from downstream to upstream of Burrendong Dam.

In accordance the requirements of the WMA and WMP, a change of extraction zone is permitted if:

- The total extraction potential in the upstream zone does not exceed 40,000 ML/year; and
- Environmental and third-party user impacts are not significant.

As the potential extraction in the zone upstream of Burrendong Dam is only 27,000 ML/year, the first criterion was met. As required, NOW undertook detailed modelling analysis to assess whether there would be any significant impacts on environmental flows or other water users. Following NOW's determination that the impact would not be significant, the change of extraction zone for WALs associated with 2,311 ML was approved by the Minister under Section 71S of the WMA in June 2011.

This change of extraction zone has led sections of the community and local government to express concerns that this transfer may have adverse impacts on the security of supply for town water supply and holders of general security WALs on the Cudgegong River upstream of Burrendong Dam.

As part of this review, a meeting was held with representatives of NOW to clarify the basis of the analysis that was undertaken to assess the significance of any impacts on environmental flows and other holders of WALs. A copy of the presentation made by NOW to the Mid-Western Regional Council was subsequently provided for information. In addition, Mid-Western Regional Council also made available a copy of a detailed technical review undertaken on behalf the Council[7].

The key factor that underlies NOW's assessment that there would be no significant impact on other water users on the Cudgegong River or downstream of Burrendong Dam is that, for operational purposes, Windamere Dam (on the Cudgegong River) and Burrendong Dam are operated as a single source. The operation of the dams as a single source includes rules for the bulk transfer of water from Windamere Dam to supplement the water in Burrendong Dam (subject to a minimum reserve storage below which no transfers occur). Accordingly, a volume of high security water ordered from Windamere Dam for extraction from the Cudgegong River would be the same as the same volume ordered from Burrendong Dam for extraction on the Macquarie River.

The analysis undertaken by Gilbert & Sutherland for the Mid-Western Regional Council included detailed examination of the river basin model used for the assessment undertaken by NOW. A copy of the river basin model (presumably provided by NOW) was also used to examine a variety of scenarios requested by the Council. The advice provided to Council included:

> *'. . . .there is no reason why the transfer of HS entitlements as proposed should cause a decrease in the security or reliability/performance of other water users along the Cudgegong. In particular it is not likely to have any noticeable effect on the performance of General Security (GS) entitlements held within the Cudgegong Creek section of the system."*

[7] *Water Modelling -Cudgegong River (draft)* letter to Mid-Western Regional Council from Gilbert & Sutherland, 14/3/2013

The advice from Gilbert & Sutherland considers at some length the potential for an impact on the reliability of town water supply and notes:

> *'Whilst there is potential for increased water use in the Cudgegong to reduce the security of town water supply (e.g. Mudgee) the volume of transfer proposed and conjunctive approach to the operation of the Windamere/Burrendong supply system allow for a level of such transfers without necessarily affecting the performance of the existing users. An outcome of 'no adverse impact' would be dependent on some changes to the specific conjunctive rules under which Burrendong and Windamere are operated. Of most import would the determination of an appropriate Windamere reserve below which Bulk Water Transfers (BWT) are not undertaken, and then the ongoing adherence to that modified reserve.'*

The assessment undertaken by NOW indicates that the change of the extraction zone for the WAL of 2,311 ML from downstream to upstream of Burrendong Dam will not have a significant impact on the reliability of supply for water users along the Cudgegong River. However, as noted above, the issue of reliability of town water supply to Mudgee is related to the total water use along the Cudgegong River and the adopted reserve level in Windamere Dam below which bulk water transfers from Windamere to Burrendong cease. NOW recognises that the recent drought (which was more severe that the previous record drought used to assess the required reserve storage) has led to the need to reassess the adopted reserve level in Windamere Dam. This process is currently underway through a sub-committee of the Customer Services Committee for the Macquarie and Cudgegong Regulated Rivers Water Source.

CHC received Works Approval in September 2011 for the construction of a pump station on the Cudgegong River about 2 km upstream of Yamble Bridge. One of the conditions of the approval was that CHC must provide an Extraction Strategy Agreement to State Water Corporation before the start of each water year. The main purpose of the Agreement would be to assist State Water Corporation's operational efficiency objectives by "mopping-up" operational surplus flows of greater than 25 ML/day at Yamble Bridge. Given that any operational surplus flows would contribute to the volume of water held in Burrendong Dam, and could reduce the volume of any subsequent bulk water transfer from Windamere Dam, the effect of any "mopping-up" on the overall water resource availability in the Macquarie and Cudgegong Regulated Rivers Water Source is likely to be small.

4.4.3 Lower Talbragar River Water Source

Three licensed dams in the Lower Talbragar River Water Source, with a combined 1,780 unit shares of water access licences, are located on land owned by CHC:

- A licence to divert up to 43 ML of water per year for the purpose of 'irrigation'.
- A licence for two separate dams, referred to as the 'Woolandra Dams'. The larger Woolandra West Dam (1,470 ML) is located in the headwaters of Blackheath Creek and the smaller Woolandra East Dam (548 ML) in the headwaters of a Tucklan Creek tributary. The current licence allows CHC to divert up to 1,737 ML of water per year from these dams for the purpose of 'irrigation'.

Both these licences have been converted to annual volumetric entitlements with unregulated access as per a requirement of the *Water Sharing Plan* (WSP) *for the Macquarie Bogan Unregulated and Alluvial Water Sources 2012.* The licences allow CHC to divert up to twice the licensed volume in any one year, provided the total diversions do not exceed three times the

licensed volume in any three year period. In accordance with the requirements of the WSP these access licence can be then used for any purpose, including mining. CHC is required to apply for a change of purpose to 'mining' in accordance with Section 92 of *Water Management Act 2000*.

The *Surface Water Assessment* (page 33) notes that the total combined induced loss of flows in the Lower Talbragar River Water Source peaks at 799 ML/year. Whilst up to 480 ML/year is attributable to the induced baseflow loss (see **Section 4.1.3**), the source of the remaining 319 ML/year is not apparent. Appendix C to the *Surface Water Assessment* provides an assessment of the changes in flow at the junction of Sandy Creek and Talbragar River at different stages of mining and for different climatic scenarios. Table 5-2 of that appendix indicates that in a 10th percentile dry years the mine is expected to slightly decrease flows by up to 6% (maximum 37 ML/year in Mine Year 12). In median and higher rainfall years the mine is expected to lead to increased flows in Sandy Creek by up to 10% during mining. Also, notwithstanding a small decrease in the catchment area of Sandy Creek post mining (242 ha draining to the remnant void), the flow in Sandy Creek is predicted to increase under all climate conditions that were assessed (10th percentile dry, median and 90th percentile wet rainfall conditions).

Given the predicted relatively minor change in flow regime in Sandy Creek associated with any phase of mining, the difference between the stated total induced loss of flow in the Talbragar River (799 ML/year) and the baseflow loss due to groundwater lowering (maximum 480 ML/year) is unclear.

5 Water Balance Assessment

5.1 Adopted Modelling Approach and Assumptions

The water balance assessment has been undertaken using a model that accounts for all inputs and outputs of the mine water management system on a daily basis using 111 years (1900-2010) of historic rainfall data and a synthetic dataset for evaporation derived from the Data Drill web site. Five separate models were developed which represented mine conditions (areas of mine pit and overburden, sizes and linkages between water storages, etc.) for Mine Years 1, 4, 12, 16 and 20 using the data sources and assumptions summarised in **Table 5.1**.

Table 5.1: Water Sources, Uses, Losses and Transfers Represented in the Water Balance Model

Model Element	Data Source / Assumptions
Water Sources	
Direct rainfall onto the surface of water storages	Storage:area characteristics of storages active at the time; Rainfall
Surface water runoff	Areas and runoff characteristics of pits, overburden, haul roads, etc. corresponding to the Mine Year. Daily rainfall and evaporation. Excludes runoff reporting to Woolandra Dams (see Section 4.4.3)
Groundwater seepage to the open pits	Average daily value corresponding to the mine pit inflow from the groundwater model (see Table 4.1) after allowing for evaporation loss from sumps.
Imported water	Raw water imported from the Cudgegong River under CHC's high security access licence (see Section 4.4.2). Pumping assumed at 20 ML/d. (Pump and pipeline designed for 24 ML/d).
Water Uses and Losses	
CHPP make-up for water lost in tailings	Average daily value assumed corresponding to ROM production and assumed 5.5% tailings (see Section 2.3)
Dust suppression	Average daily value assumed corresponding to area of active haul road and number of vehicle movements (see Section 3.2)
Workshops and vehicle wash-down	Assumed to increase in proportion to the ROM tonnage from 9 ML in Mine Year 1 to 150 ML/year from Mine Year 5 onwards.
Evaporation loss from water storages	Daily data using Morton's formula for shallow lakes (Morton 1983).
Seepage losses from storages	Assumed negligible.
Operational Rules	
Water transfers from sediment dams	Water pumped to the nearest mine water management dam if the dam is less than 25% capacity. Otherwise, the sedimentation dam water is discharged to the creek system in accordance with relevant licensing requirements.
Pumping from mine pits	Pumping stops if the corresponding Mine Water Dam capacity exceeds 90%. During extended wet periods, surplus mine water would be stored in the mine pits.
Other water transfers	Numerous different rules for individual storages. Objective is to ensure no overflows from dams that retain runoff from pits, CHPP, stockpile area or infrastructure area.
Raw water import from Cudgegong River	Pumping occurs on 'as needed' basis to maintain water level in the Raw Water Dam (RWD1) – capacity 1000 ML. Minimum flow rule in Cudgegong River not considered.
CHPP supply	A portion (approx. 18%) of the CHPP make-up water demand is always sourced from the Raw Water Dam. Remaining make-up water sourced from (in order of priority): 1) Mine Water Dam 4 (375 ML), 2) Raw Water Dam.

In essence, the water balance model represents all important inputs, losses and transfers between the main sources and uses of water, and accounts for the associated changes in water storage contents. Factors that are governed by climate, such as runoff from different surfaces, were modelled using a well-recognised rainfall:runoff model (AWBM) while groundwater inflows were based on the results of the groundwater modelling (see **Section 4.1**). The basis for the water demands that constitute about 90% of the total are input to the model as daily values corresponding to the annual estimates for:

- CHPP make-up (see **Section 3.1** above);
- Dust suppression (see **Section 3.2** above).

5.2 Runoff Modelling

Runoff inputs to the water balance model were modelled using the well-recognised rainfall:runoff model (AWBM) which requires:

- Daily rainfall (111 years of historic data used);
- Daily evapotranspiration (derived from Data Drill using Morton's formula for shallow lakes (Morton 1983);
- Runoff characteristics for 'undisturbed areas' derived from analysis of historic rainfall and runoff data from a gauging station on Sandy Creek (1966 – 1985);
- Runoff characteristics for mine overburden, etc. from data published by ACARP (2001).

This modelling follows current accepted practice and the estimated average runoff as a percentage of rainfall are within the expected bounds.

5.3 Water Storages

Each water balance model contains a different number of storages that represent the expected configuration of the mine at the particular years adopted for analysis (Mine Years 1, 4, 12, 16 and 20). In total the various models include:

- A raw water dam (1,000 ML);
- 13 mine water dams (range 6 ML to 500 ML);
- 39 sedimentation dams (range 2.5 ML to 130 ML);
- 10 clean water dams for capture of runoff from catchments upstream of highwalls or the tailings dams.

Table 5.2 summarises the water proposed storage capacity for supply of water for mine operations at various stages in the life of the mine, excluding sediment control dams and clean water diversion dams.

Table 5.2: Mine Water Storage Capacity

Mine Year	Mine Water Dams (ML)	Raw Water Dam (ML)	Total Storage Capacity (ML)
1	1,696	1,000	2,696
4	2,199	1,000	3,199
12	2,166	1,000	3,166
16	2,166	1,000	3,166
20	2,216	1,000	3,216

Source: *Surface Water Assessment*, Appendix E, Table 5-4

5.4 Water Management System Performance

In the course of this review, a number of issues were identified in relation to various aspects of the *Surface Water Assessment*, particularly in relation to the water requirements for tailings disposal, dust suppression and the assumptions regarding the availability of groundwater from the mine pit.

5.4.1 Tailings Disposal

As discussed in **Section 2** above, there are two unresolved issues in relation to tailings disposal:

- The current proposal for tailings disposal does not appear to be adequately justified on economic grounds. The use of paste thickeners or solid bowl centrifuges would appear to be 'line ball' in terms of NPV compared to slurry disposal and both these options have the potential to reduce CHPP make-up water by up to 1,100 ML/year on average (assuming tailings comprise 5.5% of ROM) or 2,550 ML/year in a year when tailings comprise 10% of ROM.
- Even if the preferred option of tailings disposal as a slurry is finally adopted, the water balance analysis fails to take account of the possibility (acknowledged for the CHPP design) that up to 10% of ROM may comprise fine tailings. If this were to occur over a full year, an additional 1,900 ML of make-up water could be required.

5.4.2 Dust Suppression

As noted in **Section 3.2**, the analysis of water requirements for dust suppression assumes that these requirements are only a function of the area of haul roads and the traffic volume in the year of interest. However, an indicative assessment using rainfall data from Dunedoo and pan evaporation data from Wellington indicates that water requirements could vary by about 250 ML from the average for wet and dry years. In Mine Year 12 (the predicted maximum year) the water demands would be of the order of:

- 10^{th} percentile dry year 1,900 ML;
- Median year 1,650 ML;
- 90^{th} percentile wet year 1,400 ML.

In response to a question about the effect of climate on water requirements for dust suppression, particularly in a dry year, CHC's consultants provided the following advice:

'The water balance modelling is based on the assumption that dust suppression will constitute a major component of the site water demand. Management measures are available to CHC to greatly reduce this demand, e.g. through the use of dust suppressants. Typical water demand reductions achieved by dust suppressants are in the range of 40 to 70%. The list below provides water demand reductions for four typical products:

- *RST Dust Management: 40%*
- *DusTreat by GE: 50%*
- *Water$ave by Polymer Innovations: 50%*
- *Range of products by 3M: up to 70%*

The achievable reduction in water demand for dust suppression through use of such products significantly exceeds the ±20% potential variation in demand from the average between wet and dry years. CHC can therefore employ dust suppressants to reduce this water demand during dry periods, and reduce reliance on imported river water.'

5.4.3 Groundwater Availability for Mine Operations

In the course of this review, some apparent anomalies were noted in the water balance data presented in Table 6-1 to 6-3 in Appendix E to the *Surface Water Assessment*. In response (memo dated 7 March 2013) the consultants acknowledged that, although the table quoted the correct values for seepage into the pit, the water balance calculations for Mine Years 12, 16 and 20 used incorrect values and, '*The effect of these errors was to reduce the groundwater inflow considerably below the intended input values, as shown in Table 5.'* (reproduced in **Table 5.3** below).

Table 5.3: Predicted Inflow to Mine Pits

Mine Year	Total Pit Inflow (ML/year)
1	130
4	1,069
12	2,447
16	2,403
20	1,162

The consultants were also invited to explain the fact that the water balance model included all the groundwater inflows identified in the groundwater model and made no separate allowance for in-pit evaporation of seepage that is likely to occur from small seeps around the perimeter of the pits, rather than as a distinct flow that can be directed to a sump. In response the consultants initially advised:

'Inflow from groundwater seepage reports to the mine pit sump from which it is pumped to the mine water dams. Evaporation from the mine pit sump as well as mine water dams are accounted for. As noted, the pit inflow values are quoted from the groundwater assessment report. Evaporation loss is then applied as part of the water balance in the mine pit sumps and mine water dams.'

It is acknowledged that the water balance analysis includes provision for evaporation losses from water surfaces. However, as this figure comprises evaporation losses from all water storages (in pit sumps, mine water dams, the raw water dam and sediment dams), it is not possible to assess

the reasonableness of the allowance for evaporation from groundwater entering the pit. For a median rainfall year the detailed water balance analysis (Table 2-4 of the *Addendum* – March 2013) shows that the net evaporation loss from all water storages and sumps is only about 5% of the total contributions from all sources (including groundwater inflow and imported water). On this basis, it appears that any evaporation losses for seepage into the pit are likely to be trivial compared to the total volume derived from the dewatering analysis in the groundwater model.

Subsequently the consultants expanded their advice:

> *'The reviewer has raised the valid concern that the groundwater inflow contribution to the mine water balance may be significantly overestimated. However, CHC can implement management measures to greatly reduce evaporative loss of groundwater inflow to maximise the use of this water source. A range of dewatering methods can be investigated if groundwater is heavily relied upon for water supply during dry conditions, particularly in later years when groundwater inflow and water demand are high. Examples of dewatering methods include in-pit or out-of-pit dewatering bores, horizontal and inclined seepage holes drilled into the pit face or dewatering galleries*.'

Notwithstanding the technical feasibility of the proposed measures, they are likely to add to the total cost of the project and their implementation cannot be guaranteed.

5.4.4 Revised Water Balance

Table 5.4 and **Table 5.5** summarise the key features of the water balance analysis for each of the mine years selected for analysis. **Table 5.4** summarises the water demands as set out in Table 4-1 of the *Surface Water Assessment* (January 2013) while **Table 5.5** summarises the requirements for imported water from the Cudgegong River based on the corrected values of groundwater inflow included in the analysis for Mine Years 12, 16 and 20 (from the *Addendum,* March 2013).

Table 5.4: Mine Water Demand Summary

Mine Year	Product Coal (Mt/a)	CHPP Make-up Water (ML/a)	Mine Infrastructure Area Demand (ML/a)	Haul Road Dust Suppression (ML/a)	Potable Water Demand (ML/a)	Total Site Demand (ML/a)
1	0.7	134	9	376	5	524
4	11.2	2,092	140	968	10	3,210
12	12	2,524	150	1,651	15	4,340
16	12	2,524	150	1,603	15	4,292
20	12	2,524	150	1,371	10	4,055

Source: *Surface Water Assessment* Table 4-1

The revised estimates of demand for imported water for dry and median years are now significantly less than those reported the *Surface Water Assessment* (January 2013). On the basis of the analysis summarised in **Table 5.5** the project would not be required to call on its full 3,311 ML of regulated river (high-security) water access entitlements from the Cudgegong River. The analysis indicates that in a median year only about 50% of the entitlements would be required once the mine is fully operational. In a 10th percentile dry year the requirement could reach about 70% of the entitlements. However, as noted previously these estimates are highly dependent on the assumptions regarding the proportion of groundwater inflow actually available for mine operations and possible under estimation of dust suppression requirements in dry years.

Table 5.5: Revised Summary of Imported Water Requirements

Mine Year	Total Site Demand (ML/a)	Groundwater Seepage (ML/a)	Imported Water (ML/year)		
			Dry Year (1967)	Median Year (1906)	Wet Year (1990)
1	524	131	120	120	0
4	3,210	1,069	1,840	1,300	360
12	4,340	2,446	580[1]	960[1]	400
16	4,292	2,403	1,220	1,040	380
20	4,055	1,163	2,400	1,660	400

Source: *Surface Water Assessment – Addendum,* March 2013, Table 2-6

Note 1: The Addendum provides the following explanation for apparently anomalous results for a median year. '*The climate of the year preceding the dry year of 1967 is wetter than the climate preceding the median year of 1906. This results in a larger volume of water stored in the mine water dams at the start of the dry year than the median year. This difference in starting storage is particularly pronounced for the mine water management system configuration of Year 12, and therefore results in a lower demand for imported water in the dry year than in the median year*.'

Despite having corrected for groundwater inflow, the detailed water balance tables contained in the *Addendum* (replacements for Tables 6-1 to 6-3 in Appendix E of the *Surface Water Assessment*) appear to show apparently anomalous data for the evaporation losses from the water storages.

5.4.5 Imported Water Supply

The imported water supply requirements listed in **Table 5.5** relate to specific mine years and representative rainfall years. Figure 2.15 in the *Addendum* shows the annual imported water supply requirements for Mine Year 20, which is representative of maximum mine production (20 Mtpa of ROM) and close to the maximum area reporting to the mine water management system, but has reduced dust suppression demand compared to Mine Year 16 (see **Table 5.4**). **Figure 5.1** summarises the statistics for imported water supply requirements in Mine Year 20 for a 'base case' and scenarios with increased water losses:

1) For the 'base case', 100% of groundwater draining to the mine pit is included in the water balance analysis (which includes accounting for evaporation loss from in-pit sumps). For this scenario, on average, 1,280 ML/year would be required (about 32% of average total mine water requirements). The demand for imported water would vary from approximately 500 ML (minimum top-up of fresh water required for CHPP operations) in 20% of wetter years up to about 2,300 ML in 10% of dry years.

2) Tree increased loss scenarios (500, 1,000, and 1,500 ML/year) which represent situations in which there is an increased loss of groundwater before it becomes 'available' for use and water demands for tailings disposal, dust suppression seepage loses are higher than has been assumed. For these scenarios, the ability of the mine to meet its demands from imported water progressively decline with average annual demand for imported water increasing to 1,780 ML, 2,280 ML and 2,780 ML per year respectively. As shown on **Figure 5.1**' the ability of the mine to fully meet demand from imported water would progressively decline to the point where (in the case of increased use and loss by 1,500 ML/year) there would be a shortfall in 25% of years.

The results from the increased loss scenarios indicate that, as long as the additional demand for water is less than about 500 ML/year (approximately corresponding to Mine Year 16), there is low probability that the mine would experience water shortage.

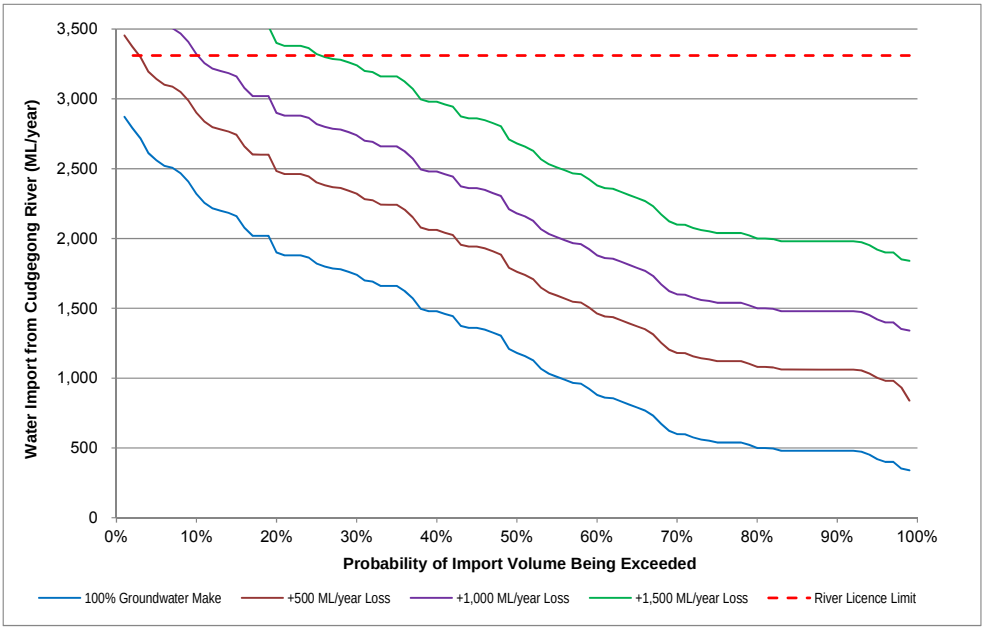

Figure 5.1: Probability of Water Import Requirements Being Exceeded

Source: Data for '100% Groundwater Make' from *Surface Water Assessment – Addendum,* March 2013, Figure 2.15

5.5 Limitations of Water Balance Modelling

All models are a simplification of reality and are only as good as the conceptualisation of the main processes and the derived or assumed parameters used to describe those processes. The previous sections of this review have identified a range of issues that lead to uncertainty about the true water balance situation that would prevail for the Cobbora Project including:

- The assumption that tailings will comprise 5.5% of ROM coal on average, but failure to account for the possibility that at some stage poorer quality coal might comprise 10% tailings (as assumed for the design of the coal handling facilities). While the average of 5.5% may be correct over the life of the mine, the difference in these assumptions could require an additional 1,900 ML/year in a year when poor quality coal was encountered.
- Water requirements for dust suppression do not account for the differences between wet and dry years which could account for an additional requirement for up to 250 ML in a 10th percentile dry year unless chemical dust suppressants were also used – at additional cost.
- Seepage losses from dams have been ignored. While this is a reasonable assumption for conditions in which overflow of dams is a risk, for the Cobbora Project, the acknowledged strategy is to retain any excess water in the mine pits and the seepage losses should therefore be accounted for.
- The assumption that a large proportion of the groundwater inflow (as predicted by the groundwater modelling) will actually be available to make a significant contribution to the overall water balance (up to 50%) is highly questionable.

The matters summarised above indicate that the water balance analysis may underestimate the water requirements for the project and that the full entitlement of the high security licence for 3,311 ML from the Cudgegong may be called on more frequently than the water balance analysis suggests. Suggested strategies to deal with any shortfall include direct access to groundwater by installation of dewatering bores and the use of chemical dust suppressants to reduce water requirements for dust suppression, both of which would add to the cost of the project.

On the other hand, by only assessing the water balance for selected mine years, the analysis does not necessarily provide an accurate picture of the risk of having to retain water in the mine pits for an extended period. The annexure to the submission by Mid-Western Regional Council (7 March 2013) comprises a review of the surface and groundwater assessments prepared by Gilbert & Sutherland who prepared their own water balance model for the project. Although the modelling by Gilbert & Sutherland claims to be based on same model inputs as the *Surface Water Assessment* no data is provided to substantiate this claim. Notwithstanding, the important aspect of their modelling is that they assessed the 'life-of-mine' water balance by applying the climatic data and mine layout details on a continually evolving basis, rather than the climatic and mine layout 'snapshot' approach adopted for the *Surface Water Assessment*. Results for the example 'base case' are:

> *Results from the base case scenario modelling indicate extended periods where volumes of greater than 2,000 ML are required to be stored within the pits occurring within some 50% of climatic sequences assessed. Similarly, results show required total pit storages of greater than 5000 ML in some 15% of climatic sequences. Figure 1 shows an example of life of mine pit water storage behaviour for one such climatic sequence. Of particular importance is the extended and continuous period of more than 10 years with greater than 1500 ML, and more than 5 years requiring management of 3000 ML or more. Whilst the climatic conditions for this sequence are above average, they could not be considered 'extreme'.*

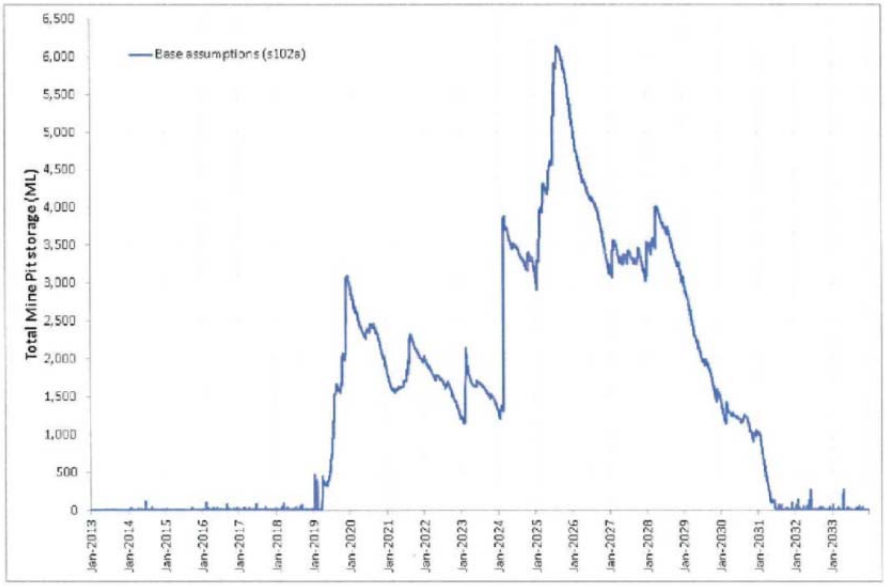

Figure 1: Simulated life-of-mine Pit water storage (1944-1964 climatic sequence)

The analysis provided in Figures 2.7 to 2.9 of the *Addendum* (March 2013) addresses the same issue but, because the data is presented for individual pits, rather than the whole project, the significance is not as apparent. By inspection of these figures, it would appear that in a 'worst case' historic climate sequence, the combined volume of in-pit storage would be about 1,700 ML

for over 10 years with a peak of about 8,000 ML. Figures 2.10 to 2.12 provide an assessment of the probability of excess water being held in each pit. However, the data presented in these figures is based on an analysis of individual years and fails to adequately convey the carry-over effects which could persist for a number of years.

Given the way that the water balance analysis in the *Surface Water Assessment* has been undertaken and the assumptions that underpin the analysis, there appears to more than the expected degree of uncertainty associated with the surface water assessment for the Cobbora Project.

- On one hand, the mine could encounter conditions in which it faced a shortage of water;
- On the other hand, the modelling indicates that excess water, which would need to be stored in one of the pits, might persist for several years.

These issues all relate to probability and risks. The important issue is how would the mine operate under any of the extreme conditions of too little or too much water?

- In a situation of **excess water**, the mine could:
  - Initially seek to reduce the importation of water to the absolute minimum required to provide potable supply and maintain the required water quality for the CHPP;
  - At the same time, identify opportunities for disposal of water onto bare overburden;
  - Any remaining excess water could then be relocated to one of the mine pits to allow operations to continue in the other two;
  - Finally, if the situation persisted, a reverse osmosis plant could be commissioned to provide water of a suitable quality to substitute for imported raw water for the CHPP, for irrigation or for discharge to the environment (subject to obtaining a discharge licence and meeting water quality criteria).
- In a situation of **water shortage**, the mine could implement a range of actions, some of which have been canvassed previously:
  - Install dewatering bores or other in-ground measures to directly access groundwater that would otherwise report to the pit;
  - Reduce water usage for dust suppression by the use of chemical suppressants;
  - Purchase additional water from the Cudgegong River on the 'temporary trade' market at the prevailing market price. In this regard, the proposed pump and pipeline would need to operate for less than half the year to account for the full high security entitlement. The pump and pipeline therefore would have capacity to provide additional water from this source.

While it is acknowledged that the proposed capacity of the mine water storage dams (up to 3,199 ML)(see **Table 5.2**) would be used to balance variation in water supply and demand from year to year, there would not be sufficient storage to accommodate all mine water in extended periods of wet weather.

Based on the assumptions that underpin the water balance analysis, it appears that a water shortage is more likely than excess. Rather than investing in dewatering methods such as dewatering bores, a more cost effective solution could be to significantly reduce the overall water demand for the project by using mechanical dewatering which, as indicated in **Table 2.3,** has the potential to significantly reduce make-up water requirements.

6 Impacts of Mining on Flow and Groundwater

6.1 Flow Regime in the Creeks

Appendix C of the *Surface Water Assessment* identifies the following flow objectives[8] for 'uncontrolled streams' such as Laheys Creek, Sandy Creek and the Talbragar River:

- *During periods of 'no flow' (flows exceeded 100% of the time) it is important to protect water levels in pools as these may act as refuges for aquatic plants and animals. Reduction in water levels under these conditions may make it difficult for a species to recover after a drought. The objectives state that during a period of no flow, extraction from the streams is not permitted in order to protect these pools.*
- *Extraction during 'very low flow' (flows exceeded 95% of the time) or 'low flows' (flows exceeded 80% of the time) imposes long artificial droughts that increase stress on aquatic plants and animals. The objectives state that extraction during very low and low flow conditions cannot be more than 30-50% of the available flow on a daily basis.*
- *It is important to protect 'high flows' (flows exceeded 20% of the time). Height, duration, frequency and season are all important in protecting shape of channel, water quality and reproduction of plans and animals. The objectives state that extraction during these flow conditions cannot be more than 30-50% of the available flow on a daily basis.*

The water balance analysis undertaken for the mine (Appendix E to the *Surface Water Assessment*) has been used to assess the impacts of the mine on flows in Sandy Creek, Laheys Creek and the Talbragar River and to assess the impacts of mining against the criteria listed above. This analysis took account of progressive changes in contributing catchment areas as well as releases from sediment dams that would collect runoff from overburden dumps.

Table 6.1 summarises the flow data reported in Appendix C to the *Surface Water Assessment* for Sandy Creek at the confluence with Talbragar River. The table shows that during mining (after Year 4) the annual flow in Sandy Creek can be expected to reduce by 3-6% in a 10th percentile dry year but increase by up to 10% in median and wet years. Post mining, flows are expected to increase for all climate conditions that were assessed.

Table 6.1: Modelled Impact of Mining on Flow in Sandy Creek

	Annual Flow (ML/year)			% Change in Flow		
	10th Percentile	Median	90th Percentile	10th Percentile	Median	90th Percentile
Pre Mining	575	1,852	26,088	-	-	-
Mine Year 1	618	1,960	27,241	7%	6%	4%
Mine Year 4	559	2,014	27,355	-3%	9%	5%
Mine Year 12	538	2,046	27,301	-6%	10%	5%
Mine Year 16	540	2,043	27,462	-6%	10%	5%
Mine Year 20	548	1,930	27,439	-5%	4%	5%
Post Mining	642	1,933	28,830	12%	4%	11%

Source: *Surface Water Assessment – Appendix C*, Table 5-1

[8] *Macquarie-Bogan River Water Quality and River Flow Objectives* (NSW Government, 2006)

Although the flow data in **Table 6.1** specifically relates to Sandy Creek at the confluence with Talbragar River, the flow duration curves (Figures 5-1 to 5-3 in Appendix C) show:

- Negligible change in the flow distribution in the upper reaches of Sandy Creek;
- Slightly greater persistence of low flows in Laheys Creek and the lower reaches of Sandy Creek.

The assessment in Appendix C concludes that while there is a potential decrease in the annual yield from the Sandy Creek system in low rainfall years, the periodic releases of water from the sediment basins would modify the flow duration characteristics and lead to a minor increase in flows within the ranges defined by the flow objectives. However, it is unclear from the analysis the extent to which the adopted strategy for release of water from the sediment dams (i.e. only transfer water from sediment dams while mine water dams are less than 25% full) is specifically intended to modify the flow regime to achieve the stated flow objectives.

The analysis presented in Appendix C to the *Surface Water Assessment* focusses entirely on surface runoff into the creeks and does not take account of the predicted loss of baseflow attributable to groundwater drawdown (see **Section 4.1.3** above) which is projected to peak at 480 ML/year in 2038 (3 years after completion of mining). As an indication of the potential effect of loss of baseflow on Sandy Creek, **Table 6.2** has been prepared using the data in **Table 6.1** with the following additional simplifying assumptions:

- The predicted maximum baseflow loss of 480 ML/year actually occurs in the Sandy Creek catchment (not Talbragar River). (The *Groundwater Assessment* does not differentiate between baseflow losses in Sandy Creek and those that occur directly to the Talbragar River);
- The rate of loss increases linearly over time after Year 1 of mining. (The *Groundwater Assessment* provides no data relating to the progressive increase in baseflow loss over time.)

Table 6.2: Modelled Impact of Mining on Flow in Sandy Creek after Accounting for Baseflow Loss

	Annual Flow (ML/year)			% Change in Flow		
	10th Percentile	Median	90th Percentile	10th Percentile	Median	90th Percentile
Pre Mining	575	1,852	26,088	-	-	-
Mine Year 1	618	1,960	27,241	7%	6%	4%
Mine Year 4	499	1,954	27,295	-13%	6%	5%
Mine Year 12	318	1,826	27,081	-45%	-1%	4%
Mine Year 16	240	1,743	27,162	-58%	-6%	4%
Mine Year 20	148	1,530	27,039	-74%	-17%	4%
Post Mining[1]	162	1,453	28,350	-72%	-22%	9%

Note 1: Post mining flow assessed for Mine Year 24 when peak baseflow loss of 480 ML/year is predicted

As shown in **Table 6.2**, by accounting for baseflow loss in addition to the change in surface runoff, the predicted flow regime in Sandy Creek is significantly different from that summarised in **Table 6.1** and indicates that the overall impact of mining could be much more significant than assessed in the *Surface Water Assessment*. While it is acknowledged that the data in **Table 6.2** is based on a highly simplified analysis, it indicates that baseflow losses need to be taken into account in assessing the predicted impacts of mining on the flow regime in Laheys Creek and Sandy Creek.

6.2 Semi-Permanent Pools

Appendix A to the *Surface Water Assessment* provides an analysis of the elevation of the bed of the channels at a number of semi-permanent refuge pools compared to the modelled groundwater level for 'existing' conditions. Where the modelled water table elevation was found to be higher than the creek bed level by more than 1 m, the pool site was deemed to be groundwater dependent; and where the water table was found to be within ±1 m of the creek bed the pool site was deemed to be 'potentially' groundwater dependent. Of the 14 pools identified, two were deemed to be groundwater dependent and four potentially groundwater dependent.

Table 7.1 of the *Groundwater Assessment* summarises the expected impacts of groundwater drawdown as follows:

> *'Modelling indicates that significant drawdown is likely to occur in the Permo-Triassic units adjacent and to the west of mining areas A and B. This may induce leakage from the alluvium and cause a decline in groundwater seepage in semi-permanent pools that are connected to those groundwater systems along Sandy Creek and Laheys Creek. Despite the predicted drawdown, temporary groundwater storage in the alluvium may continue to sustain these pools for 6 to 8 months following flood recharge events. The increased incidence of low flow events during and post mining from the surface water systems is likely to mitigate the groundwater impact to some degree as further discussed in the Cobbora Coal Project - Surface Water Assessment (Parsons Brinckerhoff 2012)'*

Table 5.4 of Appendix C to *Surface Water Assessment* shows that groundwater drawdown is expected to result in:

- One pool that is considered to be groundwater dependent changing to being potentially groundwater dependent;
- Three pools that are potentially groundwater dependent no longer receiving groundwater.

While groundwater drawdown has the potential to affect water levels in four of the fourteen identified pools, the other ten would remain dependent on flow in the creeks. The *Surface Water Assessment* notes that the magnitude of drawdown at two of the potentially groundwater dependent pools is expected to be relatively low and is within the margin of error of the groundwater modelling and the ground level survey data.

However, the assessment of the impacts of groundwater drawdown on the semi-permanent pools is entirely dependent on the validity of the assessment of groundwater drawdown. As noted in **Section 4.1.2,** Dr Kalf has identified an issue with the way that the groundwater modelling has treated the creeks in the area, leading to a possible underestimation of the groundwater drawdown. A further assessment of the potential drawdown impacts on the semi-permanent pools may be required once this issue is resolved.

While groundwater drawdown has the potential to reduce the groundwater contribution to some pools, the assessment in Appendix C concludes that the predicted changes in the flow regime (see **Section 6.1** above) could positively affect the semi-permanent pools within the Sandy Creek and Laheys Creek catchments downstream of the mining areas as a result of increases in the frequency and magnitude of low and very low flows which would feed the pools more regularly, leading to less frequent drying out.

Notwithstanding the possibility that releases from the mine could positively affect the semi-permanent pools, no analysis has been undertaken to demonstrate this effect. In addition, two of the pools identified as changing from potentially groundwater dependent to having no groundwater inflow are located on Laheys Creek and Sandy Creek upstream of any of the locations identified for a sediment dam. Therefore, any discharge from the sediment dams would not contribute to these pools.

A further unresolved issue relates to the potential additional loss of flow in Laheys Creek and Sandy Creek as a result of the baseflow losses identified in the Groundwater Assessment (see **Section 6.1**). On the basis of the analysis in **Section 6.1** it appears that the combined impact of reduced surface runoff and baseflow loss could lead to significantly greater impact on continuity of water supply to the semi-permanent pools than has been assessed to date.

6.3 Flow in Talbragar River

The impact of mine operations on the surface flow regime in the Talbragar River has been assessed using the same methodology as that used for the assessment of the flow regime in Laheys Creek and Sandy Creek (see **Section 6.1** above). In addition, the *Groundwater Assessment* provides an assessment of the impact of drawdown on baseflow to the Talbragar River (see **Section 4.1.3**).

The analysis in **Table 4.3** relates only to the predicted impact of baseflow on the flow regime in the Talbragar River. However, if predicted reductions in surface runoff during mining are also taken into account, the potential reduction in the flow in the river would be even greater than the 62% for a 1 in 10 low flow year (as shown in **Table 4.3**).

The assessment of the cumulative impacts of mining on flow in the Talbragar River (Section 6.2 of the *Surface Water Assessment*) notes that an increase in baseflow losses of 0.18-0.21 ML/day (66-77 ML/year) may occur in the Talbragar River system while mining occurs at the Ulan Coal Mine, rising to 0.38 ML/day (139 ML/year) after completion of mining. The *Surface Water Assessment* notes that the Ulan Mine proposes to offset these losses by discharge of treated surplus mine water. However, the ability of the mine to continue this offset after the completion of mining is questionable.

The *Surface Water Assessment* concludes that:

> *Given the minor impacts of the Project and the management actions proposed at Ulan to offset baseflow impacts, it is concluded that there is negligible cumulative impact of both mining operations on the Talbragar River.*

In view of the issues identified above, this conclusion warrants re-assessment. In addition, it is unclear how the total induced losses of 799 ML/year for the Lower Talbragar Water Source has been calculated (see page 33 of the *Surface Water Assessment*).

6.4 Flooding in Laheys Creek and Sandy Creek

Appendix D of the *Surface Water Assessment* provides a detailed assessment of the potential flood impacts of the mine on the flood flows and the impact of those flows on the flood regime in Laheys Creek and Sandy Creek.

Accepted flood estimation procedures were followed to assess the peak flow rates for floods of various probability of occurrence. The estimated flood flows were verified against the flood record on Sandy Creek at Medway (limited data) and the Talbragar River at Elong Elong.

For flood impact assessment purposes, flows were estimated for current land use and for Mine Year 20. Mine Year 20 was identified as the critical mine stage for flooding as it would result in the highest flows entering the creeks due to catchment diversions and increased runoff from overburden dumps, haul roads, etc. Peak flow estimates were prepared for relatively frequent events (2 and 5 year average recurrence interval (ARI)) and relatively rare events (100 and 2,000 year ARI).

An hydraulic model was prepared which represented the channels and floodplains of Laheys Creek, Sandy Creek and their tributaries by means of approximately 170 cross sections derived from LiDAR data (accuracy ±150 mm). Standard values of hydraulic roughness were adopted. Two versions of the hydraulic models were prepared:

1. Existing conditions without any facilities associated with the mine;
2. 'With mine' conditions including any encroachments onto the floodplain and creek channels by mine infrastructure, levees, creek crossings for external roads, haul roads and the rail line and the rail line embankments.

The process of developing indicative designs for key creek crossings on Laheys Creek and Sandy Creek involved the use of the hydraulic model to define waterway opening sizes, bridge clearances and embankment levels which met the following criteria:

- Bridge spans and openings for the access and haul roads were generally sized to provide clearance (with 600 mm freeboard) above the 100 year ARI flood and to avoid excessive localised increase in flood levels:
  - 500 mm for land owned by CHC and within, or adjacent to, the main mining activity.
  - No increase in flood level beyond CHC's land ownership.
- Three existing crossings on the Spring Ridge Road are flooded in a 10 year ARI event. For the proposed road re-alignment the crossings were designed to be serviceable in the 50 year ARI event to reduce the height of the road embankment and associated impacts on flood levels upstream.
- A high level haul road that crosses Laheys Creek and the existing Spring Ridge Road would be constructed at a level above the 2,000 year ARI flood level.

As the Project is predicted to have minimal impact on flooding within Sandy Creek and Laheys Creek outside of land owned by CHC, no mitigation measures are proposed other than those in the immediate vicinity of the mine.

Figure 6.1 is an extract from Figure 6-6 in Appendix D of the *Surface Water Assessment*. It shows the location of creek crossings and proposed flood levees (green) and scour protection along the toe of the overburden dumps (red) in the vicinity of the mine.

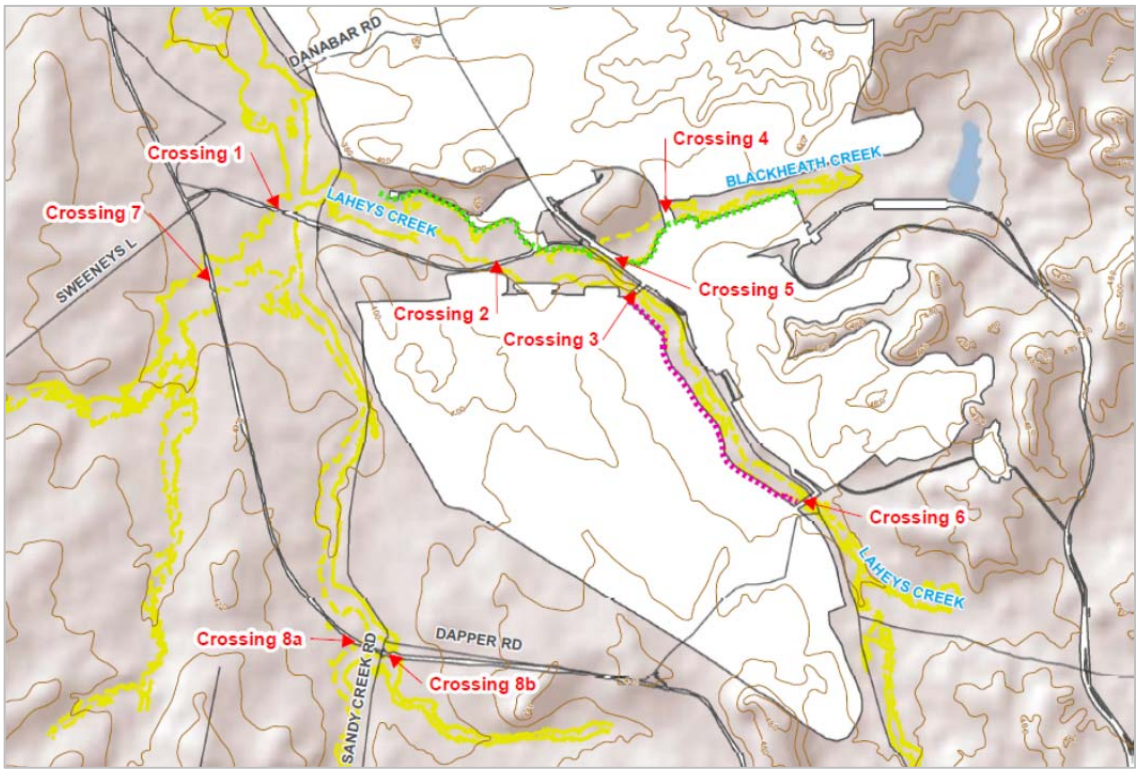

Figure 6.1: Extract from Figure Showing Creek Crossings, Levees and 100 Year ARI Flood Extent
Source: *Surface Water Assessment - Appendix D*, Figure 6-6

Table 7-1 in Appendix D of the *Surface Water Assessment* identifies the flood level increases at various structures. **Table 6.3** summarises these increases for the locations shown in **Figure 6.1**. The table shows that the flood level increases in the vicinity of a number of structures are predicted to be significantly greater than the adopted criteria of 0.5 m and are therefore likely to result in significant localised increases in velocity. In particular, significant flood level increases are predicted for Crossings 4 and 5 near the junction of Blackheath Creek and Laheys Creek and for Crossing 7 on Sandy Creek.

Table 6.3: Flood Level Increases at Structures

Crossing Number	Flood Level Increase (m)		
	100 m Upstream	Just Upstream	Just Downstream
1	na	+0.1	-0.01
2	+0.37	na	-0.03
3	na	+0.19	+0.06
4	+1.03	na	+0.11
5	+1.51	+2.57	+1.16
6	0.00	0.00	0.00
7	0.66	+1.13	+0.44
8a	na	+0.16	-0.33
8b	na	na	-0.13

The assessment in Appendix D concludes that the areas of significant flood level increase are mainly confined to Laheys Creek and Blackheath Creek in the vicinity of the mine infrastructure area. The mining areas would be protected by flood levees (shown as green lines on **Figure 6.1)** that extend along the length of creek where flood level increases are predicted. Accordingly, the increased flood levels would not have any adverse impact. However, the assessment acknowledges that:

> *Increased flood levels in these areas has the potential to impact on other environmental aspects of the creeks and floodplains, including riparian vegetation, ecological habitats (including refuge pools) and Aboriginal heritage artefacts. However, the crossings and levees do not significantly modify the regular flooding regime, i.e. flooding characteristics up to the 5 year ARI event, and therefore these features of the creeks and floodplains will not be subject to significantly different flood impacts for frequent flood events.*

The assessment of flood impacts does not adequately identify:

- The impacts of structures on channel and floodplain velocities in the immediate vicinity of the proposed crossings;
- Measures to control scour in the immediate vicinity of the structures where excessive velocities are likely to occur;
- The design standard to be adopted for protection of the toe of the overburden dump on the western side of Laheys Creek (Mine Zone B). **Figure 6.1** infers that the toe of the overburden dump encroaches into the 100 year flood extent in some locations. As this will be a permanent feature of the landscape which confines the width of the floodplain in this location, some consideration to maintaining stability in flood events greater than the 100 year ARI event is warranted.

6.5 Flooding on Creeks along the Rail Line

Much of the proposed rail line will be located on a 6 m high rail embankment which has the potential to cause flooding upstream of the embankment unless adequate hydraulic capacity is provided at locations where the rail line crosses watercourses and creeks.

Hydraulic models were prepared for each of the 21 identified locations at which the rail spur would cross Fords Creek, Tallawang Creek and their tributaries. Flood flow estimation and hydraulic modelling procedures were the same as for Sandy Creek and its tributaries as described in **Section 6.4** above. For the rail crossings the following preliminary design criteria were adopted:

- All structures capable of conveying a 100 year ARI flood without overtopping of the embankment;
- For a 100 year ARI flood, flood level increase limited 500 mm immediately upstream of the crossing, and reducing to no more than 100 mm within 200 m upstream;
- Beams of bridge structures to be a minimum of 600 mm above the 100 year ARI flood level.

The preliminary designs developed for the major crossings of Fords Creek and Tallawang Creek have been estimated to lead to flood level increases 200 m upstream of the rail line of 0.14 m and 0.01 m respectively.

6.6 Flyblowers Creek

During Mine Years 12 to 20, up to 86 ha of the lower Sandy Creek catchment on its eastern side would be diverted north into the eastern arm of Flyblowers Creek. The hydrologic analysis showed that, due to the increase in catchment area, the peak flow from this creek would be increased by about 30% for the 2-, 5- and 100-year ARI events.

Because the predicted increase in peak flow has the potential to impact the culvert underneath the Golden Highway, it is proposed to construct a dry detention basin. The hydrologic analysis shows that a detention basin with a volume of 70 ML would be required to restore peak flows at the Golden Highway culvert to the existing levels.

6.7 Final Voids

The proposed final landform involves backfilling of two of the pits (Mine Areas A and C) to a level that is at least 3 m above the predicted final groundwater level. In finalising the actual base level of the voids at the time of mine closure, two key considerations will be:

- An updated prediction of the final long term groundwater level taking account of groundwater monitoring data collected during mining and refinement of the groundwater model;
- Further consideration of whether 3 m would be an adequate barrier to prevent capillary rise of saline groundwater or to limit the growth of trees. Whilst 2 m has commonly been accepted as a 'rule of thumb' for minimising the risk of land salinisation in the Murray-Darling basin, it would be appropriate to revisit this prior to finalisation of the landform for mine areas A and C.

The mine plan includes one remnant void (Void B) in the south-west corner of Mine Area B. Void B would have a total catchment area of 242 ha, including the lake that would form in the base of the void. A separate water balance analysis has been undertaken to assess the long term behaviour of the lake in terms of water level and salinity.

For purposes of assessing the groundwater inflow to the lake, the groundwater model was used to provide estimated inflow rates depending on the water level in the lake. These flow rates (Table 5.4 in Appendix H to the *Groundwater Assessment*) show an increasing inflow rate as the lake level rises to about 270 ML/year once the lake reaches an equilibrium level of about 373.9 m AHD. The accompanying text explains this apparently counter-intuitive effect as being a result of the differential rate of rise in the groundwater level compared to the lake level. This observation implies that the lake level is expected to rise as a result of runoff and direct rainfall at a more rapid rate that the surrounding groundwater.

In order to assess the likely range of lake levels, a water balance analysis was undertaken using 100 replicates of 1,000 years of synthetic daily rainfall record (using the Stochastic Climate Library developed by the CRC for Catchment Hydrology). The analysis indicated that the lake level would initially rise rapidly from a base level of about 340 m AHD to a level of about 374 m AHD within 100 years and thereafter vary within a range of about 370 to 378 m AHD depending on the climate. The salinity is predicted to progressively increase linearly to a median estimate of about 8,900 mg/L after 100 years and continue to increase at the same rate thereafter.

Key findings of the water balance analysis are that:

- The maximum equilibrium water level from 100 climate replicates of 1,000 years is 29 m below the top-of-void level of 407 m AHD. The void is therefore not expected to overtop.
- The maximum equilibrium water level is 2 m below the adjacent creek level of 380 m AHD. The void is therefore expected to be a net groundwater sink and no groundwater outflow will occur from the void lake towards the creek.

The water balance analysis does not appear to have taken account of possible climate change effects. However, in general, climate change is expected to lead to reduced rainfall (1% by 2030[9] and ongoing reduction thereafter) and increased evaporation (2% to 4% by 2030 and ongoing reduction thereafter) which would reduce runoff to the lake and increase evaporation leading to a lower equilibrium level than that assessed from the water balance modelling.

[9] *Surface Water Assessment*, Appendix A, Section 3.3

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7 Water Quality Baseline and Potential Impacts

7.1 Water Quality Monitoring

Baseline water quality monitoring at approximately monthly intervals commenced at the end of August 2009 at five locations each of which is equipped with a continuous water level recorder from which flow rate can be derived:

- Laheys Creek upstream of the confluence with Sandy Creek (SW1);
- Sandy Creek upstream of the confluence with Laheys Creek (SW2);
- Sandy Creek downstream of the confluence with Laheys Creek (SW3);
- Talbragar River downstream of the confluence with Sandy Creek (Elong Elong) (SW4);
- Talbragar River upstream of the confluence with Sandy Creek (Cobbora) (SW5).

These locations provide a sound basis for assessing the existing baseline water quality in the relevant creeks and river. However all three sites on Laheys Creek and Sandy Creek will be impacted by mining. Accordingly, it is likely that once the project commences two other sites will need to be established further upstream on sections of the creek not directly affected by mining to monitor baseline conditions.

The water quality data presented in the *Surface Water Assessment* covers 23 sampling dates up to November 2011. As noted in the *Surface Water Assessment* very low, or no, flow conditions persisted in Sandy Creek and Laheys Creek until January 2010 and this may need to be considered in interpreting the data. For instance at site SW1 on Sandy Creek, the electrical conductivity (EC – a measure of salinity) averaged about 7,200 µS/cm between August and November 2009 but averaged only about 2,650 µS/cm from January 2010 to November 2011.

The water quality dataset presented in the *Surface Water Assessment* has not been updated to include any data collected since November 2011. Such data could have been used to update the existing water quality characteristics of the creeks and river. Appendix A to the *Surface Water Assessment* presents detailed tables of the suite of water quality parameters measured. However some data appears to have been omitted because the discussion of water quality characteristics comments on the concentrations of total suspended solids, which is not listed in any of the data tables.

The water quality monitoring data for the three sites on Laheys Creek and Sandy Creek all contain a large proportion of records when there was low flow. As noted in Appendix A, this is a common issue in routine water quality sampling and can result in the following estimation problems when using such data to understand the water quality within the system and set appropriate water quality objectives for sites downstream of a discharge point:

- Overestimation of total dissolved solids (TDS) and soluble metal/nutrient chemical concentrations much of which is derived from groundwater baseflow and is diluted during flow events;
- Underestimation of concentrations of total suspended solids and particulate-bound metals and nutrients such as phosphorus. Much of the sediment is delivered to the creeks during storm events during which high concentrations of sediment can occur for a relatively short period.

For purposes of assessing the suitability of water for different uses (ecosystem protection, recreation, irrigation, etc.), a common starting point is the default guideline trigger values published in the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC, 2000) commonly referred to as the 'ANZECC Guidelines'. In relation to water quality for ecosystem protection, two sets of guideline values are provided: physical and chemical stressors, and toxicants. Important aspects of the guideline values for physical and chemical stressors are that:

- They are default trigger values that are intended to be used as triggers for further investigation if there is insufficient site specific data available. They are not 'pass/fail' values;
- They apply to ambient water outside any 'mixing zone' and are not intended to be discharge standards.

In the case of the Cobbora Coal Project, the *Surface Water Assessment* references the default trigger values for 'slightly disturbed ecosystems' in south-east Australia above 150 m elevation, which are classed as 'upland rivers'. However, many of the inland rivers in NSW, including those in the Cobbora project area, behave more like lowland coastal rivers. The classification between 'upland' and 'lowland' is somewhat arbitrary.

Importantly, however, the ANZECC Guidelines provide a process for assessing locally specific trigger values based on a minimum of 24 months routine monthly water quality monitoring. Although the dataset for the Cobbora project includes only 23 values, locally specific trigger values have been proposed based on the procedures set out in the ANZECC Guidelines.

7.2 Water Quality in Laheys Creek and Sandy Creek

Based on the water quality monitoring data presented in the *Surface Water Assessment*, the key characteristics of water quality in Laheys Creek and Sandy Creek are:

- Very high EC, which is a reflection of high concentrations of total dissolved solids, primarily sodium and chloride. The minimum observed EC (660 μS/cm) is approximately double the default trigger value for ecosystem protection quoted in the ANZECC Guidelines for slightly to moderately disturbed upland river ecosystems. In addition, the average for the period since January 2010 (2,640 – 3,950 μS/cm) is higher than the upper default value for lowland rivers. There is therefore sound evidence that warrant the development of locally specific trigger values for the Laheys Creek and Sandy Creek catchments.
- Relatively high concentrations of total nitrogen and total phosphorus reflect the extensive agricultural activities on the catchments. The minimum total nitrogen concentration values exceed the ANZECC default trigger value of 0.25 mg/L. In the case of total phosphorus, the minimum values are less than the ANZECC default trigger value of 0.02 mg/L, but this is exceeded for at least 80% of the time.
- 80% of samples from the creeks are less than the default trigger value for turbidity (50 NTU). However a few significantly higher readings at all sites are likely to reflect the fact that very few samples were collected during higher flows.
- A number of potential toxicants, particularly aluminium, exceed the guideline level for protection of 95% of species.

In summary, the water quality data indicate that Laheys Creek and Sandy Creek have significant naturally occurring sources of salinity and are strongly influenced by agricultural activities on the catchments.

7.3 Water Quality in the Talbragar River

The results of water quality monitoring in the Talbragar River reflect the fact that it is a much larger river system (catchment of about 3,050 km^2 compared to 280 km^2 for Sandy Creek) and has its headwaters over 100 km upstream in the Coolah Tops. Compared to Laheys Creek and Sandy Creek, key water quality attributes are:

- Significantly lower EC than Sandy Creek with increasing EC from the upstream site (Cobbora – average 722 μS/cm) to downstream (Elong Elong – average 970 μS/cm) which is likely to be influenced by flow from Sandy Creek (average 2,396 μS/cm at the downstream monitoring point) and other small catchments draining into the Talbragar River from the south;
- Concentrations of total nitrogen and total phosphorus that are even higher than those in Laheys Creek and Sandy Creek. Like conditions in these creeks, the elevated levels of total nitrogen and total phosphorus in the Talbragar River are attributable to agricultural land use on the catchment;
- Significantly higher turbidity levels than those monitored in Laheys Creek and Sandy Creek. This is likely to reflect the fact that sediment laden runoff from further up the catchment is still entrained in the flow by the time the flow reaches the monitoring points, rather than an fundamental difference in sediment transport from Laheys Creek and Sandy Creek. Although 80% of samples from the creeks are less than the default trigger value for turbidity (50 NTU), the remaining 20% are considerably higher and consequently the average is 2-4 times the default trigger value.
- Like Laheys Creek and Sandy Creek, a number of toxicants, particularly aluminium, exceed the Guideline level for protection of 95% of species.

The water quality data indicate that the Talbragar River is far from a pristine system and could be described as representing a ‘moderately to highly disturbed’ system.

7.4 Water Quality Objectives

As noted in **Section 7.2** above, the existing water quality in Laheys Creek and Sandy Creek reflect the underlying geology and land use, and do not meet the ANZECC default trigger values in many respects. In line with the philosophy set out in the Guidelines, the *Surface Water Assessment* develops a set of locally specific water quality objectives based on the observed data. Because of the ephemeral nature of the flow in Laheys Creek and Sandy Creek, a mass-balance water quality model has been used to develop customised trigger levels and assess potential impacts from sedimentation dams on water quality in Sandy Creek and the Talbragar River. The water quality model developed for this process relies on:

- The rainfall:runoff model using parameters for the ‘natural’ catchment area derived from historic flow data from Sandy Creek at Medway (Site SW3 about 6 km south of the confluence with the Talbragar River);

- Relationships between flow and various water quality parameters (total dissolved solids, total suspended solids, total phosphorus and zinc) derived from the water quality monitoring data.

This approach attempts to overcome some of the data limitations associated with the available dataset. Essentially the process involves the use of the rainfall:runoff model to generate flow estimates (presumably daily) for the period November 1970 to December 2010. Water quality characteristics were then assigned to the flow based on a derived relationship between flow and water quality. This data was then examined to determine the 80th percentile trigger values in accordance with the methodology described in the ANZECC Guidelines. Where the modelled value for a particular water quality parameter was below the default trigger value from the ANZECC Guideline, the default trigger value was adopted as the applicable trigger value for Sandy Creek or Talbragar River. Where the modelled 80th percentile was above the default value, the 80th percentile value was adopted.

This procedure has a number of limitations, particularly reliability of the mathematical relationships that have been fitted to the water quality and flow data. The representative graphs presented in Figure 3-2 of Appendix B to the *Surface Water Assessment* only relate to the downstream monitoring site on the Talbragar River and, because of the limited data representing the high flow range, show highly speculative relationships. As acknowledged in Appendix B, "*None of these regression relationships showed strong correlation, as measured by the r^2 value".* Although the text refers to a similar procedure being adopted for the other monitoring sites, the relevant graphs are not presented and it is not therefore possible to judge the reliability of the analysis for the other sites.

Notwithstanding the modelling effort outlined above, the proposed water quality objectives set out in Table 3-1 of Appendix B to the *Surface Water Assessment* are not significantly different from values that can be obtained by statistical analysis of the raw data. For comparison, **Table 7.1** summarises:

- The default ANZECC default trigger values for ecosystem protection in slightly disturbed ecosystems in upland rivers for the water quality parameters listed in Table 3-1 of Appendix B;
- Water quality objectives (or trigger values) representing the 80th percentile derived by analysis of the statistics for the data presented in Table 7-2 of Appendix B;
- Proposed water quality objectives derived from modelling as set out in Table 3-1 of Appendix B;
- Proposed limits for discharge from sediment basins (Table 4-2 in Appendix B).

In relation to **Table 7.1** it should be noted that:

- Because the ANZECC Guidelines only quote an EC of 350 μS/cm (not total dissolved solids), the default value TDS value provided in **Table 7.1** has been derived from an analysis of the relationship between EC and TDS shown by the data for Sandy Creek.
- The source of the proposed discharge limit for TDS from the sediment basin (600 mg/L) approximately corresponds to an EC of 1,000 μS/cm based on the relationship between EC and TDS derived from the data for Sandy Creek;
- As there are no total suspended solids data quoted in Table 7-2 of Appendix A, the modelled value cannot be verified against the raw data.

Table 7.1: Comparison of ANZECC Default Trigger Values and Proposed Water Quality Objectives Derived from Statistical Analysis of Monitoring Data and from Modelling

Parameter	ANZECC	Sandy Creek (SW3)		Talbragar River (SW4)		Discharge
	Default[1]	Monitored[2]	Modelled[3]	Monitored[2]	Modelled[3]	Limit
Total suspended solids (TSS) (mg/L)	–	no data	34	no data	202	50
Total dissolved solids (TDS) (mg/L)	190[4]	1,976	1,978	713	Default	600
Total nitrogen (mg/L)	0.25	1.14	0.9	2.7	2.7	0.9
Total phosphorus (mg/L)	0.02	0.10	Default	0.5	0.5	0.5
Aluminium (mg/L)	0.055	0.5	0.5	8.4	8.4	0.5
Iron (mg/L)	–	1.5	1.5	10.2	10.2	1.5
Manganese (mg/L)	1.9	2.4	2.1	0.6	Default	2.0

Notes:
1. Default ANZECC trigger value for ecosystem protection on upland streams or protection of 95% of species.
2. Derived from analysis of data in Table 7-2 in Appendix A of the *Surface Water Assessment.*
3. Table 3-1 in Appendix B of the *Surface Water Assessment.*
4. ANZECC Guideline = 350 µS/cm (no TDS value given). TDS = 190 derived from correlation of EC v TDS from data in Table 7-2 in Appendix A of the *Surface Water Assessment*.

Despite the effort that has been invested in the water quality modelling to derive localised water quality objectives (**Table 7.1**), the modelling results are not dissimilar to those that could be derived from direct statistical analysis of the monitoring data. It would be appropriate for the water quality monitoring data to be re-analysed and revised objectives to be set out in the project Water Management Plan along with monitoring protocols and statistical tests designed to detect any change in water quality associated with mining activity.

7.5 Management of Mine Water

Any impacts of the mine on water quality in the creeks will be a function of the ability of the mine to control the sources of any pollutants. **Table 7.2** summarises the main sources of pollutants and the proposed control methods. The table shows that the primary control method would be retention of pollutants within the mine water management system. The only exception would be the sediment dams that would collect runoff from the overburden dumps and the associated haul roads.

Table 7.2: Surface Water Pollutant Sources and Proposed Controls

Source	Potential Pollutants	Proposed Controls
Pit and mine facilities including CHPP, stockpiles and coal loader	▪ Coal dust ▪ Hydrocarbons ▪ Salt	▪ All drainage to the pit of mine water dams. ▪ Mine water dams designed to retail all water under all possible climate conditions represented in 111 years of historic rainfall.
Out of pit tailings dams[1]	▪ Coal dust ▪ Salt ▪ Dissolved metals	▪ Decant water in sumps pumped back to mine water dams. ▪ Conditioning of base of storage area to minimise seepage. ▪ Seepage collection below dams pumped back to mine water dams.
In pit tailings dams	▪ Coal dust ▪ Salt ▪ Dissolved metals	▪ Decant water and seepage from the in-pit tailings emplacement will be lower than the ground surface and ultimately retained within the backfill in the voids.
Out-of-pit overburden dumps and haul roads	▪ Sediments ▪ Salt ▪ PAF material?	▪ Sediment dams. ▪ Water of unacceptable quality for discharge to the environment would be transferred to the mine water dams.

Note 1: The *Acid and Metalliferous Drainage Assessment* (GeoTerra, 2012), Section 6.1 concludes that '*The risk of saline runoff and seepage from the washery waste is anticipated to be low to moderate*.' (Median $EC_{1:2}$ 206 µS/cm; range 158 – 2,010 µS/cm)

The key to the satisfactory implementation of the pollution control systems summarised in **Table 7.2** will be design, construction and operation of these facilities to the required standards, most of which are set out in the relevant sections of the EA or PPR and could be confirmed in any conditions of project approval.

All mine water is proposed to be retained within the mine water management system and reused for dust suppression, in the CHPP washing process or for other internal mine operating purposes. The only discharge would be water from the sediment dams that are proposed to be sized and operated in accordance with the relevant guidelines (DECC, 2008). The principal requirements for these dams are:

- Water storage capacity capable of retaining all runoff from the nominated design storm (typically 90th percentile 5 day storm, but other designs storms (2, 10 or 20 days) can be selected based on operational constraints);
- Return of the dam to full capture capacity within the same period after the storm as the duration of the selected storm (e.g. 5 days) by:
  - Discharge to the environment, provided the water quality is of acceptable quality for discharge (see last column of **Table 7.1**); or
  - Transfer to a mine water dam.

7.6 Water Quality Impacts

The water balance analysis prepared for the Cobbora Coal Project includes an allowance for water to be transferred to the nearest mine water dam as long as the dam is less than 25% full. The resulting transfers of water to the mine water management system are accounted for in the mine water balance analysis. The modelled discharge from the sediment dams has been accounted for in a separate model that accounts for flow and water quality in Laheys Creek and Sandy Creek. For purposes of modelling the impact of discharge from the sediment dams on water quality in the creeks, the runoff water quality was assigned attributes that reflected:

- Leachate characteristics taken from the *Acid and Metalliferous Drainage Assessment* (GeoTerra, 2012) (values not quoted in Appendix B*)*:
  - Median pH 6.3, (range 30.4 – 8.08);
  - Median EC 238 μS/cm (range 47 – 1,161 μS/cm);
- Median concentrations of total nitrogen and total phosphorus from shallow groundwater bores closest to the sediment dams (values not quoted in Appendix B).
- TSS concentrations in cease to flow conditions (values not quoted in Appendix B).

Notwithstanding the use of relevant sources, in the absence of specific data relating to the assumed chemical characteristics of runoff from the sediment dams, it is not possible to assess the reasonableness of these assumptions.

Figure 3-3 of Appendix B provides histograms showing compliance with the water quality objectives for Sandy Creek and the Talbragar River listed in **Table 7.1** for each of the mine years assessed (1, 4, 12, 16 and 20). Histograms are provided for aluminium, manganese, TDS, TN, TP and TSS. In general the histograms show compliance with the proposed objectives except for exceedance of the TDS criteria in Sandy Creek for all mine years.

These results imply that, while adhering to the discharge water quality criteria specified in the last column of **Table 7.1,** runoff from the overburden dumps can be expected to have a significant influence on water quality in Sandy Creek. In view of the relatively small catchment area attributable to overburden dumps, compared to the overall size of the Sandy Creek catchment, these results appear counter intuitive. **Table 7.3** lists the broad classes of mine catchment areas derived from Tables 2-3 to 2-5 in the *Addendum*:

- Mine pits, work areas and tailings dams draining to the mine water management system (no discharge);
- Overburden draining to sediment dams for controlled release or transfer to a mine water dam. Occasional uncontrolled discharge is possible.
- Runoff from rehabilitated overburden draining off-site with no controls.

As can be seen, the maximum area of overburden draining off site via sediment dams (where some water quality control can be exercised) would be 1,633 ha. This compares with the total catchment area of Sandy Creek of 28,000 ha. It should be noted that the sediment dams would have no effect on TDS or salinity concentrations. The only way that some control could be exercised over saline discharge from the sediment dams (or any other dissolved characteristic such as metals, nitrogen, or pH) would be for all water that exceeded the adopted discharge criteria to be transferred to a mine water dam. This would involve a change in the operating strategy from that adopted in the water balance analysis.

Table 7.3: Classification of Mine Catchment Areas in Mine Years 4, 12, 16 and 20, and Post-Mining

Mine Year	Mine Pits, Work Areas & Tailings (ha)	Overburden Draining to Sediment Dams	Overburden Draining Off-Site (ha)	Total Mine Water Management Area (ha)
4	314	622	0	936
12	1,352	1,633	294	3,279
16	1,820	1,539	842	4,213
20	1,508	1,234	1,409	4,151
Post-Mining	384	0	3,750	4,134

Source: Tables 2-3 to 2-5 of *Addendum* (March 2013)

Provided the following facilities are in place and the required management practices are followed, there is no reason why the mine would significantly impact on water quality in Sandy Creek or the Talbragar River:

1. Mine water management facilities are designed and managed so as to retain all mine runoff;
2. Facilities are provided to allow the transfer of water from sediment dams to the mine water dams in the event that the water does not comply with the discharge criteria.

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8 Impacts on Water Resources of the Macquarie Valley

Earlier sections of this review have canvassed the details of the potential impacts of the proposed mine operation on the water resources of the Macquarie Valley. This section provides an overview of the matters considered in the earlier sections in the context of the water requirements for mine operations.

Figure 8.1 is a schematic diagram which illustrates the water resources of the Macquarie Valley and water requirements for the proposed Cobbora Mine Project at key locations for a median year based on data from the following sources:

- Median annual flows in the Talbragar, Cudgegong and Macquarie Rivers derived from an analysis of the annual flow data for the period 1984-2012 taken from the NOW web site (http://realtimedata.water.nsw.gov.au/). The period after 1984 was chosen because Windamere Dam was completed that year.
- Water uses, losses and sources for a median rainfall year in Mine Year 16 summarised Table 2-4 in the *Addendum* to the *Surface Water Assessment* (March 2013).

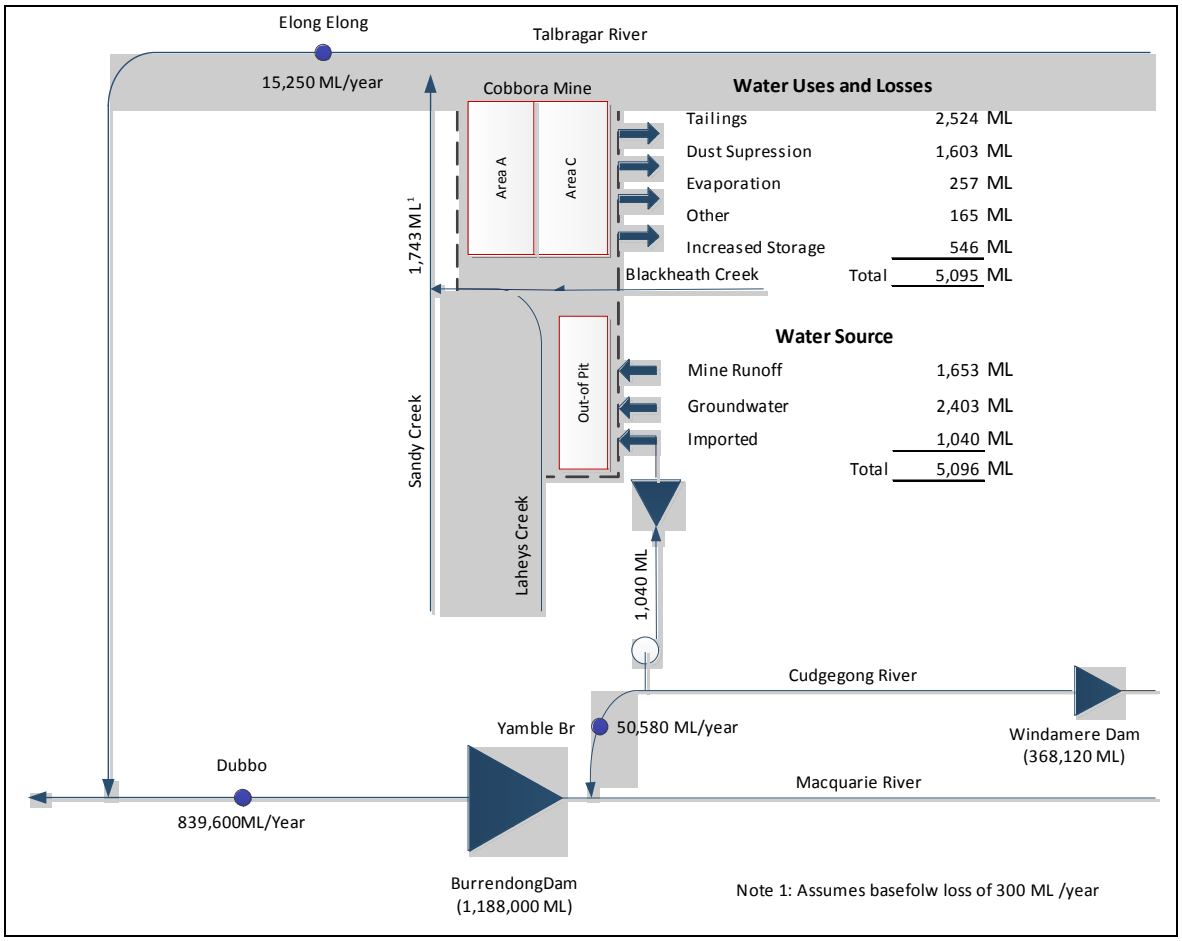

Figure 8.1: River Flows and Mine Water Sources/Losses in a Median Year

As shown in **Figure 8.1**, in a median year:

- The expected extraction of water from the Cudgegong River for supply to the Cobbora Mine amounts to about 2% of the median flow as measured at Yamble Bridge, after most extraction has taken place;
- The flow in Sandy creek, based on runoff modelling (and after allowing for baseflow loss of 300 ML/year - see **Table 6.2**) would contribute about 11% of the flow in the Talbragar River at Elong Elong;
- The data for water uses and losses shown in **Figure 8.1**, includes a value of increased storage of 546 ML. This occurs because in the water balance model the particular year corresponding to median conditions is one in which, because of the assumed operating rules, the mine would increase the volume held in storage over the year from 558 ML to 1,104 ML (= 546 ML) even though that water would not be 'used' un that year.

8.1 Cudgegong River

CHC holds a total of 3,311 ML of regulated river (high-security) water access licence entitlements for the Cudgegong River Zone in the Macquarie and Cudgegong Regulated Rivers Water Source. This water would be provided to the project site by a 26 km pipeline from a pump station on the Cudgegong River about 2 km upstream from Yamble Bridge.

Of the 3,311 ML, 2,211 ML was originally acquired from downstream of Burrendong Dam and, following analysis by NOW, was transferred to upstream of Burrendong Dam. The analysis by NOW showed that the transfer would not breach the total extraction limit in the Cudgegong River Zone and would not have a significant impact on the availability or reliability of supply to other users in the zone. Independent analysis undertaken by Gilbert & Sutherland for the Mid-Western Regional Council supports NOW's assessment, '. . . *there is no reason why the transfer of HS entitlements as proposed should cause a decrease in the security or reliability/performance of other water users along the Cudgegong.'*

Mid-Western Regional Council is also concerned about the future security of town water supply to Mudgee in view of progressive increases in total demand for water and the need to account for the effects of a more prolonged drought between 2000 and 2010 than had been used for the previous 'drought of record' (used to determine the reserve storage to be retained in Windamere Dam). As provided for in the *Water Sharing Plan*, this matter is currently under review by NOW and State Water.

CHC proposes to prepare an Extraction Strategy Agreement with State Water that would involve operating the pump on the Cudgegong River so as to 'mop-up' excess flows in the Cudgegong before they enter Burrendong Dam. As any such 'mopping-up' would appear to have the effect of subsequently requiring additional bulk transfer of water from Windamere Dam, the utility of this operational strategy appears questionable.

8.2 Talbragar River

From the analysis in the *Surface Water Assessment* and the *Groundwater Assessment* it is difficult to determine:

- The expected magnitude of the combined losses of baseflow and surface runoff on flows in Laheys Creek, Sandy Creek and the Talbragar River over the course of mining and groundwater recovery;
- The reaches of creeks and/or river that would be affected by baseflow loss attributable to groundwater drawdown;
- The progressive increase over time in baseflow loss as the mine develops and the subsequent groundwater recovery occurs.

CHC has three licensed dams in the Lower Talbragar River Water Source, with a combined 1,780 unit shares. The majority of this is associated with the two 'Woolandra Dams' (1,470 ML and 548 ML). The current licence allows CHC to divert up to 1,737 ML of water per year from these dams for the purpose of 'irrigation'. CHC is required to apply for a change of purpose to 'mining' in accordance with Section 92 of *Water Management Act 2000*.

The *Surface Water Assessment* (page 33) notes that the total induced loss of flows in the Lower Talbragar River Water Source peaks at 799 ML/year. The *Groundwater Assessment* (page 115) states that induced baseflow loss of up to 480 ML/year would occur in 2036 (Mine Year 24), but the source of the remaining 319 ML/year is not apparent. This difference is not accounted for the relatively minor changes in surface flow described in Appendix C to the *Surface Water Assessment* (maximum 37 ML/year in Mine Year 12 in a 10th percentile dry year).

In median and higher rainfall years that occur during mining, increased flows in Sandy Creek by up to 10% are expected. Flows are also predicted to increase under all climate conditions post mining.

With reference to the total combined losses of 799 ML, the *Surface Water Assessment* implies that this would be accounted for by the surrender of a portion of the existing surface water licence, but the details are unclear. Notwithstanding any surrender of water access licence entitlements to account for the predicted loss of baseflow to the Talbragar River, further consideration may need to be given as to how the incidental 'take' of baseflow is administered. The water sharing rules for the Lower Talbragar River Water Source prohibit pumping when there is no visible flow into and out of a pool. However, the incidental 'take' of water as a result of groundwater lowering will continue even when there is no visible flow in the river.

In addition, the assessment of the baseflow to the Talbragar River only considers the maximum loss (480 ML/year) as a percentage of the average flow (0.9%). However, this baseflow loss would constitute 62% in a 10th percentile low flow year, 10% in a 20th percentile low flow year and 2.7% in a median flow year. If any of these losses actually occur in Sandy Creek or Laheys Creek (not the Talbragar River itself), they would significantly affect the flow in these creeks as well.

The issues relating to baseflow and surface runoff losses to the surface water systems require further clarification as to their magnitude, location and progression over time. The proposed mechanisms for offsetting the losses also require clarification.

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9 Conclusions

This review has identified a range of uncertainties associated with the estimated water requirements for the operation of the Cobbora Mine and the relative contributions from different sources of supply. Notwithstanding these uncertainties, none of them individually or collectively would be 'show stoppers'. A range of options are available that would allow the mine to adapt its water use and manage the various sources to allow the mine to operate within the constraints of the available water resources. The mine proposes to construct mine water dams and a raw water dam with a combined capacity of approximately 3,000 ML which would provide opportunities to balance water uses and losses in the short term (6 – 12 months). In the longer term, water use could be reduced by using mechanical de-watering. Alternatively, additional certainty of groundwater supply could be achieved by the installation of de-watering bores.

There is also some uncertainty associated with the extent and magnitude of groundwater drawdown that could affect privately owned bores as well semi-permanent pools in Laheys Creek and Sandy Creek. The impact of the project on baseflow and runoff to Laheys Creek, Sandy Creek and the Talbragar River is also unclear. While the project has sufficient water licence entitlements in the Lower Talbragar Water Source to cover the projected loses, the mechanism for any offset requires clarification.

Cobbora Mine proposes to draw an average of approximately 1,270 ML/year (approximately 30% of average water requirements) from the Cudgegong River using its high security water access entitlements for up to 3,311 ML/year. These entitlements include 2,211 ML which were acquired from downstream of Burrendong Dam and, following analysis by NOW, transferred to the Cudgegong River upstream of the dam. Windamere Dam (which regulates flow in the Cudgegong River) and Burrendong Dam are operated as a single source for purposes of meeting the licenced water entitlements on the Cudgegong River and the Macquarie River. The analysis undertaken by NOW (and verified by independent analysis undertaken by consultants commissioned by Mid-Western Regional Council) shows that the transfer by CHC of a high security licence from downstream to upstream of Burrendong Dam would not significantly impact the water availability or reliability of supply to other users on the Cudgegong River.

The concerns raised by the Mid-Western Regional Council relating to changes in the reserve storage in Windamere Dam in order to maintain security of supply arise from a re-assessment of the 'drought of record' following experience in the decade up to 2010. This reassessment has been commenced by NOW and State Water.

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Appendix 8

TABLE OF THREATENED SPECIES

Threatened Species	**Status under the *Threatened Species Conservation Act 1995***	**Status under the *Environment Protection and Biodiversity Conservation Act 1999***	**Recorded or likely potential for occurrence on site, where not recorded** (as predicted by the Proponent)	**Outcome**
Birds				
Australasian Bittern (*Botaurus poiciloptilus*)	Endangered	Endangered	Recorded on site	Not significant
Barking Owl (*Ninox connivens*)	Vulnerable		Recorded on site	Significant
Blue-billed Duck (*Oxyura australis*)	Vulnerable		Recorded on site	Not significant
Brown Treecreeper (*Climacteris picumnus victoriae*)	Vulnerable		Recorded on site	Significant
Cattle Egret (*Ardea ibis*)		Migratory (China-Australia Migratory Birds Agreement (CAMBA))	Recorded on site	?
Diamond Firetail (*Stagonopleura guttata*)	Vulnerable		Recorded on site	Significant
Glossy Black-Cockatoo (*Calyptorhynchus lathami*)	Vulnerable		Recorded on site	Significant
Great Egret (*Ardea alba*)		Migratory (CAMBA and Japan-Australia Migratory Birds Agreement (JAMBA))	Recorded on site	?
Grey-crowned Babbler (*Pomatostomus temporalis temporalis*)	Vulnerable		Recorded on site	Significant
Hooded Robin (*Melanodryas cucullata cucullata*)	Vulnerable		Recorded on site	Significant
Little Lorikeet (*Glossopsitta pusilla*)	Vulnerable		Recorded on site	Not significant
Masked Owl (*Tyto novaehollandiae*)	Vulnerable		Recorded on site	Significant
Malleefowl (*Leipoa ocellata*)	Endangered	Vulnerable & Migratory (JAMBA)	Recorded on site	Not significant
Powerful Owl (*Ninox strenua*)	Vulnerable		Recorded on site	Significant
Rainbow Bee-eater (*Merops ornatus*)		Migratory (JAMBA)	Recorded on site	?
Speckled Warbler (*Chthoronicola sagittata*)	Vulnerable		Recorded on site	Significant
Superb Parrot (*Polytelis swainsonii*)	Vulnerable	Vulnerable	Recorded on site	Not significant
Turquoise Parrot (*Neophema pulchella*)	Vulnerable		Recorded on site	Not significant
Varied Sittella (*Daphoenositta chrysoptera*)	Vulnerable		Recorded on site	Significant
White-fronted Chat (*Epthianura albifrons*)	Vulnerable		Recorded on site	Not significant

Threatened Species	**Status under the *Threatened Species Conservation Act 1995***	**Status under the *Environment Protection and Biodiversity Conservation Act 1999***	**Recorded or likely potential for occurrence on site, where not recorded** (as predicted by the Proponent)	**Outcome**
Bats				
Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*)	Vulnerable		Recorded on site	Not significant
Large-eared Pied Bat (*Chalinolobus dwyeri*)	Vulnerable	Vulnerable	Recorded on site	Significant
Little Pied Bat (*Chalinolobus picatus*)	Vulnerable		Recorded on site	Not significant
Southern Long-eared Bat (*Nyctophilus corbeni syn. Timoriensis*)	Vulnerable	Vulnerable	Recorded on site	Significant
Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*)	Vulnerable		Recorded on site	Significant
Amphibians				
Sloane's Froglet (*Crinia sloanei*)	Vulnerable		Not recorded - *Moderate potential for occurrence	Not significant
Reptiles				
Pale-headed Snake (*Hoplocephalus bitorquatus*)	Vulnerable		Not recorded - *Moderate potential for occurrence	Not significant
Birds				
Black-breasted Buzzard (*Hamirostra melanosternon*)	Vulnerable		Not recorded - *Moderate potential for occurrence	Not significant
Black-chinned Honeyeater (*Melithreptus gularis gularis*)	Vulnerable		Not recorded - *Moderate potential for occurrence	Not significant
Brolga (*Grus rubicunda*)	Vulnerable		Not recorded - *Moderate potential for occurrence	Not significant
Bush Stone-curlew (*Burhinus grallarius*)	Endangered		Not recorded - * High potential for occurence	Not significant
Flame Robin (*Petroica phoenicera*)	Vulnerable		Not recorded - *Moderate potential for occurrence	Not significant
Freckled Duck (*Stictonetta naevosa*)	Vulnerable		Not recorded - *Moderate potential for occurrence	Not significant
Gilbert's Whistler (*Pachycephala inornata*)	Vulnerable		Not recorded - *Moderate potential for occurrence	Not significant
Little Eagle (*Hieraaetus morphnoides*)	Vulnerable		Not recorded - *Moderate potential for occurrence	Not significant

Threatened Species	**Status under the *Threatened Species Conservation Act 1995***	**Status under the *Environment Protection and Biodiversity Conservation Act 1999***	**Recorded or likely potential for occurrence on site, where not recorded**	**Outcome**
			(as predicted by the Proponent)	
Painted Honeyeater (*Grantiella picta*)	Vulnerable		Not recorded - *Moderate potential for occurrence	Not significant
Regent Honeyeater (*Anthochaera phyrgia*)	Critically Endangered	Endangered & Migratory (JAMBA)	Not recorded - * High potential for occurence	Not significant
Scarlet Robin (*Petroica boodang*)	Vulnerable		Not recorded - *Moderate potential for occurrence	Not significant
Spotted Harrier (*Circus assimilis*)	Vulnerable		Not recorded - *Moderate potential for occurrence	Not significant
Square-tailed Kite (*Lophoictinia isura*)	Vulnerable		Not recorded - * High potential for occurence	Not significant
Swift Parrot (*Lathamus discolor*)	Endangered	Endangered	Not recorded - *Moderate potential for occurrence	Not significant
Bats				
Eastern Cave Bat (*Vespadelus troughtoni*)	Vulnerable		Not recorded - * High potential for occurence	Not significant
Non-flying mammals				
Eastern Pygmy-possum (*Cercartetus nanus*)	Vulnerable		Not recorded - *Moderate potential for occurrence	Not significant
Koala (*Phascolarctos cinereus*)	Vulnerable	Vulnerable	Not recorded - *Moderate potential for occurrence	Not significant
Spotted-tailed Quoll (*Dasyurus maculates*)	Vulnerable	Endangered	Not recorded - *Moderate potential for occurrence	Not significant
Squirrel Glider (*Petaurus norfolcensis*)	Vulnerable		Not recorded - *Moderate potential for occurrence	Not significant

Source: EMM 2012 and EMM 2013

Appendix 9

TIMELINE

On 26 October 2012 the Commission received the Direction from the Minister for Planning and Infrastructure, requesting the Commission review the Cobbora Coal Project and conduct public hearings during the review.

On the same day Ms Gabrielle Kibble AO nominated Mr Paul Forward and Mr Brian Gilligan to the Commission for the review. Ms Kibble chaired the review.

The project was on public exhibition at the time the Commission received the request. The exhibition period closed on Friday 16 November 2012.

On 2 November the Commission wrote to the local Councils, Government agencies and the Proponent to advise them of the review and public hearings.

The Commission would commonly write to public submitters at this stage as well, however as the exhibition period was still underway, the submissions had not yet been received. Letters were sent to the submitters on 23 November 2012 after the close of the exhibition period (see below).

On 20 November 2012 the Department of Planning and Infrastructure provided a briefing on the project.

The Public Hearing was first advertised in newspapers on 5 November 2012 in the Mudgee Guardian and the Dubbo Daily Liberal, and on 7 November 2012 in the Sydney Morning Herald and the Daily Telegraph.

A second advertisement ran on 21 November 2012 in the Wellington Times and Dubbo Daily Liberal, on 23 November 2012 in the Mudgee Guardian and on 28 November in the Sydney Morning Herald and Daily Telegraph.

On 23 November 2012 the Department of Planning and Infrastructure provided details of those who had made submissions during the exhibition period.

On the same day, 23 November 2012, the Commission wrote to those people who had made submissions to the Department of Planning and Infrastructure's exhibition of the project, to invite them to the Public Hearing. Registrations to speak at the Hearing closed on 6 December 2012.

On 4 December 2012 the Chair of the Commission, Ms Gabrielle Kibble AO had a brief telephone discussion with Dr Kerry Schott of NSW Treasury, regarding the Treasurer's recent announcements in Dubbo - that the project may not proceed. Dr Schott confirmed the application had not been withdrawn and the Commission should proceed with the review of the project.

On 10 December 2012 the Commission visited the site and was briefed by the Proponent.

On 11 December 2012, the Public Hearing was held at the Jubilee Hall in Dunedoo.

On 19 December 2012 the Commission met with representatives from NSW Treasury to confirm the status of the project and to briefly discuss the state level economic issues with the project.

On 19 December 2012 the Commission also met with Emeritus Professor Jim Galvin to discuss the mine plan. Following this meeting the Commission requested some of the background studies behind the mine plan.

On 20 December 2012 the Proponent agreed to provide a Resources Statement, Reserve Statement and Mine Plan Report, by 24 December 2012.

On the afternoon of 24 December 2012 a scoping study was provided to the Commission by the Proponent.

The Commission had arranged to meet with each of the four Councils who had spoken at the Public Hearing on 16 January 2013. Due to the bushfires in the Warrumbungle area and the threats posed to the other Councils from the weather conditions, the meetings were postponed.

The Proponent provided some parts of its response to submissions in a draft form with a draft groundwater report submitted on 29 January 2013. The complete document (the Preferred Project Report and Response to Submissions) was finally received in full on Monday 11 February 2013. The Department of Planning and Infrastructure determined to publicly exhibit the Preferred Project Report, from 13 February 2013 to 8 March 2013.

On Monday 18 February 2013 the Commission, accompanied by Dr Steve Perrens, met with the NSW Office of Water to discuss the concerns raised at the public hearing regarding the proposed extraction of water from the Cudgegong River.

The Commission met with Warrumbungle Council on Wednesday 27 February 2013.

The Commission met with Mid-Western, Wellington and Dubbo Councils individually on Friday 1 March 2013.

On Thursday 7 March 2013 the Commission held a second meeting with NSW Treasury representatives.

On Thursday 21 March 2013, Ms Kibble and Mr Forward met with the Treasurer.